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INDIA POLICY FORUM 2021

VOLUME 18

EDITED BY
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PURPOSE AND ORGANIZATION

This 18th *India Policy Forum 2021 Volume* comprises papers and highlights of the discussions at the India Policy Forum (IPF) held virtually on July 12–15, 2021, due to the persistence of the Coronavirus pandemic. The IPF is organized by NCAER, the National Council of Applied Economic Research, India's oldest and largest, independent, non-profit, economic think-tank.

The IPF promotes original economic policy and empirical research on India. The IPF Editors commission both empirical research papers and policy-focused expert reviews, the latter also based on robust, original research. It provides a unique combination of intense scholarship and policymaker engagement at the annual IPF Conference that reviews this research, leading to its eventual publication in this international journal.

An international Research Panel of India-based and overseas scholars with an abiding interest in India supports this initiative through advice, active participation at the IPF Conference, and the search for innovative papers that promise fresh insights, especially from younger scholars. An international Advisory Panel provides overall guidance. Members of the two IPF panels are listed below.

Papers appear in this annual *IPF Volume* after revisions based on IPF discussants' comments, a lively floor discussion, and editorial guidance provided by the IPF Editors. To allow readers to get a sense of the richness of the conversations that happen at the IPF, edited discussants' comments as presented at the IPF are included here. The 2021 volume also provides hyperlinks to the video of each IPF session, including the floor discussion with IPF participants. Consistent with the editorial independence of the IPF, the papers and associated comments represent the views of the individual authors and do not imply agreement by the Governing Body, the IPF Editors, the management and staff of NCAER, or the IPF Panels.

The IPF 2021 also featured two Policy Roundtables, along with the 3rd *T.N. Srinivasan Memorial Lecture,* titled, "Responding to COVID-19 amidst Market and Government Failures," delivered by Professor Shanta Devarajan, Georgetown University and NCAER, and the *IPF Lecture* titled "Federalism during the Pandemic," delivered by Mr N.K. Singh, Chairman, Fifteenth Finance Commission and former member of the Rajya Sabha. This *Volume* carries summaries of the Roundtables and hyperlinks to their videos. The videos of the lectures are available at the hyperlink shared at the end of the Editors' Summary.

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Correspondence about papers in this *IPF Volume* should be addressed directly to the authors (each paper contains the email address(es) of the corresponding author(s)). All author affiliations in the papers are as of the IPF Conference. Unsolicited manuscripts are not accepted for review because the IPF Volume is devoted to invited contributions. Feedback on the IPF Volume itself may be sent to: The Editors, India Policy Forum, NCAER, 11 Indraprastha Estate, New Delhi 110002, or by email to ipf@ncaer.org. More information on the IPF is available on www.ncaer.org, including links to downloadable previous IPF Volumes and videos of individual IPF sessions for the past several years.

THE IPF TEAM

NCAER is responsible for the development, planning, organization, editing, and publication of the India Policy Forum. Holding the IPF virtually in 2021 for the second time in 18 years posed new challenges. A dedicated team of professionals at NCAER rose to the occasion. The Editors are deeply grateful to the following NCAER staff for their major contributions to the 2021 IPF Conference and this *Volume*:

Anil Kumar Sharma	*Overall management*
Anupma Mehta	*Managing editor*
Eman Rahman	*Communication support*
Jagbir Singh Punia	*Publication and production*
Khushvinder Kaur	*Team assistance*
Poonam Munjal	*Overall coordination*
P.P. Joshi	*Logistics*
Praveen Sachdeva	*Communication and IT support*
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Ritesh Kumar Tripathi	*IT support*
Ritwik Kinra	*Technical editing and research assistance*
Sangita Chaudhary	*Team assistance*
Shilpi Tripathi	*Media relations*
Sudesh Bala	*Team management*

Editors' Summary

The India Policy Forum (IPF) marked its 18th year with its second virtual conference during July 12–15, 2021. Since the country was just recovering in the aftermath of the highly infectious and deadly "Delta" variant wave of the COVID-19 pandemic, the 2021 IPF was held online. To accommodate overseas participants at the Conference, especially from the US and EU, the IPF was held daily from 1830 IST onwards.

The primary goal of the IPF is to promote original policy and empirical research on India. The annual IPF Conference provides a unique combination of intense scholarship and commentary on the research, as well as a focus on its policy implications. The revised papers are published in this report and benefit from a wide international readership. Over the past 18 years, since the IPF was started, interest in India has grown to the point where there is now much more original research on India appearing in international economic journals. IPF's original goals have also changed, making room for more policy-focused review articles that seek to define the best policy advice based on robust, empirical research. The IPF has also added one or more topical roundtable discussions, usually on issues dominating current Indian policymaking, and also on drawing lessons from the past, and very often charting a path for policymaking going forward. This annual report of the IPF contains the 2021 IPF papers, the discussants' comments on the Conference versions of each paper, a summary of the floor discussion for each paper, and summaries of the two Policy Roundtables.

This Editors' Summary contains summaries of the four papers presented at the IPF 2021 Conference, and ends with hyperlinks to the IPF 2021 program with onward links to the Conference versions of the IPF 2021 papers, video recordings, and presentations made in each IPF 2021 session, including the 3rd T.N. Srinivasan Memorial Lecture, the 2021 IPF Lecture, and the two IPF Policy Roundtables.

Big, Open Data for Development: A Vision for India

In 1881, the first recognizably modern census was conducted in India, covering both British India and the princely states. Over a two-month period from December 1880 to February 1881, a standard survey was conducted, covering every one of the 253,982,595 inhabitants of the subcontinent, the results of which were published in dozens of volumes describing the demographic, economic, linguistic, religious, educational, and geographic characteristics of India's massive population. More than half a million enumerators travelled to 714,707 villages

and towns. Today, more data is generated by the Government of India in a single day than in the entire Census of 1881. Every payment in the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and minute details of every rural road constructed under the Pradhan Mantri Gram Sadak Yojana (PMGSY) are recorded and stored across a sprawling network of databases. Some of these data are analyzed to inform policy, and some are released publicly for use by a wide range of actors across government, civil society, and the private sector. But the vast majority sits idle in virtual warehouses, behind restricted log-ins and arcane websites, inaccessible even to those within government who could use them for the public good.

India is in many ways already a leader in the broad field of data for development. The Indian Statistical and Economic Services are a deep pool of expertise in the collection and use of data. Many rich data sources like the National Sample Survey have been collected for decades. In contrast to many other developing countries, most government programs have management and information systems that record detailed administrative microdata. A wide assortment of government websites make data available to the public: data.gov.in, microdata.gov.in, ecourts.gov.in, among others. Indeed, the World Bank's Statistical Performance Indicators, which rate countries on the availability, quality, and usability of their government data, rank India the 14th best in the world globally, adjusting for income. Yet despite these strengths, all data generated by the Government is not easily available or accessible to those who need it.

In this paper, the authors present a vision for the use and dissemination of public data that can unlock far more of its potential, based on four principles as discussed below:

1. **Government data should be free.** Borrowing terminology from the open-source software movement, it should be "free" in that access should be unrestricted except to prevent harm. Data belongs to the people of India, not to their government. Data should also be "free" in that the cost of accessing it should be zero, not only in terms of monetary costs, but in terms of all other costs: search, cleaning, and harmonizing, among other things.
2. **Government's primary role in the data pipeline is to generate and disseminate data.** India's vibrant civil society and private sectors have repeatedly demonstrated that they have the capability to generate original insights and add value to government-generated data. Making government data open can thus benefit society both directly and indirectly by improving government policymaking and accountability.
3. **Data production requires clear quality standards.** Data quality is essential for its effective use. There currently exist many sensible standards for the production of government data, but implementation of these

standards can be improved significantly. Concerns over the quality of data are legitimate but should not prevent the opening of data to the public: openness contributes to data quality through scrutiny.

4. **Data must be delivered effectively to maximize its social value and prevent abuse.** If posted data is inaccessible to users, it is not open in practical terms. For non-sensitive data, there should be unrestricted access to raw data via Application Program Interfaces (APIs) and other mechanisms that enable all members of society to use it for their myriad purposes. For sensitive data, minimal geographic aggregation and restricted access following international guidelines can protect privacy while maintaining usefulness.

Two broad themes run through the argument presented in the paper. The *first* is that given the investments already made in the generation and dissemination of data, achieving this vision entails high returns but relatively low marginal cost. The *second* is that public access to data is valuable because its potential uses are so varied. It is impossible for public officials (or anyone else) to anticipate the myriad uses to which the data generated by their programs may be put to use. The authors argue that government data should be open by default, and restricted only where there is a clear case in doing so for the public interest.

This paper describes the principles behind wider access to government data and demonstrates some of the potential benefits through a series of case studies. The authors then elucidate how the government should change its data production pipeline such that it is no longer the chief bottleneck in access to public data. They outline the key steps required to improve the quality of government data. They also discuss how data dissemination can maximize usability subject to the imposition of appropriate safeguards by meeting three standards: frictionless access, appropriate delivery, and conceptual clarity. This builds on some of the authors' own work at Development Data Lab in creating Socioeconomic High-resolution Rural-Urban Geographic Platform for India (SHRUG), a data platform designed explicitly to broaden access to otherwise inaccessible government data. The authors then assess India's performance thus far in delivering government data for use by policymakers, civil society, and the private sector. Finally, they examine the case study of the ongoing COVID-19 crisis in India.

It is clear that India can be the world leader in open data for development. The Indian state has often excelled in creating islands of excellence while struggling with the final mile delivery of services such as electricity, education, and health. Thanks to the Internet, the final mile of service delivery for data is much shorter than in other domains. Relative to the huge resources that have gone into the digitization of government functions, small investments are required to push virtually all of government data out into the public domain, where it can be used to improve governance and propel economic growth. The larger shift

required is philosophical: the government must recognize that government data belongs to the people of India, and as such, it must be made available at zero cost to anyone who wants to use it, with restrictions only to prevent harm. A now-common refrain is that data is the new oil, but instead of fueling economic growth at great cost to bank balances, health, and the environment, data has the potential to drive widespread development in India through better governance and more efficient markets, but only if it is truly set free.

Analyzing India's Exchange Rate Regime

The exchange rate regime of a country depends on the manner in which the currency of the country is managed with respect to other countries' currencies. There are primarily three different types of Exchange Rate Regimes (ERRs)– freely floating, fixed, and pegged or managed floating. Most developed countries of the world have freely floating ERR wherein the central banks do not intervene in the foreign exchange markets to stabilize currency fluctuations. On the other hand, there are countries such as Hong Kong, which has a fixed parity with the US dollar and the Hong Kong central bank uses its monetary policy to maintain this peg. A majority of the emerging economies lie somewhere in between these two extremes. They are mostly characterized by "managed floating" ERR or some version of a "pegged" regime, with their respective central banks intervening in the foreign exchange market on a regular basis. India falls in this category.

The official *de jure* classification of the ERR of a country often diverges substantially from the *de facto* ERR that exists in practice. Full information about the ERR is often not disclosed by the central banks and hence the ERR needs to be uncovered from historical data using statistical methods. Given the active foreign exchange intervention by the Reserve Bank of India (RBI), it is difficult to decipher India's ERR by simply looking at the level of the exchange rate or the volatility. The actual rate that is observed is partly an outcome of the underlying macro-financial conditions or shocks faced by the economy and partly of the intervention policy or currency policy of the central bank.

India shifted to a "market determined exchange rate system" in the early 1990s consistent with the liberalization, deregulation, and globalization reforms. There has been a currency market since then, and at the same time, the RBI actively trades in this market, with the extent and dynamics of the trading varying from time to time. While the RBI intervenes in the forex market with the stated goal of "containing volatility," there is evidence that the central bank intervenes in an asymmetric manner, buying US dollars, and selling rupees in order to prevent a currency appreciation. This shows that India offers an interesting case study for deciphering the underlying ERR using a data-driven analytical framework.

In this paper, the authors use empirical methods to uncover the different regimes that India's exchange rate has gone through over the last two decades. They also study the manner in which the exchange rate has been managed by analyzing the kind of pressure that the exchange rate has faced across these regimes.

The *de facto* ERR literature is limited in that while it uses observed data on exchange rates, it is unable to integrate this with the policy intentions of the central bank. The authors use the techniques developed in the Exchange Market Pressure (EMP) literature to understand how the pressure on the exchange rate is absorbed through foreign exchange (FX) interventions or relieved through the movements of the exchange rate across the various exchange rate regimes. This brings into focus the exchange rate policy of the central bank.

The authors' work helps to analyze currency regimes through the prism of the EMP, and also to use the methodological advances in this field that have taken place over the last ten years, for studying ERR changes in India over more than a 20-year period. The authors find four periods in India's *de facto* ERR. These regimes differ on the basis of the volatility of the exchange rate, and the magnitude and direction of the EMP, as well as the extent to which the rupee is pegged against other currencies. The mode of currency management through FX intervention has also undergone changes over time, from the RBI intervening directly in the spot market to the RBI taking a position in the forward market.

In particular, the authors find that there was one ERR (2008-2013) in which the rupee faced a pressure to depreciate and it was a period of relatively high volatility of the rupee. The other three periods saw pressure on the rupee to appreciate and relatively low volatility of the rupee. In these periods, the RBI accumulated reserves. The paper also provides evidence that the RBI has been intervening in the forex market in an asymmetric fashion. When there has been pressure on the rupee to appreciate, the RBI has typically responded by accumulating reserves. On the other hand, during the periods in which there has been pressure on the rupee to depreciate, only a tiny fraction of the reserves were used for resisting the pressure. Such pressure is absorbed by depreciation of the rupee.

Some of the major periods of FX intervention by the RBI have happened in response to capital flow surges or capital outflows. For instance, India received massive capital inflows in the period 2004-2008, during which the RBI engaged in an asymmetric intervention in the FX market in order to prevent the rupee from appreciating. Conversely, in response to capital outflows, the RBI sometimes intervened in the FX market to prevent the rupee from depreciating, and sometimes let the exchange rate absorb the depreciation pressure without intervening in the FX market (for example, the post-2008 period in the aftermath of the Global Financial Crisis).

In this paper, the authors have not been able to measure the role of monetary policy or of capital controls in the context of exchange rate management. The techniques for measuring these in absorbing exchange market pressure are still evolving. This is thus an agenda for future research.

COVID-19 and India's Macroeconomy: Pre-existing Conditions, Performance, and Prospects

This paper seeks to undertake a holistic assessment of the impact of the pandemic on India's macroeconomy and, more importantly, what it portends for the future. The need for a framework to understand performance and prospects is made more urgent by the following cross-currents and contradictions that have characterized the economy over the last year:

- A sharper-than-expected economic contraction in the April-June quarter in 2020 juxtaposed with a stronger-than-expected rebound in subsequent quarters raising questions about the cumulative impact of COVID-19 on the economy;
- An initial presumption in some quarters that consumption had led the rebound juxtaposed with subsequent data confirming that consumption, in fact, had been the slowest to recover; instead the second-half recovery was led, in part, by strong government spending;
- A nominal GDP contraction in 2020-21 but juxtaposed with surging listed company profits followed by strong corporate tax collections;
- Lower-than-expected gross Non-performing Assets (NPAs) for large corporates but juxtaposed with muted real credit growth in the banking system;
- Ostensibly large output gaps juxtaposed with sticky and elevated core inflation, raising questions about the shock to the supply side and the sources of inflation; and
- Strong export growth juxtaposed with adverse terms-of-trade shock from higher crude prices, raising questions about how beneficial, on net, the global economy will end up being.

This paper, therefore, attempts to put together a framework to rationalize these moving parts and generate appropriate policy implications. It seeks to do so by posing and answering the following questions: (i) What was the state of India's economy coming into COVID? What contributed to slowing growth in the years before the pandemic? (ii) What has the cumulative macroeconomic impact of COVID been; where are the divergences most visible and what are the steady-state macroeconomic implications of a K-shaped recovery? (iii) Where is growth likely to come from in the aftermath of the pandemic—household consumption, private investment, government capex, or exports; and which growth drivers have the potential to fire and which may be dormant for some time post-pandemic? (iv) What are India's potential growth prospects? To what extent has slowing of Total Factor Productivity (TFP) growth contributed to any downshift? What, in turn, are the macro determinants of TFP and necessary policy implications?

In effect, this paper takes a funnel approach, starting near and narrow before broadening out. The main findings of the paper have been delineated as follows. *First,* in contrast to the previous decade when exports and investment drove growth, consumption was the main driver of growth between 2012 and 2019, but was increasingly financed by households running down savings and running up debt. Incipient balance sheet concerns began to emerge by 2018—before the NBFC shock—causing households to retrench and private consumption to slow down coming into the pandemic.

Second, strong government spending was, therefore, the key to propping up growth in the years before COVID. This, however, meant that a meaningful quantum of fiscal space had been used up before COVID, likely impacting the fiscal response during the pandemic year.

Third, if GDP grows at about 9 percent in FY22—in line with advance estimates—the quarterly level of activity by end-FY22 will be about 7 percent below India's pre-pandemic path, consistent with discernible scarring in the labor market. *Fourth*, contrary to the common presumption, neither household consumption nor private investment necessarily appear poised to drive growth in the immediate aftermath of the pandemic. Income scarring from the pandemic will simply accentuate balance sheet pressures that households perceived pre-pandemic, and these "income" effects are likely to dominate "price" effects from lower real interest rates; this explains why households remain very cautious about future spending in surveys. The binding constraint on private investment for large firms has shifted from leverage to weak demand; even as large firms have progressively de-leveraged in recent years, manufacturing utilization rates have fallen to the mid-60s, levels that are unlikely to spark a broad-based investment cycle until demand recovers. Furthermore, balance sheet pressures are likely to increase for SMEs from the pandemic.

The paper also suggests that exogenous demand drivers will be needed to break the sub-optimal equilibrium that private consumption and private investment had gotten into even pre-pandemic. Exports and sustained government capex have the potential to serve as those demand drivers. A strong demand revival in developed markets in 2021 induced strong export growth, before the Delta wave of COVID-19 slowed down global growth. One demand driver, however, may not be enough. Exports will need to be supplemented by continued government capex; this has been the government's strategy with the Centre budgeting large capex increases since the pandemic commenced. Meanwhile, sustained privatization, expenditure re-orientation, and tax reforms will have to create fiscal space to finance public investment, given the fiscal consolidation imperative in the coming years. All told, exports and government capex will need to create a growth bridge till private investment and consumption recover.

The authors also suggest that the imperative for higher trend growth to make up pandemic-induced income losses and ensure public debt sustainability has

increased dramatically post-COVID. While much attention has been focused on factor accumulation (investment and labor force participation), slowing TFP growth has shaved off about 250 basis points from trend growth since its peak before the Global Financial Crisis of 2008; put more starkly, its contribution to potential output has halved over the last 15 years.

Empirically, the authors find three important macro determinants of TFP: trade openness, a healthy financial sector, and strong public investment. All told, reforming the financial sector and resolution mechanisms, creating fiscal space through privatization and asset sales to sustain and ramp up public investment, and creating an export-conducive environment constitute a synergistic package of interventions that will be crucial for boosting India's medium-term prospects.

Integrating Biometric Authentication in India's Welfare Programs: Lessons from a Decade of Reforms

Around the world, 161 countries have digital ID systems, and many of them recently introduced it in an attempt to achieve the UN's target of providing legal identity to all by 2030. India's biometric unique ID Aadhaar has been at the forefront of this global revolution in digital identification; nearly 1.3 billion people have Aadhaar cards as of going to press. Aadhaar is India's most significant investment in state capacity over the past decade. Yet, its application to social protection programs has been controversial. Proponents claim that the use of Aadhaar to identify and authenticate beneficiaries in these programs has led to considerable fiscal savings, while critics claim that it has led to denial of benefits to the marginalized and caused substantial harm. In this paper, the authors review research on the use and impact of Aadhaar in social programs in India over the last decade, distilling policy suggestions in order to obtain the benefits of Aadhaar while minimizing the risk of harm to beneficiaries.

The authors begin with a generic framework for thinking about the challenges a government faces when trying to transfer value to remote beneficiaries, and how biometric authentication might plausibly affect these. They describe what exactly biometric authentication can and cannot do: it can help link eligibility and identity at the point of transfer, and can prevent transfers from going to fictitious people, but it cannot *per se* improve the quality of eligibility tests, nor can it prevent government agents from capturing parts of transfers due to beneficiaries. To understand the potential benefits of mandating Aadhaar, one thus needs to understand precisely the issues with a particular scheme that Aadhaar might be able to solve, how serious are the risks of exclusion and transactions costs, and what mechanisms might mitigate these risks.

The authors next describe Aadhaar use cases in Indian social protection programming, using their framework to categorize whether the use is *a priori*

reasonable. They find that Aadhaar use is ubiquitous, across States and government ministries, and for flagship as well as boutique schemes. They document at least 183 use cases, which translates to hundreds of millions of individuals now using Aadhaar to access schemes. Moreover, usage seems to have expanded since the 2018 Supreme Court ruling.

The paper then reviews academic evidence on Aadhaar. Considering the pervasive role of Aadhaar as described above, it is very surprising how little research of any type exists, particularly compared to the vast amount of research on MGNREGS, for example. Beginning with high-quality descriptive research, the authors find that there is no credible data on leakage at all, a serious lacuna given that one of the main arguments for integrating Aadhaar into transfer programs in the first place was to reduce leakage. Exclusion risk may be small but it is real, and appears to disproportionately affect the most vulnerable. However, non-Aadhaar exclusion risk is also significant, in most cases higher than that attributable to Aadhaar. Transactions costs are again small but non-trivial, coming largely from authentication failures that result in beneficiaries having to make additional trips to obtain rations. Opinions seem positive overall, but depend on context.

The paper proceeds to present studies that conduct credible causal inference to try to assess how outcomes are *different* as a result of Aadhaar's use, of which there are only three: Barnwal (2019) on the use of Aadhaar-enabled Direct Benefit Transfer, or DBT, in LPG subsidies, and two of the authors' own studies on the use of biometric Smartcards to make payments to MGNREGS workers and pensioners in Andhra Pradesh, and the integration of Aadhaar in the Public Distribution System (PDS) in Jharkhand (Muralidharan et al. 2016; 2021). Barnwal (2019) provides compelling evidence that the use of Aadhaar to reform the way in which LPG subsidies were delivered led to meaningful reductions in leakage. However, the lack of matched administrative-household data means that it is difficult to entirely rule out exclusion. The authors' own studies also find significant reductions in leakage in both cases. However, in Andhra Pradesh, they find no evidence of exclusion, while in Jharkhand, they find significant evidence of exclusion. They suggest that the main reason for the differences in impacts was the difference in political priorities around the use of biometric authentication technology. Specifically, Andhra Pradesh focused on improving the beneficiary experience, while Jharkhand focused on fiscal savings.

The paper concludes with five policy suggestions based on the authors' framework, review of literature, and experience conducting their own research on biometric authentication in social programs in India. These are: (i) build in safeguards against exclusion, including offline fallback options; (ii) focus on using Aadhaar-based authentication to improve the beneficiary experience rather than trying to achieve fiscal savings; (iii) implement solutions for real-time

measurement of beneficiary experiences to quickly detect problems of exclusion and address them promptly; (iv) incorporate questions about Aadhaar in representative household surveys like the National Sample Survey (as well as private surveys like the Centre for Monitoring Indian Economy); and (v) build trust between the government and civil society in order to manage the trade-off between benefits from fiscal savings and the costs from increased exclusion.

The 2021 T.N. Srinivasan Memorial Lecture, IPF Policy Roundtables, and the 2021 IPF Lecture

The 2021 IPF hosted the 3rd T.N. Srinivasan Memorial Lecture. Professor Srinivasan, who passed away in November 2018, was one of IPF's most ardent supporters, not missing a single IPF over its first 15 years. His persistent focus on the quality of data and empirical analysis remains a guiding theme for the IPF. The Lecture, titled *Responding to COVID-19 amidst Market and Government Failures*, was delivered by Shanta Devarajan, at the Georgetown University in Washington D.C. Devarajan's in-depth lecture focused on various issues of social and economic concerns arising out of the Coronavirus pandemic. The recording of the Lecture is available at NCAER's website: please see the hyperlinks below.

The 2021 IPF also featured two Policy Roundtables that are summarized in this *Volume*. The first Roundtable on "The Future of Economic Reforms: 30 Years after '*Bata Teri Raza Kya Hai*' (What's Your Wish?) Looking Back to Look Ahead" was moderated by K.P. Krishnan, IEPF Chair Professor at NCAER, with panelists Montek Singh Ahluwalia, Former Deputy Chairman, Planning Commission; Vijay L. Kelkar, Former Adviser to the Finance Minister of India; Ashok Chawla, Former Chairman, Competition Commission of India; and T.V. Somanathan, Finance Secretary in the Government of India.

Sonalde Desai, Professor at NCAER and at the University of Maryland, moderated the second Policy Roundtable on "India Emerging from the Long Shadow of COVID-19," with panelists Gautam Menon at the Ashoka University; Farzana Afridi at the Indian Statistical Institute in New Delhi; Lant Pritchett at the University of Oxford; and Renana Jhabvala at SEWA.

In conclusion, the IPF featured the *2021 IPF Lecture* on "Federalism during the Pandemic," delivered by the Chairman of the 15th Finance Commission and former Rajya Sabha Member, N.K. Singh. This final session of the IPF 2021 Conference was chaired by a former Co-editor of the IPF, Arvind Panagariya, Professor at Columbia University. The video of the session is available at NCAER's website and for those interested in reading the lecture, the detailed version is also available at NCAER's website, www.ncaer.org.

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The session video and all slide presentations for this IPF session are hyperlinked on the IPF Program available by scanning this QR code or going to https://www.ncaer.org/IPF2021/agenda.pdf

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Big, Open Data for Development: A Vision for India§

ABSTRACT The government generates terabytes of data directly and incidentally in the operation of public programs. For intrinsic and instrumental reasons, these data should be made open to the public. Intrinsically, a right to government data is implicit in the right to information. Instrumentally, open government data will improve policy, increase accountability, empower citizens, create new opportunities for private firms, and lead to development and economic growth. A series of case studies demonstrates these benefits in a range of other contexts. We next examine how government can maximize social benefit from government data. This entails opening administrative data as far upstream in the data pipeline as possible. Most administrative data can be minimally aggregated to protect privacy, while providing data with high geographic granularity. We assess the status quo of the Government of India's data production and dissemination pipeline, and find that the greatest weakness lies in the last mile: making government data accessible to the public. This means more than posting it online; we describe a set of principles for lowering the access and use costs close to zero. Finally, we examine the use of government data to guide policy in the COVID-19 pandemic. Civil society played a key role in aggregating, disseminating, and analyzing government data, providing analysis that

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was essential to policy response. However, key pieces of data, like testing rates and seroprevalence distribution, were unnecessarily withheld by the government, data which could have substantially improved the policy response. A more open approach to government data would have saved many lives.

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1. Introduction

In 1881, the first recognizably modern census was conducted in India, covering both British India and the princely states, with the exception of Kashmir and areas controlled by other European powers. Over a two-month period from December 1880 to February 1881, a standard twelve-question survey was asked of every one of the 253,982,595 inhabitants of the subcontinent, the results of which were published in dozens of volumes that provided detailed descriptions and tabular data on the demographic, economic, linguistic, religious, educational, and geographic characteristics of India's massive population. More than half a million enumerators traveled to 714,707 villages and towns. They faced problems ranging from logistical challenges accessing mountainous and forested regions, to concerns that the census was preparation for a major forced displacement or recruitment for war. In some parts, enumerators were preceded by rumors that they would bring bad luck or injury, motivating people to respond behind closed doors or hide in family members' houses when enumerators were present. In others, the questions about age and marital status were entertained and said to cause "much amusement" (Plowden 1883).

Today, more data is generated by the Government of India in a single day than in the entire Census of 1881. Every payment in the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), every health insurance claim under Pradhan Mantri Jan Arogya Yojana (PMJAY), and minute details of every rural road constructed under Pradhan Mantri Gram Sadak Yojana (PMGSY) are recorded and stored across a sprawling network of disparate databases. Some of these data are analyzed to inform policy, and some are released publicly for use by a wide range of actors across government, civil society, and the private sector. But the vast majority sits idle in virtual warehouses, behind restricted logins and arcane websites, inaccessible even to those within government who could use them for the public good. This paper lays out a vision for setting those data free, to power India's development through better policy design, greater accountability, and more efficient markets.

India is in many ways already a leader in the broad field of data for development. The Indian Statistical and Economic Services constitute a deep pool of expertise in the collection and use of data. The Population Census, National

Sample Survey (NSS), and Annual Survey of Industries (ASI) are among the many rich data sources that have been collected for decades. In contrast to many other developing countries, most government programs in India have management and information systems that record detailed administrative microdata. A wide assortment of government websites make data available to the public, like data.gov.in, microdata.gov.in, and ecourts.gov.in, to name a few. Indeed, the World Bank's Statistical Performance Indicators, which rate countries on the availability, quality, and usability of their government data, rank India the 14th best in the world globally, adjusting for income. India's world class technology sector has helped to build much of the public data infrastructure and finds myriad ways to generate economic growth from government data. A vibrant civil society, ranging from academic researchers to watchdog non-governmental organizations (NGOs) and a free press, uses government data to improve the understanding of India's economy, evaluate policies, and advocate for better governance.

All this notwithstanding, India's Government is hampering growth and development through poor service delivery in the realm of government data. Just as India's economic growth and poverty alleviation would be enhanced if a high level of education were accessible to the entire population, so would development be accelerated by more widespread access to government data. Currently, much of the data generated by the government is either not released or is put out in a way that makes it impossible to use effectively. Resources are wasted recreating imperfect copies of databases that ministries operate but only partially release through their websites. Data collected at the village and neighborhood levels are often released only as State-level aggregates which have limited value for decision-making.

In this paper, we present a vision for the use and dissemination of public data that can unlock far more of its potential, based on four principles, as discussed below:

1. **Government data should be free.** Borrowing terminology from the open source software movement, it should first be "free" in that access should be unrestricted except to prevent harm. Data belongs to the people of India, not to their government. Second, data should also be "free" in that the cost of accessing it should be zero, not only in terms of monetary costs, but in terms of all other costs: search, cleaning, harmonizing, among others. Too many of India's "public" datasets are, for all practical purposes, not in fact accessible at scale, with data stuck behind web portals with attractive layouts but minimal data access.
2. **The Government's primary role in the data pipeline is to generate and disseminate data.** India's vibrant civil society and private sectors have repeatedly demonstrated that they have the capability to generate original insights and add value to government-generated data. Making government data open can thus benefit society both directly and indirectly by improving government policymaking and accountability. The government needs

capacity to conduct its own analyses, but this should never crowd out the delivery of data to those outside the halls of power.

3. **Data production requires clear quality standards.** Data quality is essential for its effective use. There currently exist many sensible standards for the production of government data, but implementation of these standards can be much improved. Concerns over the quality of data are legitimate but should not prevent the opening of data to the public: openness contributes to data quality through scrutiny.
4. **Data must be delivered effectively to maximize its social value and prevent abuse.** If posted data is inaccessible to users, it is not open in practical terms. For non-sensitive data, citizens should have unrestricted access to raw data, via APIs and other mechanisms, which enable all members of society to use it for their myriad purposes. For sensitive data, minimal geographic aggregation can protect privacy while maintaining usefulness. Protocols for accessing personally identifiable information, following well-established international guidelines, can allow researchers and others pursuing the common good to use such data without risking harm through privacy violation.

This paper explains why virtually all government data should be open, and how to go about the process of delivering that open data to all of India. It contains many proposals on how to maximize the value of data to Indian society while respecting the hard constraint of privacy protection. However, this paper is not a manual of the exact regulations that would accomplish such a goal. We do not pretend to examine every possible privacy risk or technical challenge; rather, we seek to show how a broad consensus is possible around opening much of the government's data, even as the debates rightly continue on how to respect privacy and prevent abuse.

Two broad themes run through our argument. The first is that given the investments already made in the generation and dissemination of data, achieving this vision entails high returns but a relatively low marginal cost. The second is that public access to data is valuable because its potential uses are so varied. It is impossible for public officials (or anyone else) to anticipate the myriad uses to which the data generated by their programs may be put to use. Many billion dollar "unicorns" in Silicon Valley are built upon a foundation of free access to data on real estate, geospatial information, satellite imagery, and other standardized data layers; their Indian equivalents are far behind not because of a lack of talent or skills, but because of lack of access to data, the raw material of the information sector. Once it has generated the data, the government can maximize social welfare by delivering it to the entire society at zero cost, monetary or otherwise.

Government data should be open by default and restricted only where there is a clear case in doing so for the public interest. Indeed, the Indian Government already has a commitment to share its internal data with the public through the Right to Information (RTI) and various open data policies. But the RTI

mechanism implies access restriction by default: only through significant work can the public obtain data that was collected from them, and even then, not always. A more complete right to information would require that government data is open, usable, and available even without requiring a heroic effort by the public to unlock it. In 2021, there is no technological or other constraint on making the entirety of non-sensitive government data open and easily accessible.

This paper proceeds by describing the principles behind wider access to government data and demonstrating some of the potential benefits through a series of case studies describing downstream effects of open data from around the world (Section 2). We then elucidate how the government should change its data production pipeline such that it is no longer the chief bottleneck in access to public data (Section 3). In Section 4, we outline the key steps required to improve the quality of government data and argue that appropriate concerns about data quality are no reason to keep data from the public. We discuss in Section 5 how data dissemination can maximize usability subject to appropriate safeguards by meeting three standards: frictionless access, appropriate delivery, and conceptual clarity. This builds on some of our own work at Development Data Lab in creating the Socioeconomic High-resolution Rural-Urban Geographic Platform for India, or SHRUG, a data platform designed explicitly to broaden access to otherwise inaccessible government data. In Section 6, we assess India's performance thus far in delivering government data for use by policymakers, civil society, and the private sector.

Finally in Section 7, we examine the case study of the ongoing COVID-19 crisis in India. We highlight the dynamism of policymakers, researchers, the open data community, journalists, and businesses, who worked together to use data to fight the pandemic. We also highlight the tragedy of missed opportunities caused by a lack of detailed, high-quality, and timely data. More open data would have enabled governments to better understand the spread of the disease, to better target non-pharmaceutical interventions, and to better prioritize scarce resources by age and health conditions. Opening government data can enable India to be better prepared for the next major crisis.

It is clear to us that India can be the world leader in open data for development. Kapur (2020) points out that the Indian state has often excelled in creating islands of excellence but has struggled with the final mile delivery of services such as electricity, education, and health. Thanks to the Internet, which transports data effortlessly across space to anyone with signal and a device, the final mile of service delivery for data is much shorter than in other domains. Relative to the huge resources that have gone into the digitization of government, small investments are required to push virtually all of government data out into the public domain, where it can be used to improve governance and propel economic growth. The larger shift required is philosophical: government must recognize that government data belongs to all the people of India, and as such, it must be made available at zero cost to anyone who wants to use it, with restrictions only to prevent harm. A now-common refrain is that data is the new oil, but instead of

fueling economic growth at great cost to bank balances, health, and the environment, data has the potential to drive widespread development in India through better governance and more efficient markets, but only if it is truly set free.

2. Set Government Data Free

This section describes some of the many benefits that can arise from the creation of a more open ecosystem around government data in India. We argue that increasing access to government data is both intrinsically and instrumentally important.

Government data is information collected from the people of India, and it intrinsically belongs to the Indian people. They should have a right not only to access this information but also to access it seamlessly and free of cost, both locally, to understand how government data represents the place where they live, and in aggregate, to understand the impacts of policy choices on a national scale.

In addition to its intrinsic ownership by the Indian people, we highlight numerous instrumental advantages to India of building a more open government data ecosystem. Increasing access to government data will allow the media to better inform the public, civil society to advocate for the marginalized and hold the government accountable, and the private sector to innovate and drive economic growth.

Throughout this section, we use the term "government data" to refer to data collected intentionally and incidentally through the execution of government programs. This includes survey data, like the Economic Census and the NSS, as well as incidentally-collected data, such as MGNREGS projects completed and roads built under PMGSY. As regards incidentally collected data, this paper is strictly concerned with geographically aggregated data such that individuals cannot be identified but can understand highly local patterns of development. There are naturally significant opportunities in creating a data ecosystem around individual data as well, but the privacy tradeoffs are more significant and demand greater attention. We deal with this question in Section 5.

2.1. The Right to Data

Government data comprise a collection of information about the people and businesses of India, as well as the actions of the government. These data are generated and possessed, but not owned by the government as a distinct entity from the people of India. As the Chief Information Officer of the United States National Oceanic and Atmospheric Administration put it: "It's our job to get that data out there. The data doesn't belong to us, it belongs to the American people" (Rogawski et al. 2016). Most goods in possession of the government, like schools or canisters of cooking gas, belong to the public but must

be given to some, because one person's use precludes another's. Not so with data: there is nothing to stop it from being freely shared with all members of society, as their right.

This is not a new concept in India. The RTI Act grants all citizens of India the right to petition the government for information that it holds:

> Right to Information Act 2005 mandates timely response to citizen requests for government information. […] The basic object of the Right to Information Act is to empower the citizens, promote transparency and accountability in the working of the Government, contain corruption, and make our democracy work for the people in real sense. It goes without saying that an informed citizen is better equipped to keep necessary vigil on the instruments of governance and make the government more accountable to the governed. The Act is a big step towards making the citizens informed about the activities of the Government. (Government of India 2005)

The right to information can take many forms; its implementation in India takes the form of a government commitment to respond to petitions requesting specific pieces of information. This approach makes sense in a twentieth century technological paradigm, where there are significant idiosyncratic costs associated with obtaining and disseminating that information.

In the twenty-first century, however, much of government information is computerized and stored in the form of structured data, which can be queried rapidly and free of cost. In this context, there is no value added by requiring an intermediary to respond to requests from the public; it is technologically feasible for the public to query the government databases directly, if only they are made unrestricted. In short, the computerization of government activity and the Internet for the first time enable a right to information that can be provided by default rather than intermediated through slow bureaucratic processes. In a digital world, the right to data is merely the logical conclusion of the right to information.

Technological change also means that information can now be analyzed in aggregate as data. Many insights are only possible when information is standardized and aggregated into datasets. Statistical methods can be used to identify inequalities, flag unreasonably high procurement costs, and test for the impacts of government programs. The practice of the right to information should keep up not only with technological change in information access and delivery but also with the potential uses of information.

Currently, government data is closed by default: unless a decision is made to share a dataset with the public, it sits on government servers, often inaccessible or poorly-accessible, sometimes even to those who generate it. If a decision is made to share the data with the public, ad hoc design decisions are made about the subset of the variables to be released, the level of temporal and geographic aggregation, and the type of delivery mechanism (such as API and click-through website).

The implication of the right to data is that government data should be available to users by default, with a clear set of dissemination standards. As with

other rights, this right to data has limits. Most speech is free but hate speech that promotes harm to other members of society is prohibited by the Indian Penal Code. Likewise, most government data should be freely available to all, apart from that which can cause harm by undermining security or violating privacy.

We describe a set of dissemination standards in Section 5, which would ensure that the public has maximum accessibility and benefit from government data, while retaining safeguards to prevent harmful use.

2.2. The Myriad and Unpredictable Uses for Government Data

Open government data has substantial instrumental value—it serves as a key input in efforts to improve governance, inform the public, create better public policy, or generate new economic opportunities. Some impacts are more easily quantified, such as the market valuation of technology firms that depend on public data resources, while others are more difficult to evaluate, like the extent to which data-driven transparency initiatives improve governance.

In this subsection, we demonstrate with five case studies how freely accessible data can yield a range of benefits through both public and private sector channels. We first describe how making data available to officials in Pakistan improved the performance of public health clinics. We then summarize two studies that showed how providing data to citizens can improve democratic performance. In the third case study, we use examples from our own research to demonstrate the insights that can be gained from using government data to evaluate government programs, but only if multiple datasets are available and linkable. Finally, two case studies from the United States illustrate the massive potential economic impact of high-quality open government data in the hands of the private sector: the rapid growth of the real estate technology sector, and the data products of the US National Oceanic and Atmospheric Administration (NOAA).

A key message is that government data is valuable for a wide range of potential uses, which are impossible for public officials in charge of data generation and dissemination to anticipate. This implies that a policy of data restriction by default will prevent a wide range of potential uses; only a policy of open data by default lays the foundation for the innovative use of data for development.

Case Study 1: Data to Empower Public Officials

The first domain in which government data can be leveraged for development is by the government itself. If officials can access clean, reliable data in a format that is accessible to them, they can improve performance through improved monitoring of staff and spending. One example of this comes from Punjab, Pakistan, where the public health system was plagued by low attendance and performance. Callen et al. (2020) conducted a randomized controlled trial of the introduction of a new inspection tool, "Monitoring the Monitors," which replaced the existing paper-based system with a smartphone-based app to collect data on rural public health clinics. Critically, this system both generated high quality data and fed it

into an online dashboard that flagged in red underperforming facilities, delivering the data to inspectors in an easily accessible format.

Despite the many other challenges faced by the rural health system, this relatively minor informational intervention yielded impressive gains in performance. At the baseline, monthly inspections were occurring in only 23 percent of the clinics and doctors were present in only 24 percent of the clinics during operating hours. Inspections more than doubled in the first six months of the intervention, though more than half of the increase was lost by the next survey another six months later. Doctors also increased their attendance in treatment clinics. Senior policymakers appeared to use the data: flagged clinics saw much larger gains in attendance than similar clinics that had slightly better baseline attendance and thus were not flagged. Taken together, the evidence suggests that providing data to policymakers in a format that focuses attention on areas of underperformance can have meaningful effects even in very low-performing agencies and in the absence of other reforms. It is worth noting that the government did not develop the monitoring dashboards in-house; it was only through partnership and data-sharing that they were able to obtain actionable information.

Case Study 2: Data to Empower Citizens and Improve Electoral Performance

Elections are understood to improve governance through two related channels. First, voters choose politicians whose innate characteristics will make government work better for the electorate, because either their policy preferences are more aligned with their voters, or their high ability will produce good governance. Second, politicians in office may forgo opportunities for corruption if it makes voters more likely to re-elect them. Both channels rest on the assumption that voters have information on politician characteristics and performance, and can thus reward good politicians with their votes and punish bad ones. But voters may find it difficult to access the information required to discipline politicians.

Two recent studies in India suggest that this is the case. In the first, Banerjee et al. (2020) conducted an experiment generating report cards grading politicians on how well their spending aligned with the surveyed preferences of slum dwellers in their constituencies. They gathered detailed data on the allocation of councillors' local development funds; notably, this information was only accessible to researchers through Right to Information Act filings and thus not easily accessed by voters in advance of the study. Councillors who received performance information changed their spending patterns, but only when they were told that the report cards would be published in the newspaper, making the information available to their voters.

In a separate experiment, George et al. (2018) studied the impact of providing information to voters on the criminality of political candidates in Uttar Pradesh. Since 2004, the Supreme Court has required all candidates for elected office to submit sworn affidavits detailing their personal information, assets, and any pending criminal cases against them. There is evidence that the election of

criminal politicians harms local development outcomes (Prakash et al. 2019) and that voters prefer candidates who are not criminals (Banerjee et al. 2014), yet nearly a third of candidates and elected politicians in India face open criminal charges. This information is theoretically available to voters via Election Commission websites, yet it is locked away in large PDF files that are difficult to find, download, and read. The Association for Democratic Reforms (ADR), an non-governmental organization dedicated to improving the electoral process in India, has converted tens of thousands of these into machine readable data, making possible a large body of research on politicians in India.[1] George et al. (2018) used ADR data to send 600,000 voters information on the criminal charges pending against politicians running in their constituencies via both phone calls and text messages. This information caused voters to redirect votes toward cleaner candidates.

Taken together, these two studies suggest that making government data more available to citizens can lead to cleaner elections and improve politician responsiveness to voter preferences while in office.[2] Both experiments used data that was collected by government but was not functionally available to citizens, either because it was locked up on government servers until the filing of an RTI, or because it was released in a format that made it difficult for voters to access. The studies also demonstrate the creative applications of data that diverse users invent when given access. Banerjee et al. (2020) partnered with three institutions to conduct their study: *Satark Nagrik Sangathan* (Society for Citizens Vigilance Initiatives, an NGO) to file the RTI requests and construct the report cards, *Dainik Hindustan* (Delhi's second largest newspaper) to publish the report cards, and Abdul Latif Jameel Poverty Action Lab South Asia (JPAL, a research organization) to conduct audits of public goods provision and disseminate information to politicians. George et al. (2018) relied on ADR data, partnered with three telephone companies to deliver their information to voters, and then used publicly available data from the Election Commission to observe effects on voter behavior. A key benefit of making government data more open is that it enables innovative uses of that data—uses that are difficult to anticipate in advance.

Case Study 3: Understanding the Impacts of Major Government Programs

The government spends many crores every year on programs whose impacts are unclear and for which there is no built-in evaluation. Yet rich open government data provide researchers with the opportunity to study the impacts of these

1. See, for example, Asher and Novosad (2020) on the impacts of mining on criminal politicians, Prakash et al. (2019) on the economic impacts of electing criminal politicians, Vaishnav (2017) on why criminal politicians are so successful in India, and Fisman et al. (2014) on the returns to political office.

2. In a similar spirit but totally different domain, Berlinski et al. (2021) find that information on student performance delivered to parents via text messages improved grades and attendance.

programs and provide useful evidence for the improvement of future policy. We conducted a series of studies on the impacts of the Prime Minister's Village Road Program (PMGSY), which spends approximately ₹15,000 crores per year (PRS 2021) and has to date constructed nearly 700,000 km of rural roads in over 200,000 villages (Adukia et al. 2020; Asher, Garg, and Novosad 2020; Asher and Novosad 2020). Our research sought to provide evidence on the impacts of new roads on economic development, educational attainment, and the local environment. We found that the main value of these roads was to connect people to urban areas: while PMGSY roads had small to no effects on business growth, living standards, agricultural practices, and deforestation, they did increase the exit of workers from agriculture via work outside of the village, as well as educational investments when returns to education in nearby urban areas were high.

This body of work relied almost entirely on government data. We merged data from many different government datasets at the village level: program administrative data from the PMGSY management and information system website, demographic data from multiple rounds of the Population Census, employment in businesses from the Economic Census, occupation and assets from the Socioeconomic and Caste Census, estimates of agricultural productivity and deforestation based on data from US government satellites, and educational attainment from the District Information System for Education. Some of these data were easy to obtain and merge, such as the multiple rounds of the Population Census. Others were easy to obtain but took years to link to the rest of the data due to data quality issues like inconsistent location codes and incomplete documentation. The PMGSY program data was technically publicly available at http://omms.nic.in/, yet it was only available as individual pages on specific roads, requiring much time and money to assemble into an analyzable dataset.

The takeaway of this case study is that government data allows for the evaluation of government programs, providing critical evidence to better allocate future resources. This research was only possible because of the Indian Government's commitment to making such data available in some form. However, we spent multiple years and incurred significant expenses to obtain, clean, and link data, work that would not have been necessary had the government taken small steps (described in Section 5) to make these data available and interoperable. Evidence on the effectiveness of a huge number of government programs is currently lacking because data in possession of the government is not for practical purposes being released.

Case Study 4: Improving the Performance of Real Estate Markets

One area where open data has created tremendous economic value is in the real estate sector. Real estate is inherently costly and illiquid; buyers require detailed information about properties before making a purchase. The last decades have seen an explosion of innovative companies that combine private data from multiple listing services (essentially, aggregated lists of properties managed by

multiple brokers) with municipal records of deeds and liens, tax information, and neighborhood characteristics, vastly expanding the information available to buyers and sellers of real estate.

In the US, just two of the most well-known players in the property technology (proptech) space, Zillow and Redfin, have a combined market capitalization of $35 billion. These firms offer data-intensive services such as neighborhood comparisons, housing indices, real estate search, and property valuation (like Zillow's *Zestimate* product). While these firms have since expanded into mortgage lending and real estate investment, among other activities, the core of their offerings and their original purpose centers heavily on the delivery of public data to customers in a streamlined and specific way. Indeed, Zillow originated as a company doing little more than providing customers with complete information about properties they were interested in, most of which was generated by governments and public agencies but not previously combined.

Without easily accessible, high-quality open data, the proptech market would not exist as it does today. Companies such as Zillow leverage a vast array of public data to fulfill their mission: surveys from the Census Bureau, parcel information in county records, economic indicators, imagery of homes, GIS data (such as from the Census Bureau, United States Postal Services, counties, and OpenStreetMap), and administrative boundaries (neighborhood, ZIP code, city, county/Federal Information Processing Standard (FIPS), metro/core-based statistical area (CBSA), state). Furthermore, the proptech sector develops and open-sources additional proprietary data that contributes back to the open data ecosystem (such as Zillow Research datasets[3]) and has also partnered with government data providers[4] to advance open data standards and better align data production and consumption between the public and private sectors.

In short, an entire self-sustaining open data ecosystem has developed around the public data held in municipal and county records, an ecosystem of companies and data that would not exist if these county offices used a restricted-by-default approach to property and property transaction data. The market value of property technology companies depends entirely on a system of open government data. And yet the public benefit gained from the existence of this sector is vastly higher—because consumers capture much of the benefit created by these companies. The United States real estate sector transacts trillions of dollars per year; if property tech companies built on open government data can make this sector even a bit more efficient, then the economic value-added of that open data measures in the hundreds of billions of dollars.

The Indian real estate market is expected to reach a trillion dollars in size by 2030. The network of open government data on property characteristics and transaction history does not exist in India. Many firms such as housing.com and

3. https://www.zillow.com/research/data/.

4. https://www.zillow.com/research/data-advisory-council-announcement-9042/.

Terra Economics and Analytics Lab are already trying to make use of government data in this space, but are constrained by limited access and inconsistent standards. Shifting the government owners of administrative datasets on real estate from a default of restriction to a default of open, clean, and interoperable data could unlock hundreds of billions of dollars in economic value.

Case Study 5: The Many Uses of Remote Sensing Data

The value of proptech companies like Zillow depends on a vast array of upstream public data from a range of sources. In this case study, we examine the downstream value derived from the data products of a single federal agency. The US National Oceanic and Atmospheric Administration (NOAA) is a scientific agency focusing on weather and atmospheric conditions, and serves as a major provider of public environmental data via the National Weather Service and a variety of satellite missions. Diverse users depend daily on NOAA products, from weather warnings to climate, ecosystem, and commercial data and modeling activities.

Many private companies have developed products and services that layer on top of NOAA capacities. The Climate Corporation, which was sold for $1.1 billion in 2013 (Tsotsis 2013), provides data-intensive agricultural consulting and insurance services that depend on and extend NOAA data and forecasts. The United States' $8–10 billion financial market in annual weather derivatives is built in part upon NOAA's data (Rogawski et al. 2016). More generally, nearly the entire US transportation network is dependent on NOAA to some degree, as weather routing for air and marine freight rely extensively on NOAA forecasts to avoid billions of dollars in losses due to weather interruptions (Government of the USA 2011).

Private products built upon NOAA data span many sectors and applications, including weather forecasting (micro-forecasting, domain-specific modeling), agricultural and fisheries planning and operations, intelligence for commodities trading, financial risk management/insurance/re-insurance, emergency forecasting and response, property management, energy, and transport.

While private players are now emerging in the field of meteorological data production, they are unlikely to displace NOAA activities as (i) private data are often complementary to NOAA data products; (ii) NOAA provides a stable baseline and benchmark of data and modeling capacity that are reliably free to use; and (iii) NOAA is trusted to provide impartial and unbiased data and models that are insulated from political pressure and the profit motive. Historically, the private sector has added value to NOAA data and sold that value-add in the private market. Now, private partnerships are evolving from strictly value-add to co-production; for example, Google and NOAA have tied up to leverage Google's computing resources to make climate information "as accessible to the public as using Google Maps to get driving directions" (Rogawski et al. 2016).

As in Case Study 4, the government's initial move toward creating an open data ecosystem has created tremendous private value, embedded both in the

companies that use these data and the customers who buy their products. These companies have, in turn, created new open data products which could have further downstream effects.

As these case studies make clear, there is an enormous range of different applications for data that government generates. In the next section, we develop a theory of the optimal role of government in the production, dissemination, and analysis of such data.

3. The Role of Government in Building an Open Data Ecosystem

In this section, we discuss the roles that governments can and should play in facilitating a data ecosystem that maximizes benefits to society, which has many creators and users of data other than the government, including citizens, the media, civil society, and the private sector. We argue that governments have a comparative advantage and essential role in some aspects of the data pipeline, but should take a back seat and work primarily as facilitators of socially beneficial activities in other areas.

We begin by presenting a framework guiding the optimal use of limited government resources. We show that data on citizen activities like that routinely collected by the government has many characteristics in common with classical public goods in economics; there is thus a strong rationale for governments to play a key role as a data creator. However, there are many civil society and private sector actors capable of data analysis, and the analysis and dissemination of insights have fewer positive externalities, so there is less of a role for government to prevent other actors from playing a role in these domains.

Throughout this section, we consider a data production and analysis pipeline, as depicted in Figure 1. In order, data is (i) collected; (ii) cleaned and validated; (iii) analyzed; and finally, (iv) real-world decisions can be made on the basis of that analysis.[5] Each step of the pipeline can be undertaken by the same actor; alternatively, data can be transferred between actors at any stage. Government, NGOs, the private sector, and citizens can all engage in any step of the pipeline, provided they can access outputs from the prior step. Data and analysis at any stage can be kept private or can be made open; making data open would allow

FIGURE 1. The Data Production Pipeline

Source: Authors' illustration.

5. The data production and analysis pipeline discussed throughout this section was developed based on the framework laid out in Figure 0.1 in the *World Development Report: Data for Better Lives* (World Bank 2021).

all actors to use data outputs in downstream stages of the pipeline. We examine how actors would behave in a free market, and the optimal role for government.

3.1. Non-rival and Non-excludable Goods, and the Rationale for Government Action

Economists define two categories of goods in whose production there may be a particular rationale for government involvement: non-rival and non-excludable goods.

3.1.1. Non-rival Goods and the Data Pipeline

Non-rival goods are goods where one individual's consumption does not prevent another individual from consuming it. Free markets will often produce non-rival goods without intervention, but their prices are likely to be higher than socially optimal prices. For instance, software and recorded music are both non-rival, and both are produced by vibrant private industries.

However, markets in non-rival goods are characterized by the same distortions as other high fixed cost and low marginal cost markets—indeed for non-rival goods, the marginal cost of production is zero. The distortion arises because firms need to charge positive (and thus inefficient) prices to recoup their fixed costs.

Governments that produce non-rival goods will optimally charge lower prices than the private sector, expanding consumer surplus from those goods. This is the rationale behind various government policies, such as public disclosure of patent contents and patent buyouts (Kremer 1998), both of which recognize that innovative ideas have an optimal price of zero. In a similar vein, the United States National Institutes of Health mandate that any research that they fund must be made open access; research findings are non-rival, and thus social value is maximized when the price of viewing those research findings is set to zero. In contrast, a private publisher of research (such as Elsevier) sets a high price for access to research findings, which is socially suboptimal given the non-rival nature of that research.

Every output of the data production pipeline in Figure 1 is non-rival. Raw data, clean data, and information about the world in the form of data analysis are all non-rival—their use by one party does not preclude others from using them. In fact, the more individuals using a given data source, the greater the value to the others using it, as errors are detected, and insights discovered. However, private producers of data are likely to charge sub-optimally high prices for data access to recoup their costs of production. The end result is that researchers at well-financed universities in wealthy countries often have better access to Indian data than researchers in India.

3.1.2. Non-excludable Goods and the Data Pipeline

Non-excludable goods are goods where it is impossible to exclude non-payers from deriving benefits from those goods. For instance, clean outdoor air and

national defense are classic non-excludable goods; if the goods are produced, individuals cannot be prevented from benefiting from them, even if they do not want to pay for them.

Non-excludable goods will be under-produced by a private market, because customers who can derive the benefits of the goods for free will not pay for them. Economic theory thus suggests a clear rationale for government participation in goods production: when non-excludable goods have significant social value, they should be produced by the government. Indeed, governments are the primary producers of many famous examples of non-excludable goods, like national defense, clean air, and water (produced by government through regulatory actions), large fireworks celebrations, and lighthouses.

The intermediate and final outputs of the data production pipeline are best characterized as partially excludable (Ostrom and Ostrom 1977). Each output is, in principle, excludable, but once a data output is in the public domain, it is difficult to prevent it from being shared further. There is nevertheless an active market in the production and sale of data and analytic outputs, especially in the domain of real-time data, where the eventual escape to the open is less important to a producing firm's bottom line.

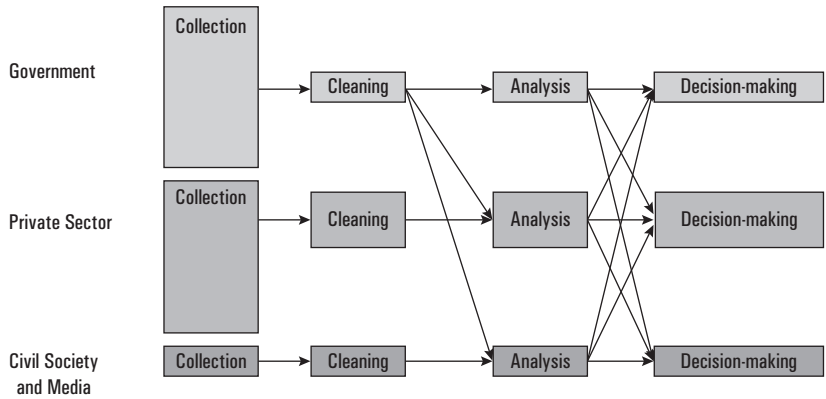
3.2. The Economics of Data Production, Dissemination, and Analysis

Social and economic data is non-rival and only partially excludable. It will, therefore, be underprovided and overpriced by the free market, justifying government participation in the data pipeline. Government participation in the production of socio-economic data is further justified by the tremendous fixed costs of generating survey data. Sample surveys and especially censuses are extremely expensive; they involve the hiring, training, and supervision of hundreds of thousands of enumerators. Few private firms are willing to engage in such costly activities in order to produce partially excludable goods.

Figure 2 provides a depiction of each sector's participation in each stage of the data collection pipeline as it currently operates. The size of the boxes indicates the size of each sector at each stage of the pipeline. Private firms, media, and civil society all engage in data collection to one degree or another. Government engages in a tremendous amount of passive data collection just through the operations of its programs. Participants in MGNREGS create an automatic stream of data on government servers; the cost of independently tracking payments and public infrastructure constructed under MGNREGS would be huge, but government obtains this data at no cost, as an incidental side effect of providing services. Across the combination of government schemes, there is an incredible multidimensional flow of information.

The private sector also collects a large amount of data passively and actively; we focus on government data in this paper for three reasons. First, it is more representative than private-sector data since government interacts in some form

FIGURE 2. The Current Role of Government, Private Sector, and Civil Society in Data Production and Analysis



Source: Authors' illustration.

Note: Currently, government passively collects far more data than it is able to analyze and use due to its limited capacity. Rich analytical findings are buried in that data, and private sector and civil society have the capability of analyzing that data, but they are not able to access it.

with nearly all its citizens. Second, government data pertains directly to the operations of public programs, which are in the public interest. Third, government data is owned by the public, so the public has a clear claim to access.

As depicted in Figure 2, at present only a tiny subset of government data is used by any sector in society. Government largely only releases data that it has used for its own analysis, and it does not have the capacity to clean and analyze a majority of the data that it collects. In contrast, the private sector, civil society, and media often collect data with the explicit purpose of guiding decisions, and thus they use a larger share of the data that they collect.

As shown by the arrows in Figure 2, there is significant sharing of intermediate outputs in the data pipeline, especially further downstream. Analytic outputs are widely shared between the different actors; private sector actors use government reports as information sources, and vice versa. Private actors also frequently use data created by the government (such as the NSS or ASI), and conduct their own analyses with them.

The economic framework presented above makes it clear why the majority of data created and analyzed by private firms is retained internally: to the extent that information and analytic results can be treated as excludable goods, they will not be shared, and to the extent that they are non-excludable, they will not be produced.

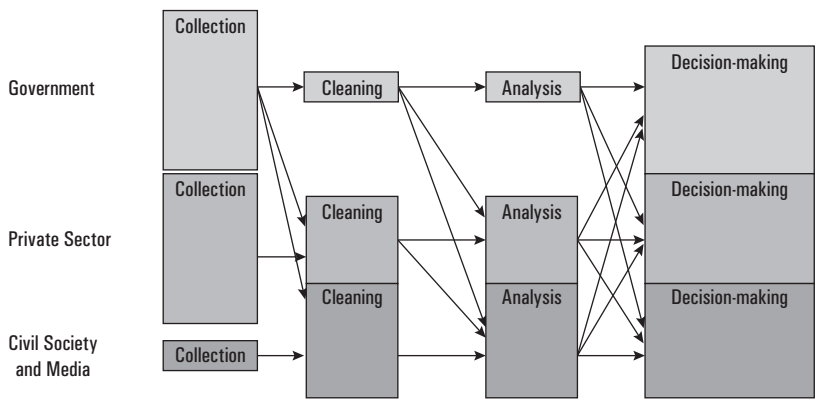
Government data, in practice, is also largely excluded from use outside government, but there is little economic rationale for this exclusion. Specifically, the vast majority of administrative data collected by government sits on servers and is never analyzed or disseminated, or is disseminated in a form that is unusable

as data. There are, of course, valid reasons to restrict access, such as for public safety or privacy, but much of the data that the government generates is not actually sensitive. Excluding potential users vastly reduces the social value that the data can generate.

There is little reason for government to sit on a vast non-rival and non-excludable good for which the price has already been paid. As we highlighted in Section 2, tremendous social value can be unlocked by freeing that data, in myriad forms that are difficult to predict. However, it is important to release that data early in the data production pipeline. A majority of the government data never even makes it to the validation and cleaning stage; treating dissemination as something that only happens after that stage ensures that a majority of the government data will never be used.

An alternate data pipeline is presented in Figure 3. This figure represents a world where government recognizes the right to information as a right to data, and non-sensitive government data is made open access by default. In this world, civil society, media, and the private sector all benefit from the mass of passively collected administrative data. They can clean and validate government data (as the ADR has done with politician affidavit information, Section 2) and use it for their own analysis. Those analyses can then feed back into the government policy function, allowing governments to make better decisions on the basis of analysis that it is not capable of being conducted in-house (as in the case of the health worker attendance dashboards described in Section 2).

FIGURE 3. Enhanced Access to Data and Analysis for Decision-making when Government Data is Opened Early in the Pipeline



Source: Authors' illustration.

Note: If government disseminates data early in the pipeline, taking care only to document and aggregate it to a level that preserves anonymity, the private sector and civil society can clean and analyze core components of that data, and use it to improve their decision-making. Analyses produced by civil society and the private sector can even be used by government, allowing government to make better decisions on the basis of its own data that it does not have the internal capacity to analyze. Decision-making in all sectors improves substantially when government data are made open early in the data pipeline.

India has a world-class technology sector, a large and sophisticated research community, a free press, and an active non-government sector ready to contribute to India's development through the use of data. Private firms stand ready to invest in new data-intensive business activities as soon as data become available, creating jobs and often using that data to increase the efficiency of markets. Other applications will hold government accountable or generate evidence that can lead to improved policies. Government undoubtedly wants to maintain its own analytic capabilities, but the non-rivalrous feature of data means that in-house analysis will not be hurt by others' using the data, and will likely be supported by having skilled analysts in the private sector and civil society working with the same data.

Maximizing social welfare in a context of non-rival and semi-excludable goods under control of the government dictates that those goods should be made non-excludable as early in the pipeline as possible. In practice, some government investments will need to be made to create usable data sources and APIs, and to aggregate data appropriately to preserve privacy. But government already invests in data portals for many forms of administrative data, though these are often unsuited for disseminating data in aggregate. The marginal cost of putting data in a form that is far more beneficial to the public is low. Section 5 discusses what it actually means to bring the cost to data end users as close to zero as possible. But first in Section 4, we address the issue of data quality.

4. Data Quality

A common mantra in computer science is *garbage in, garbage out*: any data-based analysis and decisions are only as good as the underlying data themselves. Concerns about the validity of both administrative and survey data produced by governments are widespread (Jerven 2013). In India, questions have been raised about the quality of core datasets, including the Population Census (Gill 2007), the Economic Census (Unni and Raveendran 2006), and administrative data from PMGSY (Lehne et al. 2018). These concerns focus heavily on the accuracy of public data—whether reported measures correctly reflect reality on the ground, or else have intentional or unintentional errors.

Data quality encompasses much more than whether the values in the data are correct, even if data errors draw the most attention; Table 1 highlights one categorization of the key dimensions of data quality, based on the 2021 World Development Report (World Bank 2021) and the United Kingdom Government Data Quality Framework (Government of the UK 2020). Quality can be described more expansively as the extent to which the data meets the objectives of its potential users (Redman 2008).

There is no question that the quality of much government data is suboptimal in several of these dimensions. While this paper focuses on the benefits of increased

TABLE 1. Data Quality Dimensions and Explanations

Dimension	*Explanation*
Granularity	Does the data contain maximally specific geographic and temporal resolution? For example, are dates and years of collection recorded? How granularly are locations identified?
Accuracy	Do the values in given fields correctly describe the real-world phenomenon being measured?
Completeness	Does the dataset include the data that are required or expected? Does incompleteness in the sample or in missing values introduce bias?
Uniqueness	Is the unit of observation (such as a village, person, or firm) clearly defined and measured only once, or is there duplication?
Consistency	Do collected data agree with each other when they should, in both values and terminology?
Timeliness	Are the data up to date? Is there a lag between data collection and publication?
Validity	Are data values in the correct format? Are expenditure variables numeric and birth dates in a valid date format?

Source: Authors' compilation based on World Bank (2021); Government of the UK (2020).

dissemination of government data, these benefits are complementary to improvements in data quality. In this section, we make three key points that pertain to data quality: (i) there is substantial low-hanging fruit to improving data quality if only its value is recognized, and (ii) transparency and openness are likely to improve data quality in the long run, by drawing attention to errors and holding data creators accountable. Most of this section deals with administrative data, as quality concerns in India's major sample surveys and their remedies have been widely discussed elsewhere.

4.1. Low-hanging Fruit for Improving the Quality of Government Data

The key ingredient to improving data quality is demanding adherence to a quality standard. There is no need to reinvent the wheel—many excellent data quality standards exist, both in and out of India. The United States government's General Services Administration (GSA) issues Data Quality Guidelines to "assure the quality of its information products, including their utility, objectivity, integrity, transparency and reproducibility prior to disseminating information to the public" (Government of the USA 2019). At the core of the GSA's guidelines is the importance of: (i) following best practices in data collection and processing and (ii) requiring replicability of the data. The *JPAL Handbook*[6] on using administrative data describes how to deploy data quality checks when aggregating, coarsening, or removing personally identifying information from the data (Cole et al. 2020). Many standards and frameworks have been written to encourage data quality as part of the Digital India umbrella program and the push towards e-Governance,

6. https://admindatahandbook.mit.edu/print/v1.0/handbook_print.pdf.

which contain language echoing many of the priorities of and problems identified in this paper (Government of India 2020a).

What is lacking is implementation. Standards are fragmented across agencies or not implemented at all, and data products delivered to the public do not reflect the aspirations identified in the standards.

Table 2 highlights some low-hanging fruit—ideas that are relatively easy to integrate into current data collection and dissemination practices. Many of these, like standard metadata templates or standardized location schema, simplify the process of collecting and disseminating data and contribute to interoperability across all government data—defined for this context as the ability of datasets to be linked together without loss of information.

These small efforts can yield large rewards. Consider the example of database location schema. With over 600,000 villages, 8,000 towns, and 700 districts in India, data users do not have the capacity to comprehensively correct errors in location names. When the same district is listed as "Kadapa," "Y.S.R.," and "Cuddapah" in different datasets (or in the same datasets), it creates substantial frictions and errors in analysis.

For a second example, consider how health clinics are characterized by two of the flagship data collection operations of the Indian Government: the Economic Census and the Population Census. The Economic Census characterizes firms according to the National Industrial Classification (NIC), and thus classifies

TABLE 2. Some Low-hanging Fruit for a Data Quality Standard

Quality Standard Element	*Description*
Standardized schema (such as location identifiers)	For example, geographic identifiers (village and town names and ID codes) should be systematically based on the most recent Population Census and reference those codes. Late into Census periods, alternate sampling frames (such as Local Government Directory) should be standardized and used across all ministries.
Standardized variable definitions	Unify variable specifications across all producers as appropriate. For example, industrial codes, land cover classification types, binary values for yes/no variables.
Metadata standards	Metadata for administrative data should be as detailed as it is for survey data. A standard metadata template can serve as a guideline for both dataset-level fields (such as data producer and owner, sampling methodology, spatial and temporal coverage) and variable-level fields (such as variable type, encoding, construction notes, questionnaire, and enumerator instructions).
Routine validation checks	Automated tests that catch common data errors. For example, negative incomes or years of education should raise red flags. If personally identifiable information is being stripped from medical records to ensure anonymity, the total population count should remain the same before and after anonymization. Or if household incomes are aggregated to the village level, then district-wise and State-wise totals and mean incomes should remain constant before and after aggregation.

Source: Authors' compilation.

health clinics and hospitals under industry codes 86 and 87 (NIC-2008), and records their size (in terms of the number of employees) and public or private ownership. The Population Census records a range of different clinic types, such as primary health center and maternal and child welfare center, but does not record ownership. In practice, the inconsistency makes it difficult to use these datasets to assess the need for additional health infrastructure; clearer documentation on definition classifications for either of these datasets would make this task much easier. Indeed, many government departments have resorted to creating redundant GIS systems recording data like these, such as the National Rural Roads Development Agency, which recently released its own inventory of public services in a new data platform.

None of the ideas in Table 2 are difficult to implement, but they demand a paradigm shift in the creation of administrative datasets. These datasets normally originate from software designed to track the delivery of government services internally; the data that is created is a side effect rather than a central objective. As a result, the standards in Table 2 may not even be on the radar of the ministries generating the data. Designers of data collection platforms need to understand that they are incidentally producing valuable information in the form of data, and these low-hanging fruit can increase that value substantially.

India's large-scale sample datasets like the NSS and ASI are released with end-users in mind and thus obey many more quality standards. However, they remain imperfect in terms of standardized schema and interoperability, and there is no single metadata standard across the different flagship operations. However, this is an area where standards have improved substantially when compared with old survey rounds.

4.2. Quality Concerns, Open Data, and Transparency

Open access government data is obviously of greater value when the data is of higher quality. What is less obvious is that opening access to government data is likely to directly improve the quality of that data as well, through two channels. First, data users will have the ability to identify errors; in the best case, this will allow for those errors to be studied and corrected. In the second best case, other users will at least be aware of the errors and able to adjust their analyses for them. Second, transparency creates accountability; if the operators of administrative data-producing systems know that their output will be scrutinized, they will have greater incentive to put more effort into their work and apply some of the quality standards mentioned above.

There is admittedly some risk that data fabrication could increase as data is scrutinized more closely, for instance, to hide the fact that a government program is underperforming. However, this risk is likely to be inflated. First, it is very difficult to fabricate data in a credible fashion—it will be inconsistent with secondary measures of the same real-world values, or it will leave a trail of fabrication that can be detected by data analysts in the public. Fabrication is unlikely to succeed

and, in fact, the incentives for fabrication are likely to fall as the probability of being detected increases.

More importantly, administrative data are already used in the implementation of programs; entries in administrative datasets determine who will get paid under MGNREGS, which firms will receive government contracts, and which households will be eligible for income support. Errors in these data have real consequences for recipients of government programs, and bringing these data to light for the errors to be detected is likely to have substantial social value.

Data quality is not only an input into an open data system, but also a critical outcome. Opening data to use and scrutiny creates a feedback loop that corrects mistakes, improving trust and quality as more users provide more inputs into the system. Data originators in government should not conceal low-quality data behind firewalls, but rather open them with the admission and objective that they can be improved.

In their report on open data,[7] the Omidyar Network argues that open data should be considered critical infrastructure (Verhulst and Young 2016). The first step in doing so is bringing data originators on board with the value of what they are producing (even if the production is incidental), such that they recognize the value of adhering to a quality standard.

5. Effective Data Dissemination

This section discusses the "final mile" of data production: taking data that has been collected, and effectively delivering it to policymakers, researchers, journalists, businesses, and other potential users. Establishing high-quality data production systems requires massive public investments—investments that the Indian Government has in large part already been making. Running large-scale surveys, tracking data from government programs, and building the infrastructure to store incoming data is costly and complex. However, once collected, too much government data is hosted in silos across a fragmented ecosystem of websites, locked behind log-ins, hidden in convoluted catalogues, buried in cumbersome dashboards, or displayed in non-machine-readable formats. Accessing government data is still costly—either monetarily, or through time and technical capacity. This need not be the case. Effectively delivering data (with appropriate privacy safeguards) to a wide range of potential users costs very little when compared with the already paid costs of collection and the returns to better dissemination.

Consider the 2013 Economic Census as an example. Between January 2013 and April 2014, 1.17 million enumerators surveyed all 58.5 million establishments in India, covering every State and Union Territory in the country. The massive effort allowed the government to gather crucial data on businesses and

7. https://odimpact.org/files/open-data-impact-key-findings.pdf.

employment that greatly informs decision-makers in the public and private sectors. Commendably, the Ministry of Statistics and Programme Implementation (MoSPI) has changed its policies to make Economic Census microdata available for anyone to download—in earlier censuses, data needed to be purchased. However, the data files are stored in the obscure .nesstar format, which requires specialized technical knowledge to open. An average user or web application cannot access the data inside without considerable time, energy, and technical skill. The location identifiers can be linked to the 2011 Population Census, but only indirectly and there is no clear documentation for doing so. A huge investment in data collection was made, and the data was even made available for public download—the Economic Census is among the most open data releases of the Indian Government. But access to end-users remains limited because of insufficient last-mile investments. Most other administrative data platforms in India fare far worse on this dimension.

5.1. Delivery Principles

The goal of data dissemination is straightforward: data should be as easily used as possible. In India, dissemination is a key bottleneck between data collection and use. For the widest possible range of users to be able to leverage data at the lowest cost, dissemination must meet three standards: frictionless access, appropriate delivery, and conceptual clarity.

5.1.1. Frictionless Access

Frictionless access means that users can find and view data of interest with minimal time or monetary cost. Given the near-zero marginal cost of delivering electronic data, the optimal access cost for government data is zero. Restricting access through pricing, approval processes, or location requirements limits the potential applications that could be developed downstream from government data.

Data access is also constrained by search costs. This remains a thorny problem because similar fields can be found in different datasets with different levels of geographic granularity or population subgroup disaggregation. For example, a user interested in employment data may not be aware that firm-level employment data is reported by the Economic Census while State-level employment rates can be generated from the Periodic Labor Force Survey. In principle, search engines can lower search costs, but they often fail to deliver (see Section 6.2), depending on indexed data with clear metadata standards and consistent documentation, which may not exist for many datasets.

5.1.2. Appropriate Delivery

Appropriate delivery implies that the right data are served in the right format for the widest possible range of users. There is enormous variety in the format of data that users may request: government decision-makers will likely require high-level summary dashboards, researchers need direct access to machine-readable

data, and web applications require data to be served via Application Program Interface (API). Ideally, government data are sufficiently standardized such that they be format-agnostic, delivering data in all these formats as needed, providing access to users from a range of technical backgrounds.

APIs have become the standard mechanism for transmitting data across web applications and users. With APIs, organizations can build applications that add analytical or visualization layers on top of government data and have it updated in real time, or even develop complex commercial products that depend on public data. Data delivery by API is a universal standard for technical accessibility. Additional formats are useful if they match user interest but should not detract from the primary focus of delivering the raw data in a standardized, accessible manner.

Many government data delivery systems invest considerable time and effort in displaying simplified data through single observation access, dashboards, or visualizations. Accessing a single observation may be appropriate for some users, but is highly inadequate as a primary means of accessing government data; it essentially makes datasets near-impossible to assemble without building wasteful data scraping machinery.

Visualizations are helpful for data communication, but they are not the best way to serve raw data. Visualizations require selections, filters, and explicit choices about which data to display. While a chart or graph only has two or three axes, datasets have dozens, if not hundreds, of variables that a user may want to explore. Serving data strictly through dashboard visualizations is tantamount to effectively restricting access to the vast majority of potential uses of that data. In contrast, allowing users to directly access raw data unleashes applications beyond what any data originator could envision.

5.1.3. Conceptual Clarity

Conceptual clarity implies that the contents of government data are easy to understand. If a user does not understand a dataset and all the variables it contains, then that dataset is inaccessible and cannot be used effectively. Conceptual clarity is improved when all datasets are accompanied by metadata that describes when, where, and how the data was collected, and how exactly each variable is defined. Metadata is most effective when it is clear, concise, and presented in an expected format, so a user is immediately presented with the most important information. To that end, creating standardized, structured tables with mandatory fields for every metadata file ensures that the information a user will require in order to understand the contents of a dataset is present and reported consistently across data files. A metadata standard in government would vastly increase interoperability between different government datasets.

Finally, transparency around the entire data delivery pipeline is desirable. Government survey data include detailed manuals explaining sampling strategy, questions used by enumerators, protocols for non-respondents and enumerator instruction manuals. This level of documentation should be just as important for administrative data, but is often lacking, at least in part because the data is

gathered incidentally and released as an afterthought. But in many cases, these same enumerator manuals exist and are just not published. Documentation for the data preparation and aggregation process may not currently exist for administrative data, but documenting these steps is a best practice which would improve both usability and reduce data errors.

5.2. Safeguards

When discussing data delivery, it is important to consider the reasons why data are often not made available by government. Many of these reasons are not justifiable, such as the fear of exposing program implementation problems to public scrutiny or a lack of vision about how the data could be used by those outside of government. But some of these reasons are valid and should be considered carefully—the most important of these is the concern for privacy. Researchers and businesses are always interested in using the most disaggregated microdata available, as it allows for the richest analysis, but this can risk exposing Personally Identifiable Information (PII) that could be used for harm. The value of insights that can be gleaned from granular data is high, but is always secondary to government's legal and ethical responsibility to protect individuals' rights to privacy, as upheld by the Supreme Court of India in 2017.

There are several well-established techniques to handle privacy concerns. PII can be carefully scrubbed from the data, ensuring that individual records cannot be linked to any identifying information. Data can also be aggregated to higher geographic units, such as shifting from individual records to summaries of neighborhoods, towns, or villages; releasing data aggregated to town and urban neighborhood level poses little risk. If geographic aggregation is not appropriate, data can be pooled across other dimensions or otherwise transformed to mask the identities of individuals or firms—this was recently done to great effect by Chetty et al. (2020) as they developed data resources out of PII to track the post-COVID economic recovery in the United States.

In cases where there is high value to making PII available in government data, secure data centers are a standard solution, allowing permitted researchers selective access to complete data. Proposals for such use need to be solicited and vetted to ensure that such data is being used purely for research purposes that serve the public interest. Governments can also elect to allow for the release of complete data including PII after a certain amount of time has elapsed. The United States Census Bureau releases all records 72 years after collection.

5.3. The SHRUG Open Data Platform

At Development Data Lab, one of our primary goals has been to make Indian data more accessible. Two key platforms for this work have been the Socioeconomic High-resolution Rural-Urban Geographic Platform for India[8] (SHRUG; see

8. https://devdatalab.org/shrug.

Asher et al. 2021) and the DDL COVID-19 India platform, following many of the principles outlined in this paper. The SHRUG currently stitches together 30+ years of socioeconomic data on the universe of individuals and firms in India, with records from censuses, data exhaust from administrative programs, and remotely-sensed measures of crop productivity, economic activity, and poverty. Geocoded to the village and town, this dataset allows researchers, activists, and policymakers to understand the economics, demographics, and public services of every village, town, and legislative constituency over the period 1990–2018. The SHRUG has been downloaded over 10,000 times and is used by all segments of society. The DDL COVID-19 India platform is a series of district-level aggregates put together to provide information for policymaking around responding to COVID-19, and is described in more detail in Section 7, following similar principles to the SHRUG.

In order to maximize *frictionless access*, we freely released SHRUG data under an Open Data Commons Open Database License (ODbL), ensuring that each dataset is catalogued with both high-level and detailed descriptions, and that all data were accompanied with extensive codebooks containing information on all platform contents. While limited resources have delayed our ability to develop and maintain APIs, *appropriate delivery* is facilitated by serving bulk microdata downloads in multiple formats (CSV and Stata), and via a mapping platform for easy visualization as an add-on to downloadable data but not a substitute. We target *conceptual clarity* by using a machine-readable metadata standard, ensuring that the same information is represented for each dataset. The codebook further explains every variable, the data collection process, and errors and concerns with the data.

The process of constructing the SHRUG involved ten years of work identifying, collecting, cleaning, and linking data across a range of government sources. Much of this work involved backing out location identifiers which were available to data originators but were not included with the data (for instance, when datasets were based on a recent Population Census but included village names rather than village codes). The requirement to put in this kind of work to obtain usable data is, in practice, a major barrier to access. We have processed and included data from dozens of government datasets and schemes, but there are hundreds more that we have not had time or funding to integrate. There is no reason that the Indian Government cannot deliver its data in a fully interoperable format, eliminating the need for this additional effort.

6. Assessing India's Government Data Status Quo

This section evaluates the current state of government data in India. Enormous progress has been made in the computerization of government data, and impressive efforts have been made to make data available through a range of both program-specific portals and sites that aggregate data from a variety of sources.

Yet despite these gains and the existence of multiple policies committing the government to opening its data, much administrative data continues to be under restricted access. Further, the subset of government data available in the public domain is often delivered in a way that prevents widespread use. Nearly a decade ago, the National Data Sharing and Accessibility Policy (NDSAP) of 2012 committed the government to the principles of open access, searchability, machine readability, documentation, interoperability, and quality to all non-personal, non-sensitive data produced using public funds. However, government datasets rarely live up to all of these principles.

Fortunately, given the strong foundation of digitization of government and efforts made to encourage availability and a mindset of public ownership of data, the path to realize this paper's vision is largely restricted to comparatively low-cost issues of last mile delivery. The remainder of this section describes and applauds the Indian Government's commendable efforts toward digital data production, and outlines the critical missing investments in delivery that can fully capture the potential returns of open government data.

6.1. Strong Fundamentals: Digitization and e-Governance across Center and State

The Government of India has made extraordinary strides not only in moving from paper to computers, but also in the development of a modern vision of digital service delivery. This vision has evolved over the years, from isolated computerization efforts and localized digitization initiatives in the late twentieth century to the expansive whole-of-government Digital India flagship program of today. One of the three core vision areas of Digital India is "governance and services on demand," which has been supported by the National e-Governance Plan (2006) calling for the digitization of governance across multiple domains ranging from agriculture to justice, and its replacement, the e-Kranti program (2015), which strategizes and advocates for the electronic delivery of public services. The language in these foundational documents illustrates a deep recognition of the need for data that is interoperable and integrated, publicly-owned, safeguarded, and easily accessed.

Digitizing administrative data is the first essential step to open government data. The Government of India has made significant progress toward digitizing data collection; registration of crop pesticides, State-wise details of active taxpayers, water and air quality monitoring, voter registration, motor vehicle registration, and the tracking of cases filed across district courts are some of the many processes that have been computerized. For example, the Ministry of Finance has implemented complex and extensive digitization projects such as setting up a Tax Identification Number (TIN) for Income Tax applications, Indian Customs Electronic Data Interchange (ICES), and Automation of Central Excise and Service Tax (ACES). More generally, the Ministry of Electronics

and Information Technology (MeitY) is actively pursuing public-private partnerships under Digital India to modernize data collection and governance. The government has also announced that the upcoming Population Census will move away from the traditional paper-based survey to digital data collection, much like the United States' transition to a digital census for the first time in 2020. Further, digital Management Information Systems (MIS) have been set up for a range of national welfare programs and schemes such as MGNREGS, Pradhan Mantri Fasal Bima Yojana (crop insurance), direct benefit transfers, export promotion schemes, PMJAY-Ayushman Bharat, National Urban Livelihoods Mission, electrification schemes, PMGSY, and so on.

As a result of these significant and commendable ongoing investments, the volume of administrative data generated by all levels of government in India has increased enormously in the past decade. However, much of this valuable administrative data remains locked behind dashboards and user log-ins, is not made available in an appropriate manner, and lacks the necessary documentation and metadata required for use. These remaining barriers mean that the potential value of these hard-won digital resources is not being fully realized.

6.2. Poor Delivery: Missing Last Mile Investments that Deter Use of Open Data

As described previously, three standards are required to be met for the greatest value to be delivered to the largest possible set of users: frictionless access, appropriate delivery, and conceptual clarity.

6.2.1. Frictionless Access

Restricted portals. The District Development Coordination and Monitoring Committees (DISHA) dashboard, built by the government in partnership with a civil society organization, was a promising effort to harmonize disparate government data but still falls short. The platform was intended to harmonize data from 42 national government schemes (such as MGNREGS) in a fully structured interoperable dataset with maximum geographical and temporal disaggregation. The real-time scheme data hosted on the platform can be interrogated at the Gram Panchayat level and is supplemented by interactive visualizations. Unfortunately, despite the fact that it does not contain sensitive data, access to the platform is limited to government officials, so the technical success of DISHA is limited, and the potential value among firms, software developers, think-tanks, researchers, and private citizens is unrealized.

High search costs. While most government data is locked in restricted access portals, the narrow sliver of data that is published on the public domain is difficult to use because of high search costs and extremely variable documentation standards. The aim of data.gov.in, the flagship national Open Government Data (OGD) Platform for India, was to create a public intent data lake where users can freely access data to explore, test, or power detailed analysis. It is an extensive

repository of structured and unstructured datasets. In the absence of high-quality search and consistent documentation on the variables contained within each dataset, it is difficult to find relevant data. As one expert we interviewed put it, "One can occasionally come across a very useful dataset on the portal, but this happens mostly by chance."

6.2.2. Appropriate Delivery

Few APIs. The Government of India has demonstrated an inclination toward API access for non-sensitive publicly available data, but APIs still need to be built across all publicly available datasets at narrow geographical units. Currently, this directive is not consistently met, even for data that are open. The OGD platform offers APIs only for a subset of databases hosted, and the usability and capacity of the APIs is lacking. While the ongoing India Urban Data Exchange initiative prioritizes open APIs and good documentation for every dataset, the platform has limited scope and coverage.

Excess aggregation. In many domains, it is impossible to find geographically disaggregated data in the public domain. Most datasets hosted on major public data platforms—such as OGD, National Data Archive, Census digital library—host data at the state and, in rare instances, district level. Data aggregated to States masks substantial heterogeneity and has limited potential for innovative reuse. Disaggregated data is accessible through select digital portals, such as the MGNREGA public data portal, but this should be the standard for all government schemes. Platforms such as E-courts allow users to download unit-level (case level) data, but the data is difficult to process and devoid of any documentation.

Lack of interoperability. The ability to link distinct datasets and analyze them together unlocks extraordinary value, but is rarely a feature of India's current publicly available data. Multiple strategy documents suggest that many within the government understand its importance (Government of India 2018; the National Data Sharing and Accessibility Policy [NSDAP 2012]).[9] Further, an interoperability framework for e-governance was developed and published by the Ministry of Electronics and Information Technology in 2015 (Government of India 2015). However, in practice, datasets on the OGD platform are very difficult to combine because of inconsistent units, definitions, and standards (geographic, industry names, and so on). Often, data products generated even within the same department are not interoperable.

Inadequate safeguards. In the absence of clear safeguards for privacy, data is neither open nor secure in the Indian context. In the status quo, on the one hand, non-sensitive microdata is arbitrarily held from the public domain. On the other hand, individual level sensitive data are often available in the public domain on a discretionary basis. In some cases, substantial personally identifiable information

9. https://smartnet.niua.org/content/2bac29b3-ffbd-45df-a219-91c07b343dbd.

is accessible in the public domain without any checks or safeguards, such as in electoral rolls and MGNREGS beneficiary details.

6.2.3. Conceptual Clarity

Insufficient metadata. Without descriptions and instructions for a dataset at the variable and dataset levels, it is nearly impossible for a user to successfully interpret and deploy the information that has been collected. This includes both higher-level descriptions of the mechanisms and choices applied during data collection as well as specifications of variable construction, type, encodings, and other essential information. The absence of clear metadata for many administrative datasets is likely to lead to analytical errors and misinterpretation. In the Indian administrative data context, metadata is rarely available, and does not follow a consistent standard across data sources.

Transparency. It is almost unheard of for administrative datasets to have clear and detailed documentation describing the data collection and aggregation process, and possible sources of errors. As these data are increasingly used for decision-making, it is important to demand greater documentation of all these steps.

A comparison between the national open data platforms of India and the UK makes clear that while the OGD platform should be commended for the quantity of data that it makes publicly available at zero charge, the quality of both the data and the delivery system can be much improved.

The absence of final mile investments in delivery prevents the latent value of the enormous quantities of administrative data generated by the Indian Government from being harnessed by researchers, civil society, firms, and other government departments. However, several steps in the right direction are underway to address the delivery deficiencies outlined above. For instance, The National Data Analytics Platform (NDAP) is an initiative under development at NITI Aayog seeking to standardize and centralize access to public data (Government of India 2020b). NDAP aims to harmonize data from across all sectors and ministries in the Indian Government and re-host them in a standardized, well-documented manner that will allow free access to users. NDAP will be designed to allow users to access and download data alongside comprehensive and standardized metadata from multiple sectors—health, agriculture, education—in one place, linked together using a common data model. Critically, all data will have consistent geographic identifiers, allowing for the joint analysis of data coming from disparate sources.

Some states have already established effective open data platforms, such as the Government of Telangana open data portal. It is searchable, up to date, well documented, provides API access, and adheres to the principle of maximal disaggregation. The Chief Minister real-time dashboards developed for multiple states are similarly useful, but quality standards vary by state and the backend data is not available for bulk download at the village or town level. Inconsistent

quality and the inability to download data in their original format prevent these data from feeding any analysis or application at scale. However, the success of digitized governance at the sub-national (state, urban local body) level through a government partnership with the E-gov Foundation has made impressive progress, which needs to be followed through with a clear commitment to opening the data.

6.3. Concrete Steps towards Realizing the Potential of Open Data in India

This subsection sketches a few concrete steps that would make major progress towards truly open government data. The core principle is that data should be *open by default* unless there is a justifiable reason for restricted access, and that restricted access can be both safe and much better than no access.

First, all data not referring to individuals should be automatically open at a zero nominal and real cost. This would entail open access APIs at the microdata level, as opposed to geographically aggregated data. Non-sensitive and non-confidential data collected by any public authority must be hosted on an easy to navigate platform with clear standards for documentation and interoperability.

Second, all data deemed sensitive should still be released in an aggregated form at the minimal geographic level that prevents the potential for harm. For population and asset ownership data collected in the Population Census, this is likely to be the enumeration block, which would allow for systematic access to neighborhood-level data for the first time in Indian history. Other datasets, such as health insurance claims through PMJAY, may only be collected with village/town identifiers and thus should be released at that level. The protection of marginalized communities may argue in favor of releasing religious or caste data at lower resolutions, but the point here is that there is always a level of aggregation that prevents harm and delivers valuable data to potential users.

Finally, where appropriate, personally identifiable data should still be made available to researchers and policymakers at minimal cost and minimal hassle through standardized and secure procedures following global best practices (for example, anonymization, secure environment, remote access on a controlled server for analysis). There is no need for India to reinvent the wheel on restricting access to sensitive data. For instance, in Japan, under the recent Act on the Protection of Personal Information (APPI) adopted in 2017, an independent agency has been set up to handle two specific kinds of data: personal information (name, date of birth, email address or biometric data) and special-care information (medical history, marital status, race, religious beliefs, and criminal records). The system of the United Kingdom Data Service Secure Laboratory elaborated in Box 1 is another example of open by default and restricted use in a controlled environment for personally identifiable and sensitive information. The United States Census similarly allows researchers access to sensitive data in a secure environment that prevents the risk of leaking personally identifiable information.

BOX 1. A Comparison of National Open Data Platforms of India and the United Kingdom

A comparison between the national open data platforms of India and the United Kingdom (UK), widely considered one of the world leaders, illustrates the high-return investments that India is not yet making. Both platforms host enormous quantities of open access administrative data at zero monetary cost. Despite hosting open data at comparable scale as the UK, the national open data portal for India falls short of delivering high returns because of delivery issues described below.

Searchability: The search functionality for data.gov.in requires users to know the exact name of the dataset, and tables are stored in a flat structure without an ability for the user to track multiple datasets that may be components of the same data collection exercise. On the other hand, the primary feature of the landing page of data.gov.uk are categories of data to guide the user in her exploration of useful datasets. Related datasets are nested and displayed on a single page with technical notes and supplementary information for the user to understand how the components are related.

Documentation: data.gov.uk has clear documentation that walks the user through steps to access data via API or publishing a database on the platform. All datasets hosted on the platform are machine readable. Each individual table is supplemented with documents and technical notes describing the data and contact information for further queries. On the other hand, only a subset of datasets hosted on data.gov.in have supporting metadata. There are no structured metadata fields required for describing what is in the data either at the dataset or variable level. Instead, there is usually a link to the ministry that produced the data. It is highly likely that a user will need to seek more information to unlock value using the data.

Disaggregation: The two open data platforms have substantially different approaches to disaggregation. While the integrity of most datasets are generally maintained from production to release on data.gov.uk, this is not the case on data.gov.in. The datasets hosted on UK's national open data platform are typically available at the unit of data collection (for instance, a number of datasets hosted under the health category are disaggregated at the hospital level; some datasets are available at a spatial resolution of 10 kilometers square). On the other hand, most datasets hosted on the OGD platform for India are disaggregated at the State-level and rarely at the district level. The low spatial resolution of data limits usability severely by non-government and government actors.

Open by default with safeguards for privacy: Finally, the UK approach follows the principle of open by default, and restricted access only when justifiable. The UK Data Service Secure Lab[10] was established to ensure data that is too detailed, sensitive, or confidential can still be accessed for analysis but in a controlled environment. Specialized staff apply statistical control techniques to guarantee safe delivery. Data accessed through the Secure Lab cannot be downloaded. Once researchers and their projects are approved, they can analyze the data remotely from their organizational desktop, or by using a Safe Room. In the Indian context, microdata is almost never released in the public domain. The absence of protocols in place to ensure confidentiality when microdata is sensitive leads to a system where the ability to access data hinges on connections with bureaucrats in appropriate government departments. In India, the government is the de facto owner of data, whereas in the UK, public intent data belongs to the people both in spirit and practice.

Source: Authors' compilation.

In the next section, we illustrate how the existence of the mandate under a proposed coherent Right to Data could have already saved significant lives and livelihoods in the context of the pandemic in India.

10. https://www.ukdataservice.ac.uk/use-data/secure-lab.aspx.

7. Application: The COVID-19 Crisis in India

The pandemic is a compelling example of how open data could have literally saved lives and livelihoods in India. Even after two devastating waves of COVID-19, incomplete data on testing and deaths continues to hamper our understanding of the virus and to plan the policy response. In this section, we first call attention to the successes of Indian civil society in transforming fragments of discordant data released by various levels of governments into high-value efforts to inform the COVID-19 response. We then show that the absence of critical open government data has led to a series of missed opportunities to save lives.

Despite the paucity of open access health infrastructure, civil society has filled the information vacuum. Consider district-level COVID-19 infection and death counts, the most basic information required for responding to the virus. While individual states have been releasing infection and death data through daily bulletins and reports, these daily updates have not been machine-readable and were often released as images by disparate official state and district government accounts on social media. This made them relatively difficult to access as data, until a volunteer-based organization, covid19india, set up a system to automatically aggregate these daily updates and hosted the data for all states in a single open access databasecovid19india.org. Crowd-sourcing efforts based on media accounts also created the first public dataset describing COVID-19 cases disaggregated by age and gender. These crowd-sourced projects have been the single most important source of information for citizens, journalists, think tanks, and researchers trying to understand the pandemic.

At Development Data Lab, we created an open access portal, posting and linking a wide range of policy-relevant variables at the district level, including demographic data extracted from censuses, public and private hospital capacity data, migration, vaccination counts, and price and volume from agricultural markets, among others.[11] We supplemented this with regularly-updated infection and death data from covid19india, an easy step given their data release in the form of an API.

To our knowledge, the site was the only data source directly linking COVID-19 information to external social and economic data. Journalists used data from the platform for investigative analyses of rural-urban divergence in disease spread (Radhakrishnan 2021a) and vaccination disparities across districts (Radhakrishnan 2021b) and gender (Deshpande 2021). Health secretaries of State governments used the platform to plan quarantine infrastructure for returning migrants. Epidemiologists used platform data to develop risk forecasting models.

The parsimonious reports released by the government were transformed into useful data by civil society. Unfortunately, a considerable volume of essential data has been withheld by the government. We highlight three examples.

11. https://github.com/devdatalab/covid.

First, real-time and reliable testing data continues to be the single largest gap in COVID-relevant open data in India. Testing numbers are essential for understanding whether changing case counts in a district reflect changing infections or just changing testing rates. If daily cases for a given district appear to be declining while the number of tests conducted are also being scaled down, a false sense of security is created.

The Indian Council of Medical Research (ICMR) has an operational portal where all testing centers report daily tests conducted. This portal is accessible to State governments for monitoring, but the data from this portal were never made public, even in aggregate, a decision strongly in tension with the spirit of Right to Information clause 4(2) (Government of India 2005). The public's option to file an RTI request is of no help when data are needed in real time. Testing data could have been used to design early warning systems, inform public health campaigns, and to allocate aid and medical resources.

Next, consider the use of serological surveys. India has been at the forefront in the gathering of sero-positivity data, with dozens of studies conducted across India through ICMR. But disaggregated data from these sero-surveys were never released. Protection of privacy is not a defense, as district-level rates do not reveal anyone's private information, nor does concern that the data were noisy or subject to error. Releasing these data would have put valuable information in the hands of analysts, inform vaccine prioritization, and non-pharmaceutical interventions. In contrast, in Brazil, another leader implementing national sero-surveys, sero-data was made much more widely available, allowing better tracking of infection rates across regions (Hallal et al. 2020; World Bank 2021).

Finally, the case of gated Goods and Services Tax (GST) transaction data is a considerable missed opportunity to leverage open data for an effective pandemic response in India. This was highlighted by Pronab Sen during the 2nd T.N. Srinivasan lecture delivered as a part of the India Policy Forum in 2020 (Sen 2020). Sen rightly pointed out that the GST database, which is gated (like most administrative datasets), is extremely valuable for tracking the economic consequences of the pandemic and associated lockdowns, but has not been put to use. It is unprecedentedly granular in terms of geography and economic transactions. The real-time GST dataset is an excellent example of microdata that can be released with open-access APIs aggregated at the village, town, or sub-district to protect confidentiality of parties while still adding tremendous value. In the absence of these data, researchers had no choice but to resort to imperfect proxies for economic activity such as nightlights (Beyer et al. 2021), agricultural weekly market data (Lowe et al. 2020), and online retail data (Mahajan and Tomar 2021) to uncover the impact of COVID-19 on economic activity in India. Removal of the artificial barriers on administrative data such as aggregated GST records could have provided a substantially higher resolution understanding of the economic impact of COVID-19 that could have then informed policies focused on economic recovery.

The missed opportunities from inaccessible administrative data have hampered the response to the COVID-19 crisis in India since March 2020. However, the examples laid out in this section illustrate how safeguarded, yet high-resolution administrative data should be made open by default as a priority to prevent unnecessary ignorance in future waves of COVID-19 or other crises.

In view of the unprecedented health and administrative emergency caused by COVID-19, there were understandable gaps in government capacity to handle the crisis. However, it is important to learn from experience and the pandemic could motivate better policymaking and more inclusive functioning at all levels of the government by taking civil society and the private sector on board when their support is most needed. Simultaneously, it is critical to provide universal access to government data at all times in order to educate and inform the public, which would, in turn, help save lives and mitigate suffering in the event of another health crisis in future.

8. Conclusion

In this paper, we have argued that government data should be freely accessible to all members of society, both as their right, and because opening government data contributes in myriad ways to development and economic growth. Open government data improves policymaking, contributes to accountability, empowers citizens, and provides valuable inputs to firms throughout the economy. To achieve its potential, data must be high quality and the marginal time and monetary costs of accessing it must be close to zero, so that all potential users can make use of it.

For reasons of space and coherence, this paper could not do justice to many issues regarding the production and use of government data in India and beyond. In this paper, we chose to focus on the feasible steps that could make the huge amounts of data generated and released by the Government in India much more valuable to policymakers, researchers, and the society at large. For thoughtful discussions of the political economy of data generation and dissemination, regulatory issues such as privacy, and data quality, please see the excellent discussions by Robert Cull and Ashwini Deshpande appended with this paper.

In the introduction, we called for a philosophical shift in the government's attitude towards data: away from treating it as the private property of government elites and towards thinking of it as belonging to the people of India. It is likely that this will require not only top-down action from officials as we propose here, but for a broad coalition of activists, journalists, researchers, and private sector leaders to build a consensus around the responsibility of government to make data freely available to the very people from whom it was collected in the first place.

To conclude, we highlight three additional investments that are complementary to opening government data and would have high returns in terms of economic growth and development.

8.1. Private Sector Data for the Public Good

This paper has focused on the value of open public data, but increasingly, the richest data on the Indian economy is in the hands of the private sector. Payments platforms generate data on consumer expenditure, job sites capture information on labor supply and demand, and banks record information about default and household savings. The private sector has particularly rich real-time data, as the operations of firms generate huge amounts of information on the economy. But these data are rarely used for research or the design of public policy.

One reason for this is that there is not a clear unified framework for such contributions to be made. Facilitating the creation of linked public and private sector data would benefit researchers and policymakers alike. Economic researchers would gain access to much richer data on consumer and firm behavior. Policymakers would be able to respond to needs much more rapidly with real-time data at their fingertips. Participating firms contributing data to this effort would signal a strong commitment to being socially responsible citizens.

Privately-held data describing spending, business activity, employment, education, and public health have been safely leveraged in the United States by Opportunity Insights[12] at Harvard University to understand the economic impacts of COVID-19, and to inform policymaking in the United States (Chetty et al. 2020). This data release is exemplary in safely balancing the tradeoff between privacy and precision. While the underlying high-resolution data contains individual information, data is shared with the public at an aggregate and anonymized level, maintaining high geographic granularity but virtually no possibility of identifying individuals.

A much more detailed discussion of how private and public data can be combined for great impact can be found in the excellent *World Development Report 2021: Data for Better Lives*. For instance, it highlights how private sector sources can yield far richer poverty maps and thus improved targeting of anti-poverty programs as compared to government data alone, how commercial data can be used to monitor public health, or how aid can be allocated for disaster recovery.

8.2. Investing in Data Literacy throughout Society

Data on its own does not improve development outcomes; it is an input, like electricity or education. For data to contribute to India's development, it needs to be used for decision-making. We have argued that a wide range of actors across

12. https://opportunityinsights.org/paper/tracker/.

the public, civil society, and private sectors stand ready to put government data to productive use. But data literacy in India remains low and the capacity of the government, in particular, to use data effectively is limited.

As importantly, government should have better capacity to make use of data to improve its own functioning. Open and interoperable data is a starting point for making evidence-based policy, but the generation of evidence also requires data analytic skills and the resources (such as time and computing) to apply them. Building this capacity can be done in many ways. The Indian Statistical and Economic Services could be expanded to provide a pool that policymakers and administrators could draw on to help answer the questions critical to their programs. Data analytics units could be created in every ministry (both at the Center and in the States) to organize and release administrative data, and to use that data to provide insights and flag problems.

8.3. Open Data for Decentralization

With the passage of the 73rd and 74th Amendments in 1992, India committed itself to improved governance through decentralization of powers to the municipal level (rural panchayats and urban local bodies). Social scientists often write about decentralization as a tradeoff between improved information and incentives on the one hand, and the potential for elite capture and decreased professionalism on the other (Bardhan 2002). Open data can help support the implementation of decentralization in India, in particular by providing citizens, *gram sabhas*, and elected panchayat officials with essential data on the economic status and performance of government programs in their local regions, and information on how those compare to other regions.

Since many of these local bodies may have limited data literacy, they need something more than raw data. But the government creators of these data do not have the comparative advantage in conducting the market research to understand the information that leaders need, nor to develop appropriate delivery platforms. The government's role is to make the raw data open, at which point advocacy and private sector organizations can build the information provision layers that will make these data useful to their audience of local leaders.

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To view the entire video of this IPF session and the General Discussion that ended the session, please scan this QR code or go to https://youtu.be/_bH61Dktr70

Comments and Discussion*

Chair: **Suman Bery**
Bruegel and former Director General, NCAER

Robert J. Cull
World Bank

The paper's main arguments are quite compelling and India certainly provides a fascinating context to study the potential benefits of, and impediments to, open public data. These main arguments boil down to two key points. Government data are valuable. Making it more open enables innovative uses of that data, uses which are impossible for public officials in charge of data generation and dissemination to anticipate. Secondly, for India, effective delivery of data with appropriate privacy safeguards to a wide range of potential users costs very little when you compare it with the already paid costs of collection and the returns to better dissemination.

As a newcomer to the Open Data situation in India, these points and the evidence used to support them seem eminently reasonable. They also resonate quite well with the key messages from *World Development Report 2021: Data for Better Lives*, for which I was one of the co-directors. However, this paper lays out a clear vision for achieving open data in a large and influential country in a way that was not possible in the *World Development Report* (WDR). My critiques and suggestions involve placing greater emphasis on a few topics. The first is the potential for exploiting synergies between data generated and collected by the private sector and public intent data collected by governments. The second is a call for more on the scope of the remaining challenges regarding data protection and data governance. The third is on the political economy of government data sharing in the Indian context.

Data Synergies

With respect to synergies, the paper has relatively limited treatment. This is by design; it focuses on government data for three reasons. First, government data is more representative than private sector data since government interacts with

* To preserve the sense of the discussions at the India Policy Forum, these discussants' comments reflect the views expressed at the IPF and do not necessarily take into account revisions to the conference version of the paper in response to these and other comments in preparing the final, revised version published in this volume. The original conference version of the paper is available on NCAER's website at the links provided at the end of this section.

all citizens in one form or another. Second, government data pertains directly to operations of public programs, which are in the public interest. Third, since government data is ultimately owned by the public, the public has a clear claim to access to it. Thus, making government data available widely should be a high priority.

At the same time, near the very end of the paper, it is acknowledged by the authors that "increasingly, the richest data on the Indian economy is in the hands of the private sector," and that, "the private sector has particularly rich real-time data, as the operations of firms generate a huge amount of information on the economy. But these data are rarely used for research or the design of public policy." A key theme from the *World Development Report (WDR)* 2021 is the potential to combine public and private intent data to address development challenges. Indeed, the WDR argues that public and private intent data are inherently complimentary since the strengths of one are the weaknesses of the other. Specifically, compared with traditional public intent data from censuses and surveys and administrative data sets, new private data sources can offer greatly improved timeliness, frequency, and granularity of data. Although as noted, these private data tend not to be fully representative in coverage. Given these features, new private intent data can contribute significantly to addressing public sector development challenges.

Private intent data collected through cell phones, Internet usage, satellites, remote sensors, and other sources provide information about individuals and geographical locations that traditional public data simply cannot. The COVID-19 pandemic provides a timely illustration in which call detail records and geospatial data from cell phones have been used to track the spread of the disease and to assess the effects of policies designed to mitigate it, such as "stay-at-home" orders.

Beyond the pandemic, the WDR highlighted, for example, the benefits of combining data sources for poverty mapping, and thus better targeting of resources and services to the poor. Household surveys, which gather extensive data on living standards, consumption, income, and expenditures, are the basis for estimating national poverty rates in most countries. But those surveys are costly and infrequently performed. Recent advances are showing how combining the survey data with call detail records or, especially, with satellite imagery data can provide greater geographical resolution and timelier maps of poverty. Other examples from the report include repurposing commercial data and exploiting synergies with public intent data to monitor public health and improve predictions of disease spread in general, for streamlining service delivery, for improving road safety, and for allocating aid in disaster recovery.

More information about India's efforts to incorporate private intent data and their analytics and to combine it with more traditional forms of data would be welcome in this paper. The Government's envisioned role in the frameworks presented in the paper is almost entirely as a collector and disseminator of public data. In the short term, that is a sensible and important goal. But if the richest data on the Indian economy and the economic and social activities of the Indian

people are in the hands of the private sector, the Government will need the technological capabilities and human capital to become fuller analytical partners with the private sector over time.

At the end of the paper (in Section 8.2), there are brief suggestions about how the Indian statistical economic services could be modified to achieve some of these goals. An example from another country of a more comprehensive effort to improve data capabilities, especially government data capabilities, is the Data Science Campus in the UK's Office of National Statistics (ONS). This is a unit within a national statistical office that is tasked explicitly with leveraging the latest advances in data science, and the synergies between public intent and private intent data sources to serve the public good. The campus works on data science projects for the UK Government and with international organizations in collaboration with partners from academia and the private sector. More information about whether similar efforts are underway or are being contemplated for India would be welcome.

Data Protection and Data Governance

Sharing public data more widely is the focus of this paper, and India's considerable achievements in terms of government data collection are rightly lauded. These achievements and capabilities are also reflected in the World Bank Statistical Performance Indicators (SPIs), which were released in conjunction with the WDR 2021. The SPIs are used to assess the availability, quality, and usability of public intent data across 166 countries. India's SPI score ranks within the second highest quintile in the sample, which is uncommonly high among low- and middle-income countries. Controlling for per capita income in a regression analysis, India ranks 14th globally in SPI. Perhaps this new data source could be used to buttress quantitatively some of the claims made in the paper.

Given these statistical capabilities, an open question is why India has not made more use of its public data. An answer put forth in the paper is that a change in mindset—viewing data as being owned by the Indian people, not the government, which should instead focus primarily on disseminating those data widely in a readily usable format—is needed. While that would be important, perhaps even crucial, in and of itself, that change may not be sufficient to unleash the data sharing and dissemination envisioned. The WDR 2021 argued that a variety of factors prevent countries, particularly low- and middle-income countries, from realizing greater value from both public and private intent data, including lack of resources, technical capacity, data governance arrangements, and the demand for data-informed decision-making. Based on the description in the paper, all those factors could be playing a role in India.

Greater emphasis could be placed on data governance, which WDR 2021 defined as being comprised of a set of building blocks to enable and deliver the

potential benefits of data, while safeguarding against harmful outcomes. These include data infrastructure policies and connectivity; the policies, laws, and regulations around data; related economic policies in terms of anti-trust, tax, and trade; and data governance institutions. A closer look at, in particular, the laws and regulations around data and the institutions of data governance could provide a better understanding of the bottlenecks in sharing and disseminating India's public data. Two additional data sources released in conjunction with the WDR may be of use in this regard, namely the World Bank Global Data Regulation Survey, and the database of Digital Government/Gov Tech Systems and Services (DGSS).

The data regulation survey has questions about enablers of e-commerce transactions, and separate sections on the enablers of sharing and repurposing public intent and private intent data. It also provides information about safeguards with respect to personal data, non-personal data, cross-border data flows, and cybersecurity.

A stark pattern emerges from the responses to the Data Regulation Survey. Countries, especially low- and middle-income ones, score more highly on enabling data flows and e-commerce than on safeguarding and protecting data, and India is no exception. It scores just over 50 on a 100-point scale for enablers, but less than 40 on a 100-point scale for data safeguards. And the description in the paper also indicates that data protection is a major concern in India:

> On the one hand, non-sensitive micro data is arbitrarily held from the public domain. On the other hand, individual-level sensitive data are often available on the public domain on a discretionary basis. In some cases, substantial, personally identifiable information is accessible on the public domain without any checks or safeguards, such as in electoral rolls and details about beneficiaries of programs such as MGNREGA.

It seems likely that these concerns will loom larger as more public data are shared, and if and when the government incorporates new private data sources in its analysis, decision-making, and dissemination.

The data regulation survey assumes that a good-practice regulatory environment, specifically with respect to sharing and enabling re-use of public sector data, includes foundational legislation on open data and access to information as well as digital identity verification and authentication; a formal data classification policy; adoption of syntactic and semantic interoperability across data sets; and user-friendly licensing arrangements. Countries have adopted about half of such good practices, ranging from less than 30 percent in lower-income countries to about two-thirds in high-income countries.

The discussion in the paper suggests that India is falling short on a number of these dimensions, especially those related to data classification, interoperability, and user-friendly licensing agreements. Information from the data regulation survey could enable the authors to benchmark India's progress on these aspects of public data sharing relative to other countries in a more systematic way.

Finally, the paper could devote more effort to explaining whether the core institutions of data governance in India are lacking. For example, the comparison in Box 1 with the UK Data Service Secure Lab seems to suggest that there is no comparable data protection agency in India, but it would be good to know more about which institutions have the responsibility for formal data protection in India, and why it has been so lackluster. Also, is there a specialized unit within the Indian statistical economic service or elsewhere designed to ensure the interoperability and standardization of public data? And does it have any authority over other agencies to impose and enforce that interoperability and standardization?

Political Economy of Data Sharing

Governments around the world have mixed feelings about sharing data widely and well. It is costly, it requires expertise, it is likely to require institutional restructuring and/or creation of new government agencies, and demand for data-driven analysis may be low among government officials and policy-makers. And, because the potential re-uses of data and synergies across data types are impossible to forecast with any precision (as is argued in the paper), it is difficult to measure and demonstrate the value that will be created through these efforts. But also, and quite importantly in some contexts, governments are reluctant to release data that would open them up to greater scrutiny. Indeed, *WDR 2021* highlighted cases not only of governments hiding inconvenient data but of occasionally falsifying it.

Empirical analysis showed that two factors are strongly correlated with a better environment for public data production and dissemination as reflected in higher SPI scores: the political independence of the national statistical office and freedom of the press. Based on the description in the paper, it appears that India does well on both these dimensions, and so those analyses provide additional quantitative support for key points made by the authors.

Perhaps more importantly, this suggests that the failure to unlock the value of India's public data through better dissemination is not driven by the lack of political openness but more likely by the absence of effective data governance arrangements and institutions. These patterns provide clues about where the country should focus its efforts if it wants to get the most value for its citizens from the data it collects.

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Thank you to all the authors for a really interesting paper. It is a paper that I almost fully agree with, which makes the discussant's job hard. Normally, as a discussant, one raises questions related to specific points of disagreement and identifies gaps in the paper, and these collectively end up as Discussant's comments. Preparing comments for this paper was challenging because in terms of the main sentiment and the effort, I find myself in complete agreement with the authors. I would like to take this opportunity to congratulate the authors for setting up the Socioeconomic High-resolution Rural-Urban Geographic Platform for India (SHRUG), which researchers use widely. In fact, when we set up the Centre for Economic Data and Analysis (CEDA), the center that I am leading at Ashoka University, we had extensive discussions about the focus of our center. Since SHRUG was already in existence, we decided not to re-invent the wheel and therefore, CEDA occupies a complementary space.

I completely agree with the authors that publicly available data is tremendously useful for all the reasons that the paper outlines thoroughly. This argument could not have been made at a better time, as India, like the rest of the world is battling the COVID-19 pandemic. More than at any other time, it is now during the pandemic that all of us all across the world have realized the urgency of good, reliable data in real time, as it can literally save lives. In India, it is really the paucity of data in real time that is striking at this time. It is ironical that we are facing this data shortage in the age of Big Data and campaigns such as Digital India through which we leave footprints of our daily lives, as literally every action of ours gets stored somewhere as a data point. The irony is that just when data on all aspects of our lives could potentially be collected like never before, data availability for public use is very low.

India, as the paper rightly points out, has a very long and rich history of producing credible data. The Indian data collection apparatus and statistical systems are remarkable both for the country's level of development and for how poor the country was when the statistical system was established. India has several national data collection agencies that have significant capacity to produce good quality data under challenging conditions. Unfortunately, in the last six to seven years, and particularly during the COVID-19 pandemic, what stands out is the absence of actionable data in real time.

One source of high-frequency data released in real time is that from the Centre for Monitoring Indian Economy (CMIE), which is privately collected data available for purchase. While the use of CMIE data is increasing, we should note that it is costly. This is the time when the need for free and official, transparent data to assess COVID-19 induced changes could not have been more pressing. For instance, the CMIE releases a new round of the Consumer Pyramids data every four months. This is nationally representative panel data, which enables us to

assess which exact indicators have changed and by what extent. However, the cost barrier is binding for several users who might have wanted to use the data. In the absence of reliable, official data, civil society actors and journalists are assembling data from disparate sources: from news reports, from crematoria, among other places, as if they are recreating the full picture by putting together pieces of a giant jigsaw puzzle.

There are initiatives like SHRUG and CEDA, which are engaged in efforts to promote sensible and scientific evidence-based research and dialogue. What we are doing at CEDA is using publicly available data that is freely available, like various rounds of the National Sample Survey, National Family and Health Survey, and decennial censuses. We are calculating summary statistics (averages, frequencies, and proportions), and creating a dashboard for users who may not want to or may not be willing to engage with complex unit-level data. Unit-level data are already easily available, and SHRUG, in a tremendous act of public service, has already done a lot of convergence across geographies and across time. In CEDA, we are making summary statistics available because typically when a member of the general public says, "I need data", what they mean is that they want immediately *usable* numbers, which are easy to access. CEDA is also creating short data narratives to show how these numbers can be used to intelligently analyze economic developments.

To sum up, one issue is that for effective and efficient policy-making, it is extremely important that data are getting generated and disseminated in real time. The COVID-19 pandemic has highlighted the urgency of high-frequency indicators.

The other issue about data is quality, by that I mean: how meaningful is the information that the data reveals? One of the examples in the paper is the property real estate market, which Sam also mentioned in the presentation. Anybody who is familiar with the real estate market in India knows how it actually functions. If we were to get data on the prices at which properties register, it would be misleading. This is because there is a legal rate, which is called the circle rate, but this is not the price at which the transaction actually takes place. Therefore, even if the property registrar's data were to be made publicly available, it would not actually capture the true value of the real estate market as far as the purchase of the property is concerned. The paper does not go into the question of quality of data, one example of which is the real estate market.

Let me give a few examples of data deficiencies, which relate both to availability and quality. Last year when the COVID-19 pandemic started, UN Women and other agencies pointed out that as the pandemic spread globally, as countries imposed lockdowns, the shadow pandemic of domestic violence followed, since women and children were locked in with their abusers. A colleague of mine and I decided to examine real-time trends in domestic violence in India. The only source of any data on this was from the National Commission for Women (NCW). But NCW is typically not the first port of call for women who are in

distress. Women typically first approach the police, or helplines, or shelters. In order to assess if the incidence of domestic violence (which in any case is under-reported) was increasing during lockdowns, we would have wanted data from these sources in real time. I tried to approach several State governments individually. Some governments shared some data and some governments refused. The police data comes to the National Crime Records Bureau after two years, but by then it would be too late for immediate action.

Another data-related issue that I am personally very interested in is women's labor force participation (LFP). A strong and popular narrative argues that women are withdrawing from the labor force because of an increase in conservative social norms. That *sounds* plausible and believable. However, if we weigh this argument against the fact that the decline in women's labor force participation, first of all, has happened over the last 15 years, actually even longer, and secondly, the bulk of the decline has been for rural women, and within rural women, for Adivasi or tribal women, then we need to think hard about whether the narrative of increasing conservative social norms *as the main cause* of the decline in women's labor force participation rate is really valid or not. There is research (including mine) that argues why this narrative has to be questioned, but in order to present evidence on this question, one needs better data. One key issue is measurement of women's work. In fact, NCAER is a good place to talk about this, because the India Human Development Survey (IHDS), which comes out of NCAER, and Sonalde Desai's team have actually been engaged in the very important task of measuring women's work correctly. Based on their work, we have proof that efforts to collect better data can yield results. However, in the LFP debate, there are other questions, such as is it the case that employers have lower demand for women's work? Is it the case that there isn't availability of jobs that women could do in rural areas? Is it all of the above things? Again, to gauge these questions, we need data in real time.

Let me give another example which highlights another dimension of the data problem. A few years back, I did some work in Maharashtra on the State Rural Livelihoods Mission (MSRLM). When we were doing the survey, we asked women, "Which Self Help Group (SHG) are you a member of?" They knew the name of that SHG, which we collected. When we came back to Delhi and analyzed the data, we realized that women were unable to say whether their SHG belongs to MSRLM or not (Maharashtra has a wide variety and a long history of SHGs). We assumed that we would easily be able to match the names of individual SHGs based on the MIS data of the program, which is computerized. But we were not able to. Even when data does get generated, some vital information somehow gets missed, or does not get recorded, and therefore, it is rendered unusable. For our project, one of the research questions was assessment of the difference between the program SHGs and other SHGs. Despite having names of individual SHGs, we could not analyze this question, because we could not determine which messages were program messages.

Why is data not available for long periods of time? What are the concerns? There might be concerns that if data becomes more transparent and easily available, it will rock the boat, or it will threaten effective governance, because people will be more aware of non-performance or lapses in functioning. I personally don't think that's true at all. A large number of well-informed citizens armed with data don't overthrow governments. There was an amazing article in *The New Yorker* in 2017, which showed how facts don't change our minds. We have been seeing that around many countries around the world. I would like to make the case for giving us (researchers and scientific personnel) more data. We might write a few papers using this data but this would never threaten effective governance. If anything, research can be useful to make policy more effective. The demand for data, we must acknowledge, is coming from those who genuinely care about India's development and about India's people. Forces that are antithetical to India's interests don't analyze data to plan their strategies.

When the scientific and research community (which, in the case of India, is large and vibrant) asks for data, it is because we are concerned about the people of India and believe that we can contribute insights into development challenges as well as suggest possible solutions. Data transparency would increase the mutual trust between the government and its people, and would improve governance, not hinder it. Finally, in the last eight years, more or less, we have not had any of the large surveys, for example, the NSS Consumer Expenditure Survey, and the Employment Unemployment Survey. The Annual Survey of Industries (ASI) was last done in 2013. These are vital chunks of data that we desperately need. India needs to move in the direction of making the surveys more, rather than less, frequent as well as open and democratize data. Given India's impressive survey capability, we should use that resource for the benefit of India's development.

General Discussion

The Chair, Suman Bery, led the discussion by highlighting the need for building an ecosystem for improving the quality and the dissemination of administrative data. He noted that government departments often place just a fraction of the data that they should in the public domain, and often not in a way that can be consumed by researchers. He posed the following critical questions: Why does a lot of individual well-intentioned activity stop short of adding up to more than the sum of its parts? What are the incentives offered within individual ministries to actually publicly share the entire available data? Why are the data shared only partially? Is it because there is no demand for these data? Is it a data governance issue, or is it, in a sense, a hint that too much data is a dangerous thing in the eyes of bureaucrats because it imposes an accountability on them that they may not be

comfortable with? What would it take for this issue to be taken seriously and who would be the node to lead such an initiative?

K.P. Krishnan, a former bureaucrat himself, offered his perspective on the subject. He pointed out that the answer to a lack of headway in mass data dissemination lies in the combination of questions put forward by Suman Bery. One, there is no incentive; two, very often there is no capability; and three, more data means greater accountability. And clearly, all three are reasons as to why the dissemination is never done in a manner whereby a researcher can actually use the data. While half the data are put in PDF formats, the other half are embedded in Excel spread sheets, implying that they are not disseminated in a manner that facilitates a researcher to actually use the data. Additionally, most administrative departments are seriously conflicted because the data that they need to put out is the data on which they will get funding for the forthcoming year, for which they will be evaluated. Hence, there are serious (dis)incentive issues here that need to be addressed.

When NCAER President, Nandan Nilekani, was the Chairman of the Unique Identification Authority of India (UIDAI), he had written a report on data dissemination standards for Government of India departments. K.P. Krishnan suggested that the issues of how to ensure that individual departments actually released the data in a periodicity that is predictable, in a manner that is compatible with the rest of the world, and using definitions that are aligned with the domain, were covered in the report. However, the report was never released, indicating the lack of interest at the bureaucratic and political levels to deal with the issue of sharing of government data. The primary government agency that can help in ensuring outcomes in this sphere is the Cabinet Secretariat.

Karthik Muralidharan discussed the path ahead for ensuring improvement in administrative data quality and availability, and whether solutions are more counter-productive at the Union level as compared to the State level. He averred that the problem with a lot of the data collection and data-type initiatives in the government is that even the more committed Secretaries and Ministers, who are interested in tackling the issue, do not have the time horizon needed to invest in data systems, and they would much rather just launch programs because they have a tenure of two years in the best of situations. The question they try to answer is thus, "What program am I launching?," as opposed to, "How am I putting in place a system to collect data that may show up and have returns five years down the line?" He said that one might, however, find champions in specific States, and that NITI Aayog, with which the authors Sam Asher and Paul Novosad are engaging, could be one such a logical place to push some of this agenda. But even there, it would be prudent to work with specific sectors.

Surjit S. Bhalla commended the paper and endorsed the claim that data is the ultimate public good. He argued that dissemination of bad data is actually better for policy advice and for policy discussion than dissemination of good

data. There is, however, no argument for withholding any data. In India, the one data that has been withheld is the Consumption Survey of 2017–18. It should be disseminated because it showed an abominably low level of consumption among Indian households. Thus, the dissemination of that data would help us better understand the outcomes related to consumption.

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Analyzing India's Exchange Rate Regime§

ABSTRACT We analyze India's exchange rate regime through the prism of exchange market pressure. We estimate the various regimes that India's de facto exchange rate has been through during the period 2000 to 2020. We find four specific regimes of the Indian rupee differentiated by the degree of flexibility of the exchange rate. We document the manner in which the Exchange Market Pressure (EMP) Index in India has either been resisted through foreign exchange market intervention, or relieved through exchange rate change, across these four *de facto* exchange rate regimes. In particular, we find that after the 2008 Global Financial Crisis, the rupee-dollar exchange rate was relatively more flexible and the share of the exchange rate in EMP absorption was the highest. After 2013, there was a change in the way the EMP was absorbed. The exchange rate was actively managed using spot as well as forward market intervention. We also find that the response of the Reserve Bank of India (RBI) to EMP has been asymmetric. When there has been pressure to appreciate, the RBI has typically responded by purchasing reserves. On the other hand, during the periods in which there has been pressure to depreciate, only a tiny fraction of the reserves were used for resisting the pressure. Such pressure is absorbed by rupee depreciation.

Keywords: *Exchange Rate Regime, Forex Intervention, Reserves, Exchange Market Pressure, Structural Change*

JEL Classification*: E58, F31, F41*

1. Introduction

The exchange rate regime of a country depends on the manner in which the currency of the country is managed with respect to other countries' currencies. There are primarily three different types of exchange rate regimes—freely floating, fixed and pegged, or managed floating. Most developed countries of the world have freely floating exchange rate regimes wherein the central

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banks do not intervene in the foreign exchange markets to stabilize currency fluctuations. On the other hand, there are countries such as Hong Kong which have a fixed parity with the US dollar and the Hong Kong Central Bank uses its monetary policy to maintain this peg. A majority of the emerging economies lie somewhere in between these two extremes. They are mostly characterized by "managed floating" exchange rate regimes or some version of a "pegged" regime, with their respective central banks intervening in the foreign exchange market on a regular basis.

India falls in this category. In 1993, India officially moved towards a "market determined exchange rate" from a fixed peg to the US dollar. This was part of the liberalization and deregulation reforms of the early 1990s. There has been a currency market since then, and at the same time, the Reserve Bank of India (RBI) actively trades in this market.[1] In this paper, we infer and document the evolution of India's Exchange Rate Regime (henceforth, ERR) over a long period of time, from 2000 to 2020. We introduce a novel angle of analyzing the ERR, by using an Exchange Market Pressure Index (henceforth, EMP). Specifically we ask how the EMP was managed across the different exchange rate regimes. The degree of foreign exchange intervention and the degree of flexibility in the exchange rate are likely to differ across the regimes based on the response of the central bank to the EMP.

The official *de jure* classification of ERR of a country often diverges substantially from the *de facto* ERR that exists in practice (Reinhart and Rogoff 2004). Full information about the exchange rate regime is often not disclosed by the central banks and hence the ERR needs to be uncovered from historical data using statistical methods. Given the active foreign exchange intervention by the RBI, it is difficult to decipher India's ERR by simply looking at the level of the exchange rate or the volatility. The actual rate that is observed is partly an outcome of the underlying macro-financial conditions or shocks faced by the economy and partly of the intervention policy or currency policy of the central bank.

IMF's AREAER report (till 2004) has classified India's *de facto* ERR as "managed floating with no pre-determined path for the exchange rate." The existing literature classifies India's ERR as a *de facto* pegged exchange rate to the USD in the post-liberalization period (Patnaik 2004; 2007; Patnaik and Shah 2009; Zeileis et al. 2010). Using data on market-determined parallel exchange rates, Reinhart and Rogoff (2004) classify India's *de-facto* ERR (in the post-liberalization period) as a "peg to US dollar" from August 1991 to June 1995, and a "crawling peg to US dollar" from July 1995 to December 2001. Calvo and Reinhart (2002) use a metric of currency flexibility that combines exchange rate volatility, reserves volatility, and interest rates volatility. They find that the currency flexibility in India has not changed in the 1979–1999 period despite the move to a "market-determined" ERR in 1993.

1. See Patnaik (2004; 2007) for more details.

The RBI intervenes in the forex market with the stated goal of "containing volatility" (Patnaik 2005) but there is evidence that the central bank intervenes in an asymmetric manner, buying US dollars and selling rupees in order to prevent a currency appreciation (Sen Gupta and Sengupta 2013). This shows that India offers an interesting case study for deciphering the underlying ERR using a data-driven analytical framework.

The EMP measures the pressure on the exchange rate, which is either resisted through foreign exchange market intervention or relieved through an exchange rate change. In a floating ERR, when macro-financial shocks hit the economy, this exerts pressure on the exchange rate and the exchange rate freely fluctuates according to market forces. In a pegged or a managed ERR, when shocks materialize, there is EMP and the exchange rate does not change or changes much less. Instead, the central bank intervenes in the foreign exchange market to absorb the EMP.

In the last decade, significant advances have been made in the literature in the context of dating exchange rate regimes and also in terms of measuring exchange market pressure. New and relatively more sophisticated statistical tools are being used in these fields which offer greater conceptual clarity. In this paper, we make use of these methodological innovations.

We estimate the exchange rate regimes in India using the methodology outlined in Zeileis et al. (2010). Their method is an improvement on a much-used linear regression framework popularized by Frankel and Wei (1994). Once we find the ERR, we study the exchange market pressure that prevailed during each of the regimes. For this, we use a new EMP index proposed by Patnaik et al. (2017), who measure the EMP by analyzing the amount of adjustment needed in the exchange rate to remove any excess demand or excess supply of the currency that may exist in the foreign exchange market in the absence of any currency intervention.

We look at the evolution of this EMP measure in India over the last two decades and document the manner in which the RBI may have responded to changes in the EMP across the different exchange rate regimes. Specifically we ask whether the RBI attempted to manage the EMP by intervening in the foreign exchange market or let the exchange rate move absorb the EMP. As mentioned above, an attempt to manage or counter the EMP would lead to stabilization of the exchange rate, which has direct implications for the underlying ERR.

We also try to understand the transition from one regime to the next. The COVID-19 pandemic has triggered unforeseen consequences for economies all over the world. While on one hand, the US Federal Reserve has announced a massive fiscal stimulus which is already causing overheating of the economy, on the other hand, India continues to struggle with economic recovery. Towards the end of our paper, we briefly discuss what this pandemic might imply for India's exchange rate dynamics going forward and what policy options might be available in this context.

If the objective is to stabilize the exchange rate, this can be done using three instruments from the central bank's toolkit: (i) forex intervention, (ii) capital controls, and (iii) monetary policy. According to the Impossible Trilemma, which is a key insight of modern-day open economy macroeconomics, a country cannot simultaneously have an open capital account, a fixed exchange rate, and monetary policy independence. This implies that if India has an open capital account, and the RBI prefers to fix the exchange rate, monetary policy is driven solely by the need to maintain the fixed exchange rate.

Alternatively, if the RBI wishes to retain monetary policy autonomy and at the same time fix the exchange rate, it has to impose capital controls. In other words, if the decision is to manage the exchange rate as opposed to letting the exchange rate float, then this objective can be fulfilled in multiple ways. In this paper, we primarily analyze how the RBI used forex intervention to manage the exchange rate from time to time. In future research, we plan to delve deeper into the use of monetary policy and capital controls to stabilize the exchange rate across ERR.

Our paper is closely related to the sizeable literature that exists by now on analyzing exchange rate regimes (see for example, Bubula and Ötker-Robe 2002; Levy-Yeyati and Sturzenegger 2003; Reinhart and Rogoff 2004; among others). This literature mostly developed in the 2000s when it became increasingly clear that a country's *de jure* ERR (announced by the central bank) is not always the same as its *de facto* ERR. Our study is also related to existing work on dating structural breaks in India's exchange rate (see for example, Patnaik and Shah 2009).

The contribution of our work is to analyze the ERR through the prism of the EMP, and also to use the Zeileis et al. (2010) methodology to study the ERR in India for more than a 20-year period. Most of the existing studies end in 2008. Extending the sample period gives us the opportunity to throw light on the evolution of the *de facto* ERR over a long period of time.

We find that during our sample period, India witnessed four ERRs, roughly spanning the periods from 2000 to 2004, 2004 to 2008, 2008 to 2013, and 2013 to December 2020. In three out of the four regimes, the pressure on the rupee was to appreciate. The RBI responded to this appreciation pressure by intervening in the forex market and buying dollars, which resulted in a large accumulation of reserves. In one regime, in the aftermath of the 2008 Global Financial Crisis, there was pressure on the rupee to depreciate. The RBI mostly allowed the rupee to freely fluctuate in this time period. This is consistent with the evidence we provide in the paper which confirms that the RBI intervenes in the forex market in an asymmetric fashion, predominantly buying dollars when the rupee faces an appreciation pressure. In the fourth and last ERR in our sample ranging from 2013 to 2020, following the taper tantrum, the rupee was being actively managed through currency trading in both the spot and forward markets.

In the rest of the paper, we describe the methodology used to estimate the ERR and discuss the results we obtain for India in Section 2. In Section 3, we introduce the EMP measure and analyze the exchange rate regimes using this EMP Index. We discuss the transition periods from one regime to the next in Section 4. In Section 5, we discuss the ERR during the period of the COVID-19 pandemic and touch upon the way forward. Finally, we end with our concluding remarks in Section 6.

2. Exchange Rate Regimes

We estimate the exchange rate regimes prevalent in India from 2000 onwards using the structural change dating methodology described in Zeileis et al. (2010). They devise a data-drive, inferential framework to study the evolution of the ERR. Their method is based on the standard, linear exchange rate regression model popularized by Frankel and Wei (1994), which has been used in a number of studies to analyze a country's *de facto* ERR.[2] The model uses the returns on cross-currency exchange rates expressed in terms of a suitable numeraire currency.

To apply this method, we use the New Zealand dollar (NZD) as the numeraire currency, given its stability over a long period of time.[3] The underlying model that is estimated is as follows:

$$y_t = x^T_t \beta + u_t \ (t = 1, ..., n) \qquad (1)$$

where y_t are the returns of the target currency, in our case, the Indian rupee (INR) in terms of NZD and the x_t are the vectors of returns of a basket of currencies at time t. For our purpose, we use the US dollar, Japanese yen, Euro, and British pound all expressed in terms of the NZD. These are the most important floating currencies in the world.[4] We use the weekly returns of these exchange rates in order to reduce the noise in the data and also to ease the computation burden of the regime-dating algorithm.[5] This regression picks up the extent to which the INR/NZD rate fluctuates in response to fluctuations in any of the currencies on the right-hand side of the equation.

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2. See, for example, Kawai and Akiyama (2000), McKinnon (2001), Baig (2001), Ogawa (2002; 2004), Bowman (2005), Patnaik (2005), Bénassy-Quéré et al. (2006), Ogawa and Kudo (2007), Frankel and Wei (2007), Ogawa and Yang (2008), Shirono (2008), Patnaik and Shah (2009), Kawai and Pontines (2016), among others.

3. While Zeileis et al. (2010) used the Swiss Franc as the numeraire currency, we use the NZD instead because in recent years the SWF has been actively managed with respect to the Euro. However, as mentioned in Frankel and Wei (1994; 2007), for the managed exchange rates, the results of the regression analysis do not critically depend on the choice of the numeraire.

4. Since our sample period starts from 2000, we can safely use the Euro which was introduced as the official currency of the Euro zone from 1999 onwards.

5. We compute log-difference returns (in percentages) of all the currencies, i.e., 100 (log p_t–log p_{t-1}), with p_t being the price of a currency at time t expressed in terms of a numeraire currency.

For example, if the INR is pegged to the USD, then the corresponding beta value will be close to 1 and all the other beta values will be close to zero. If on the other hand, the INR is not pegged to any of these currencies, then all the beta values will be different from 0 and will reflect the true trade and financial linkages of the economy with the rest of the world. If the INR is instead pegged to a basket of currencies, then the beta values would reflect the corresponding weights of the currencies in that basket. In the case of reduced exchange rate flexibility, the R-squared of this regression would also be very high, while lower values would be obtained for floating currencies.

Using this linear regression model, one can find out the relationship that exists between the y_t and x_t currencies over a specific period of time. However, one cannot infer whether this relationship is stable within a given time period, whether it remains stable with future incoming observations, and in case of instabilities in the model parameters, when and how the estimated regime underwent a change. In other words, this regression model alone cannot help in understanding if and when changes in ERR take place.

Exchange rate regimes can change due to changes in the policy interventions by the central bank. However, the precise timing of these interventions is often not known which makes it difficult to assess the time-window over which this model can be fitted. As a result of these interventions, the underlying model parameters would change. In order to estimate the changes in the ERR, we need a methodology that takes into account the parameter instabilities and dates the regime changes based on these instabilities. This is the main premise of the Zeileis et al. (2010) method. They use statistical procedures for testing the stability of the ERR based on past data, monitor the stability of the regimes as new data comes in, and estimate the break points when the ERR changes using the structural change methodology of Bai and Perron (2003).

The conventional method of estimating structural changes in the exchange rates was based on the algorithm devised by Bai and Perron (2003) juxtaposed on the Frankel and Wei (1994) ordinary least squares regression model mentioned in Equation (1). One shortcoming of this method was that it did not take into consideration changes in the error variance as a full model parameter. A change in the underlying ERR necessarily involves a change in the error variance and hence excluding this parameter would result in an incomplete picture. The error variance captures the flexibility of the ERR. If for example, the INR is pegged to the basket of five currencies, then the error variance will take a low value, whereas if the INR is in a floating ERR, then the error variance will be relatively high.

Zeileis et al. (2010) extend the dating algorithm of Bai and Perron (2003) to the maximum-likelihood and quasi maximum-likelihood (ML and QML) models, include the error-variance in the set of model parameters over and above the estimated beta coefficients, and assume that the error is normally distributed.

In particular, they estimate a quasi-normal model specified by the following density function:

$$f(y|x, \beta, \sigma^2) = \varphi((y - x^T \beta)/\sigma)/\sigma \quad (2)$$

where $\varphi(.)$ is the standard normal density function with combined parameter $\theta = (\beta^T, \sigma^2)^T$ which has a length of $k = c+2$ (i.e., c currency coefficients or betas, intercept and error variance). In this way, they are able to assess the parameter instability *jointly* for β and σ^2. They then devise a unified framework for testing and monitoring the stability of these parameters and apply the dating algorithm of Bai and Perron (2003) to their maximum-likelihood model.

They assume n observations of y_t and x_t such that the conditional distribution $y_t|x_t$ follows the quasi-likelihood function $f(y_t|x_t, \theta_t)$, with θ_t being a k-dimensional parameter, as mentioned above. The hypothesis they test is that the parameter is stable over time, i.e.

$$H_0: \theta_t = \theta_0 \, (t = 1, 2, ..., n) \quad (3)$$

The alternative hypothesis is that θ_t changes over time (which is what we would expect in the case of changes in the ERR). If the parameters θ_t are stable over time, they can be estimated by minimizing the corresponding negative log-likelihood function (i.e., $-\log f(y_t|x_t, \theta_t)$).[6]

If the null hypothesis in Equation (3) is rejected, i.e. there is evidence that the parameters do change over time, then the dating algorithm can be applied to find out when these changes take place. If the break-dates are known *a priori*, then estimation of the model parameters would be relatively straightforward for each of the regimes or segments. Typically however, the break-points are not known. In that case, the optimal number of regimes (and hence break-points, m) can be computed by using some information criteria (such as the BIC and a modified BIC suggested by Liu et al. (1997)).

Zeileis et al. (2010) applied their methodology to India to uncover the *de facto* ERR. Using their methodology, we too find four distinct exchange rate regimes in India during our sample period, 2000–2020, with the first two regimes overlapping with the last two segments found by Zeileis et al. (2010). We report the dates of these regimes along with the corresponding, estimated coefficients of the basket of currencies, the standard errors as well as the values of the error-variance and the R-squared in Table 1.

- The first regime ranges from January 2000 to March 2004, and can be categorized as one where the rupee was closely pegged to the US dollar. The highly statistically significant coefficient of the US dollar is close to 1 (0.95) while the coefficients of the remaining four currencies are close

6. Further details on the tests and the monitoring mechanism can be seen from Zeileis et al. (2010).

TABLE 1. INR Exchange Rate Regimes, 2000–2020

Start/End	*USD*	*JPY*	*EUR*	*GBP*	*Sigma*	*R-squared*
January 14, 2000 to March 19, 2004	0.95*** (0.02)	0.00 (0.02)	–0.01 (0.02)	0.00 (0.02)	0.24	0.97
March 26, 2004 to February 29, 2008	0.75*** (0.05)	0.09** (0.04)	0.03 (0.07)	0.05 (0.06)	0.51	0.86
March 7, 2008 to November 22, 2013	0.63*** (0.06)	–0.05 (0.05)	0.11* (0.06)	0.02 (0.06)	0.95	0.61
November 29, 2013 to December 31, 2020	0.87*** (0.04)	–0.04 (0.04)	–0.02 (0.05)	0.00 (0.03)	0.59	0.73

Source: Bank of International Settlements (BIS) database and authors' calculations.
Note: Standard errors in parentheses. *p < 0.1; ** < 0.05; ***p < 0.01.

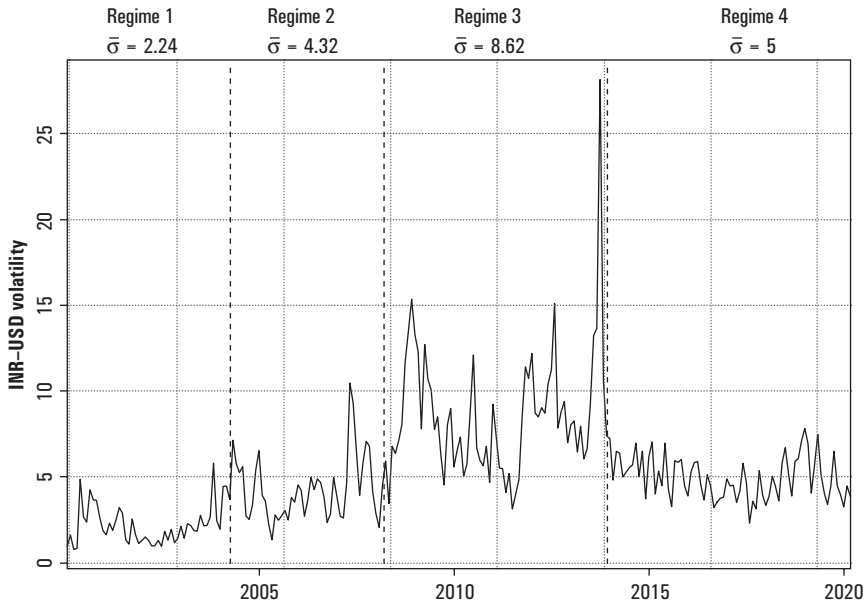
to 0. The σ is the lowest in the sample period and the R-squared value is the highest, further confirming a pegged ERR.

- The second regime spans the period March 2004 to February 2008. The R-squared value comes down from 0.97 to 0.86 and the σ goes up from 0.24 to 0.51. The INR seems to have shifted to a less tight peg where the weight of the USD, though still the highest, is lower than regime 1.
- The next regime goes from March 2008 to November 2013, and is characterized by the lowest value of the R-squared, and the highest value of σ. This can, therefore, be classified as the most flexible ERR in our sample period. The estimated coefficient of the USD is also the lowest, implying that much less weight was assigned to the dollar in the basket of currencies.
- The fourth and final regime lasts from November 2013 to the end of our sample period. It is the longest period under one single exchange rate regime. The flexibility of the INR gets reduced as compared to the previous regime as shown by the increase in the R-squared value and decrease in σ. The weight of the USD is also the second highest in the sample period, implying that the INR went back to being relatively more "pegged" to the dollar, as compared to its increased flexibility in the preceding ERR.

We next plot the annualized volatility of the rupee-dollar exchange rate as well as the level of the exchange rate across the four regimes in Figures 1 and 2, respectively. Consistent with our categorization of the ERR, we find that the average currency volatility was the highest in Regime 3 (8.62 percent) and lowest in Regime 1 (2.24 percent). The volatility increased in a staggered fashion, implying a gradual increase in the flexibility of the exchange rate which peaked in Regime 3, and then declined sharply in the last regime (5 percent), almost down to the same level as Regime 2, indicating a more managed ERR.

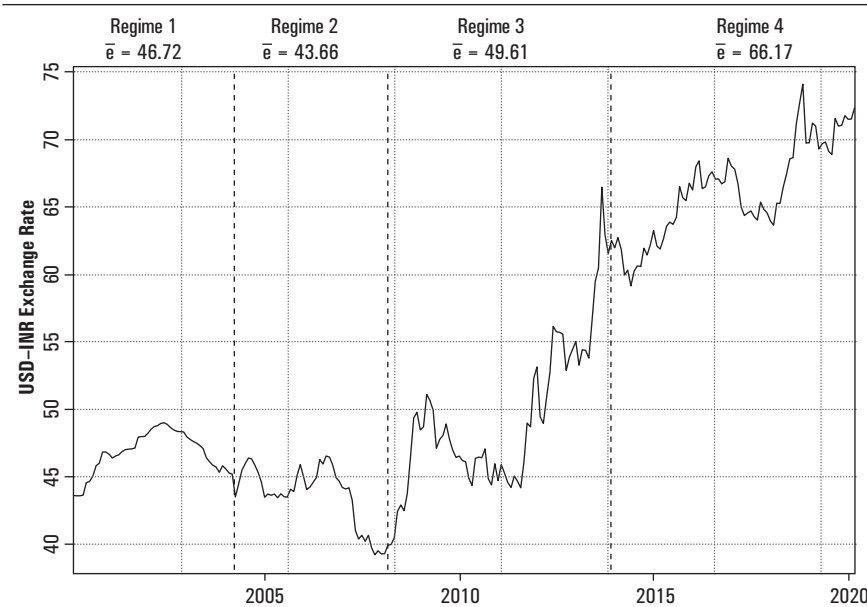
Figure 2 shows that while there were brief phases of currency appreciation, especially towards the beginning of our sample period, overall the rupee has been

FIGURE 1. Exchange Rate Regimes and Volatility of the INR/USD Exchange Rate



Source: BIS database and authors' calculations.
Note: This graph plots the annualized volatility of the INR/USD nominal exchange rate across the different exchange rate regimes. The mean currency volatility ($\bar{\sigma}$) in each regime has been mentioned at the top of the graph.

FIGURE 2. Exchange Rate Regimes and the INR/USD Nominal Exchange Rate



Source: BIS database and authors' calculations.
Note: This graph plots the level of the INR/USD nominal exchange rate across the different exchange rate regimes. The average exchange rate values ($\bar{e}$) in each regime has been mentioned at the top of the graph.

depreciating. This largely reflects the underlying macroeconomic fundamentals of the Indian economy, specifically the inflation differential between the US and India. The only exception seems to be Regime 2 during which the rupee, on average, seems to have appreciated.

3. Exchange Market Pressure

Exchange market pressure measures not only the change in the exchange rate that is observed, but also the foreign exchange intervention that prevented a movement of the exchange rate. The ERR analysis focuses on observed changes in the currency. The EMP allows us to understand how much of the observed change was policy-determined.

3.1. Measuring the EMP

The EMP is the total pressure on the exchange rate, resisted primarily through forex intervention (thereby causing a change in reserves) or relieved through the exchange rate change. There exist several measures of EMP in the literature that combine changes in the exchange rate and reserves, but most of them suffer from problems of units. Some other measures have tried to resolve this problem by normalizing the exchange rate and reserves and weighing them by the inverse of their respective volatilities (or using alternative weights).[7] However, as pointed out by Pontines and Siregar (2008), all these EMP indices are characterized by the common problem of the arbitrary choice of weights.

This, in turn, can result in misleading conclusions about the EMP, especially during the ERR changes. For example, having the inverse of the standard deviation of the exchange rate and reserves as the weights imply that in a fixed ERR, the weight assigned to movements in the exchange rate by construction would be infinity (Patnaik et al. 2017). This means that if in a country with a fixed ERR, small changes in the exchange rate are allowed, this will show up as very high EMP values because of the large weight assigned to exchange rate movements and small weight assigned to reserve changes.

The EMP measure proposed by Patnaik et al. (2017) avoids these problems and also measures the EMP in consistent units, i.e., percentage change in the exchange rate. They calculate the EMP as the actual change in the exchange rate that took place and the change that would have occurred in the absence of any forex intervention. They estimate the following equation to derive the EMP measure:

$$EMP_t = \Delta e_t + \rho_t I_t \quad (4)$$

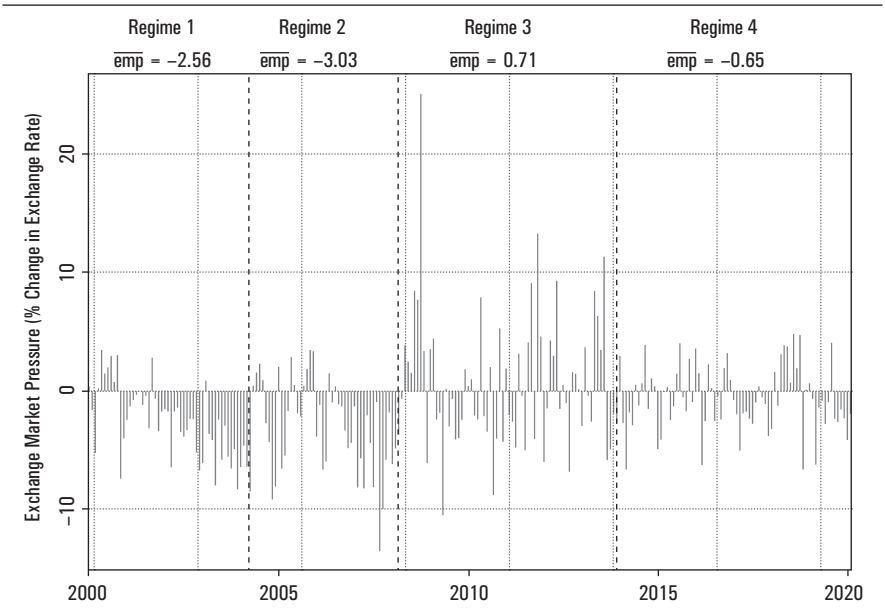
7. See, for example, Eichengreen et al. (1996), Sachs et al. (1996), Kaminsky et al. (1998), Pentecost et al. (2001), Klaassen (2011), among others.

where, Δe_t is the percentage change in the nominal exchange rate, I_t is the actual intervention in the forex market measured in billion dollars, and ρ_t is the percentage change in the exchange rate associated with $1 billion forex intervention. They estimate the value of ρ_t which they call the conversion factor. $\rho_t I_t$ is, therefore, the exchange rate change that would have materialized had there been no forex intervention. This, added to the actual change in the exchange rate, gives a comprehensive measure of the pressure faced by the exchange rate.

A negative EMP value denotes an appreciation pressure vis-à-vis the US dollar, whereas a positive EMP value captures the depreciation pressure. The EMP index is expressed in units of percentage change in the exchange rate over a one-month period.

We plot the EMP over our sample period in Figure 3 and highlight the four exchange rate regimes using vertical lines.[8] We find that during the first, second,

FIGURE 3. Exchange Rate Regimes and Exchange Market Pressure Index



Source: Authors' calculations based on Patnaik et al. (2017).

Note: This graph plots the Exchange Market Pressure index across the four exchange rate regimes. The average EMP index values ($\overline{emp}$) in each regime has been mentioned at the top of the graph. This EMP measure is constructed based on Equation (4) and using data on forex intervention, percentage change in exchange rate and the same rho values as in Patnaik et al. (2017). A negative EMP index denotes pressure on the currency to appreciate whereas a positive EMP implies pressure on the currency to depreciate.

8. The EMP for India refers to the pressure on the rupee to appreciate or depreciate vis-à-vis the US dollar. As shown in Table 1, the dollar consistently comes up as the currency against which the rupee is managed during the period of our study. Also as shown by Ilzetzki et al. (2017), the US dollar continues to be the world's dominant anchor currency. In the case of India, as of 2012, 86 percent of the exports and 80 percent of the imports were denominated in dollars.

and fourth ERR, the EMP was mostly negative. This implies that the rupee experienced a pressure to appreciate for a majority of the sample period. The direction of the EMP changed around the time of the 2008 Global Financial Crisis. During the third ERR, which ranges from 2008 to 2013, the rupee primarily faced a pressure to depreciate.

When we look at Figures 2 and 3 in conjunction with each other, the implications are interesting. During three of the four regimes, the EMP and the actual movement of the exchange rate seem to have been in the same direction. In Regimes 1 and 2, the EMP shows a pressure on the rupee to appreciate and the exchange rate seems to have actually appreciated. In Regime 3, the EMP shows a pressure on the rupee to depreciate and the currency seems to have actually depreciated. However, this does not seem to be the case for Regime 4. In the next section, we explore this in greater detail and for this we look into the response of the RBI to the EMP across the four exchange rate regimes.

3.2. Managing the EMP across Exchange Rate Regimes

In this section, we ask how the EMP was managed across the four exchange rate regimes. Specifically we look into the proportion of EMP that was resisted through forex intervention and the proportion that was relieved through the exchange rate change in each of the regimes.

Equation (5) shows the share of the EMP absorbed by the exchange rate change ($\Delta e_t/EMP_t$) and the share of the EMP absorbed by forex intervention ($\rho_t I_t/EMP_t$). If the ERR is a pegged (flexible) or actively (less actively) managed one, the share of forex intervention in the EMP absorption would be relatively higher (lower) and the corresponding share of the exchange rate would be lower (higher).

$$\begin{aligned} EMP_t &= \Delta e_t + \rho_t I_t \\ 1 &= \Delta e_t/EMP_t + \rho_t I_t/EMP_t \end{aligned} \tag{5}$$

In Table 2, we report the average values of shares of the EMP absorbed by the exchange rate change and forex intervention for all the four exchange rate regimes. Here we look at the currency spot market intervention. We also report the average values of the EMP, the actual change that took place in the exchange rate, and the net spot market intervention (dollar purchase less dollar sale) during these regimes.

We find that during Regime 1 (2000–2004), the EMP and the exchange rate moved in the same direction. The average EMP was –1.95 percent, indicating a pressure on the rupee to appreciate. The actual change in the exchange rate was –0.005 percent, meaning that the exchange rate appreciated but by much less than what was implied by the EMP. This was because during this period, the RBI intervened in the forex market and bought enough reserves to counter the currency appreciation but not to change the direction of movement of the

TABLE 2. Exchange Market Pressure (EMP) Management across Exchange Rate Regimes

FX Regimes	*EMP^*	*Change in Exchange Rate^*	*Net Spot Intervention# (USD Bn)*	*Share of Exchange Rate*	*Share of Intervention*
January 14, 2000 to March 19, 2004	–1.945	–0.005	1.140	–0.094	1.094
March 26, 2004 to February 29, 2008	–2.075	–0.174	2.792	0.653	0.347
March 7, 2008 to November 22, 2013	1.017	0.647	–0.804	1.029	–0.029
November 29, 2013 to February 29, 2020	–0.526	0.186	2.074	0.603	0.397

Source: RBI and BIS databases, EMP index from Patnaik et al. (2017) and authors' calculations.

Note: The columns report averages across the four exchange rate regimes.

#Net spot intervention is the purchase of dollars minus the sale of dollars. A positive value means more USD were bought, on average, during the regime, while a negative value means more USD were sold.

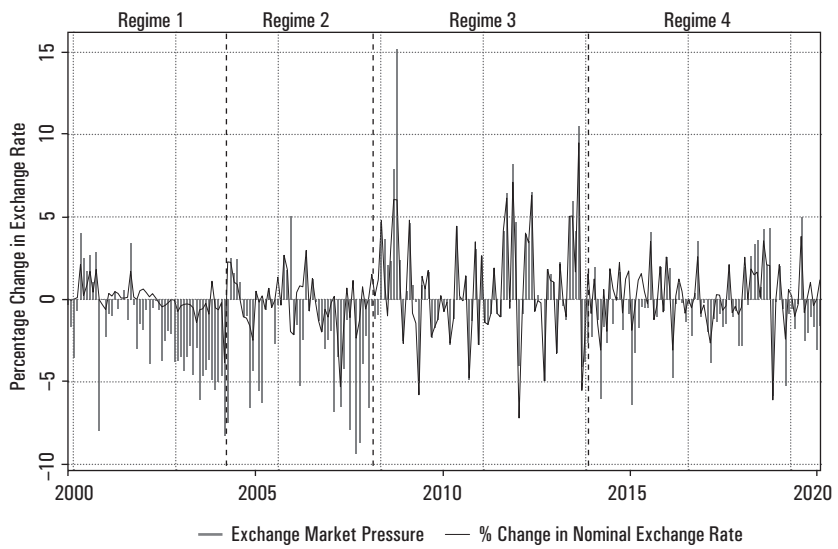
^A positive value corresponds to currency appreciation and a negative value to currency depreciation. While the last regime continues till the end of our sample period (December 2020), here we only show till February 2020 because after that the country was hit by the COVID-19 pandemic and we analyze the exchange rate dynamics of the pandemic period in a subsequent section.

exchange rate. As Table 2 shows, the average net spot market intervention (dollar purchase net of dollar sale) by the RBI was $1.14 billion. The average share of spot market intervention was also higher than the share of the exchange rate in EMP absorption; in fact, it was the highest in the sample period. This can also been seen in Figure 4, which plots the EMP series against the actual change in the nominal exchange rate. This is consistent with the description of Regime 1 as one where the rupee was mostly pegged to the dollar as shown in Table 1.

By comparison, the rupee was relatively less managed in Regime 2 (2004–2008). The actual appreciation in the exchange rate (–0.174 percent) was significantly lower than the appreciation pressure indicated by the EMP (–2.075 percent), implying that forex intervention by the RBI continued to have a role to play. The appreciation pressure on the rupee in this regime was the highest in our sample period. This might explain why the RBI's average net purchase of dollars ($2.79 billion) was also the largest in this regime. At the same time, the share of the exchange rate (65 percent) was higher, indicating that the rupee was allowed to fluctuate more.

This trend of the RBI intervening and buying dollars to prevent or lower the extent of rupee appreciation was reversed during Regime 3 (2008–2013). The average change in the exchange rate was closer in magnitude to the average value of the EMP. This was the only period in our study during which the RBI became a net seller in the currency spot market. In the aftermath of the 2008 crisis, the rupee faced depreciation pressure, as shown by the positive, average EMP value of 1.02. The RBI sold dollars in the forex market as a result of which

FIGURE 4. Exchange Market Pressure (EMP) and Change in Exchange Rate across Regimes



Source: BIS database, EMP index from Patnaik et al. (2017) and authors' calculations.

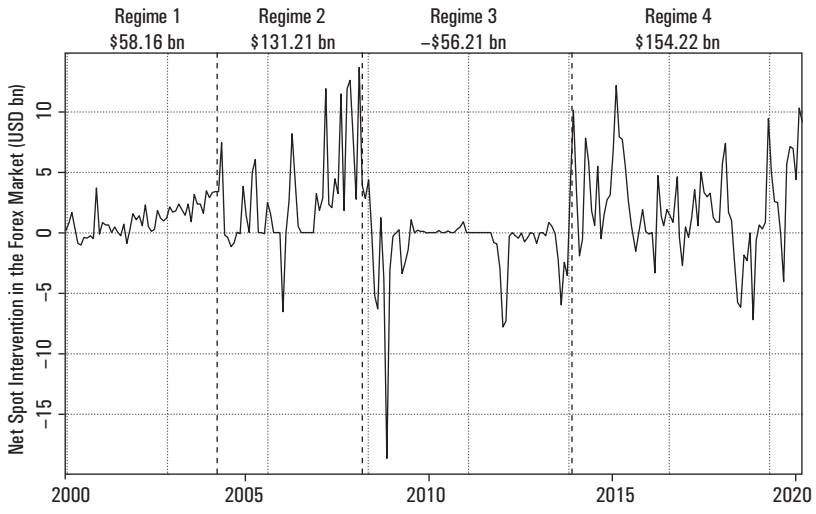
the exchange rate depreciated but by less (0.65 percent on average) than what was implied by the EMP.

Attempts by the RBI to resist the currency depreciation by selling reserves did not contribute significantly to EMP management. The EMP was primarily relieved through the exchange rate change, as can also be seen from Figure 4. The absolute magnitude of the average change in the exchange rate was the highest in this regime and the share of the exchange rate change in the EMP absorption was also the highest. This shows that during this period, the exchange rate was predominantly in a floating regime. This confirms our earlier observations based on the results presented in Table 1, which showed that this was the only regime in our sample period when the rupee came closest to being a flexible currency.

The contrast between Regimes 1 and 2, on one hand, and Regime 3, on the other hand, are further highlighted in Figure 5, which plots the EMP series against the net spot market intervention. The figure clearly shows that spot market intervention was relatively lower during Regime 3, and in the direction of the dollar sale, whereas the higher interventions in Regimes 1 and 2 were mostly in the direction of dollar purchases. Figure 6 plots the gross intervention by the RBI in the forex market (dollar sale + dollar purchase). The figure shows similar magnitudes during Regimes 1 and 2. During Regime 3, the turnover in the forex market was the lowest. It went up again in Regime 4.

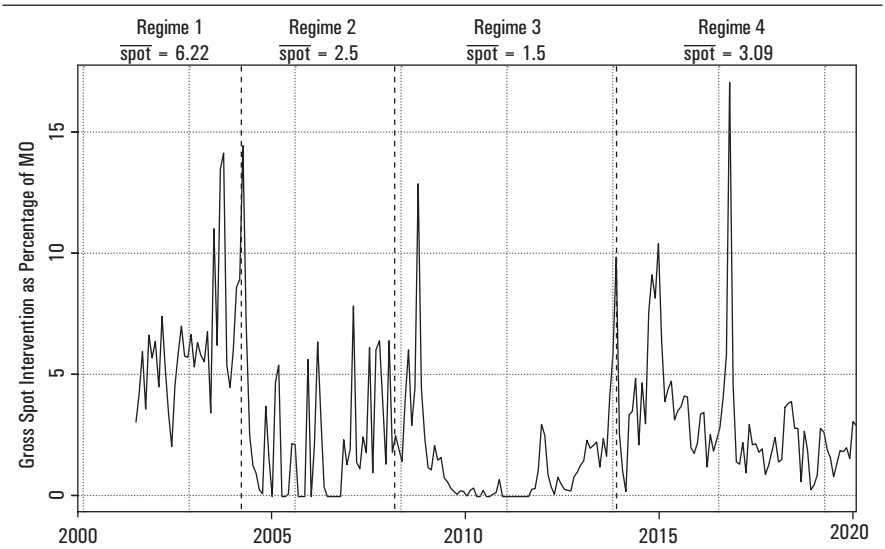
During the last and most recent regime (2013–2020), the average EMP was –0.53 percent and the actual change in exchange rate was 0.19 percent. This means that on average, there was a pressure on the exchange rate to appreciate

FIGURE 5. Net Intervention in the Currency Spot Market



Source: RBI database and authors' calculations.
Note: Total spot intervention by RBI in forex market (in USD billion) is mentioned at the top of each regime's duration in the graph.

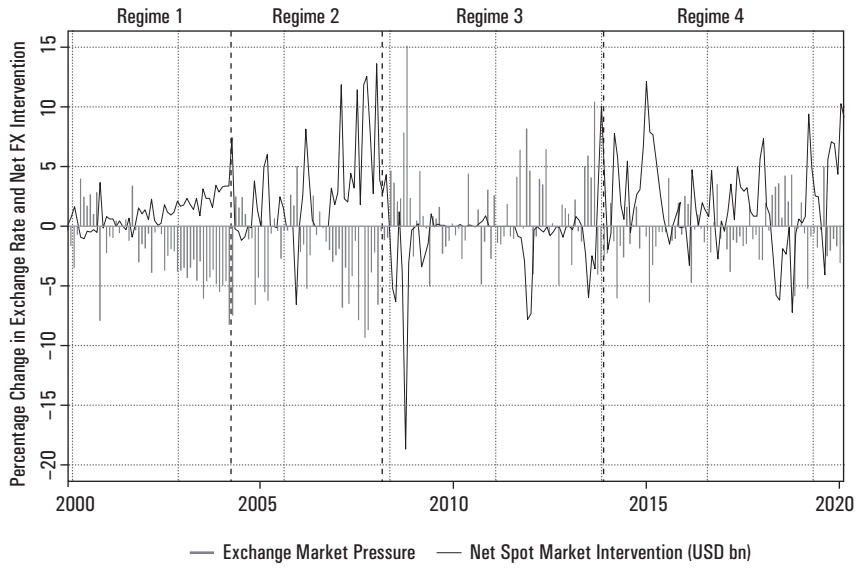
FIGURE 6. Gross Turnover in the Currency Spot Market



Source: RBI database.
Note: This is a graph of the total dollar sale and purchase by the RBI expressed as a share of MO (*spot*). The average spot values ($\overline{spot}$) are reported at the top of each regime's duration in the graph.

but the exchange rate depreciated. The only way this could have happened was if the RBI did "excessive intervention" in the forex market to buy dollars. If the RBI bought enough dollars to counter the currency appreciation or simply to reduce the currency volatility, then the exchange rate, on average, would still

FIGURE 7. Exchange Market Pressure (EMP) and Net Spot Market Intervention



Source: RBI database, EMP index from Patnaik et al. (2017) and authors' calculations.

have appreciated but the magnitude of appreciation would have been less than what was reflected in the EMP, as was the case in Regimes 1 and 2.

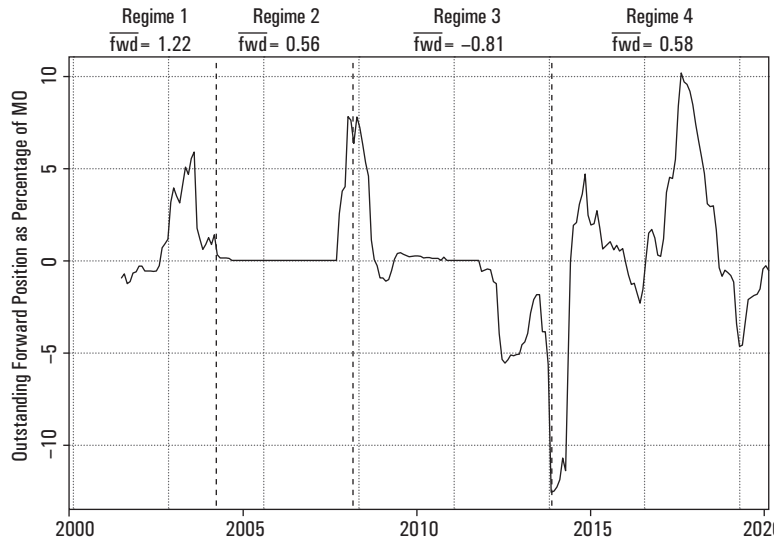
It is interesting to note a sort of anomaly in this context. As can be seen in Figure 7, in Regime 2, when RBI's net dollar purchase was the highest ($2.79 billion), the appreciation pressure on the rupee was also the highest (–2.08 percent), whereas in Regime 4, even though the net purchase was the second highest ($1.86 billion) in the sample period, the appreciation pressure on the rupee (–0.53 percent) was the lowest during our study period. This potentially indicates "excessive" forex intervention by the RBI. The average share of the exchange rate in the EMP absorption was higher than that of spot market intervention but Regime 4 was clearly one where the exchange rate was more managed as compared to the previous ERR and was, in fact, largely similar to that in Regime 2. This corroborates our findings from Table 1 as well.

Over and above intervening in the currency spot market, the RBI also intervenes in the forward market. Figure 8 shows the monthly outstanding position of the RBI in the currency forward market as a percentage of the total money supply.[9]

In Figure 9, we plot the EMP measure against the RBI's net foreign exchange intervention in a four-quadrant graph. The figure sheds some more light on the RBI's asymmetric intervention in the currency market. For a majority of the time, the RBI has been a net buyer of dollars in response to an appreciation

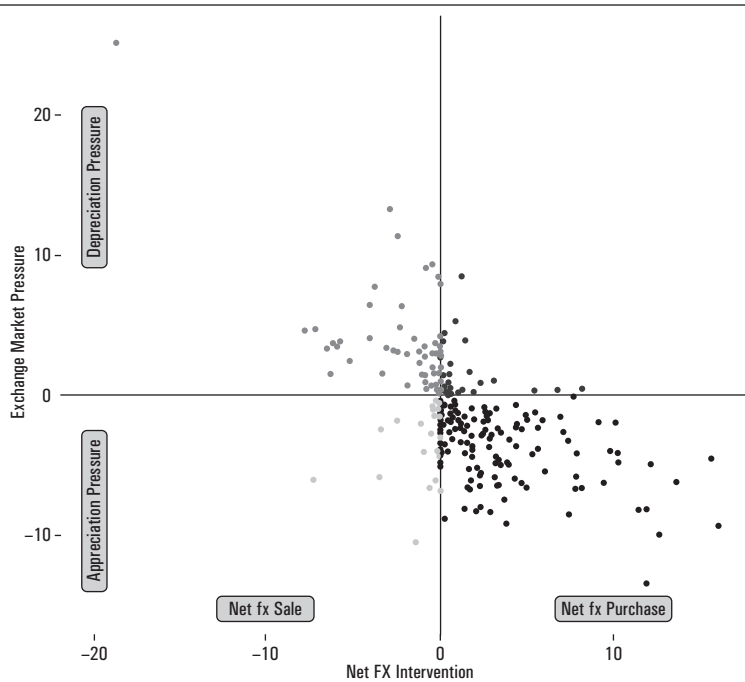
9. In the absence of detailed data on the RBI's forward market interventions, we are not able to delve deeper into this particular aspect of currency management.

FIGURE 8. Outstanding Position in the Currency Forward Market



Source: RBI database and authors' calculations.
Note: This is a graph of the monthly outstanding forward position as a share of MO (*fwd*). The average values ($\overline{fwd}$) are shown at the top of each regime's duration in the graph.

FIGURE 9. RBI's Asymmetric Intervention in the Forex Market



Source: RBI database, EMP index from Patnaik et al. (2017) and authors' calculations.
Note: This is a four-quadrant graph plotting the monthly net forex (fx or FX) intervention by the RBI against the Exchange Market Pressure index.

pressure on the rupee, as seen from the density of the scatter plot in the lower right hand quadrant of the graph. This further suggests that the RBI does not intervene in the forex market only to contain volatility of the rupee because if that had indeed been the case, then we would have seen a more well-rounded distribution of the scatter plot.

4. Understanding the Regimes and the Transitions

In this section, we delve deeper into the transitions from one ERR to the other to throw some light on the underlying macroeconomic conditions. While it is difficult to exactly pinpoint the factors that cause regime changes, we provide a descriptive analysis of the events leading up to a regime transition. The idea here is that the manner in which the EMP was managed in one regime versus the other might have been a function of the underlying macroeconomic conditions or shocks faced by the economy during the transition periods.

We primarily analyze the transitions across the regimes from the perspective of changes in capital flows, resultant changes in the EMP, and how this was subsequently managed by the central bank. As discussed in Ilzetzki et al. (2017), forex intervention and accumulation of reserves by countries since the early 2000s have much to do with the desire to stabilize exchange rates in an environment of increased capital market integration.[10] Figure 10 shows the evolution during our sample period of the forex reserves holding of the RBI across the four ERR.

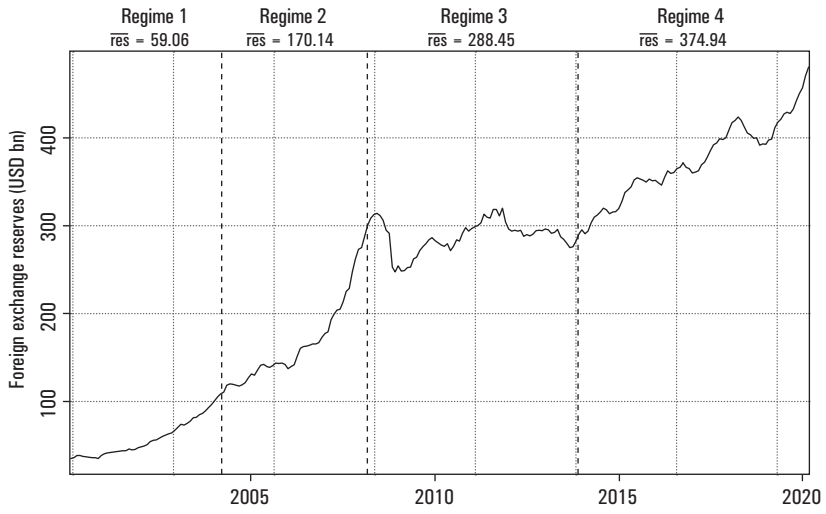
4.1. Transition to Regime 2 (March 2004)

The transition from Regime 1 to Regime 2 was shaped by the depletion of government bonds on the RBI's balance sheet towards the beginning of 2004, thereby hampering the process of sterilization of the RBI's net dollar purchases in the forex market.

During the first exchange rate regime (January 2000 to March 2004), the Indian economy received a total capital inflow of roughly $220 billion and witnessed an outflow of $175 billion. The net capital inflows led to the appreciation pressure as reported in Table 2. This, in turn, caused the RBI to intervene in the forex market and conduct an aggregate net purchase of dollars of $58.2 billion. Reserves went up sharply from $34 billion in 2000 to $110 billion by early 2004, registering an average annual growth rate of around 33 percent, the highest in our sample period. Most of this forex intervention by the central bank was sterilized

10. While we describe what the various regimes in India were during our period of study, we do not go into the potential rationale behind the central bank's actions. For example, we are not trying to explain why the RBI let the rupee depreciate in 2008–2013 or why the RBI attempted to prevent an appreciation in the 2013–2020 period. This may be taken up in future research.

FIGURE 10. Exchange Rate Regimes and Foreign Exchange Reserves



Source: RBI database.

Note: This graph plots the level of the foreign exchange reserves (*res*) held by the RBI across the different exchange rate regimes. The average value of the reserves ($\overline{res}$) in each regime has been mentioned at the top of each regime's duration in the graph.

as a result of which inflation could be kept insulated from the consequences of RBI's reserve accumulation.

The purchase of dollars and full sterilization by the RBI had led the market participants to believe that once the stock of government bonds on the RBI's balance sheet was exhausted, the RBI would stop buying dollars as it would not want to do unsterilized intervention lest it fuels inflationary pressures. As a consequence, when that happened, i.e., when the RBI indeed ran out of government bonds, the rupee would appreciate. This further pushed up the level of capital flows into India as foreign investors believed that the rupee was a one-way bet. Either the rupee dollar rate would stay where it was, if the RBI kept intervening, or the RBI would stop intervening and the rupee would appreciate. This would increase the dollar returns of rupee assets.

As a result, the pressure on the currency to appreciate continued unabated and the RBI did not stop buying dollars either. In 2004, a new arrangement for sterilization of forex intervention was put in place. Under this system, the RBI could continue to peg to the USD, buy dollars and sell Market Stabilization Scheme (MSS) bonds whose sole purpose was sterilization. This allowed the RBI to continue its purchase of dollars without worrying about how to sterilize them.

4.2. Transition to Regime 3 (March 2008)

In March 2008, Bear Sterns in the US had a liquidity crisis. These were the first signs of trouble in the US financial system that eventually led up to the Global

Financial Crisis, culminating in the collapse of Lehman Brothers in September 2008. For emerging economies like India, this was the beginning of pressure on the currency to depreciate. Net capital inflows fell sharply by 93 percent, from $106 billion in 2007–2008 to a mere $7 billion in 2008–2009. The average EMP went from an appreciation pressure of –5.8 percent in 2007 to a depreciation pressure of roughly 2.6 percent in 2008 in response to the massive capital outflows. The ERR turned from one of a pegged rupee that was not being allowed to appreciate to one that was much more volatile with the RBI permitting it to depreciate.

4.3. Transition to Regime 4 (November 2013)

The exchange rate transitioned to the fourth and last regime in November 2013. The events leading up to this date may help throw some light on the transition. In May 2013, the erstwhile Federal Reserve Chair Ben Bernanke announced that the US Fed would soon commence tightening of monetary policy and would taper the quantitative easing program that had been initiated in the aftermath of the 2008 crisis. This episode was widely known as the "taper tantrum." In response to this announcement, the US 10-year yield went up drastically, which in turn, triggered massive capital outflows from emerging market economies including India. India's net capital inflows nearly halved from $89.3 billion in 2012–2013 to $48.8 billion in 2013–2014. This was the second biggest decline in net inflows in our sample period, the largest being during the 2008 Global Financial Crisis. This resulted in a sharp currency depreciation.

In April 2013, the EMP value for India was –2.58 percent, indicating pressure on the currency to appreciate. This increased to 8.46 percent in May 2013, implying a strong pressure on the rupee to depreciate. The average EMP for the period January–April 2013 was –0.55 percent, while the average EMP for the next four-month period from May to August 2013 increased to 7.41 percent. In fact, if we ignore the turbulent period of the 2008 Global Financial Crisis, August 2013 witnessed the highest depreciation pressure on the rupee in our sample. Figure 1 shows the sharp increase in currency volatility during this period. Volatility went up from 6.8 percent in May 2013 to 28.2 percent by September 2013, once again the highest in our sample period. This goes on to show the kind of pressure and volatility experienced by the rupee-dollar exchange rate towards the end of Regime 3.

The RBI and the government responded to the sharp and rising depreciation pressure on the rupee, in the immediate aftermath of the tapering announcement, in multiple ways. These involved restrictions on the currency derivatives markets, a series of steps by the RBI to squeeze liquidity in the banking system and raise short-term interest rates, tariff hikes, restrictions on gold and silver imports, tightening of capital controls to discourage capital outflows by firms

and households, increasing investment limits for foreign institutional investors, liberalizing external commercial borrowing by Indian firms, and so on.

The 91-day Treasury Bill rate, which is a reasonable proxy for the overall monetary policy stance, went up from roughly 7.5 percent in May 2013 to 12 percent in October 2013, a dramatic increase of 440 basis points. At the same time, however, the RBI did not actively intervene in the forex market to defend the rupee. Between May and October 2013, it sold a net amount of only $10 billion in the spot market. In other words, the rupee defense was carried out mostly through monetary policy and capital controls.

It seems that after a prolonged period of minimal intervention to stabilize the currency (2008–2013), the measures undertaken in the wake of the taper tantrum episode to reduce liquidity in the system and defend the exchange rate may have triggered a change in the ERR. As shown in Figure 1 earlier, from December 2013 onwards, the average volatility of the currency came down from 8.6 percent to 5 percent, indicating a more managed exchange rate.

5. The Pandemic and Beyond

During the period of the COVID-19 pandemic (March 2020 to March 2021), specifically in the April–June and July–September quarters of 2020, India witnessed a current account surplus after 17 years of deficit. Exports from India are expected to rise, going forward, as the US economy and world trade recover from the shock imposed by the pandemic. In addition, India remains an attractive investment destination with both Foreign Direct Investment (FDI) and Foreign Portfolio Investment (FPI) flows coming into India.

Between March 2020 and February 2021, the average EMP was –1.95 percent, implying that the rupee faced an appreciation pressure, whereas on average, the rupee appreciated by 0.2 percent. The RBI did an aggregate net purchase of $70 billion during this period, presumably to reduce the extent of rupee appreciation. Foreign exchange reserves went up from roughly $475 billion in March 2020 to close to $580 billion by March 2021. Our estimation of the ERR shows that the pandemic period was a part of Regime 4, which started in November 2013. In other words, the trend of the RBI intervening in the forex market to buy dollars and to manage the EMP by reducing currency appreciation continued during the pandemic.

With the opening up of the trade and the capital accounts, the currency market has grown very large.[11] Old solutions, like buying a few billion dollars to

11. The gross turnover in the currency spot market in January 2000 was roughly $2.34 billion (total dollar sale and purchase by the RBI). This had gone up to $47.92 billion by February 2021. This only captures trading by the central bank.

prevent appreciation, or selling a few billions from the central bank's reserves to prevent a currency depreciation, may no longer work. Moreover, the Indian economy is struggling to recover from the adverse impact of the COVID-19 pandemic, which has dealt a severe blow to economic growth. In the event of an external shock, such as the US Fed announcing a tightening of monetary policy, similar to the 2013 taper tantrum episode, the rupee might depreciate sharply against the dollar. If the RBI attempts to defend the currency either by tightening liquidity in the domestic financial system or by raising interest rates to discourage capital outflows, this may hamper the growth recovery process. The RBI would need to weigh the pros and cons of a currency defense strategy, especially from a medium-term perspective, before embarking on a drive to prevent the rupee from depreciating.

6. Conclusion

The research on *de facto* exchange rate regimes is an evolving field. In this paper, we have tried to understand India's exchange rate regime using the techniques developed in the field in recent years. The *de facto* exchange rate regime literature is limited in that while it uses observed data on exchange rates, it is unable to integrate this behavior with the policy intentions of the central bank. We, therefore, use the techniques developed in the Exchange Market Pressure literature to understand how the pressure on the exchange rate is absorbed, through forex interventions, or relieved through the movements of the exchange rate. This brings into the analysis the exchange rate policy of the central bank.

We find four periods in India's *de facto* ERR. Among these, we find that there was one regime (2008–2013) in which the rupee faced a pressure to depreciate and it was a period of relatively high volatility of the rupee. The other three periods saw pressure on the rupee to appreciate and relatively low volatility of the rupee. In these periods, the RBI accumulated reserves. We also provide evidence that the RBI has been intervening in the forex market in an asymmetric fashion to prevent the rupee from appreciating.

In this paper, we have not been able to measure the role of monetary policy (Goldberg and Krogstrup 2018) or of capital controls (Akram and Byrne 2015). The techniques for measuring these in absorbing the exchange market pressure are still evolving. This is thus an agenda for future research.

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https://youtu.be/kH5jgXcau10

Comments and Discussion*

Chair: **Raghuram Rajan**
University of Chicago and former RBI Governor

Poonam Gupta

NCAER

I enjoyed reading this paper and found it particularly interesting because it relates to some of my own work. The main point made in the paper is that India manages its exchange rate, or in other words, it stabilizes the value of its exchange rate. In order to do so, it actively uses foreign exchange reserves. The paper notes that India deviated from this practice during the period 2008–2013.

The paper also suggests that managing the exchange rate and reserve policy in such a fashion would be difficult under the current inflation targeting framework. It cautions that if an external capital flow reversal event, such as the tapering talk of 2013, were to occur now, the country may have no option but to deploy capital flow measures or capital controls under its current monetary policy framework.

One of my main comments is that the paper is silent on issues related to capital flows to the emerging markets; and therefore, it misses the context within which the emerging markets respond the way they do. The evidence shows that capital flows to emerging markets are fickle "anytime, anywhere" (Bluedorn et al. 2013). Capital flows are fickle in two ways. First, there are episodes of surges when, irrespective of whether a country has absorptive capacity or not, there can be a deluge of capital inflows. Such inflows are mostly driven by external events—e.g., a reduced risk sentiment, ample global liquidity, or easy US monetary policy. When such capital flow surges happen, countries experience exchange rate and asset price appreciation. These surges are eventually followed by the episodes of reversals. The reversals can be of different types—sudden stops, sudden pauses, or emerging market sell-off episodes. Some of the recent emerging market sell-off episodes include the tapering event in 2013, and similar events in 2015 and 2018.

A typical anatomy of the sudden stops, and to some extent that of the emerging market sell-off events, is that they are often preceded by capital flow surges, which result in large appreciations of the exchange rates. When capital flows reverse, they are followed by steep depreciations. This pattern leads to

* To preserve the sense of the discussions at the India Policy Forum, these discussants' comments reflect the views expressed at the IPF and do not necessarily take into account revisions to the conference version of the paper in response to these and other comments in preparing the final, revised version published in this volume. The original conference version of the paper is available on NCAER's website at the links provided at the end of this section.

the question as to whether an emerging market is served well by such episodes of capital flows, which are driven by external factors, and result in such large fluctuations in the exchange rate.

Eichengreen and Gupta (2015) analyzed the tapering event of 2013 and showed that the impact of the tapering was larger in countries which had received large volumes of capital flows prior to 2013, and in countries where the exchange rates had appreciated, resulting in large current account deficits. We also know that India was among the fragile five countries during the 2013 tapering event.

Ordinarily, just like most of the other emerging markets, India manages its exchange rate policy. It practices a manage float, modulates the large variations in exchange rates without targeting a specific level, and uses reserves in doing so. However, as the current paper by Patnaik and Sengupta mentions, between 2008 and 2013, India followed a passive exchange rate policy. It allowed the exchange rate to appreciate and did not build its reserve buffers, and eventually had to face the consequences of the tapering event. Clearly, therefore, a hands-off approach to the exchange rate did not work very well.

Besides, emerging markets have access to very few safety nets in order to insulate themselves from the capital flow surges and stops. One potential safety net could be the swap lines with other large central banks. But these are mostly unavailable, untested, and potentially ineffective. Another option could be the IMF contingent lines, but this too has not proven to be a credible alternative. So, all that the emerging markets have for insulating themselves against the vagaries of capital flows is international reserves.

Thus, in my view, the practice of modulating the exchange rate and maintaining reserves has served India well. While India does maintain a safe level of foreign reserves, its pace of reserve accumulation and level of reserves is comparable to that of other countries.[1]

The second point I would like to raise is regarding the policy toolkit that countries use when they encounter a capital inflow or outflow episode. A World Bank working paper by Gupta and Masetti (2018) considers a broad set of policy tools, including capital flow measures. In the paper, the capital flow measures are divided up into those on resident flows, non-resident flows, inflows, and outflows. The other policies include monetary policy, macro-prudential regulations, exchange rate, and forex reserves. The paper finds that the countries, in general, divide up the burden of sharp increases or reversals in capital flows across the last four measures, i.e., they let their exchange rates react, manage reserves, and use monetary policy. They also use macro-prudential measures but less frequently.

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1. The authors may also cite and include the institutional view of the IMF, which supports the use of reserves in the kind of conditions I mentioned—when capital flows are totally externally determined, and if the other fundamentals are in place, then the use of resources is legitimate and it does work. The way India practices monetary policy is in line with the IMF's institutional view.

Hence, based on the above evidence, I differ from the suggestion by the authors Patnaik and Sengupta that if a tapering-like event were to happen now, during its inflation targeting regime, India will not have any policy options.

Thus, the policy matrix available to emerging markets is much broader than is indicated in the trilemma framework. These policy choices include exchange rate modulation using reserves, interest rates, liquidity measures, cash-reserve ratio, macro-prudential measures, and an active communication strategy. All these were put to good use in 2013 when, despite being impacted very sharply by the tapering event, India managed to emerge from it relatively unscathed. Albeit, one policy measure that was used at that time, and is not advisable in my view, is that of capital flow restrictions in the midst of a sell-off episode. This is something India did experiment with briefly and it backfired.

Capital flow measures may be deployed in two different ways: one as a structural policy tool, which amounts to liberalizing or closing the capital account gradually; the other is in a more counter-cyclical way around the time of the capital flow surges and stops. However, once a sudden stop or a sell-off event happens, sudden capital controls can backfire and generate an additional adverse impact from the market. Indeed, the 2015 paper on "Tapering Talk," by Eichengreen and Gupta establishes that capital inflows are further liberalized during the episodes of sudden stops. There are very few cases when they were actually reversed.

What, if anything, changes during the inflation targeting? A World Bank working paper by Eichengreen, Gupta, and Choudhary (2020) shows that the exchange rate has been less volatile in India during the period of inflation targeting. This can be attributed to low and stable inflation during this period, or to the policy credibility.

So, it may be concluded that emerging markets continue to integrate globally a process that is arguably irreversible. In the process, they are exposed to the volatility triggered by global shocks. The burden of adjustment may be better shared between the exchange rate and reserves rather than letting the exchange rates over-react on each side of the capital flow cycle. The available policy matrix is wider than what the traditional trilemma framework indicates. Capital flow measures are better deployed as a structural policy tool. An active use of the capital flow measures during this period can backfire. And in any case, with low and stable inflation, and greater market credibility, the need for intervention or the need to manage the exchange rate may be less rather than more during the inflation targeting framework.

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Prakash Loungani
IMF

I would like to thank NCAER for the invitation to discuss this very interesting and informative paper. I think the paper succeeds in its task of providing a very thorough, data-based, and analysis-based narrative of the exchange rate regimes that have prevailed in India over the last 20 years. The paper also does what a good paper in a policy forum should do, namely raise interesting questions that deserve discussion and further analysis. Two broad questions, of course, come to mind. First, did the Indian policymakers, notably RBI, get it right over the past two decades? And second, then what should the policy toolkit be over the next decade?

On the paper itself, as noted by one of the authors, Rajeswari Sengupta, it rests on previous two solid pieces of previous research. I would have liked to see in this paper more discussion borrowed from Felman, Patnaik, and Shah of how the parameter rho is measured—rho is the change in the exchange rate associated with a given intervention. And if you dig into the underlying research, you realize that the measurement of rho is quite a delicate art. So from Patnaik, Felman and Shah, you see that to estimate rho, you need to have countries first which have had both regimes; you have to make assumptions about the volatility of the exchange market pressure being similar across those two periods; and the fixed and the floating regimes have to be adjacent, so you can't have too long a window of time or a break in between. This, I think, makes it quite a delicate task. And I would have liked to see more acknowledgement of that in the paper and some robustness checks, to convince us that these four regimes are indeed the ones that we should be focusing on.

I also missed a discussion of whether there is path dependence in the regime. Is it the case that some shock triggers a change in the regime but then the RBI sort of continues in that mode, even if there may be a need to adjust or is it just that a regime goes on until there is another large shock or, as Rajeswari was suggesting in her presentation, though, this is not in the paper, is it that when

the governor changes, the regime changes? As she mentioned, they do have a very interesting previous paper in which they show that monetary policy choices are correlated with who was in charge. And I think this begs a similar analysis.

Let me now turn to the first of the two big questions: Did India get it right? Of course, everyone is aware that in the 1950s and 1960s, Friedman said that we should just let the rupee go and he said, "Look at Canada, they are doing it right." What is clear is that India remains far from Canada. The paper very nicely shows that the RBI has used a very complicated multiple-targets, multiple-instruments strategy. And the answer that I think we want to know from the analysis is: In the end, what is the assessment of the RBI's strategy and the policy choices that were made?

My approach, like that of my co-discussant, Poonam Gupta, will be to look at the cross-country experience to give some clues on that question. As I said, the paper itself is somewhat silent on the merits of what the RBI was doing. And this is in contrast with the views expressed by the authors elsewhere. For instance, on the taper tantrum, Ila Patnaik, some years ago, had said that the rupee is falling and India should let it and had made statements like "the RBI has used these instruments in the past and the results have not been pretty." So, I would like to see a bit of a connection between the dispassionate tone of this paper—just saying that the RBI adjusted to shocks using these different mechanisms—and the kind of passionate views expressed in opinion articles and elsewhere.

As I said, I will use the cross-country evidence to provide a window on whether the RBI was doing it right. Of course, the fact that all central banks were doing it is no guarantee that everybody got it right. There's a lot of groupthink in central banks. But at least it shows that the RBI was not going rogue, it was doing what other central banks were doing. I will draw on a report that we just finished last year at the Independent Evaluation Office of the International Monetary Fund (IEO-IMF) that looked at how countries have dealt with capital flow volatility. There was a lot of background work supporting that report. We reviewed the experience of 27 countries and did some detailed analysis for 12 countries. And we found results that were similar to what Poonam showed from the Gupta and Masetti paper of 2018. What we found is that countries typically have used a combination of instruments and they have also used generally the full range of policy instruments. So it is not as though the countries have said, "We are going to intervene and do nothing else." Fiscal policy and other instruments were also adjusted, namely instruments beyond the ones that the authors look at in this paper. So, countries generally adjust in the right direction, sometimes they cannot adjust fiscal or they choose not to, but they try to move all instruments sort of in the right direction. And then there are some differences across countries: we found that Latin America and Asia tend to rely more on macro-prudential and foreign exchange intervention, whereas emerging Europe seems to be more willing to let the exchange rate adjust.

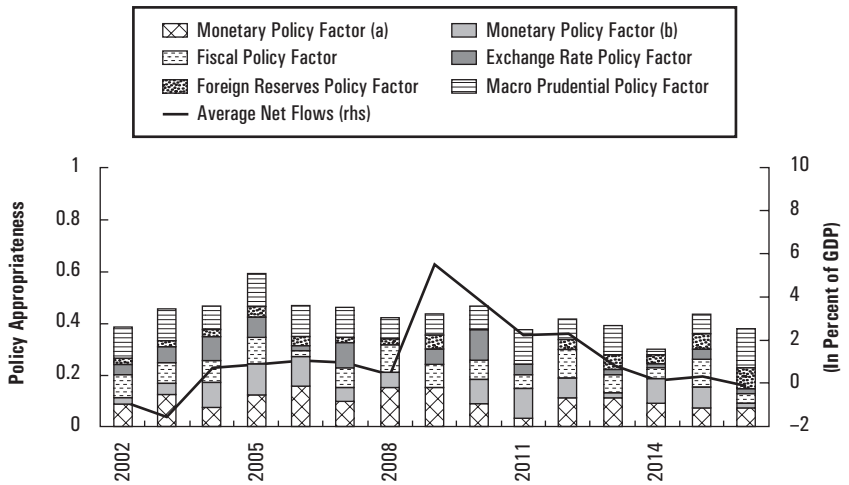
We also found that capital flow and capital controls were not really used to avoid adjustment on other fronts; in fact, their use, if anything, was complementary. So this is a point also that Viral Acharya and Arvind Krishnamurthy have made in a recent paper on how Emerging Market Economies (EMEs) use instruments in a kind of multiple fashion, using them all to bolster one another. I was also comforted to find that the results of our work are very similar to what Rakesh Mohan from his extensive experience and own analysis concluded recently in the *Economic and Political Weekly* (EPW), namely, that countries have basically practiced flexible inflation targeting. Foreign exchange intervention has been the rule rather than the exception. I am quoting Rakesh Mohan here: "Capital account management has been practised to reduce volatility. A variety of monetary policy instruments have been used, not just the policy interest rate, and financial stability concerns have led to the use of various macro-prudential policies."

One other point which came up in our discussions with countries and also in analysis, including at the IMF, is that in certain circumstances, exchange rate movements actually amplify shocks rather than dampen them in the face of volatile flows. So the reluctance to use them is not always just coming from the sort of fear of floating necessarily, but actually a fear that this will make the situation worse.

Figure 1 given on the next page is a kind of example from the work that I have been talking about. You do not need to look at the detail, what you need to know is that we looked at six different policy levers that could be used. And the purpose of the chart is simply to show that all the levers are shown, namely, it is not as though a country said, "I am just going to use macro adjustment" (shown as Macro Prudential Policy Factor), or "I am just going to use intervention" (shown as Foreign Reserves Policy Factor). Typically over the last 20 years, on average across Asian emerging markets, all levers have been adjusted, and generally too we are adjusted in the right direction.

So based on this, what should the policy toolkit be for the next decade? I will use the conclusions of our own IEO report plus the other IPF, namely the IMF's work on a so-called Integrated Policy Framework (IPF). Our own report suggested that from the country experience, and from the recent research, there is some support for the pre-emptive use of capital controls, in some circumstances. I agree with Poonam that, once the capital flow episode gets going, controls can backfire and be counter-productive. But pre-emptive use in some cases can work. We give examples of such use for Korea for Peru. And one particularly, I think convincing example, is that of Iceland in 2016, after they had got over the initial crisis, and flows started coming back. The advice they got from the usual circles was: "Well, your surge is not as big as it was in 2008–2009, there is no need for controls". And they said: "That's exactly the point. We do not want to wait till the surge gets as big as it did last time, we are going to impose some controls now and manage it now". And they got out of that episode because they did it

FIGURE 1. Use of Different Policy Levers in Asia (2002–2016)



Source: IEO staff calculations.
Note: "rhs" stands for right-hand-side y-axis.

in a sort of pre-emptive fashion. So I think that the Iceland experience as well as the kind of long-standing use by Korea and Peru is something that should be kept on the table for discussion. This is the pre-emptive use of capital controls rather than using them once an episode is underway. And the conclusions from the IMF's Integrated Policy Framework so far are also pushing in this direction. What they say is that the difficult trade-offs faced by policymakers warrant the use of multiple tools under certain conditions, the optimal policy combinations depend on the nature of the shocks, and the rules do not take the form of complete reliance on exchange rate flexibility under all circumstances. And the results suggest that in the presence of frictions of the kind still prevalent in many EMEs and links, there is a case for using a multiplicity of tools, including macro-prudential and capital controls, to balance the risks. And precautionary reserve accumulation during normal times also provides a buffer that can be used.

So let me conclude on this note. I look forward to further work in the area by these two authors. I think it would be good to incorporate monetary policy instruments and capital controls into the framework for measuring exchange market pressure. And I hope that this research will draw out the implications for the design of an overall strategy for the RBI. Like Poonam, I am less worried about whether inflation targeting creates tensions, because I think that in practice, the RBI, as the recent interview with the Governor showed, is not likely to become an inflation nutter, but continue to practice flexible inflation targeting and keep other goals in mind. I hope that the authors will continue to work on these issues and give us some guidance on whether India should remain far from Canada or if it should listen to Friedman and just let the rupee go. Thank you.

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General Discussion

Raghuram Rajan opened the general discussion by focusing on RBI interventions in the foreign exchange market as shown in Figure 6 of the paper. The fact that the Bank has engaged in both sales and purchases over short time periods is suggestive of an emphasis on reducing volatility without trying to fix the rupee's level. Policymakers were particularly worried that, in an inflation-targeting regime that still had achieved only limited credibility, those downside movements could easily become more fundamental and sustained.

He argued that there were two mechanisms by which that might occur. First, on the fiscal side, oil purchases are hugely subsidized. Therefore, any fall in the rupee would convert into a larger fiscal deficit with problematic ramifications on the future exchange rate. Second, the corporate sector has large unhedged dollar liabilities; and without a decent bankruptcy regime, downward movements in the rupee could translate into corporate stress, lower economic activity, and additional downward pressure. He reasoned that those efforts to limit volatility are not inconsistent with an inflation-targeting regime if you believe that volatility in the rupee will create dramatic surges in price inflation, making it more difficult to maintain the regime.

He agreed with Poonam Gupta that India needed a high level of own reserves because it did not have significant allies that would provide assistance in periods of financial crisis. In the 2013 taper tantrum, it was able to arrange a swap line, with Japan, but assistance was refused by the United States. He did not perceive the IMF as a viable alternative because of the associated negative stigma effects.

Currently, India has sufficient foreign exchange reserves to provide a high level of protection, sufficient to take care of any contingency.

Finally, he pointed to the ability of the government to tighten or loosen the limits on private families' export of funds as a form of macro-prudential control. He thought the control of mutual funds inflows and outflows had a similar potential as a form of regulatory control.

Suman Bery asked whether the authors were arguing that there has been no exchange rate targeting in recent years, as suggested by Raghuram Rajan's remarks. He noted that some countries, such as Brazil, believe that a flexible exchange rate regime, can be a useful shock absorber and an important part of an inflation-targeting regime. However, it is possible that India's regime is not yet at that stage.

Arvind Subramanian noted that the East Asian exchange rate policy had been quite asymmetric after the Global Financial Crisis, and he wondered if it was reflective of a need for self-insurance, as emphasized by Raghuram Rajan, or a form of *de facto* mercantilism in which countries do not allow the exchange rate to appreciate in order to maintain a strong export position. While there were both purchases and sales in the case of India, there has been a very large net accumulation of reserves. He understood the need to accumulate reserves as part of a self-insurance policy, but argued that it did raise significant competitive concerns. He thought that the paper should have done more to address that aspect.

Kenneth Kletzer suggested that the paper needed to do more to consider external shocks and the role of volatility. He believed that more should be said about the trilemma of combining full monetary autonomy, a fixed exchange rate regime, and an open capital account. In addition, there is a potential trade-off between the output gap and meeting the inflation target. If there is a supply shock there is a trade-off, but with a demand shock there is no trade-off. But that framework does not address the issue of volatility. He believed that many central banks avoided a strict interpretation of the goals and emphasized a centering around their various targets.

Karthik Muralidharan questioned why the response to volatility did not emphasize the development of a currency futures market to allow for the growth of hedging. Anant Narayan asked whether there should be a focus on the real exchange rate instead of the nominal rate.

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COVID-19 and India's Macroeconomy: Pre-existing Conditions, Performance, and Prospects§

ABSTRACT This paper seeks to undertake a holistic assessment of the pandemic's impact on India's macroeconomy. It does so by posing and answering four questions:
First, what was the state of the economy coming into COVID-19, and what contributed to the pre-pandemic slowdown? This will have an important bearing on the post-pandemic outlook.
Second, how complete is the economic recovery from COVID-19 expected to be and where are the most visible divergences? More generally, what are the steady-state macroeconomic implications of a K-shaped recovery?
Third, where is growth likely to come from in the aftermath of the pandemic? Household Consumption? Private Investment? Government Capex? Exports? Which growth drivers have the potential to fire and which may be dormant for a while?
Fourth, what do we know about potential growth coming into the pandemic? To what extent has the slowdown of total factor productivity (TFP) growth impacted potential growth since the global financial crisis? What are the macro determinants of TFP growth and what are the reform implications going forward?

Keywords: *India, Growth, COVID, Consumption, Investment, Exports, Total Factor Productivity*

JEL Classification: *D14, D15, E21, E22, E24, E62, F10*

1. Introduction and Motivation

This paper seeks to undertake a holistic assessment of the pandemic's impact on India's macroeconomy and, more importantly, what it portends for the future. The need for a framework to understand performance and prospects

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is made more urgent by the several cross-currents and contradictions that have characterized the economy over the last year, including:

- A sharper-than-expected economic contraction in the April-June quarter in 2020 juxtaposed with a stronger-than-expected rebound in subsequent quarters raising questions about the cumulative impact of COVID-19 on the economy.
- An initial presumption in some quarters that consumption had led the rebound juxtaposed with subsequent data confirming that consumption, in fact, had been the slowest to recover; instead the second-half recovery was led, in part, by strong government spending.
- A nominal GDP contraction in 2020–2021 but juxtaposed with surging listed company profits followed by strong corporate tax collections.
- Lower-than-expected gross Non-Performing Assets (NPAs) for large corporates but juxtaposed with muted real credit growth in the banking system.
- Ostensibly large output gaps juxtaposed with sticky and elevated core inflation, raising questions about the shock to the supply side and the sources of inflation.
- Strong export growth juxtaposed with adverse terms-of-trade shock from higher crude prices, raising questions about how beneficial, on net, the global economy will end up being.

This paper, therefore, attempts to put together a framework to rationalize these moving parts, arrive at a more holistic assessment, and generate appropriate policy implications. It seeks to do so by posing and answering the following four questions:

1. What was the state of India's economy coming into COVID? What contributed to slowing growth in the years before the pandemic?
2. What has the cumulative macroeconomic impact of COVID been? Where are the divergences most visible and what are the steady-state macroeconomic implications of a K-shaped recovery?
3. Where is growth likely to come from in the aftermath of the pandemic? Household Consumption? Private Investment? Government Capex? Exports? Which growth drivers have the potential to fire and which may be dormant for some time post-pandemic?
4. What do we know about India's potential growth prospects? To what extent has slowing Total Factor Productivity (TFP) growth contributed to any downshift? What, in turn, are the macroeconomic determinants of TFP and necessary policy implications?

In effect, this paper takes a funnel approach, starting near and narrow before broadening out. Section 2 gives an overview of the main findings and Sections 3 to 6 seek to answer each of the four questions raised above in detail.

2. Main Findings

1. In contrast to the previous decade when exports and investment drove growth, consumption was the main driver of growth between 2012 and 2019, but was increasingly financed by households running down savings and running up debt. Incipient balance sheet concerns began to emerge by 2018–before the Non-Banking Financial Company (NBFC) shock, causing households to retrench and private consumption to slow down coming into the pandemic.
2. Strong government spending was, therefore, the key to propping up growth in the years before COVID. This, however, meant that a meaningful quantum of fiscal space had been used up before COVID, likely impacting the fiscal response during the pandemic year.
3. If GDP grows at about 9 percent in FY22—in line with advance estimates—the quarterly level of activity by end-FY22 will be about 7 percent below India's pre-pandemic path, consistent with discernable scarring in the labor market.
4. Contrary to common presumption, neither household consumption nor private investment necessarily appear poised to drive growth in the immediate aftermath of the pandemic:
    a. Income scarring from the pandemic will simply accentuate balance sheet pressures that households perceived pre-pandemic, and these "income" effects are likely to dominate "price" effects from lower real interest rates; this explains why households remain very cautious about future spending in surveys.
    b. The binding constraint on private investment for large firms has shifted from leverage to weak demand; even as large firms have progressively deleveraged in recent years, manufacturing utilization rates have fallen to the mid-60s levels, which are unlikely to spark a broad-based investment cycle until demand recovers.
    c. Furthermore, balance sheet pressures are likely to increase for Small and Medium Enterprises (SMEs) from the pandemic.
5. Exogenous demand drivers will, therefore, be needed to break the sub-optimal equilibrium that private consumption and private investment had entered even pre-pandemic.
6. Exports and sustained government capex have the potential to serve as those demand drivers.
    a. A strong demand revival in developed markets in 2021 induced strong export growth, before the Delta variant-driven COVID wave slowed global growth.
    b. One demand driver, however, may not be enough. Exports will need to be supplemented by continued government capex; this has been the government's strategy with the Centre budgeting large capex increases since the pandemic commenced.

c. In the meantime, sustained privatization, expenditure re-orientation, and tax reforms will have to create the fiscal space to finance public investment, given the fiscal consolidation imperative in the coming years.
d. All told, exports and government capex will need to create a growth bridge till private investment and consumption recover.

7. The imperative for higher trend growth to make up pandemic-induced income losses and ensure public debt sustainability has increased dramatically post-COVID.
8. While much attention has been focused on factor accumulation (investment and labor force participation), slowing TFP growth has shaved off about 250 basis points from trend growth since its peak before the Global Financial Crisis of 2008; put more starkly, its contribution to potential output has halved over the last 15 years.
9. Empirically, we find three important macro determinants of TFP: trade openness, a healthy financial sector, and strong public investment.
10. All told, reforming the financial sector and resolution mechanisms, creating fiscal space through privatization and asset sales to sustain and ramp up public investment, and creating an export-conducive environment constitute a synergistic package of interventions that will be crucial for boosting India's medium-term prospects.

3. Looking Forward by Looking Back

In order to evaluate India's prospects in a post-COVID world, one must start by appreciating the state of the economy coming into COVID. That the economy was slowing discernably is well known. There is, however, much less clarity and agreement on what contributed to that slowdown. To answer that, we must first understand what was driving growth in recent years and, in what ways, these growth drivers were different from previous episodes.

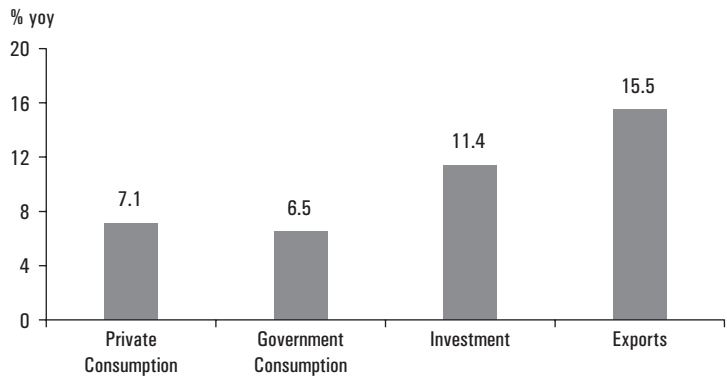
3.1. 2002–2010—India Temporarily Becomes Asian

As a starting point, therefore, it is instructive to compare growth in the years leading up to COVID with that of the early 2000s. Strong growth between 2002 and 2010 was underpinned by an unprecedented export boom (Chinoy and Jain 2018). Exports averaged 15 percent in real terms during that period—a performance that has not been repeated—as Indian firms plugged into global markets and the economy took advantage of the hyper-globalization which characterized that era (Figure 1). While India's export strength is always identified with the Information Technology (IT) sector, what is less appreciated is the strength and growing diversification of manufacturing exports that was visible at the time (Chinoy and Aziz 2010). Manufacturing exports, for instance, grew at

a 20 percent annual average pace during that period—though still lower than booming IT and services exports—and were propelled by India's new-economy exports (engineering goods including automobiles) which progressively replaced the more traditional exports such as textile and gems and jewelry (Chinoy and Jain 2018). All told, Exports as a percentage of GDP more than doubled from 11 percent of GDP to 24 percent of GDP between 2000 and 2010.

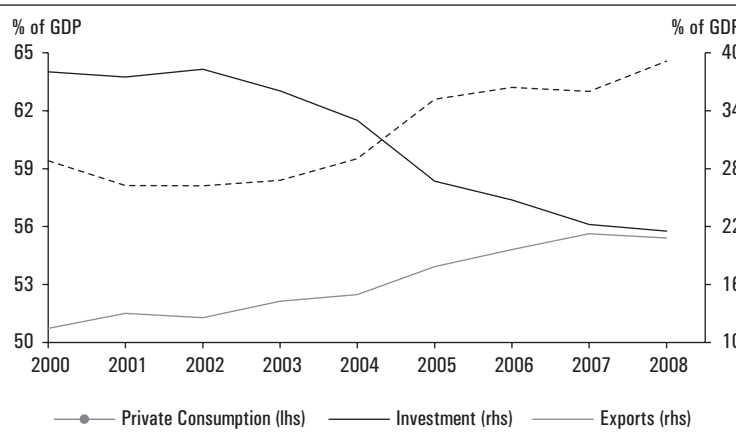
Strong and sustained export growth, in turn, generated the pre-conditions for a domestic private investment cycle as capacities had to be created to service external demand. Private investment, therefore, grew at a double-digit pace across those seven years. India had temporarily become Asian, with growth being driven by the Siamese Twins of exports and investment. In contrast, Consumption to GDP—though still the largest share of GDP—continued its secular decline, with consumption growing less than the overall pie (Figure 2).

FIGURE 1. Growth Drivers (2002–2010)



Source: Ministry of Statistics and Programme Implementation.

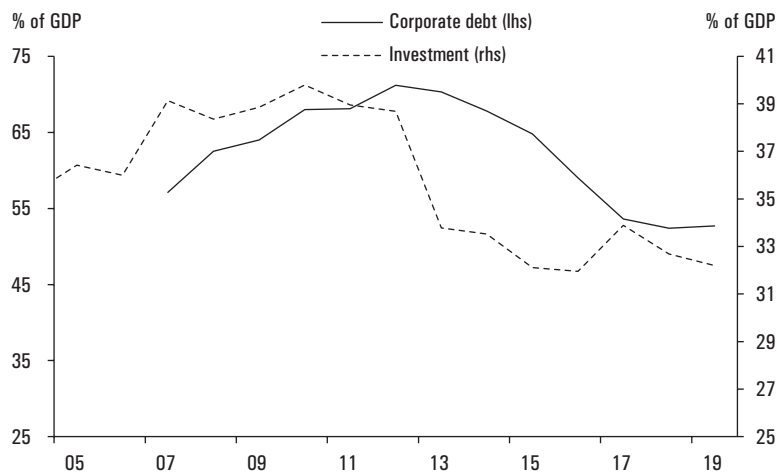
FIGURE 2. Real GDP Share



Source: Ministry of Statistics and Programme Implementation.
Note: "lhs" is left-hand-side axis, and "rhs" is right-hand-side axis.

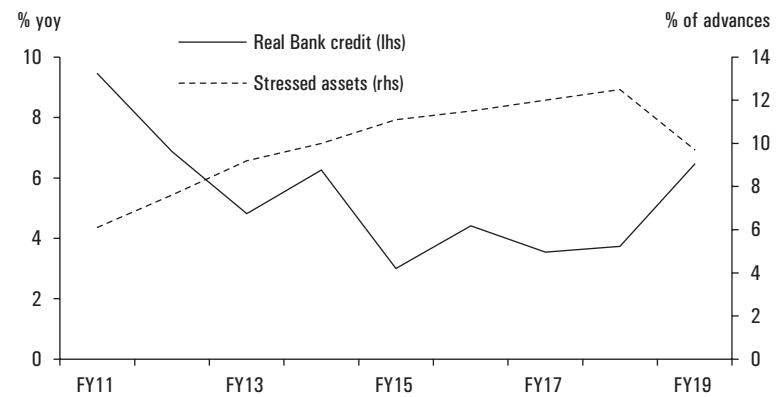
By 2012, however, this model had run its course. Global growth and exports had begun to slow down in the aftermath of the Global Financial Crisis. Meanwhile, domestic investment began to suffer both on account of over-capacity in some sectors (reflected in falling utilization rates) and implementation bottlenecks in others (reflected in rising stalled projects). As projects increasingly became uneconomic on the ground, this began to get reflected in rising NPAs on bank balance sheets creating the conditions for India's much-analyzed "twin balance-sheet" problem. The subsequent pressure on corporates to de-leverage and banks to recognize and resolve stressed assets began to weigh on growth in the following years (Figures 3 and 4). Less appreciated is the fact that these dynamics laid the groundwork for what was to drive growth in the years to come.

FIGURE 3. Investment and Corporate Debt



Source: Bank for International Settlements, Ministry of Statistics and Programme Implementation.
Note: "lhs" is left-hand-side axis, and "rhs" is right-hand-side axis.

FIGURE 4. Real Bank Credit and Stressed Assets

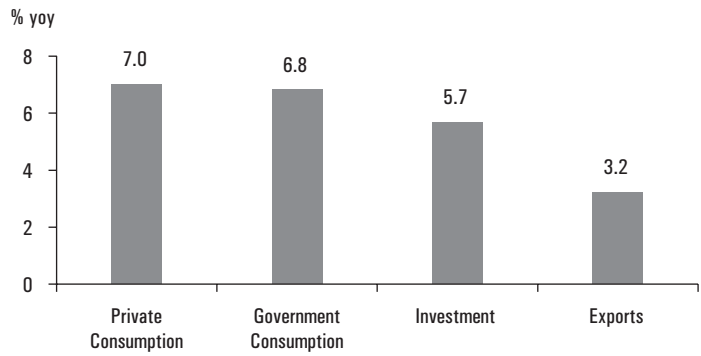


Source: Reserve Bank of India.

3.2. 2012–2019—The Baton Moves to Consumption

In contrast to the earlier episode, growth between 2012 and 2019 was driven largely by consumption, both private and public (Figure 5). While the former was visible and celebrated, the latter was less known or appreciated. At some level, the pivot to private consumption was an inevitable consequence of circumstances. Globally, slowing growth and increased protectionism had dampened export performance, with India's exports growing at just 3.2 percent year-on-year between 2012 and 2019. Domestically, the manner in which the previous growth cycle ended was also responsible for triggering a consumption cycle. As large-corporate NPAs rose and these firms began to de-leverage, bank credit was forced to turn away from large corporates, and banks turned their attention to the one sector of the economy that had been under-saturated: households. What came next was a retail credit boom as banks progressively shifted their exposure from over-levered corporates to under-levered households (Figure 6).

FIGURE 5. Growth Drivers (2012–2019)



Source: Ministry of Statistics and Programme Implementation.

FIGURE 6. Credit to Large Industry versus Retail (Real)

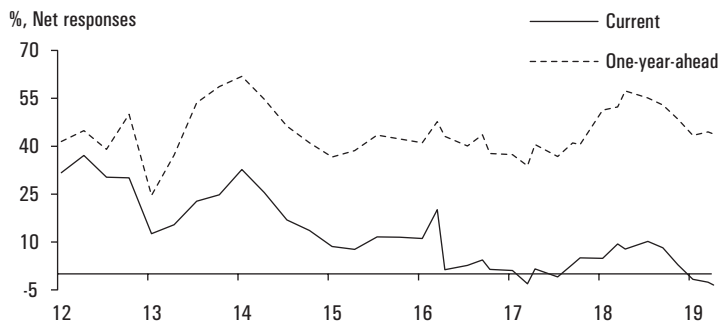
Source: Reserve Bank of India.
Note: The graph in this figure shows six-month moving averages of year-on-year growth (% yoy).

On their part, households were happy to (finally) have access to formal, and therefore cheaper, sources of institutional credit. For a young aspirational population, this seemed like an opportunity to smooth consumption across their lifetimes, borrowing now to repay later, a manifestation of the permanent-income hypothesis.

What was worrying, however, is that under the radar, income perceptions had begun to deteriorate. As the Reserve Bank of India's (RBI's) consumer confidence surveys reveal, urban income perceptions had been declining since 2012; though households held on hope about the future, reflected in future income perceptions holding steady (Figure 7). Similarly, these surveys revealed that spending perceptions consistently exceeded income perceptions after 2015 (Figure 8). All this is consistent with the hard data. Between 2012 and 2019, household disposable income fell by 2 percent of GDP and yet private consumption rose by 4 percent of GDP (Figure 9).

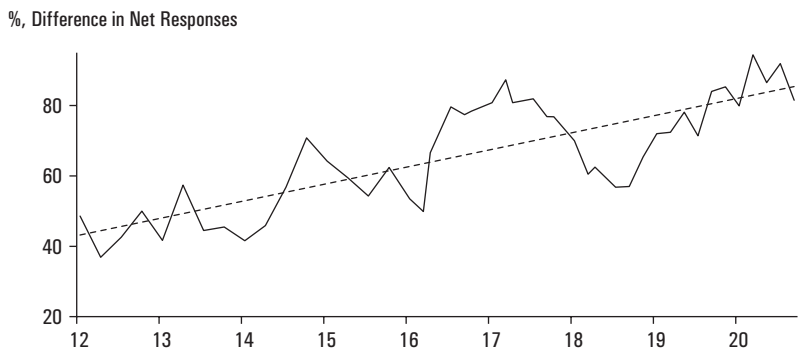
In effect, household consumption was increasingly being financed by households running down savings and running up debt, albeit off modest

FIGURE 7. Household Income Perceptions



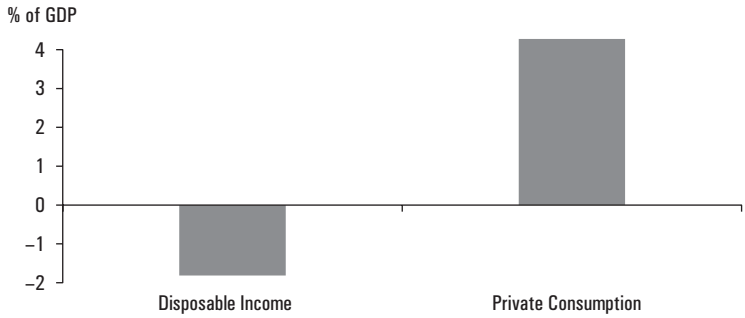
Source: Reserve Bank of India, J.P. Morgan.

FIGURE 8. Difference between Spending and Income Perceptions



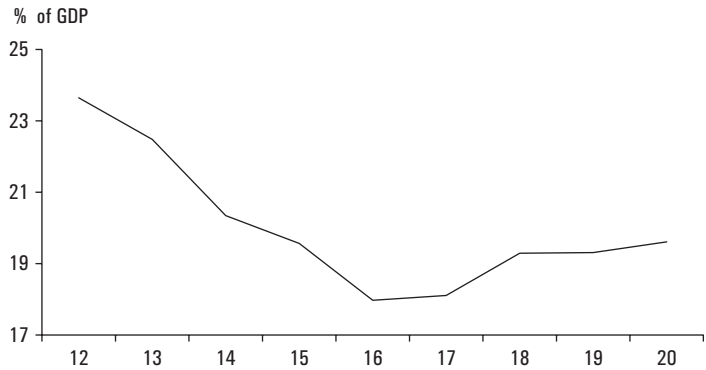
Source: Reserve Bank of India, J.P. Morgan.

FIGURE 9. Disposable Income versus Private Consumption: Change between 2011 and 2019



Source: Ministry of Statistics and Programme Implementation.

FIGURE 10. Household Savings



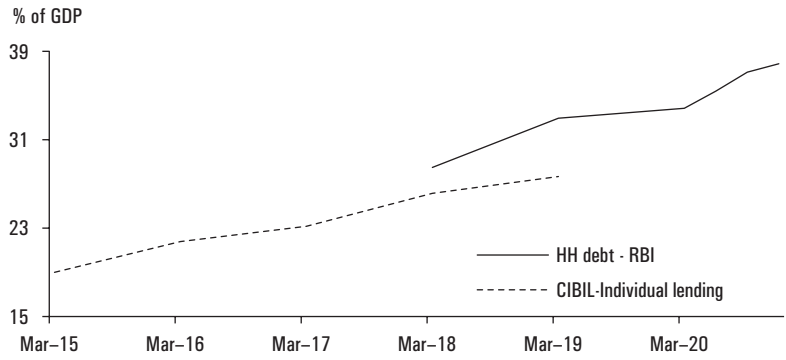
Source: Ministry of Statistics and Programme Implementation.

levels—a phenomenon that we had previously flagged (Chinoy and Jain 2019). As Figures 10 and 11 reveal, household savings fell sharply between 2012 and 2016 while household debt, though off a low base, more than doubled between 2015 and 2020.

3.3. Reality Catches Up

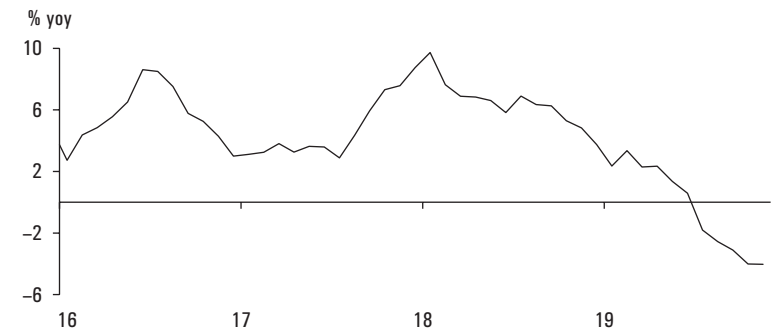
Borrowing to consume may be sustainable in the good times but becomes much less tenable during a slowdown. By 2017–2018, growth had slowed to 6.8 percent, more than a 100 basis points below the average of the previous three years. Perceptions of contemporaneous income by urban households had dampened further. It is not surprising, therefore, that private consumption began to show some cracks. As Figure 12 reveals, consumer goods within the Index of Industrial Production (IIP) began to slow from 2018 itself. Surveys corroborated this with

FIGURE 11. Household Debt



Source: Reserve Bank of India, TransUnion.

FIGURE 12. Consumption Goods (Industrial Production)

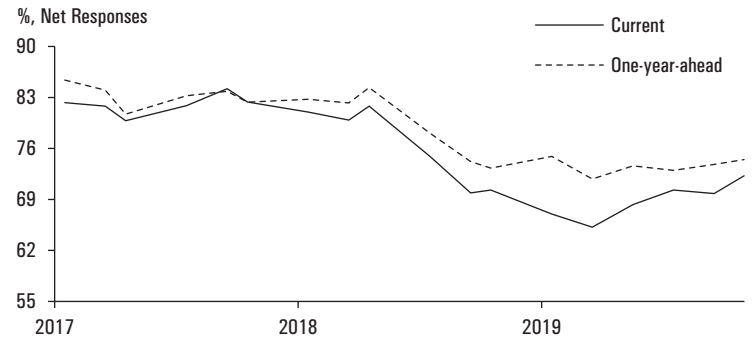


Source: Ministry of Statistics and Programme Implementation.
Note: The graph in this figure shows the six-month moving average of year-on-year growth (% yoy).

household perceptions of spending also beginning to slow from mid-2018 (Figure 13). This is consistent with household savings stabilizing at lower levels and then gradually picking back up from 2018, reflective of rising precautionary savings. To be sure, private consumption growth in GDP data began to slow a year later, suggesting that the initial slowing was led by more lumpy goods consumption (reflected in the IIP data) before broadening into services later.

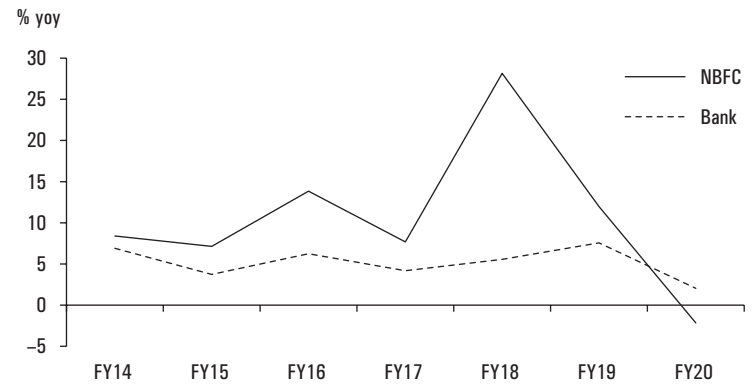
The key identification here is that private goods consumption had begun to slow in 2018 even before the NBFC shock later that year, on incipient balance sheet concerns. These pressures were exacerbated in the aftermath of the incident pertaining to Infrastructure Leasing & Financial Services Limited (IL&FS) in late 2018, as lending standards tightened meaningfully, and a risk-averse banking sector retrenched sharply. This is reflected most starkly in the sharp slowdown of NBFC credit, which was a key source of consumption financing until then (Figure 14). However, as demonstrated above, the start of the consumption slowdown had pre-dated the IL&FS incident. Diagnosing the

FIGURE 13. Household Spending Perceptions



Source: Reserve Bank of India, J.P. Morgan.

FIGURE 14. Real Credit Growth



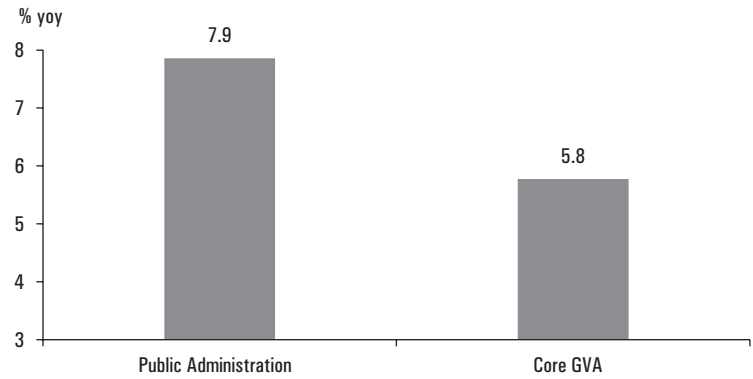
Source: Reserve Bank of India.

reasons for the pre-COVID-19 consumption slowdown—whether it was balance sheet issues or just tighter lending standards in the aftermath of the late-2018 NBFC shock—is crucial because it will inform consumption's prospects in the aftermath of the COVID-19 shock.

3.4. Government Consumption Does the Heavy Lifting

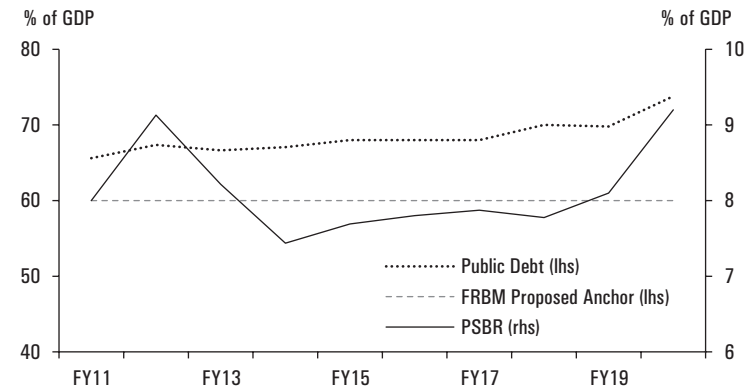
While the contribution of private consumption to driving growth pre-COVID is well recognized, that of the public sector is much less so. Public consumption grew at an average of almost 8 percent year-on-year during 2016 to 2019—two percentage points above private sector growth—as the government tried to mount a countercyclical response to slowing growth (Figure 15). In the year leading to COVID-19 (2019–2020), for example, government spending grew twice as fast as the private sector.

FIGURE 15. Government Spending Versus Private Sector (average 2016–2019)



Source: Ministry of Statistics and Programme Implementation; J.P. Morgan.

FIGURE 16. Public Debt and Public Sector Borrowing Requirement (PSBR)



Source: Reserve Bank of India, Ministry of Finance.

The flip side of this was that the combination of slowing tax revenues and strong government spending meant India's total public sector borrowing requirements increased discernably, and surpassed 9 percent of GDP pre-COVID. This also meant the Public debt, which was targeted to be reduced to 60 percent by 2024, instead continued inching up and breached 70 percent, in the years before COVID (Figure 16). These factors likely had a bearing on fiscal space and the fiscal response during the pandemic.

3.5. A Risk Averse Financial Sector

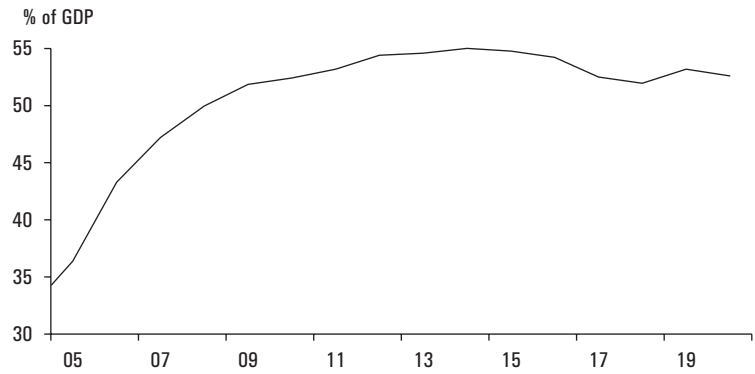
Finally, a third characteristic of India's pre-COVID economy was an increasingly risk-averse financial system after the IL&FS default. More generally, however, India's financial system in recent years has been characterized by the following three features:

First, credit deepening has stalled and partially reversed over the last decade, reflected in the plateauing and subsequent dip of Credit/GDP ratio (Figure 17)—as banks had to contend with stressed balance sheets. This likely reflected both capital constraints on bank balance sheets at various times as well as tighter lending standards.

Second, a wedge has opened up across private sector and public sector banks. Credit offtake of the latter has meaningfully lagged the private sector, suggesting that incentive-compatibility may have become a binding constraint there (Figure 18).

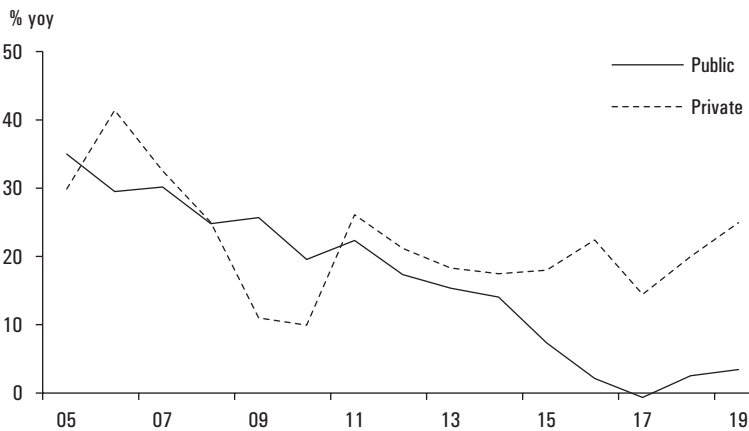
Third, pressures likely got magnified after the IL&FS default with a sharp retrenchment of credit. Incremental credit was being driven largely by NBFCs and small private banks but their balance sheets came into question in the months

FIGURE 17. Bank Credit



Source: Reserve Bank of India.

FIGURE 18. Bank Credit—Public versus Private Banks



Source: Reserve Bank of India.

before COVID-19, culminating with the Yes Bank resolution occurring just days before India's first lockdown. Slowing growth had also tightened lending standards. These three features combined to weigh on credit growth.

To understand the opportunities and challenges for India's economy post-COVID, one must, therefore, examine these three characteristics with India's performance during the pandemic—a topic to which we turn next.

4. Performance during the Pandemic

4.1. A Framework to Quantify Scarring

Our focus in this section is not to predict the exact pace of the recovery in the aftermath of the second or third wave. Instead, it is to understand more holistically the cumulative macroeconomic impact across two years.

GDP contracted a meaningful 6.6 percent in 2020–2021, though less than the contraction feared after the first quarter's out-turn. On that lower base, the Government's Advance Estimates forecast that GDP will grow by about 9.2 percent in 2021–2022.

In isolation, however, it is hard to make sense of a large contraction followed by a near double-digit rebound. It is not clear what this tells us about cumulative performance. Instead, we need to anchor these out-turns to some counter-factual baseline. The most economically meaningful baseline would be to use the forecasted pre-pandemic path of the level of GDP. This tells us what the level of GDP would have been absent COVID (i.e., the counterfactual). To assess the damage from COVID, we can then compare the actual (or forecasted) level of output with this pre-pandemic path.

Most economies have experienced large output loss during the pandemic. But this should be construed as a one-time income loss (akin to a wealth shock) and again, by itself, does not tell us much about any lasting impacts. Instead, what matters is where the level of activity is when an economy is exiting the COVID-crisis, and how that compares to a pre-pandemic path. Has the level of output gone back to the pre-pandemic path? To the extent that it has, as is the case in the U.S. and China, the recovery can be deemed to be relatively complete, in that there are no permanent output losses, though even in those cases employment will take some time to return to pre-pandemic levels.

But to the extent that activity does not converge back to its pre-pandemic path, as is the case with almost all emerging markets, it reflects permanent scarring inflicted by the pandemic. To be sure, scarring can manifest both in levels and growth rates (though these are likely to be strongly correlated). If an economy exits the pandemic some percentage points below its pre-pandemic path, but there is no scarring to trend growth, there will still be recurrent and permanent income losses compared to a pre-pandemic path.

Furthermore, if trend growth is also adversely impacted, losses will simply mount over time. To make up for the losses, therefore, emerging markets will have to push up trend growth to rates that surpass pre-pandemic levels.

4.2. Contextualizing India's Recovery

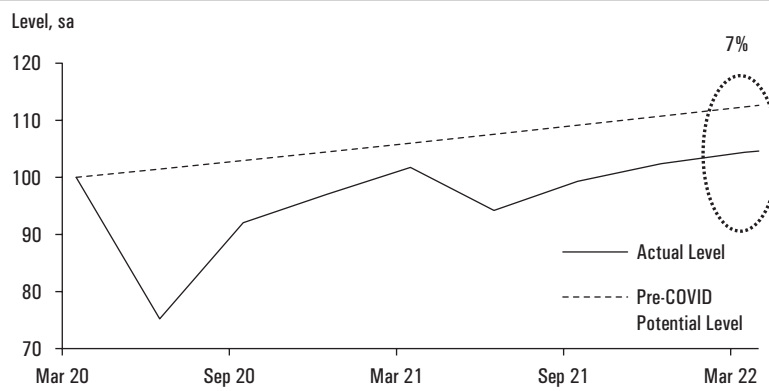
Against this backdrop, how should one think about India's performance?

- To construct the pre-COVID path, we remain conservative by using GDP growth rates of 6 percent for FY21 and FY22, consistent with India's 3-year average growth before the pandemic.
- The post-COVID path is based on advance estimates of FY22 growth of 9.2 percent. The key messages from this section do not change if the actual out-turn in FY22 is slightly different in either direction.

We find that if India grows at 9.2 percent in FY22, the level of output will be about 7 percent below the pre-pandemic path by the fourth quarter of the fiscal year (1Q22).[1] Prima facie, this is a meaningful gap with the pre-pandemic path. If one thinks about the pre-pandemic path as one that is consistent with stabilizing the labor market or one that was used to make investment and borrowing decisions, a 7 percent gap is a non-trivial shortfall (Figure 19).

India, however, will not be unique. Barring the United States and China, almost all economies will be below their pre-pandemic paths, albeit to differing

FIGURE 19. GDP Levels



Source: J.P. Morgan.
Note: IQ 2020 GDP level is considered as 100. "sa" stands for seasonally adjusted.

1. This presumes that the economy has opened up by March 2022 and there are no restrictions; to the extent that some restrictions still exist (i.e., tourism) temporarily pushing up growth above the new trend, the gap will be commensurately smaller.

degrees. Furthermore, one could argue that to compare shortfalls across countries, one must normalize for trend growth. As an example, a 6 percent shortfall for an economy with 6 percent trend growth is very different than for an economy with 2 percent trend growth. In the former's case, the economy has to grow at twice its potential to make up for the gap, say, over the next year. In the latter's case, the economy must grow 4 times its potential, to make up for the losses in the same time period.

We therefore normalize absolute shortfalls by trend growth to assess relative performance across countries. Once we do this, we can reflect any shortfall by "number of quarters of growth lost" to make it comparable across countries.

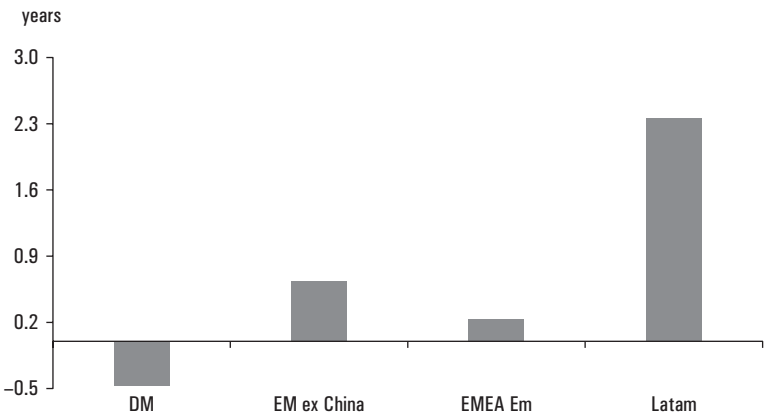
We find that, first, there is no shortfall among developed markets, given the sheer quantum of the stimulus. Second, within emerging markets, Latin America's undershoot swamps those of other regions (Figure 20).

Even adjusting for trend growth, India's shortfall is meaningful (Figure 21), comparable to Indonesia. These findings increase the imperative for stronger growth post-pandemic.

4.3. Consistent with Labor Market Scarring

The aforementioned GDP shortfall is consistent with scarring in the labor market. For example, Centre for Monitoring Indian Economy's (CMIE's) household labor force surveys find that both labor force participation rates have fallen and unemployment rates have risen, in concert. Consequently, the employment to population ratio declined from 39.5 percent pre-pandemic and appears to have stabilized at about 37–37.5 percent (Figure 22). These data points translate

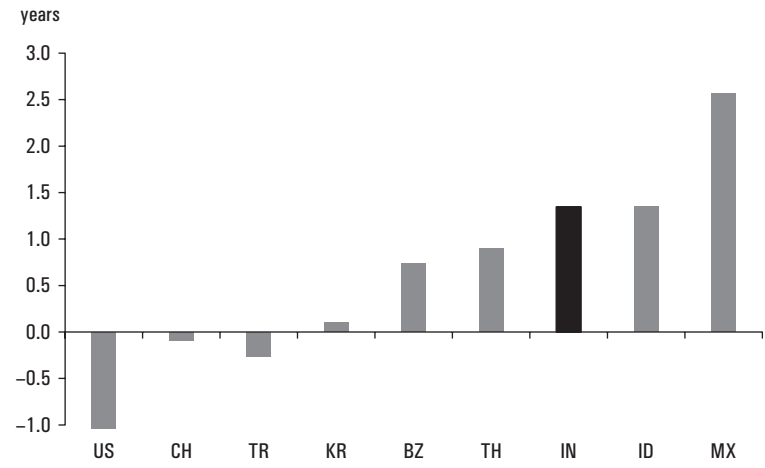
FIGURE 20. Region-wise Output Lost from the Coronavirus Pandemic (in years)



Source: J.P. Morgan.

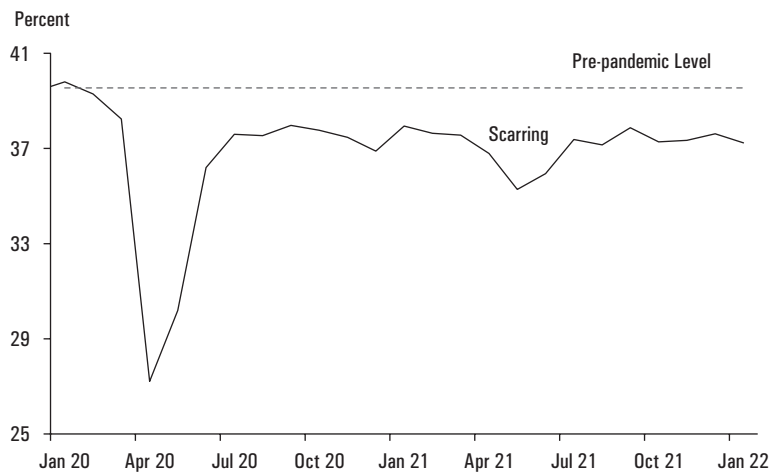
Note: Computation based on end-2022 GDP levels; DM: Developed Markets; EM ex China: Emerging Markets excluding China; EMEA Em: Europe, Middle East and Africa Emerging Markets; Latam: Latin America.

FIGURE 21. Country-wise Output Lost from the Coronavirus Pandemic (in years)



Source: J.P. Morgan.
Note: Computation based on end-2022 GDP levels; US: United States of America; CH: China; TR: Turkey; KR: Korea; BZ: Brazil; TH: Thailand; IN: India; ID: Indonesia; MX: Mexico.

FIGURE 22. Employment-Population Ratio

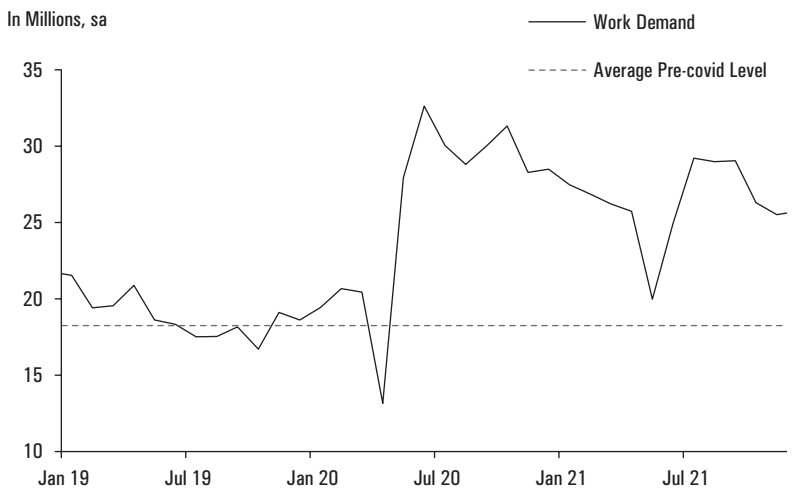


Source: Centre for Monitoring Indian Economy.

into an "effective unemployment rate"[2] of about 7.5 percent pre-COVID, and 12 percent before the second wave, with the prospect that the second wave could weigh on these further.

2. To collapse both lower labor force participation and higher unemployment into one dimension, we hold labor force participation constant at pre-COVID levels and reflect the reduced employment rate into the unemployment rate—for ease of exposition.

FIGURE 23. MGNREGS Household Work Demand



Source: Centre for Monitoring Indian Economy.
Note: "sa" stands for seasonally adjusted.

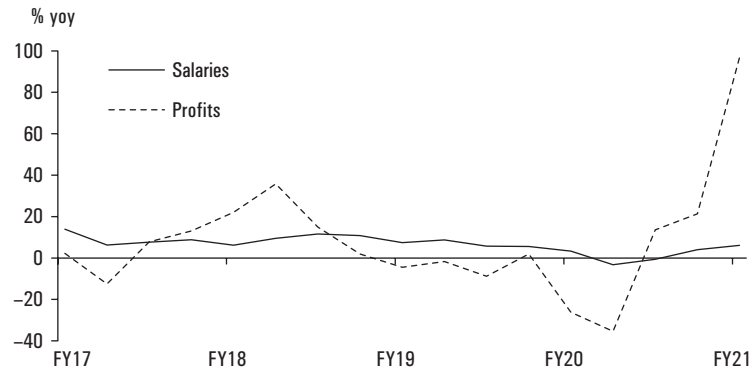
These labor market pressures are also reflected in higher demand for employment provided by the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), which serves as India's automatic stabilizer in the rural economy. Even by the end of 2021, demand for MGNREGS was about 30 percent higher than normal, consistent with labor market pressures (Figure 23).

4.4. A K-shaped Recovery

A defining feature of economies emerging out of COVID—particularly emerging markets—are divergences across multiple dimensions. In India's case, divergences are visible across factors of production, firm size, and income decile:

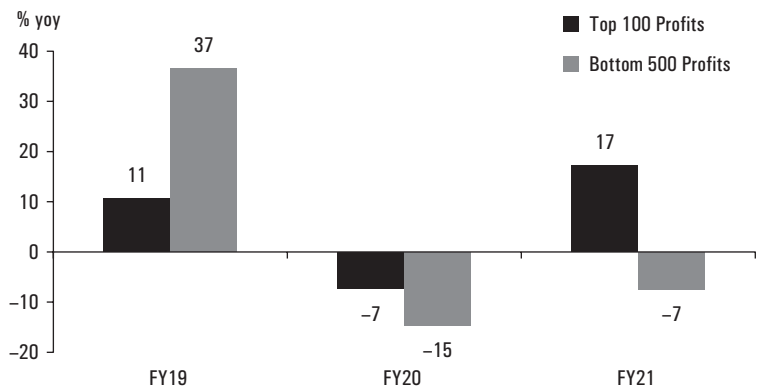
- **Profits versus Wages:** India's recovery appears to be driven disproportionately by profits rather than wages, as we had first discussed last year (Chinoy 2020). A sample of about 2000 listed non-financial firms reveals that earnings grew by 17 percent in FY21 against a wage bill which barely grew (Figure 24). For much of the year, profits were achieved, in part, by aggressive cost rationalization, reflective in the 12 percent cut in operating expenses in FY21. When revenues finally grew in the last quarter of the fiscal year, a disproportionate quantum seems to have accrued to capital rather than labor.
- **Large Firms versus Small Firms:** Furthermore, profit distribution appears to have been skewed in favor of larger firms. For example, earnings of the top 100 listed firms (by market cap) grew at a buoyant 17 percent in FY21 in stark contrast to the 7 percent contraction witnessed by the bottom 500 firms (Figure 25). A similar disconnect is visible in

FIGURE 24. Listed Corporate Profits versus Salaries



Source: 2000 listed non-financial companies' data and J.P. Morgan.

FIGURE 25. Listed Corporate Profits—Large versus Small Firms

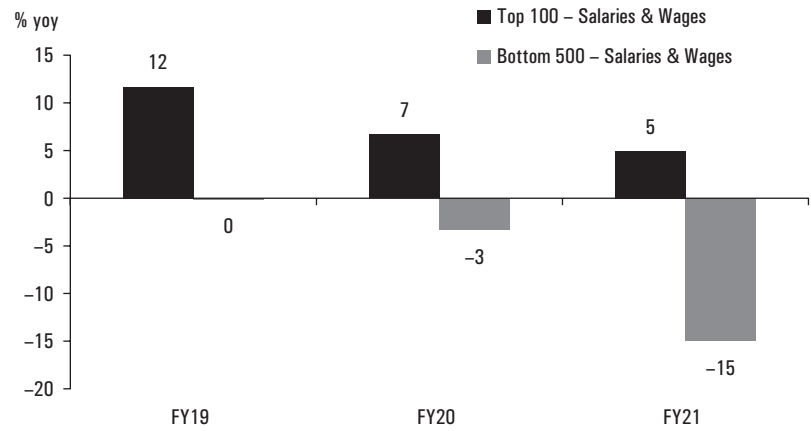


Source: 2000 listed non-financial companies' data and J.P. Morgan.

the salary bill. The top 100 salary bill increased by 5 percent in contrast to the 15 percent contraction witnessed at the bottom (Figure 26). This suggests that large firms were able to withstand the shock better and grow market share while smaller firms were forced to retrench.

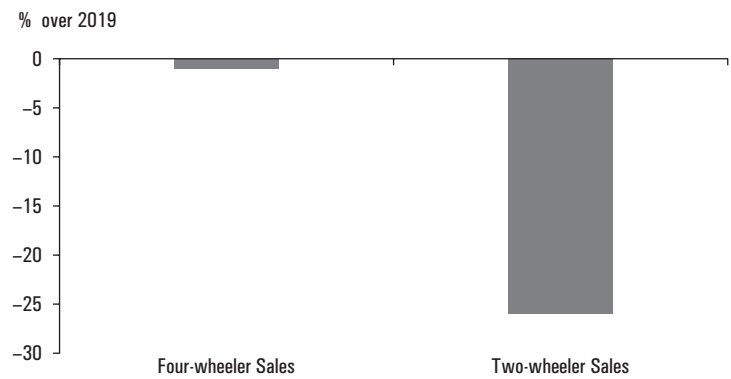
- **Upper Income versus Lower Income:** Consumption patterns reveal a similar skew between the top and the bottom of the pyramid, with the latter having borne the brunt of the shock.
  - Four-wheeler sales—which proxy for consumption at the upper end—contracted 1 percent between January and November 2021 over the corresponding period in 2019; in contrast, two-wheeler sales—proxying for lower-end consumption—contracted by about 26 percent, revealing a wide gulf (Figure 27).
  - Scooters (proxying for urban consumption) appear to have consistently undershot motorcycle purchases (proxying for rural consumption), pointing to relatively greater urban stress, at least before the second wave.

FIGURE 26. Salaries and Wages—Large versus Small Firms



Source: 2000 listed non-financial companies' data and J.P. Morgan.

FIGURE 27. Auto Registrations (January to November 2021)



Source: VAHAAN.

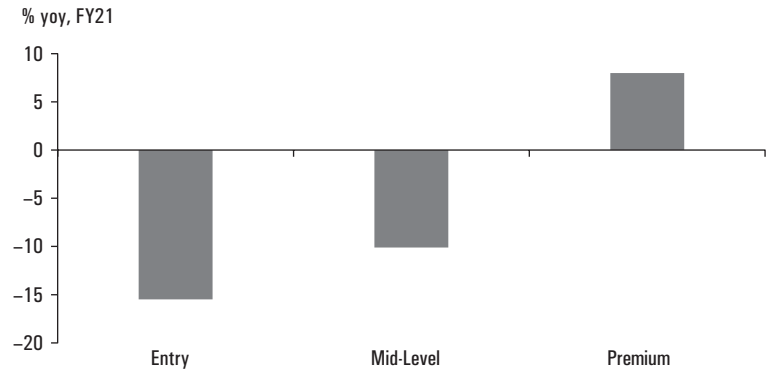
- Even within motorcycles, the premium segment grew 8 percent, the mid-level segment contracted 10 percent, and the entry segment contracted 15 percent in FY21, reinforcing a divergent recovery (Figure 28).

This analysis suggests that incomes at the top have been more protected than at the bottom, with attendant implications for savings and consumption at the bottom of the pyramid.

4.5. Reflected in the Financial Sector and GDP Composition

These real economy divergences are also becoming visible in financial sector performance. Financial institutions that are more geared to the bottom of the pyramid (NBFCs, small banks, Microfinance Institutions (MFIs)) have

FIGURE 28. Motorcycle Segmentation



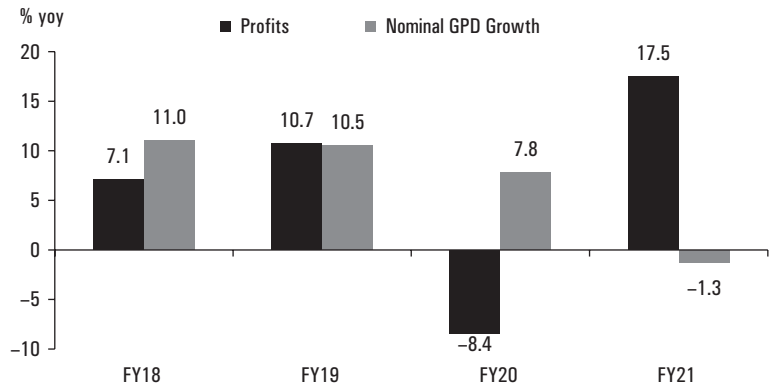
Source: Company data.

witnessed much higher gross NPAs and restructured loans compared to larger banks that cater to the salaried class and larger firms, reflecting the divergent nature of the recovery.

Finally, at the broadest level, a divergent recovery is reflected in the composition of GDP itself, when viewed from the income side. Indian GDP is reported in two ways: the sectoral, production side (agriculture, manufacturing, services) and the functional, expenditure side (consumption, investment, net exports). But there is a third way to slice the pie: the income side. Value addition must ultimately accrue to the different factors of production. On the income side, therefore, GDP is simply the sum of operating profits, the wage bill, and indirect taxes.

India's nominal GDP contracted by one percent in FY21. Yet, listed company profits for the year grew by 17 percent over the same period (Figure 29). By construction, this suggests a meaningful contraction of profits of unlisted firms

FIGURE 29. Earnings and Profits



Source: J.P. Morgan.

(SMEs) and also suggests that the wage bill of listed forms may likely overstate the out-turn of informal wages.

To be sure, the dramatic acceleration of technological adoption during COVID, and the differential productivity impacts it is likely to have on capital, skilled and unskilled labor, can have profound impacts on the future capital-labor mix, and potentially accentuate existing cleavages and inequities.

4.6. Macroeconomic Implications of a K-shaped Recovery

What are the macroeconomic implications of a divergent recovery?

- To the extent that the bottom of the pyramid has borne a disproportionately large share of the burden vis-à-vis the top of the pyramid, this is effectively equivalent to an income transfer from the poor to the rich. From a macro perspective, however, this will be demand-impeding in the steady-state, because the marginal propensity to consume at the bottom is higher than that at the top, just as the marginal propensity to import at the top is likely higher than at the bottom.
- On the firm side, increased profitability of the larger listed firms helps balance sheets, aids with de-leveraging where needed, and therefore, puts those larger firms in a better position to invest, when utilization rates begin to recover.
- To the extent that COVID has further dented SME balance sheets—firms that tend to be more labor intensive—this creates more headwinds for SME investment, which has been one of the sources of the investment decline in recent years.
- To the extent that activity has migrated from the informal sector to the formal sector, both direct and indirect tax collections should get a boost, already being witnessed in very strong tax collections.
- To the extent that the market share of the large firms has increased as a consequence, the pricing power of the larger firms could rise in tandem.

4.7. Putting the Pieces Together

India is not alone in experiencing either an incomplete or divergent recovery. Most emerging markets will be in the same boat, to different degrees. This dramatically increases the growth imperative in the coming years to close the gap with the pre-pandemic path and generate the jobs needed to ameliorate pandemic-induced scarring.

Where can this growth come from in the coming years? Sections 3 and 4 address this issue at two different horizons. Section 3 takes a more near-term view examining the components of GDP on the expenditure side (consumption, investment, government capex, exports) to evaluate which growth drivers will be available in the aftermath of the pandemic. Section 4 takes a longer view by discussing potential growth prospects in India, but specifically honing in on

the contribution of TFP to slowing potential growth over the last 15 years and identifying the macro forces that drive TFP growth.

5. Identifying Growth Drivers

The imperative for strong growth in the post-pandemic period is self-evident. The real question is where it can come from. Given the nature of India's slowdown pre-pandemic and the manner in which the COVID shock has played out, this section asks which growth engines can be expected to fire, and which engines can be expected to remain dormant, at least temporarily. Distinguishing between the two will be crucial in allocating political capital and state capacity, appropriately.

To evaluate this, we analyze the different components of GDP on the expenditure side:

GDP: Consumption (C) + Investment (I) + Government Spending (G) + Net Exports (X-M)

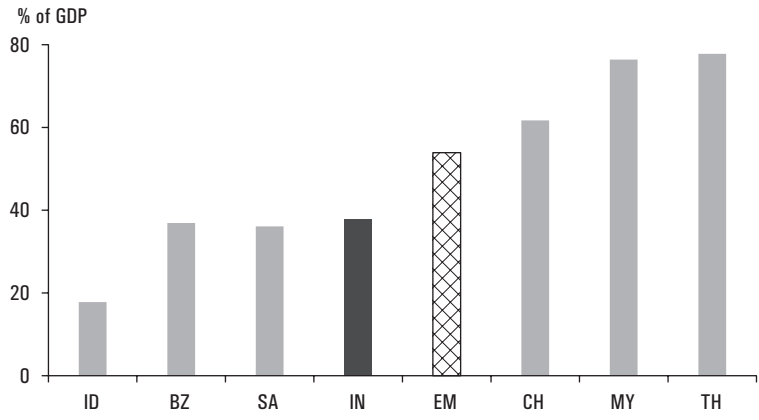
5.1. Consumption: Income versus Price Effects

Perhaps the elephant-in-the-room question is whether consumption can again become the flag-bearer of India's growth in a post-pandemic world? The strength of pent-up demand generated much excitement in the aftermath of the first wave and, in conjunction with very accommodative monetary conditions (lower real interest rates, a deluge of liquidity), created an expectation in some quarters that consumption could again drive growth once the dust from the pandemic has settled.

We remain wary of this hypothesis. As Section 1 described, consumption was already slowing in the run-up to the pandemic on household balance sheet concerns. These pressures have only been accentuated during the pandemic, manifested in visible signs of labor market scarring, wage pressures, and increased income uncertainly. To be sure, India's level of Household Debt to GDP ratio is not excessive by emerging market standards (Figure 30). But the sharp debt ramp-up in recent years juxtaposed with heightened income uncertainty from the pandemic is likely to keep households cautious in the near-term. Recall, household precautionary savings were already rising in the run-up to COVID-19. Furthermore, distributionally, COVID-19 can be thought of as generating an income transfer from the poor to rich, whose marginal propensity to consume is lower in the steady state, once pent-up demand is exhausted.

There are some offsets. Monetary conditions have eased meaningfully (lower real lending rates and a deluge of liquidity), and this should provide some tailwinds for consumption. But these beneficial "price effects" are likely to be dominated by adverse "income effects" (Figure 36) as balance sheet concerns have been accentuated, particularly at the bottom of the pyramid. Furthermore, easier monetary conditions may have to contend with tighter lending standards,

FIGURE 30. Emerging Markets Household Debt

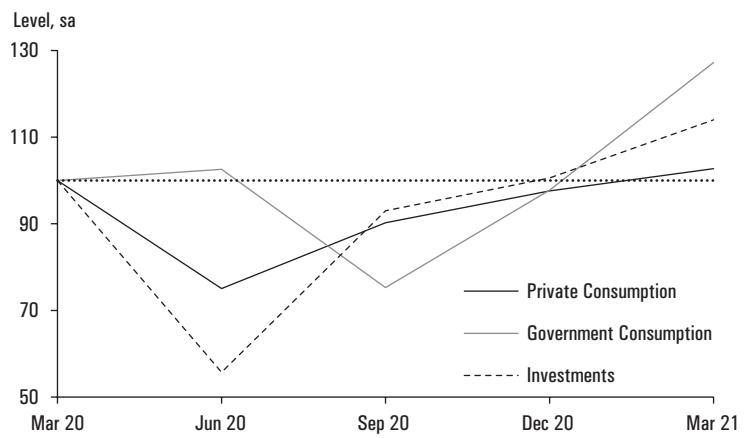


Source: Bank for International Settlements, Reserve Bank of India.
Note: India data is from the Reserve Bank of India. ID: Indonesia; BZ: Brazil; SA: South Africa; IN: India; EM: Emerging Markets; CH: China; MY: Malaysia; TH: Thailand.

particularly to the retail sector. Financial institutions that are more exposed to retail credit (NBFCs, smaller private banks, MFIs) have witnessed higher gross NPAs and may be more wary about lending aggressively to the retail segment.

It is, therefore, hard to see these forces serving as pre-conditions for a consumption boom. Hard data and surveys have begun to lend credence to this view. There was much excitement about consumption driving the recovery after the first wave. But consumption has been the slowest to recover to pre-pandemic levels, vis-à-vis other components of demand (Figure 31). Instead, the recovery

FIGURE 31. GDP Components

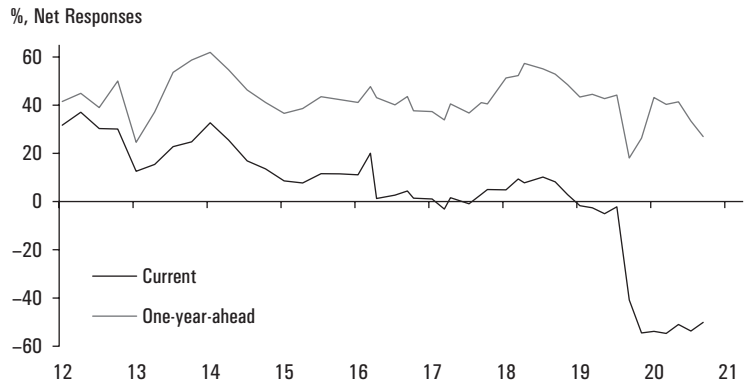


Source: Ministry of Statistics and Programme Implementation, J.P. Morgan.
Note: IQ 2020 GDP level is considered as 100. "sa" stands for seasonally adjusted.

in the second half of the year was driven largely by exports, public investment, and government spending.

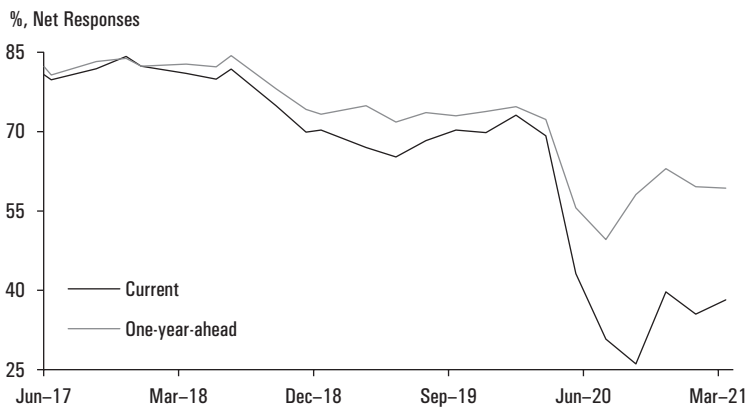
Forward-looking surveys also point to consumer diffidence. As shown earlier, the RBI's consumer confidence survey revealed that households had already begun to downgrade future income and spending expectations in the quarters before COVID. Those downgrades have become much more dramatic after the first and second waves of COVID, suggesting income scarring (Figure 32). Unsurprisingly, therefore, the survey results suggest that future household spending—particularly on discretionary items—could remain relatively depressed (Figures 33 to 36). All told, a consumption recovery is likely to lag a jobs and income recovery that first helps heal household balance sheets.

FIGURE 32. Household Income Perceptions



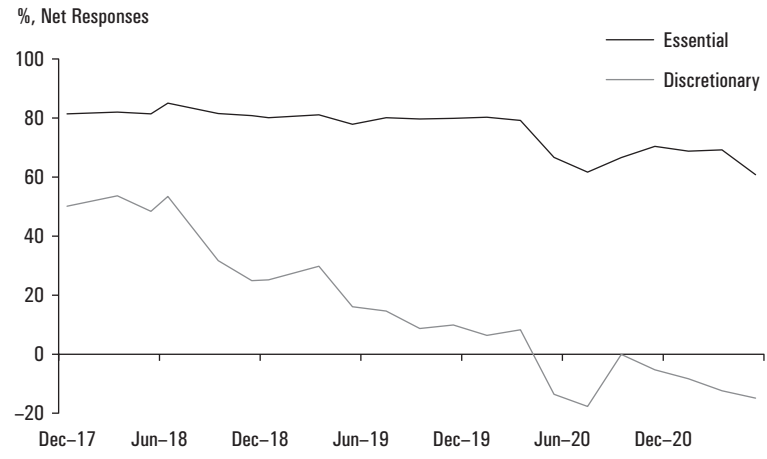
Source: Reserve Bank of India, J.P. Morgan.

FIGURE 33. Household Spending Perceptions



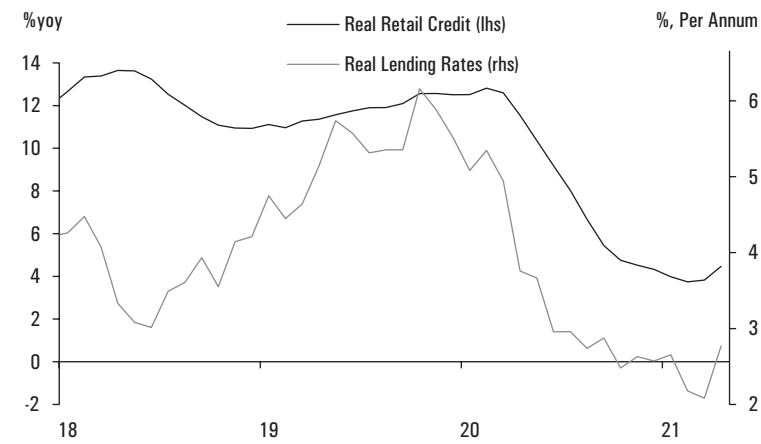
Source: Reserve Bank of India, J.P. Morgan.

FIGURE 34. Household Spending Patterns



Source: Reserve Bank of India, J.P. Morgan.

FIGURE 35. Real Retail Credit and Lending Rates



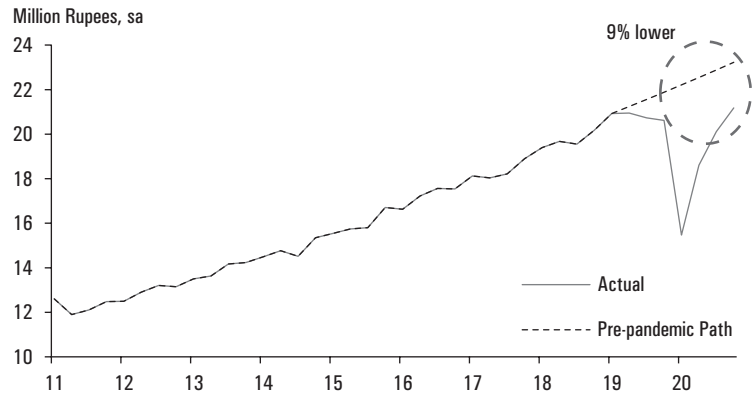
Source: Reserve Bank of India, J.P. Morgan.
Note: Six-month moving averages of year-on-year growth (% yoy) are shown for real retail credit. "lhs" is left-hand-side axis, and "rhs" is right-hand-side axis.

5.2. Investment: From Balance Sheets to Demand

The key to a consumption recovery therefore is a jobs recovery. But the key to a job recovery is an investment recovery.[3] And the key to an investment recovery is likely to be a demand recovery, creating a worrying circularity.

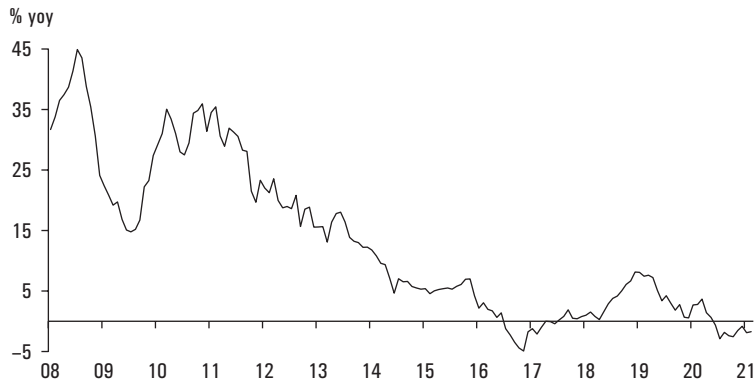
3. This is consistent with the RBI's findings that investment drives consumption, through employment and income creation, and therefore investment is key to a sustainable post-COVID recovery.

FIGURE 36. Private Consumption



Source: Ministry of Statistics and Programme Implementation, J.P. Morgan.
Note: "sa" stands for seasonally adjusted.

FIGURE 37. Large Industry Credit Growth

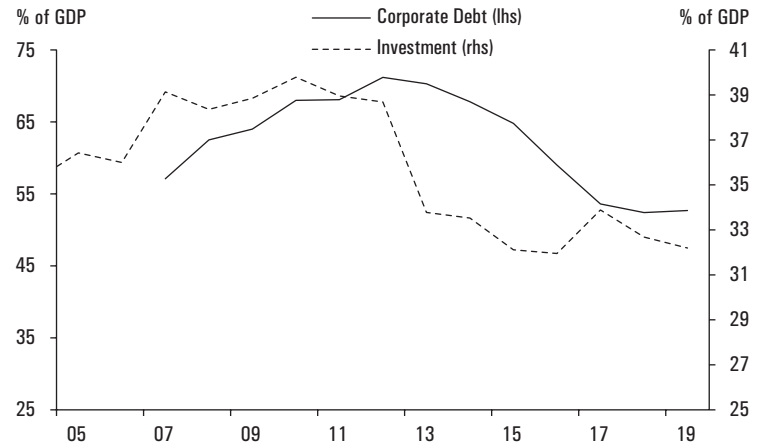


Source: Reserve Bank of India.

For several years, private investment was being held back by the "twin balance sheet" problem wherein unsustainable levels of debt on some corporate balance sheets and correspondingly high NPAs on bank balance sheets, constrained credit, investment, and growth. But after years of deleveraging—reflected in muted credit growth to corporates (Figure 37)—leverage has become much less of a binding constraint for large corporates (Figure 38).

The current binding constraint for the larger corporates, therefore, is not leverage. Instead, it is demand. Even as balance sheets have improved, capacity utilization has continued to fall in the run-up to COVID. Manufacturing utilization fell below 70 percent for three consecutive quarters pre-COVID in the RBI's Order Books, Inventories and Capacity Utilisation Survey— the first time this has happened since the Survey started in 2008—reflecting weak demand.

FIGURE 38. Corporate Deleveraging and Investment Growth

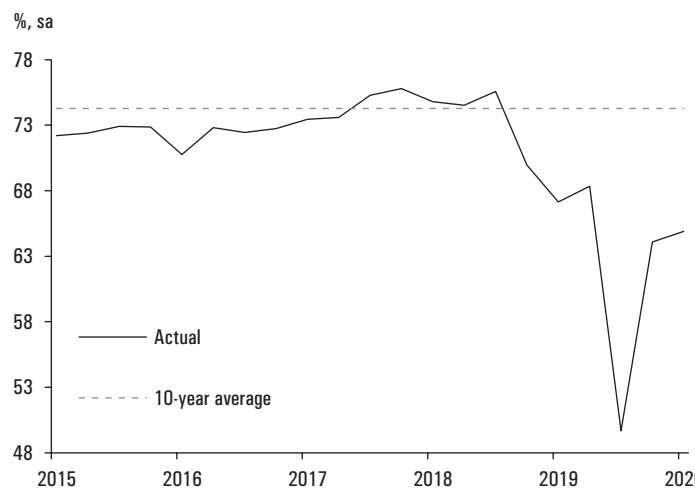


Source: Bank for International Settlements, Ministry of Statistics and Programme Implementation.
Note: "lhs" is left-hand-side axis, and "rhs" is right-hand-side axis.

Utilization fell further to 45 percent during the pandemic but recovered back to just 65 percent by the end of calendar 2021 (Figure 39, RBI Annual Report, 2020–21). Therefore, a broader private investment cycle is unlikely to pick-up until utilization rates first go up meaningfully. The binding constraint on investment is currently demand.

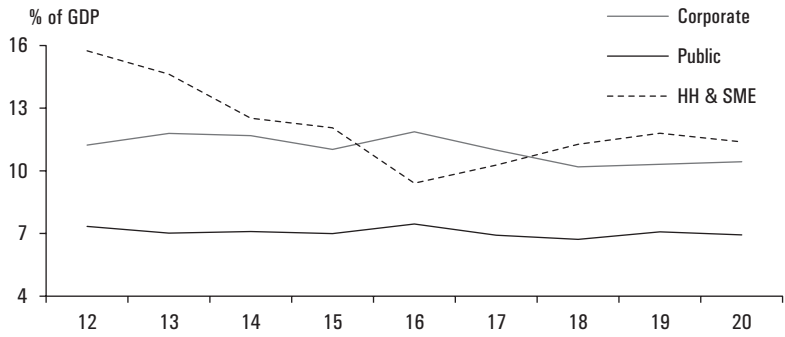
Large corporates apart, what about other potential sources of investment? To be sure, much of the decline in investment rates in recent years is on account of lower "household" investment, reflecting both lower residential real estate

FIGURE 39. Capacity Utilization



Source: Reserve Bank of India.
Note: "sa" stands for seasonally adjusted.

FIGURE 40. Drivers of Investment



Source: Ministry of Statistics and Programme Implementation.
Note: "HH" stands for Households, and "SME" stands for Small and Medium Enterprises.

and SME investment (Figure 40). Lower real interest rates could help top-end residential real estate, where balance sheets have not been impacted meaningfully, but SME investment is likely to face headwinds post COVID on balance sheet concerns.

Finally, if and when investment demand does pick-up, will financing become a constraint? Unlikely to be so in the case of large corporates. They are sitting on internal reserves, have access to international sources of financing, and banks are likely to be very willing to lend to the most credit-worthy borrowers. It is when one goes down the credit curve that financing is likely to become a constraint.

For now, however, consumption and private investment are, by themselves, unlikely to result in a virtuous cycle. Consumption is unlikely to pick up until investment and job creation picks up, but the latter is unlikely to lift if consumption and utilization levels remain weak. This was evident in the three quarters before the pandemic, when both consumption and investment growth slowed in tandem. Therefore, an exogenous demand driver will be needed to break this equilibrium.

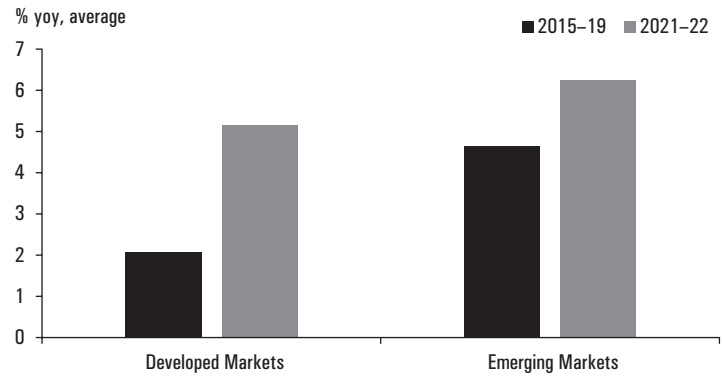
5.3. Exports Provide a (Potentially Thick) Silver Lining

What could these exogenous drivers be? With global growth expected to stay much above trend in 2022, exports could remain an important tailwind of growth (Figure 41).

We have previously found that India's merchandise and service exports are very elastic to global growth (Figure 42) (Chinoy and Jain 2018). Therefore, sustained above-trend demand growth bodes well for India's export outlook. Recent months bear testimony to this. Both manufacturing and service exports have witnessed very strong growth since the start of 2021, with total (goods and services) exports 23 percent above its pre-pandemic level by September 2021 (Figures 43 and 44).

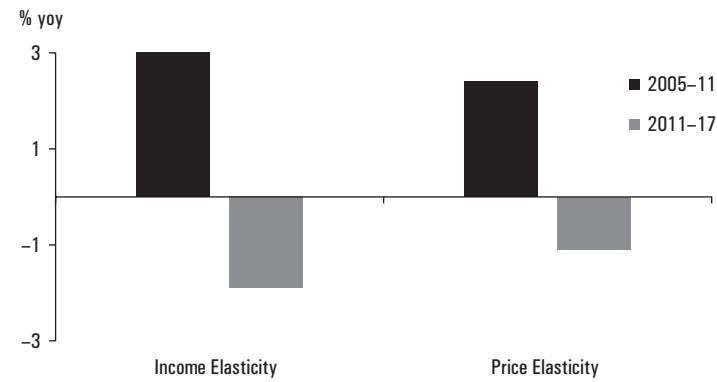
These dynamics are likely being aided by the sectoral shift that has characterized India's manufactured basket, as alluded to earlier. Within the export

FIGURE 41. Global Growth Forecasts



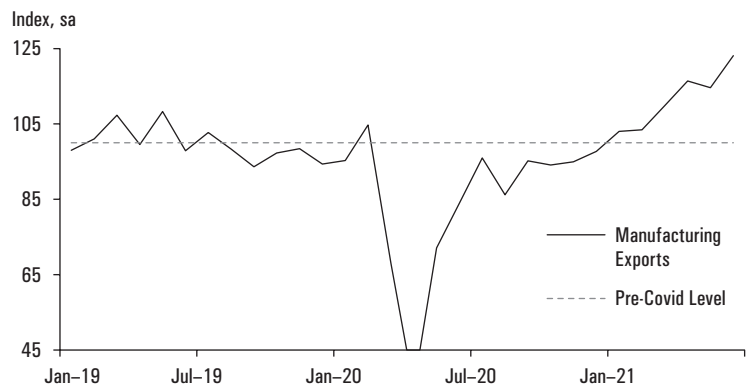
Source: J.P. Morgan.

FIGURE 42. Export Elasticities



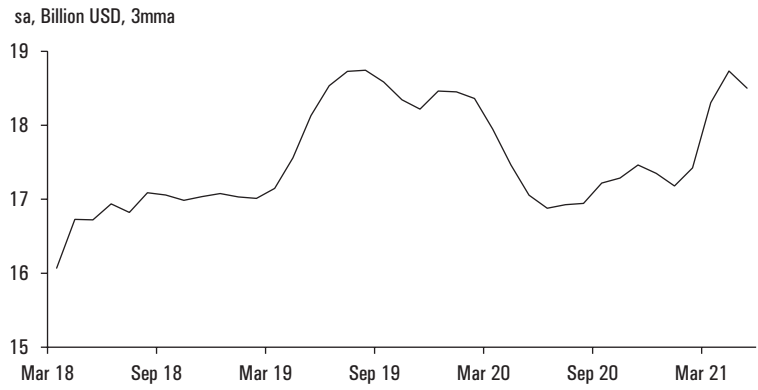
Source: Chinoy and Jain 2018, J.P. Morgan.

FIGURE 43. Manufacturing Exports



Source: Ministry of Commerce, J.P. Morgan.
Note: "sa" stands for seasonally adjusted; the average of manufacturing exports values for January and February 2020 is set to 100 for indexing.

FIGURE 44. Service Exports



Source: Reserve Bank of India, J.P. Morgan.
Note: The graph in this figure shows seasonally adjusted (sa), three-month moving averages (3mma).

basket, the share of new-economy exports (IT and business services, engineering goods, chemicals, and pharmaceuticals) has grown sharply at the expense of old-economy exports (agriculture, textiles, gems, and jewelry) and, as we have previously found, the former are more elastic to global demand than the latter (Chinoy and Jain 2018).

To be sure, these relationships are estimated during "normal times" and the unique nature of the recovery from COVID—where re-openings across the world are likely to result in disposable income being directed disproportionately towards contact-intensive domestic (non-tradable) services—could partially interfere with these relationships.

That said, COVID-19 has dramatically boosted technological adoption around the world and that bodes promisingly for India's IT exports. Already, India's share in global service exports has increased from 3 percent in 2014 to 4.2 percent in 2020, and the aftermath of the pandemic creates fresh opportunities for IT and service exports.

What are the associated policy implications? To harbor an ecosystem conducive to export growth would entail avoiding tariff increases that make exports uncompetitive (an import tariff is equivalent to an export tax), continued focus on attracting multinational corporations (particularly those diversifying from China) to help integrate into global value chains, and keeping the real effective exchange rate anchored (by containing inflation and avoiding undue nominal appreciation) to preserve competitiveness.

5.4. Government Capex: Execution is the Key

The larger question, however, is whether export growth, by itself, will be able to crowd-in a private investment cycle. This was certainly the case in the first decade of the millennium, but that was a period of hyper-globalization with

exports growing at 15 percent a year for almost a decade. It is unlikely that we will see such a level of sustained buoyancy this time around.

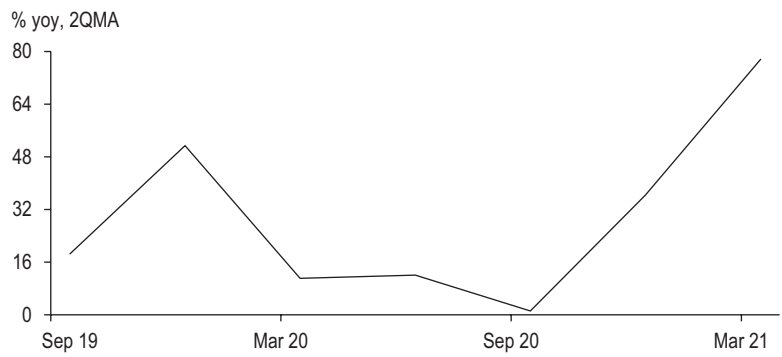
Growth will, therefore, need a second demand driver. In our view, that would need to be a sustained public investment push. The case for more physical and social infrastructure is self-evident. First, it will support near-term demand and its large multiplicative effects on activity should eventually crowd-in private investment. Second, infrastructure spend will create jobs for the bottom of the pyramid to alleviate pandemic-induced scarring. Third, sustained public investment boosts the economy's internal and external competitiveness and thereby helps trend growth, a topic to which we turn in the final section.

To policymakers' credit, a public investment push appears central to the government's strategy.[4] From the second half of last year, Central and State governments have been pushing hard on capex. In particular, Central Government capex grew a staggering 75 percent year-on-year in the second half of last fiscal and was key to the second-half recovery (Figure 45 and 46).

Both Central and State budgets have also budgeted strong capex growth in FY22, which will be key to the recovery. To be sure, at the aggregate level, there is a large swing in the fiscal thrust between FY21 (+ 4.5 percent of GDP) and FY22 (–1.7 percent of GDP), as shown in Table 1. To combat this tightening, it is crucial that the planned capex, with its large multipliers, be delivered in FY 22 (Table 2).

But boosting public investment will need to be a multi-year strategy that extends beyond FY22. The question therefore is: How will that be financed

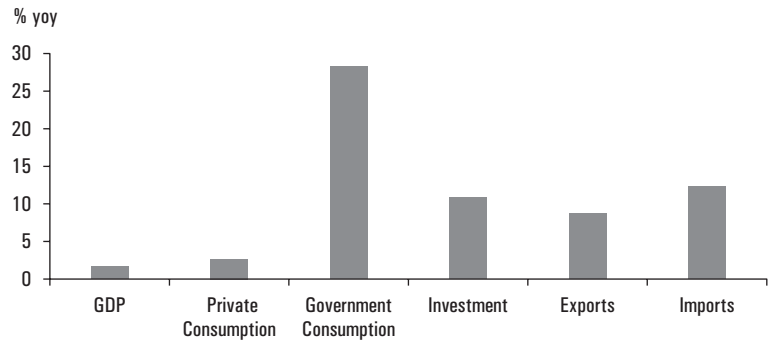
FIGURE 45. Central Government Capex



Source: Controller General of Accounts.
Note: Two-quarter moving averages (2QMA) of year-on-year growth (% yoy) are shown for Central Government capex.

4. Public investment here refers to spending directly off the budget, and potentially monetized by downstream asset sales. This does not refer to the PPP model wherein the private sector takes on upstream risk (land acquisition, regulatory clearances).

FIGURE 46. Growth Rates in 2021 Q1 GDP



Source: Ministry of Statistics and Programme Implementation, J.P. Morgan.

TABLE 1. Combined Fiscal Arithmetic (% of GDP)

	FY20	*FY21*	*FY22RE*
Central Fiscal Deficit	4.7	9.2	6.9
Adjusted Central deficit (net of asset sales and arrear payment)	5.4	8.5	7.3
Estimated State fiscal deficit	2.8	4.2	3.7
Combined fiscal deficit (adjusted)	8.2	12.7	11.0
Fiscal Thrust		4.5	–1.7

Source: Budget document, J.P. Morgan.
Note: FY 22 States deficit is an estimate.

TABLE 2. Center and State Government Capex (% of GDP)

	FY19	*FY20*	*FY21*	*FY22**
Center	1.6	1.6	2.2	2.4**
State	2.3	2.1	2.3	2.6
	3.9	3.7	4.5	5.0

Source: Budget docs, Reserve Bank of India.
Note: *Center is RE estimate and State is budget estimate, **adjusted for non-capex generating expenditure like Air India debt.

given that deficits and debt are already at expansive levels and credible fiscal consolidation will be needed from here on? The answer must be to: (i) double down on privatization and asset sales, (ii) improve the quality of expenditure (rationalize current expenditures to create more room for capex), and (iii) reform both direct taxes and the goods and services tax to eventually generate more revenue buoyancy (Chinoy and Jain 2021).

All told, exports and government capex will need to combine to create a growth bridge till private investment and consumption recover.

6. Stepping Back: Potential Growth and Total Factor Productivity

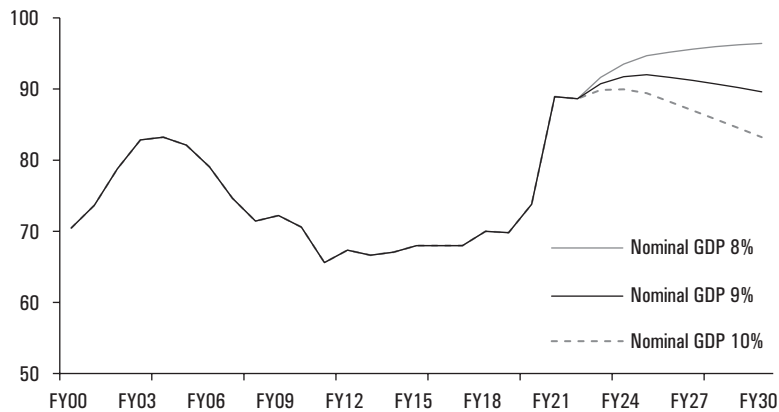
6.1. The Imperative

The previous section focused on the feasibility of using different growth drivers in the near-term. From a medium-term perspective, however, what really matters is the strength of India's underlying potential growth. What is the rate that India's economy can sustainably grow at without spawning internal or external imbalances post-COVID?

The motivation should be clear. Even before the Coronavirus pandemic, India's demographic profile necessitated strong trend growth just to create the jobs necessary for those entering the labor force over the next decade. That imperative has increased manifold, given the pandemic's impact on jobs, incomes, and public debt.

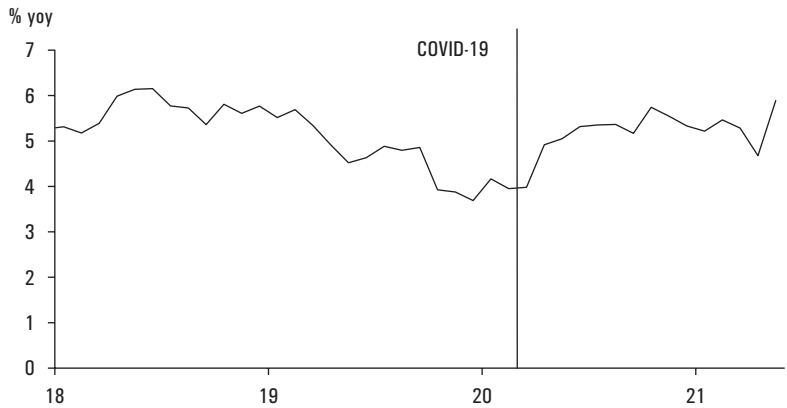
Take, debt sustainability, for instance. India's public debt is expected to remain close to 90 percent of GDP by the end of FY22. The key to sustainability will be the trajectory of the debt to GDP ratio thereafter: can the debt to GDP ratio be stabilized at these levels and gradually brought down or will it undergo a monotonic increase in the coming years, risking macroeconomic instability? Given India's post-pandemic starting points, the answer depends crucially on trend growth. If India's nominal GDP were to average about 10 percent over the coming years—corresponding to real GDP growth of 6.5 to 7 percent—debt to GDP ratio will stabilize while also allowing for a more gradual pace of fiscal consolidation. In contrast, if nominal GDP averages 8 percent in the coming years—corresponding to real GDP growth of about 5 percent—the debt to GDP ratio is expected to rise monotonically (Figure 47). In other words, trend growth will have a disproportionate influence on debt dynamics in the coming years (Chinoy and Jain 2020a, 2021).

FIGURE 47. Debt Dynamics under Different Growth Rates



Source: Reserve Bank of India, Budget documents, J.P. Morgan calculations.

FIGURE 48. Core-Core Inflation



Source: Ministry of Statistics and Programme Implementation.

6.2. Canary in the Coal Mine?

Another motivation to understand the pandemic's impact on potential output is to help solve the puzzle surrounding core inflation. Despite the economy registering its largest contraction ever, core inflation has stubbornly averaged 5 percent over the last 18 months (Figure 48). A large contraction should have generated substantial slack in the economy, manifested in lower utilization rates and lower employment-population ratios. Why has that slack not depressed core inflation? To be sure, supply disruptions from lockdowns and the surge in global commodity prices have contributed to inflationary pressures. In turn, given their adaptive nature, household inflation expectations have hardened, reinforcing inflation pressures. Yet, prima facie, these factors should not be enough to explain the stickiness of core inflation for 18 months given the quantum of perceived slack in the economy.

Or is the stickiness of core inflation telling us something about the supply side? Has the supply-side—particularly SMEs—been impacted more than believed such that output gaps are lower than thought? Has the increased market share of large firms through the pandemic increased pricing power? These concerns are tantamount to an adverse supply shock from the pandemic that could keep inflation sticky and complicates monetary policy. This makes an inquiry into the drivers of the supply-side even more urgent.

6.3. A Production Function Approach

Our focus, therefore, is to try to better understand the supply-side. To be sure, estimating potential growth in emerging markets is challenging at the best of times on account of the difficulty of separating cyclical from structural shocks in these economies (see, for instance, Aguiar and Gopinath 2004) compounded

by data challenges in these economies. A once-in-a-century pandemic makes the task truly daunting, and the dust will have to settle to get a more definitive handle on the enduring impacts of the COVID-shock on potential output.

For now, therefore, our scope is more limited. We try and understand the drivers of potential output, and how they have changed over the last 15 years. Their methodological shortcomings notwithstanding, empirical filters (Hodrick-Prescott, Christiano-Fitzgerald, Baxtor-King) provide a sense of how potential growth has evolved. But they are a black-box and don't tell us what's driving underlying changes.

We, therefore, use a production function approach to decompose output into its different constituents. As is standard in the literature, we use the canonical Cobb Douglas production function (Equation 1) to decompose output into contributions made by physical capital, labor, human capital, and TFP. This analytical separability allows us to measure the relative contribution of different factors and how they have evolved over time.

$$GDP = A\,K^{\alpha}\,(LH)^{(1-\alpha)} \tag{1}$$

Re-arranging terms and taking logs:

$$ln\,(GDP) = \alpha ln(K) + (1-\alpha)\,[ln(H) + ln(L)] + ln(A) \tag{2}$$

Equation 2 lays out the different components of the production function. *K* represents the capital stock which is a function of the investment and depreciation rates. *L* represents the workforce, and *H* proxies human capital. *A* represents total factor productivity (TFP), reflecting economy-wide productivity and allocative efficiency. A and 1–α represent, respectively, the capital and labor share of output which we parametrize at 0.35 and 0.65, respectively, in line with the standard followed in the literature.

We estimate potential output using annual data on each of these variables since the year 2000. We use the capital stock to GDP ratio data from the International Monetary Fund (IMF) and the Federal Reserve and build a capital stock time series using investment rates while assuming 6 percent annual depreciation rate. Labor force participation rates are taken from the National Statistical Office data while the human capital index is taken from the Penn World Tables.

6.4. Honing in on Total Factor Productivity

Our focus, however, is mainly on teasing out the contribution of TFP growth and how its contribution has changed over time. This is primarily because, quite apart from the fact that it is the key long-term driver of living standards, there has been much discussion on the role of factor inputs in impacting potential output. In particular, much has been written on how lower investment rates have hurt potential growth. Earlier sections focused on the binding constraints to investment, past and present. As regards the role of demographic changes, labor force participation and human capital acquisition are crucial but relatively sluggish variables that evolve

slowly over time. Labor force participation—and particularly female labor force participation—has been trending down for some time, and needs to be the subject of a more thorough inquiry, beyond the scope of this paper. Similarly, educational and human capital attainments have likely taken a dramatic hit during the pandemic with profound implications for the future. Again, these require a separate and thorough inquiry, beyond the scope of this paper.

Instead, our focus is more on the role, and determinants, of the much-ignored TFP growth, which captures economy-wide productivity growth and allocative efficiency. Why do we focus on TFP? Because a growth decomposition exercise reveals that there has been a sharp and sustained slowdown in TFP growth, nearly 200 basis points, since its peak in 2007. Put more starkly, its contribution to potential output has halved over the last 15 years. It is, therefore, crucial that policy prevent any "TFP Hysteresis" from the pandemic—a durable TFP decline from a large but temporary shock—that was witnessed post the global financial crisis (IMF 2017).

6.5. Total Factor Productivity: Cyclical versus Underlying

Given the large, and unappreciated, role that slowing TFP growth has played in impacting potential growth over the last 15 years, the obvious next question, from a policy standpoint, is: What determines TFP growth?

Before trying to tease out the determinants of TFP growth, however, we must first confront a more conceptual issue. Recall that TFP is computed as the residual in the growth decomposition exercise. In theory, therefore, it is the growth that cannot be accounted for by accumulation of different factor inputs. However, because of data constraints in most emerging markets, we are typically unable to control for utilization rate of these factor inputs: labor and capital. The absence of average work-week hours and utilization rates of capital implies that any cyclical impulses, which would change utilization rates of factor inputs, inadvertently get absorbed into our computed TFP variable.

We, therefore, need to "cleanse" the computed TFP estimate of these cyclical forces to generate the "true" underlying TFP estimate. Therefore, even as our broad approach in establishing the determinants of TFP growth is consistent with the approach followed by Loko and Diouf (2009) and (Aziz and Jain, 2017), our innovation is that we control for the cyclical impulses that may be contaminating computed TFP growth.

6.6. What's Driving TFP?

When modeling the determinants of TFP, we must control for cyclical influences so as to identify underlying structural drivers. To control for the former, we use global growth, world trade, terms of trade, and real interest rates as our cyclical proxies. Recall that we are looking for cyclical impulses that impact utilization rates. If the influence of any of the aforementioned variables is strong enough to impact investment or labor force participation rates more broadly, which

TABLE 3. Endogeneity Test

Null hypothesis: Real bank credit, Real government capex and trade openess are exogenous			
	Value	*df*	*Probability*
Difference in J-stats	3.4	4	0.4878

Source: Authors' calculations.

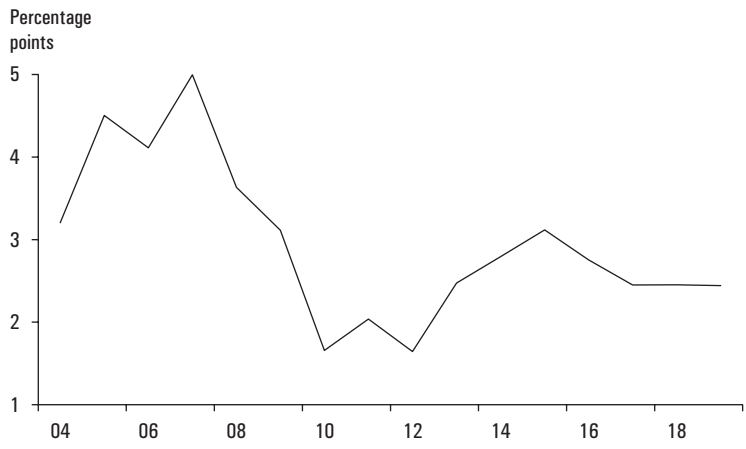
are already controlled for in the capital and labor stock variable, they will not contaminate the TFP variable. Having controlled for these cyclical influences, we run a horse race among a series of macro variables to understand which of these are correlated with TFP growth.

We use 20 years of annual data for each of the variables in our framework. Given the potential endogeneity of these macro variables, we use the Generalized Method of Moments (GMM) methodology. However, GMM endogeneity tests (Table 3) reveal an absence of endogeneity which then allows us to use ordinary least square for estimation. Furthermore, where necessary, we work in "differences" to avoid non-stationary concerns.

The results of our estimation—the baseline regression and robustness tests—are presented in Table 4. We find the following results:

1. India's "true TFP growth" has slowed sharply over the last 15 years (Figure 49). It contributed almost 5 percentage points to GDP growth at its peak just before the Global Financial Crisis in 2007, but then more than halved by 2012. It then rose briefly from 2012 to 2015 but has slowed again to about 2.5 percentage points since then. Its current contribution to trend growth is half of what it used to be in 2007.

FIGURE 49. Contribution of True Total Factor Productivity



Source: J.P. Morgan.
Note: This figure shows the three-year moving average for contribution of true Total Factor Productivity.

2. To be sure, emerging markets as a group saw TFP growth peak before the global financial crisis and slow thereafter, likely "reflecting the rapid and possibly unsustainable speed of technological catch-up in the years immediately preceding the global financial crisis," as reported by the IMF (IMF 2017; 2015a; 2015b).
3. Furthermore, the decline in TFP is not completely independent from an investment slowdown because the latter may impact investment in intangible capital, such as research and development, which hurts TFP growth (Aghion et. al 2012).
4. That said, the decline in TFP growth in India is very meaningful and will need to be reversed to boost potential growth.
5. So, what impacts TFP? Empirically, we find that three macro factors seem correlated with TFP growth: trade openness, a healthy financial sector, and public investment (Table 4):
    - **Trade Openness**: Changes in openness (proxied by exports and imports as a share of GDP) are correlated with TFP growth. As mentioned earlier, TFP is constructed after controlling for investment. Therefore, changes in trade openness are not operating through the investment channel. Instead, they are likely picking up productivity gains that accrue from increased global integration and competition as also found in the literature (Ahn et al. Forthcoming; Dabla-Norris and Duval 2016; IMF 2017). At some level, the trade openness variable is

TABLE 4. Determinants of Total Factor Productivity

Dependent Variable: Total Factor Productivity
Period: 2000 to 2019 (Annual)
Method: Least Squares

Type	*Variable*	*Baseline*	*Robustness test*				
	Constant	1.05	0.68	0.70	1.06	1.08	0.76
	Trade openness	0.21*	0.23**	0.23*	0.21*	0.23*	0.23*
Macro determinants	Real govt. capex	0.05**	0.05**	0.05**	0.05**	0.05*	0.05*
	Real bank credit	0.11**	0.13*	0.10*	0.11*	0.11*	0.10*
	Demon and GST dummy		1.81				
	Terms of trade	0.27***	0.28***	0.27***	0.27***	0.29***	0.27***
Cyclical controls	Global growth			0.17			0.16
	World trade volume				0.01		
	Real repo rate					0.06	0.01
	Adjusted R-squared	0.50	0.52	0.48	0.46	0.47	0.43
	Durbin-Watson stat	2.12	1.62	2.09	2.11	2.16	2.10

Source: Authors' calculations.
Note: *, **, and *** indicate statistical significance at 10%,5%, and 1% respectively.

likely reflecting the productivity pre-requisites that are forced upon open economies (larger firm size, improved infrastructure, nimble regulatory framework) to compete in global markets.

- **Government Capex (combined center and state)**: Second, we find that public investment is strongly correlated with TFP growth. This should be non-controversial to the point of being tautological. The provision of physical, social, and digital infrastructure is crucial to an economy's competitiveness and productivity, by creating much-needed public goods that the private sector necessarily under-produces (IMF 2014, 2015c).
- **Financial Sector**: Third, we find that the financial sector—as proxied by real credit growth—is also correlated with TFP growth. Again, because investment is controlled for, credit is not just mimicking demand impulses. Instead, it is likely proxying for the efficient intermediation of an economy's savings and the associated allocative efficiency, or lack thereof, that a financial sector is expected to perform. In India's case, weak credit growth over the last decade has likely been underpinned, at least in part, by balance sheet and/or incentive incompatibility constraints. The former likely reflects challenges with stressed asset resolution that impedes creative destruction and therefore allocative efficiency.

We find that our baseline results remain robust to the presence of various control variables: terms of the trade, global growth, world trade volume, and real policy rates. Controlling for these, our baseline results suggest that trade openness, government capex, and bank credit are the key determinants of TFP (Table 4). While some of these macro determinants may seem intuitive, we are able to find empirical support for them to guide future reforms. That said, at least two caveats are in order. First, this is not to suggest that these are the only drivers of productivity growth. There are a myriad micro and macro influences that combine to shape productivity, which cannot be fully modelled here. Second, the dramatic technological adoption that COVID has spawned is likely to be productivity-enhancing (IMF 2021). All that said, reversing slowing TFP growth will be key to boosting trend growth in a post-pandemic world.

7. Conclusions and Policy Implications

With India emerging from the second COVID wave, the need to boost growth in a post-pandemic world is self-evident. There is a belief in some quarters that household consumption and private investment will lead the revival. However, the pandemic has inevitably accentuated household balance sheet concerns that emerged pre-COVID, and is likely to keep households cautious. Similarly,

manufacturing utilization levels in the mid-60s suggest that a broad-based private investment cycle will take time. Instead, growth will first need to be driven by public investment and exports to crowd-in private investment and consumption.

More generally, boosting trend growth will require reversing the sharp and sustained decline in TFP growth witnessed over the last 15 years. Our empirical analysis finds TFP to be influenced by open trade, a healthy financial sector and sustained public investment.

All this calls for a complementary package of interventions and reforms: sustained public investment, aggressive privatization and asset sales, fostering openness and creating a conducive environment to promote exports, and reforming the financial sector while strengthening resolution (Insolvency and Bankruptcy Code) mechanisms. The synergies are obvious. Infrastructure creation will contribute to export competitiveness. Asset sales will create fiscal space for public investment. Financial sector reforms can help fund and finance the resulting growth, while strengthening resolution mechanisms will facilitate the creative destruction from this crisis and help productivity growth. These interventions will be crucial to restoring growth potential in a post-pandemic world.

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https://youtu.be/oPLQBB29NFI

Comments and Discussion*

Chair: **Shankar Acharya**
Former Chief Economic Adviser, Government of India

Ajit Pai
NITI Aayog

Thank you so much for the wonderful presentation. Overall, we found while going through the paper, there is much in common between the way we at NITI Aayog are thinking about things and the way the authors have presented it. So, I would focus on some of the areas which I want to stress a little bit more.

To begin with, the way we see the entire slowdown was largely linked to it being a banking sector issue. And the reason why I say that is not that other things were not going wrong in the Indian economy, but when you look at the impact on economic growth because of the banking sector itself, it explains about 400 basis points over the past seven years as compared to the average of the prior five years, and an impact of almost 900 basis points on growth rate from peak to trough. The second biggest impact where there is some overlap with the banking sector and credit is household investment, but primarily in real estate. So, almost all the drop in household investment was in real estate and there are some structural issues in the real estate industry. While there were governance issues, a large part of what drove the issues in the banking sector, and what the Asset Quality Report also revealed, is that a few industries got over-capitalized, including steel, power generation, and real estate.

Lastly, as has been rightly pointed out, the Indian system overall, not attributing blame to the government or private sector, responded very slowly to greater competition in the global merchandise trade post the Global Financial Crisis (GFC). Global trade itself as a percentage of GDP plateaued back and then started to decline slowly. So there was a peak in the GFC just prior, that was declining and in that environment, our merchandise exports declined even faster than those of the rest of the world because we did not keep pace with the competition. Lastly, when looking at these contributions, taking away these two impacts, even with an overlap between household investment and real estate, and also the overall financial situation, particularly banking, the Indian economy would have been growing in double digits.

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* To preserve the sense of the discussions at the India Policy Forum, these discussants' comments reflect the views expressed at the IPF and do not necessarily take into account revisions to the conference version of the paper in response to these and other comments in preparing the final, revised version published in this volume. The original conference version of the paper is available on NCAER's website at the links provided at the end of this section.

The peak growth rate towards the end of 2010, at 24 percent, declined all the way down to 4.4 percent, and then started to re-accelerate in early 2017, and then decelerated again even prior to the pandemic. The later bit was catalyzed by the IL&FS and some of the Non-Banking Financial Company (NBFC) issues, but I think those were more the last straw—there were some structural issues and there was a change in the way people were thinking about things. But the way we would quantify the impact of this on overall economic growth is, very roughly, the overall scheduled commercial banks' total amount of credit outstanding, about half of the estimated size of GDP. So if it is growing faster than the GDP, it would aid GDP growth, and if it is growing slower than GDP at any point of time, it would be a drag on GDP growth. And since the quantum is half, the difference between nominal GDP growth and the real rate of growth would be the amount of acceleration or the amount of deceleration provided by the banking credit growth itself. So when you have a downdraft of almost 20 percent, that would be about a 10 percent relative downdraft, when you're going from peak to trough, in growth rates driven by the banking sector. It was thus a very material deceleration, given the size of the banking sector and the size of the numbers involved.

Indeed, it was the household sector that drove most of the slowdown all the way to fiscal year 2016. But a huge chunk of that, i.e., 550 basis points or higher, was due to the dwellings, other buildings and structures, and the investment by the household sector in these areas. The household sector was the one that drove a very significant decline, i.e., over 600 basis points of a slowdown in annual GDP. But the component that was highly correlated, which can be used to explain almost the entire decline, is the household sector's investment in real estate. The clean-up in the real estate sector was thus similar to the clean-up in banking; it was very essential but it had a fairly significant impact on the growth rates.

There is some overlap between credit and real estate. But given that the mortgage market penetration in India is very low, we know that a lot of the transactions are happening outside of the banking system as well. That should thus be viewed as an independent factor as well, which I think was the second largest contributor to the overall slowdown, going into the pandemic. And the third factor, of course, was exports. The paper explains really well how that was contributing as well.

Looking at the current scenario, based on what we are seeing and what the authors have pointed out, the profits of large corporates are growing faster relative to spending on labor. However, this is typical in a nascent and uncertain recovery, as employers are cautious about the sustainability of the trends that they are seeing. They are not going to be hiring anytime soon and they are also going to be postponing discretionary expenses. So, I would not read too much into this massive increase in early profitability as such a trajectory is not likely to be sustainable.

I would also agree with the analysis that despite being tighter, the smaller companies would be impacted more than others not only because of volatility, but also because this pandemic is unique in terms of its diverse geographical

impact in various locations. While some people would be significantly impacted in terms of their ability to do business, the large corporates, being more diversified, will suffer less impact.

Another issue that I would look at with some circumspection in this particular equation is consumption. This has been discussed relative to previous economic cycles and even over large periods of time. This time, three factors are responsible for a drop in consumption. These include *first*, the inability to spend as there is no access to liquidity. There is now a need to provide money to people in the bottom 80 percent or the bottom 40 percent of the income distribution. The *second* is caution in the face of uncertainty, and the *third* would be restricted mobility and opportunities to consume due to the pandemic. So even if people have the money and the confidence, they cannot go to the store and spend the money, either because the stores are not allowed to open, or people are not allowed to go to restaurants and hotels.

One evident trend is that the persistent caution among people is reflected in credit and deposit trends in Scheduled Commercial banks. Credit has been growing in low- to mid-single digits, and deposits have been growing in double digits. Even *Jan Dhan* deposits, which were growing much faster than overall credit, are in high-single digits right now.

As regards the issue of employment, schemes like the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) have actually compounded some of the unemployment issues because of the meaningful government support this time. MGNREGS has also been supplemented by the Public Distribution System (PDS) and distribution of free food. In the first wave, there were also actual direct transfers to select portions of the bottom of the pyramid. But when these two are combined, and there is no rent to pay, especially for migrant workers, it has resulted in an almost equivalent compensation. So, during the second COVID wave, particularly in May and June 2021, a large number of workers stayed behind in the rural areas because they were getting food and a cash payment of ₹200–250 per day, and they had no rent to pay, because they were ostensibly staying for free back home, as a result of which they had very little incentive to return. Hence, some of the supply constraints that we are facing today are actually because enterprises, particularly factories, are facing a shortage of workers at the base of the pyramid.

Then, there are over-capitalization headwinds of some industries that are already behind us, i.e., steel and real estate. Things have stabilized over there, and consumer confidence and consumption will be the trailing indicators. We should thus not be spending too much time looking at them because those will start improving only after the economy.

We are thus proposing tweaks in the financial architecture that can reduce the cost of capital for the Indian economy and accelerate credit growth. The focus should shift from the cheapest form of debt, which is the sovereign, to driving private credit. One deviation that the paper focuses on, government capex, is that

we would instead strongly suggest looking at public infrastructure rather than at government capex, and also at crowding-in private investment because, as the authors rightly point out, the corporates have deleveraged. They have the capacity, the balance sheets of many players are actually much stronger, and the government's debt has ballooned to 90 percent debt to GDP. If one compares with other economies, in India we have it the other way around, as the government debt is very high and the private credit is very low, which significantly increases the cost of capital for the overall Indian economy. Our tenure is at 6 percent while China's tenure is at half that, at 3 percent. The other thing the government can do is provide guarantees where there is market failure, rather than assume all of this debt on its own accounts. So we are trying to be fiscally conscious while also looking at the absolute level of government debt. For example, there could be a first loss guarantee for a limited period on all A and triple B bonds, which are investment grade. Even if it is a 10 percent first loss guarantee, it would almost cover itself, but it would encourage growth in the bond market, in the corporate sector, and in investments as well. And the focus on investment in infrastructure will create the greatest bang for the buck with five times higher employment elasticity. And given that the bank deposit balances and transfers to citizens may not really have that much effect on increasing or accelerating spending, restoring confidence by increasing employment would be the way to look at it.

When you compare the incremental GDP growth, for USA, Japan, China, and India, what you are going to see is that in these countries (USA, Japan, and China) where the leverage is very high, with the overall global leverage at 370 percent of GDP, all the incremental debt has very limited impact on increasing the GDP. In contrast, when you look at India right now, because it is a capital-starved country and there is a significant shortage of credit, incremental debt in the Indian system actually translates into much higher growth and incremental GDP. Therefore, this is also an area that we should recognize in terms of how we prioritize, because if the cause was the financial sector, as pointed out by the authors, we should look at what the cause was even before the pandemic, and going forward, whether it would help if we alleviate some of these causes.

If we compare the government debt as a percentage of GDP for India, China, South Korea, and Vietnam, we observe that, historically, India has had a very high government debt relative to the other three countries. And that is how they have kept the cost of debt, their sovereign rating, very low and all the private credit is in reference to this. However, most of the growth in the past several years has been driven by their rise in private debt. And now, the government debt has had to catch up post the GFC, while India has actually been maintaining and pressuring its government debt. The GDP per capita, for a large part, in China, for example, has been driven by the rise in debt since the GFC rather than by the other factors that were having an impact earlier.

I will raise a couple of quick points on the Total Factor Productivity (TFP), not going into the classic components, but some of the other inputs that could potentially improve this rapidly. As regards capital plus labor plus knowhow,

I think one of the most significant factors that has been holding back India's per capita GDP, or even its overall TFP has been the issue of scale. For instance, agricultural farms across the world have been becoming larger and larger, and more productive. The average size is above 300 hectares and the size has been going up in North America, Ukraine, and Russia. In India, on the other hand, it has been shrinking. Similarly, a system has been set up to support the micro and small sectors and we have not been recalibrating that often. There was one last year, but the effects will take some time. But this factor of relative scale for a global environment and global competition has been impacting our competitiveness across too many sectors to name them individually. If we have the same size sector as another country, but we have 3000 players and they have three, it is very likely that the country with three players is going to be not just more profitable but also far more competitive, because they have the economies of scale and the relative ability to compete and invest in innovation.

There is also massive potential to grow TFP through improvement in logistics and infrastructure, all else being equal, and by reducing the compliance and regulatory burden. If you reduce this burden, all else being equal, things move faster, so that what is going to happen in a year would happen in six months. That is an immediate improvement both in growth rates as well as in TFP. And India's secular growth rate can explode into double digits, and consumption will follow just by focusing on credit directed towards investment and by supporting this private credit.

The government has been responding to this challenge of scale when competing internationally. Specifically on the Micro, Small and Medium Enterprises (MSMEs), in India, this redefinition was significantly much larger, almost an order of magnitude in some cases, which will hopefully provide some cushion because of factors like priority sector lending. We should also focus on production-linked incentives, which are very WTO-compatible, and try to bring some scale to key players so that we not only start operating for the domestic market, but also boost exports while being WTO-compliant.

Lei Lei Song

Asian Development Bank

I am very grateful to NCAER and its Director General, Poonam Gupta, for inviting me to this prominent forum on the Indian economy. Since coming to India in mid-2018, I have joined the IPF every year and this year is my fourth IPF. I have learnt a lot about India and its economy through the IPF and come to know many new friends. I met one of this paper's authors, Sajjid Z. Chinoy, during my first IPF in 2018, where he made a presentation on India's exports. I am going to move back to Manila to take up a new assignment at the Asian Development Bank, and hopefully I would be able to join the IPF from afar and learn about India and its economy.

I agree with Sajjid's assessment of the Indian economy in this paper. To evaluate India's economic prospects post-COVID-19, the paper looks at economic performance before the pandemic, from the early 2000s. The economy had severe pre-existing conditions and a slowdown in consumption credit with a shrinking fiscal state space even before the COVID-19 pandemic started hurting the economy badly. The pandemic has caused severe scarring effects, and as a result the prospects for consumption and investment also seem problematic. The economy may have to rely on exports and government expenditure to grow. The paper has also discussed Total Factor Productivity (TFP), and a regression analysis concluded that reform is critical to TFP growth.

After the liquidity crunch led by NBFCs in late 2018, I became interested in India's business cycles. Business cycle analysis looks at cyclical movements of an economy as well as its underlying trend, and identifies the driving forces of those movements. Building upon a series of papers by Ila Patnaik and her colleagues at the National Institute of Public Finance and Policy, such as Pandey, Patnaik, and Shah (2018), Mittal and Song (2021) uses the latest GDP data and applies refined approaches of business cycle analysis. The level of GDP, after making seasonal adjustments and applying the Hodrick-Prescott filter, can be decomposed into trend and cyclical components, the latter of which are deviation cycles. The Quarterly Bry-Boschan (BBQ) approach developed by Harding and Pagan (2002) for identifying peaks and troughs can be used to date deviation cycles into phases of expansion and recession. Emerging economies, such as India, rarely experience recession—an absolute decline in GDP, and therefore the BBQ approach can be refined by utilizing whether GDP growth is below a threshold (a recession-like level as in advanced economies where economic activity falls in level), to date business cycles into phases of upswing (from trough to peak) and downswing (from peak to trough).

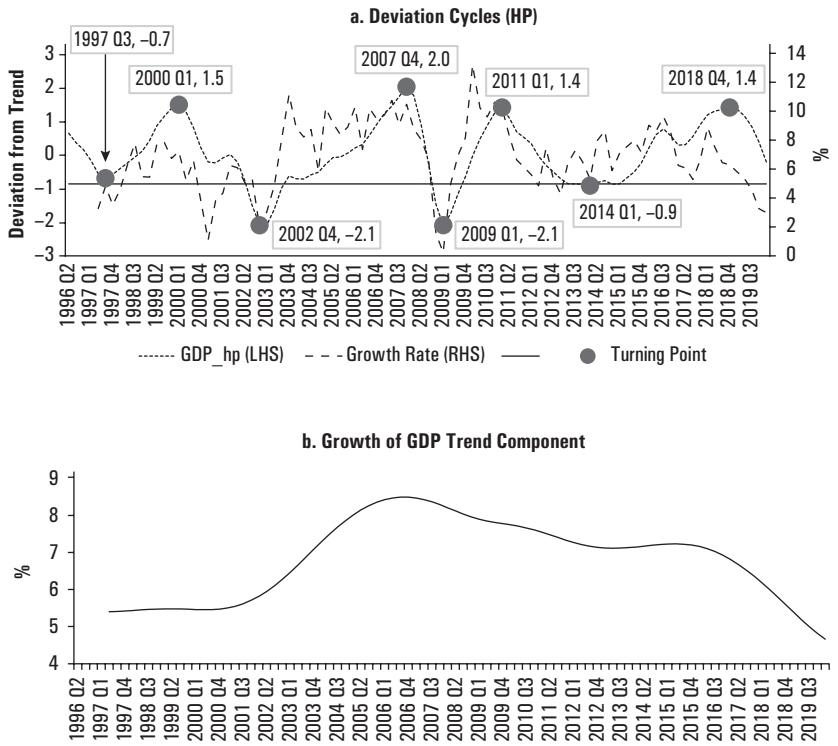
The cyclical components of India's GDP after the late 1990s until the pandemic are dated to four cycles (Table 1 and Figure 1a), with troughs and peaks being turning points, though the latest cycle has not reached a trough yet. The four cycles roughly match the periods in Chinoy and Jain (2021). The bottom panel of Figure 1 shows how trend growth in GDP performs during these cycles. Before the GFC, the trend GDP growth accelerated significantly, reaching 8.5 percent in

TABLE 1. Trend and GDP Components

Cycle/Average Growth (%)	*Trend*	*C*	*I*	*G*	*Exports*	*Imports*
1997 Q4–2002 Q4	5.6	4.8	8.1	8.1	14.7	10.0
2003 Q1–2009 Q1	7.9	7.1	13.2	7.0	20.9	20.1
2009 Q2–2014 Q1	7.4	7.6	6.9	6.1	9.3	6.8
2014 Q2–2020 Q1	6.4	7.0	6.5	8.2	2.6	4.2
2014 Q2–2018 Q4 (upswing)	6.8	7.3	7.5	8.2	3.3	5.4
2019 Q1–2020 Q1 (downswing)	5.0	5.8	3.0	8.1	–0.2	–0.4

Source: Author's calculations.

FIGURE 1. India's Business Cycles and Trend Growth



Source: Authors' calculations.

late 2006. After the GFC, trend growth started to decelerate but stayed above 7 percent until 2016 before demonetization. Following several successive shocks, including demonetization, the introduction of the Goods and Services Tax (GST), and the liquidity crunch by the NBFCs, trend growth fell from about 7 percent to below 5 percent.

The actual growth of GDP components can show driving forces of trend growth in GDP. Table 1 shows the average trend growth in GDP and the actual growth of GDP components during the four trough-to-trough cycles that include an upswing phase, followed by a downswing phase. The trend growth in GDP fell to 6.4 percent in the cycle from the second quarter of fiscal year 2014 (FY2014Q2), that is, the July-September quarter of 2014, to FY2020Q1, from 7.9 percent in the cycle FY2003Q1 to FY2009Q1. During the upswing phase of the last cycle FY2014Q2 to FY2018Q4, the GDP trend growth was still quite high, close to 7 percent, but the trend growth declined sharply in the downswing phase, starting from FY2019Q1. The average actual growth of GDP components clearly shows that investment growth is highly correlated with trend growth in GDP. In every upswing phase, investment grew fast, but decelerated sharply during the downswing phases. The data suggests that investment drove

GDP trend growth. This analysis corroborates the assessment and narrative in Chinoy and Jain (2021).

What factors were behind the significant decline in GDP trend growth since 2009? Consumption growth throughout the period was relatively stable at around 7 percent, though it fell to below 6 percent in the last cycle. Government consumption rose modestly over the period, but the growth of investment and exports fell sharply since 2009. As discussed in Chinoy and Jain (2021), it is clear that structural factors were behind the sharp fall in GDP trend growth, particularly from 2016.

The twin balance sheet problem—"unsustainable levels of debt on some corporate balance sheets and correspondingly high non-performing assets on bank balance sheets" has contributed to the poor performance of investment. Stalled financial sector reform and the NBFC crisis in late 2018 aggravated the problem and led to slowdown in growth. In addition, competitiveness issues discussed by the other discussant for this paper, Ajit Pai, slowed India's export growth. Recent difficulties in globalization did not help either.

The structural weakness compounded by cyclical downswing led to a severe downturn from FY2019Q1 until the pandemic struck in March 2020, during which period GDP trend growth fell to 4.7 percent in FY2020Q1, the lowest since 1997. The liquidity crunch led by the NBFCs may have contributed the most to the slowdown.

I also have a comment on the TFP regression. Somehow, Figure 44 in Chinoy and Jain (2021), TFP and adjusted TFP, is similar to the cyclical components in Figure 1. Can this TFP be interpreted as de-trended GDP growth? If so, then it is interesting that growth cycles are associated with credit growth, the terms of trade (which is correlated with oil prices), trade (exports), and public investment. The authors can explain this more in a revised version.

The paper focuses on the scarring effects of the pandemic and tries to quantify them. The scarring effects discussed in the paper are on the supply side. The first is on human capital or labor market scarring in the paper. Human capital is possibly damaged by the pandemic, but probably not so much. The pandemic has affected education and led to learning loss because children could not go to schools. Yet, learning losses can be compensated over time in coming years. Physical capital might have also been damaged, but again probably not very much. Some business models might have changed. Certain capital stocks might have become obsolete and could not provide much productive services. But I believe that may not affect the TFP very much. In addition, rising inequality due to the K-shaped recovery would have an impact on productivity. Therefore, the pandemic has damaged the supply side of the economy, though the magnitude is not so clear cut.

The pandemic would also impact the demand side of the economy, but demand will pick up strongly once the pandemic retreats. The aggregate balance sheet of households might not have been damaged much, though the poor and

vulnerable were affected disproportionately and might have run down their savings. The K-shaped recovery might have led to income transfers from the poor to the rich. On the other hand, the balance sheet of corporates might have been repaired because of government supports, despite some initial damages. Contrary to what was expected initially, the non-performing assets of the financial sectors have not worsened, largely due to moratoriums imposed by the Reserve Bank of India and expansionary fiscal policy. Once the health crisis passes, private investment may pick up strongly because of loose financial conditions and fiscal incentives.

India will also benefit from strengthening global demand. A large monetary and fiscal stimulus will help advanced economies rebound and grow fast, particularly in the United States (US). The US is India's largest export market, accounting for close to a quarter of exports of goods and services. As a result, US recovery will help India to recover.

Having slowed down before the pandemic, India's trend growth might have been damaged further by the pandemic. To arrest the decline of the trend growth and to boost growth, structural reform is necessary and the only way to get India back to the fast growth path it experienced before 2016. Chinoy and Jain (2021) have covered structural reform well. Three areas are the key. The financial sector needs to improve allocation efficiency and bring down borrowing costs. Public sector undertakings (or State-owned enterprises) should be reformed, and tax and expenditure reforms are the key to creating fiscal space for expenditure on health, education, and infrastructure. Improving competitiveness is crucial to promote India's exports and boost growth prospects.

Let me conclude. It may be difficult for an economy to go back to the pre-pandemic output path, because almost two years were lost and the stock in human and physical capital could not have been accumulated. Therefore, efforts are needed to return India's trend growth to the pre-pandemic level of 6–7 percent. Further, structural reform can help boost the growth trend to 7–8 percent. As a fast-growing, emerging economy, domestic demand remains strong and confidence in the economy is key to recovery post-COVID. Thank you very much again for the opportunity of commenting on this insightful and thoughtful paper and participating in the IPF.

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General Discussion

Shankar Acharya, the chair, opened the discussion by asking why so little emphasis was placed in the Conference version of the paper on demonetization and the introduction of the 2016–17 Goods and Services Tax (GST), and their impact on consumption, in the run-up to the current economic situation.

Second, he argued that more attention could be given to risk aversion as it related to the health concerns of the pandemic. He noted that while the paper cogently lays out the various reasons for the decline in consumption and investment, the pandemic-related health and morbidity concerns could make ramping up vaccinations a significant economic policy tool, as they could play a critical role in economic recovery.

Third, he would have liked to see more discussion on the fiscal situation and the acceleration of inflation in response to various supply bottlenecks. He was worried about the sustained inflation problem of the kind seen after the 2008 Global Financial Crisis up till 2014.

H.K. Pradhan asked about the prospects for growth after the Coronavirus pandemic. He noted that interest rates were low, tax rates were lower and harmonized, inflation rates were moderate, rent levels had declined, and regulatory compliances were higher. All that pointed to a lower cost structure and he thought that the future prospects for growth, post-COVID, seemed strong. Sajjid Chinoy agreed that there had been some easing of financial pressures, but the banking sector remains reluctant to extend its balance sheet and there is a lot of risk aversion. Furthermore, without a pick-up in demand, large corporations are hesitant to expand their investment.

Augustine Balraj wondered about people who did not have any income during the crisis. How were they managing? Another question pertained to microfinance institutions and whether they would revise their survival strategies, and if the definition of sustainable finance would see a significant overhaul. Lei Lei Song suggested that it was a situation in which the government needed to step in and provide additional income support for the most vulnerable groups. He thought that the government had done well in providing such support during the first year of the pandemic, but that it had now stopped.

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Integrating Biometric Authentication in India's Welfare Programs: Lessons from a Decade of Reforms§

ABSTRACT India's biometric unique ID Aadhaar has been at the forefront of the global revolution in digital identification, and India's most significant investment in state capacity over the past decade. Yet, its application to social protection programs has been controversial. Proponents claim that the use of Aadhaar to identify and authenticate beneficiaries in these programs has led to considerable fiscal savings, while critics claim that it has led to denial of benefits to the marginalized and caused substantial harm. We review research on the use and impact of Aadhaar in social programs in India over the last decade. Our main takeaway from the review is that biometric authentication has reduced leakage in multiple settings, but its impact on beneficiaries depends crucially on the protocols and details of implementation. We conclude with a list of policy suggestions for obtaining the benefits of Aadhaar while minimizing the risk of harm to beneficiaries.

Keywords: *Aadhaar, India, Service Delivery, Biometric Authentication*

JEL Classification: *D73, H53, O30, O31, Q18*

1. Introduction

The United Nations Sustainable Development Target 16.9 states: "By 2030, provide legal identity for all, including birth registration."[1] Meanwhile, the World Bank's ID4D initiative estimates that a billion people globally, or

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1. https://sdgs.un.org/goals/goal16, accessed June 30, 2021.

40 percent of people in low-income countries, do not have official proof of identity. Moreover, this lack of access is especially concentrated amongst the poor and the marginalized. Having an ID helps individuals obtain government transfers and services, access the legal system, and gain economic opportunities, amongst many other benefits. ID4D notes that "trusted and inclusive identification (ID) systems can serve as a powerful tool for development, accelerating progress in a number of areas, such as women's empowerment and gender equality, financial inclusion, and health."[2]

Around the world, developing countries have been heavily investing in ID systems. Overall, 161 countries have ID systems using digital technologies.[3] Of course, IDs do not need to be digital: the United States, for example, has unique Social Security Numbers for individuals. But digital, and especially biometric IDs, can provide considerable advantages in security as well as ease of use, given the lack of literacy and numeracy in developing countries. Recognizing these, the Global ID4D initiative helps "countries realise the transformational potential of digital identification systems."

India has been at the forefront of the digital identification revolution, starting with the 2010 roll out of its Unique ID, Aadhaar. At the time of writing, over 1.296 billion Aadhaar cards have been issued. The use of Aadhaar has been integrated into numerous government-provided services. For 8 percent of individuals, Aadhaar was their first ID ever, and further, 49 percent of respondents in a large national survey noted that they had used Aadhaar to access a service for the first time (Totapally et al. 2019).

The growing requirement to use Aadhaar to avail of a number of government and even privately-provided services has been controversial, to say the least. The argument reached the Supreme Court, which in 2018 set out specific criteria for its usage. While providing clarity, the judgment does not resolve controversy over the costs and benefits of using Aadhaar in delivering public programs. Proponents claim that the use of Aadhaar to identify and authenticate beneficiaries in these programs has led to enormous fiscal savings, while critics claim that it has led to denial of benefits to the marginalized and caused substantial harm.

In this article, we first provide a generic framework for thinking about the challenges that a government faces when trying to transfer value to remote beneficiaries, and how biometric authentication might plausibly affect these. We next describe Aadhaar use cases in Indian social protection programming, using our framework to categorize whether the use is *a priori* reasonable. We then review evidence on the impact of Aadhaar integration on leakage and exclusion, including causal evaluations as well as high-quality descriptive work. We summarize two of our own studies: the use of biometric Smartcards to make payments to the

2. https://documents1.worldbank.org/curated/en/953621531854471275/Global-ID-Coverage-Barriers-and-Use-by-the-Numbers-Insights-from-the-ID4D-Findex-Survey.pdf, accessed June 30, 2021.

3. https://id4d.worldbank.org/global-dataset, accessed June 30, 2021.

Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS or NREGS) workers and pensioners in Andhra Pradesh, and the integration of Aadhaar in the Public Distribution System (PDS) in Jharkhand.

We conclude with five policy suggestions based on over a decade of research on the use of biometric authentication in social programs in India. These are: (i) build in safeguards against exclusion, including offline fallback options; (ii) focus on using Aadhaar-based authentication to improve the beneficiary experience rather than prioritizing fiscal savings; (iii) implement solutions for real-time measurement of beneficiary experiences to quickly detect problems of exclusion and address them promptly; (iv) incorporate questions about Aadhaar in representative household surveys like the National Sample Survey (NSS) [as well as private surveys like that of the Centre for Monitoring Indian Economy (CMIE)]; and (v) build trust between the government and civil society in order to manage the trade-off between benefits from fiscal savings and the costs from increased exclusion.

2. Framework

The Supreme Court's 2018 judgment allows the government to mandate the use of Aadhaar for transactions that involve the transfer of resources between governments and citizens (reflecting the legacy of the enabling legislation for Aadhaar being introduced in Parliament as a "money bill"). These include obtaining welfare benefits, as well as filing income taxes and obtaining a Permanent Account Number, or PAN (tax ID) card. The judgment makes exceptions for children accessing benefits, and also explicitly prohibits private companies from requiring the use of Aadhaar for providing services such as bank accounts (though this has not prevented some cases of "Aadhaar-creep," where either public or private sector entities require Aadhaar in contravention of the SC judgment).[4]

Where it is legal, is mandatory Aadhaar also desirable? In order to organize our thinking about the potential benefits, we begin with a simple conceptual framework. We focus on situations in which the government wishes to transfer something of value to people who meet certain criteria. For example, it wishes to transfer PDS rations to households that meet a certain definition of poverty, or issue caste certificates to people from specified castes. The government manages these processes through its agents, the front-line bureaucrats who interact directly with citizens. Broadly speaking, the main steps in processes like these usually involve the following:

(a) Testing the *eligibility* of the applicant—whether a household is poor, whether a person is from a given caste, and so on;

4. See, for example, this article in the *Huffington Post*: https://www.huffpost.com/archive/in/entry/a-year-after-supreme-court-aadhaar-verdict-its-business-as-usual_in_5d8c69a8e4b0ac3cdda340cc.

(b) Testing the *identity* of the applicant (i.e., authentication)—whether the person who appears before the agent is in fact who they claim to be.
(c) Authorizing the agent to issue transfers. This authorization happens in real time in some cases, but can also happen asynchronously as, for example, when the government advances money or food to an agent and then subsequently *reconciles* his balances with records of transactions.

Notice that authentication, such as using Aadhaar, can play two logically distinct roles in these processes. The first is to create a reliable link across interactions. For example, in order to ensure that PDS benefits go to priority households, it is important to confirm that the person showing up to claim PDS rations today is from a household that was classified as a Priority Household last year. In order to ensure that people do not collect the same benefit twice, it is important to check whether the person claiming a benefit today did not claim the same one somewhere else yesterday. This role for authentication is *not* relevant, on the other hand, in one-shot interactions where the government can test eligibility and authorize transfers in the same interaction. For example, if the goal is to provide medical care to people sick with COVID, the government can simply immediately admit anyone who tests positive.

The second function of authentication is to ensure that the people with whom the agent interacts are real, and not "ghosts." For example, Barnwal (2019) suggests that diversion of Liquefied Petroleum Gas (LPG) to the commercial black market arises chiefly through the creation of fake accounts, which was substantially reduced (by 15 to 19 percent) after the introduction of authenticated direct transfers.

Notice that there are also aspects of the transfer process that authentication does *not* improve. It does not, *per se*, improve the quality of eligibility tests. If the government conducts a survey to determine which households are Priority Households, for example, this determination does not become more accurate if it also collects their Aadhaar numbers. This is counter to the casual rhetoric about Aadhaar preventing the leakage of benefits to the non-poor. Where authentication *can* improve eligibility tests is by making it easier to link multiple records, as for example, by cross-referencing household surveys with government payroll records to ensure that government employees are not enrolled in programs they are not entitled to.

Authentication also does not *per se* prevent government agents responsible for delivering transfers from taking some of these transfers, or charging bribes for them. The PDS is a good example of this: PDS dealers may well keep part of the beneficiaries' rations for themselves, regardless of whether or not the beneficiaries scan their fingerprints in a Point of Sale (PoS) device. (In other words, authentication may help to reduce "identity fraud" but does not obviously prevent "quantity fraud.") Authentication might in theory help indirectly by improving the beneficiaries' negotiation position, as they can threaten to

withhold authentication, but whether this is the case in practice is an open question (more on this below).

In short, authentication can plausibly help to address some forms of fraud and leakage from transfer programs, but not others. To understand the potential benefits of mandating an authentication technology such as Aadhaar in a transfer scheme, a central question is thus:

(1) ***Are there substantial issues facing the scheme that Aadhaar is well-suited to solve?***

For example, if most of the leakage from the PDS in a State takes the form of "ghost" ration cards, there is a strong case that requiring Aadhaar (at least for enrollment, if not for transactions) will help reduce it. If, on the other hand, most of the leakage takes the form of under-delivery of benefits to the enrolled households, it is not clear whether authentication will help. And if the main issue is simply that non-poor households have been classified as Priority Households (or poor households have not been able to obtain ration cards), then authenticating them more strictly will not help at all.

Understanding the details of leakage and fraud is important for deciding not only *whether* to use Aadhaar but also *how* to use it—in particular, what form and frequency authentication should take. For example, if the main issue is "ghost" beneficiaries, then it may be enough to require beneficiaries to link ("seed") their accounts to Aadhaar once, or to re-verify their identity every few years. If, on the other hand, the long-run goal is to enable beneficiaries to access their benefits from anywhere, then it is important that each transaction be authenticated so that the government can check what remaining balance the person requesting rations is entitled to, "linking" the current request with any other related transactions conducted earlier.

Note that in some cases schemes do transfer benefits to the "wrong" people, but this is not particularly consequential for the scheme's overall goals. In certain types of vaccinations, for example, it may be critical to simply get as many "shots in arms" as possible, without being concerned about the specific identity of the individual. It is worthwhile to distinguish cases like these from those where the identity of the recipient is critically important—*who* receives a caste certificate, for example, or payment for a particular MGNREGS work spell.

The benefits of limiting fraud also depend on the nature of the benefit being provided, and in particular, whether or not it is "rival," in the sense that one person's consumption of it precludes another's. Individually consumed goods and services such as rations provided via the PDS are rival in this sense, which is why it is important to prevent them from falling into the wrong hands. But some other benefits, such as slots in adult education classes or agricultural clinics, are less so. For this latter category, preventing the "wrong" people from benefiting has little value *per se*; the question is rather whether there is value in obtaining

an accurate count of the number of people benefiting, as for example, when instructors are compensated on this basis.

The information needed to assess these issues empirically—how much of various types of leakage and fraud exists in the status quo—generally cannot be found in administrative records alone. Records of the amount of grain sent to a Fair Price Shop (FPS), for example, do not tell us how much was diverted, how much of this was due to "ghost" ration cards, and so on. The key is to *match* the administrative data to independent, representative data on what is actually happening on the ground, as for example, in an audit study. The quality and availability of administrative data on India's major social programs has been increasing substantially, as for example, the detailed records of payments issued to workers through the MGNREGS. But comparable ground-truth data have, if anything, become harder to obtain, particularly now that the National Sample Survey Office (NSSO) has stopped conducting rounds of the National Sample Survey (NSS) (and chosen not to release data from the 2017–2018 Round). We return to the importance of better ground-truth data in discussing policy implications below

(2) ***How serious are the risks of exclusion, and of higher transaction costs, to the population being served?***

Understanding how much scope exists for Aadhaar authentication to improve a scheme is important because requiring authentication will usually come at some cost.

The first category of cost is exclusion: some people may be eligible, but unable to establish their identity at some step in the process, and so lose access to benefits. This may occur for a number of reasons—because they do not have an Aadhaar number, because they are not able to link one to other government records, because authentication at the point of interaction fails, and so on. The potential costs of exclusion have been graphically illustrated by the press coverage of starvation deaths in households that lost access to PDS rations because they were unable to seed an Aadhaar number to their ration card.

The second is transaction costs: some people may successfully obtain benefits, but incur much higher costs in terms of time, money, and frustration to get them. The authentication process can be costly and/or time-consuming; for example, authentication failures might necessitate multiple trips to collect benefits. For example, in Jharkhand, both our own work and that of Dreze et al. (2017) suggests that beneficiaries needed multiple trips to collect PDS rations after the introduction of online Aadhaar authentication.

The severity of these risks depends both on how *likely* they are and on how *harmful* they would be.

In order to assess likelihood, it is useful to examine the usual information about the share of the target population that already has an Aadhaar number, as well as determine how difficult obtaining an Aadhaar number (and, where relevant, seeding it) would be for those that do not. Knowing the population

being served can also give us a decent sense of the potential costs. The costs for obtaining and seeding Aadhaar are known to be high for remote and more marginalized populations (Totapally et al. 2019); cases where these populations make up a high proportion of beneficiaries might, therefore, see higher costs. The age of the beneficiary population can be an easy predictor of costs. It is clear that obtaining Aadhaar cards and being present for transaction authentication might pose particular challenges for the very young or the very old. Yet while being useful, this information cannot tell us how much exclusion will, in fact, take place *as a result of* Aadhaar, as that requires knowing what rates of exclusion would be like under the alternative—a point we return to below.

In order to assess harm, it is important to consider the type of benefit being transferred and its value from the point of view of the beneficiaries. Some benefits, such as food for vulnerable populations, can be matters of life or death. Other types of subsidies, for example, technological and quality upgradation subsidies for Micro, Small and Medium Enterprises (MSMEs) are less essential in comparison.

(3) ***What mechanisms are or can be put in place to mitigate these risks?***

The Supreme Court judgment explicitly recognized that making Aadhaar mandatory involved real risks of exclusion, and that it would be important to have fallback mechanisms in place to mitigate this risk. Yet such mechanisms are not always existent, or easy to access. In the case of the PDS, for example, a fallback option to Aadhaar authentication was supposed to exist in the form of one-time passwords (OTPs) sent to beneficiary cell phone numbers. But few PDS beneficiaries have consistently available phone numbers that are accurately linked to their Aadhaar accounts. For making MGNREGS payments in Andhra Pradesh, on the other hand, the use of simple offline fallback mechanisms—collecting fingerprints on paper, rather than scanning them, or having trusted local officials verify transfers—appears to have significantly reduced exclusion (Aadil et al. 2019; Muralidharan et al. 2016).

3. Aadhaar in Action

We next review and discuss the ways in which Aadhaar is being used by the government in practice.

We take as our point of departure the catalogue of government schemes making use of Aadhaar contained in the State of Aadhaar Report 2016–2017 (Abraham et al. 2017). At that point, 1.14 billion people (85 percent of the population) had an Aadhaar card and 139 million used it to authenticate themselves every month on average. Aadhaar was used for payments in Pratyaksh Hanstantrit Labh (PAHAL) Scheme (LPG), MGNREGS, PDS, and pensions (with 82 percent, 79 percent, 72 percent, and 51 percent seeded, respectively). Since this dataset is now several years old, and in particular was created before

the 2018 Supreme Court judgment on Aadhaar, we have also updated it. We first verified for each scheme in the original report whether Aadhaar is still required in the wake of the court judgment. We then augmented the list by examining the websites of all 51 Central Government ministries to identify additional Central Sector or Centrally Sponsored Schemes that request Aadhaar numbers from beneficiaries. We also examined all official State government websites to determine State-level schemes that request Aadhaar numbers. In doing so, we referred to the operational guidelines of various schemes and, in some cases, to application forms available online. Table A1 reports the use cases we identified, noting the specific scheme, whether it is national or particular to a State, what government or private agency is responsible, the sector, and a brief description. (For Table A1, see: https://www.ncaer.org/Events/IPF-2021/Paper/IPF_2021_Paper4_TableA1_Aadhaar_Use_Cases_in_Various_States.pdf.)

The first fact that stands out is a simple one: Aadhaar usage is ubiquitous. By usage, we mean the employment of Aadhaar in one or more of the following ways: linking to beneficiary rolls ("seeding") for de-duplication, authenticating transactions, or making Direct Benefit Transfers (DBTs) using the Aadhaar Payment Bridge. We document usage by governments in all States, and across more than twenty Central Government ministries and departments. Aadhaar is used in schemes ranging from flagship anti-poverty programs such as the MGNREGS, PDS, and the Integrated Child Development Services Scheme (ICDS), to extremely specialized schemes related to horticulture or homeopathy.

Overall, we document 183 Central-level schemes that use Aadhaar. In addition, we document 301 State-level use cases, spanning financial assistance in various schemes, requirements for permits, licenses, and certificates, as well as a number of additional identity cards (for example, family ID cards). One special case is that of online citizen service portals, such as *MeeSeva* in Andhra Pradesh, *Jharsewa* in Jharkhand, and *Seva Sindhu* in Karnataka, which provide a single window for accessing welfare schemes, citizen services, grievance redressal, and even business registration.

Usage is widespread in terms of not only the number of schemes, but also the number of beneficiaries affected. The State of Aadhaar Report 2019 (Totapally et al. 2019) reveals that of the 1.2 billion people who have Aadhaar (including 95 percent of adults and 75 percent of children), 330 million use it regularly for rations, 145 million have used it at least once for LPG subsidy, 102 million have used it for MGNREGS wages, 96 million farmers have used it to receive fertilizer subsidies, and 9 million older adults use it to receive pensions. In addition, 609 million have linked it to their bank accounts, 125 million children have enrolled in school using theirs or their parents' Aadhaar, and 345 million people used Aadhaar to get a SIM card.[5]

5. Note that the State of Aadhaar Report 2019, though more up-to-date and with a much larger survey sample, does not have a comprehensive treatment of use cases; hence, we rely on the 2016–2017 report and our own updates to describe use cases.

Second, there is some evidence that the prevalence of Aadhaar usage has risen since the Supreme Court judgment. Of the 117 schemes documented in the State of Aadhaar Report 2016–2017 (Abraham et al. 2017), we document a total of 97 cases that are still actively using Aadhaar, 5 cases which are no longer active or use Aadhaar, and 15 cases that we cannot verify; meanwhile, we found 86 *new* Aadhaar use cases, for a net increase of at least 66. In relative terms, the State of Aadhaar Report estimated that 77 percent of social protection spending ($36B out of $47B per year) passed through schemes that used Aadhaar; while we do not have budgetary figures for all schemes, that number seems likely to have increased as well.

Third, a majority of use cases involve authentication to receive a material benefit. These include both in-kind transfers (for example, PDS grains) and cash transfers (for example, DBT payments of various subsidies), and include subsidy and scholarship programs in addition to the familiar social welfare schemes. Because these use cases involve the transfer of material benefits from governments to beneficiaries, it is *a priori* reasonable to worry about duplicate or "ghost" beneficiaries, or about fraud by non-beneficiaries. Yet the costs of exclusion can also be very high (in the PDS, for example) and the burden of transaction costs substantial, especially for transfers that are repeated. It is generally thus best to examine these on a case-by-case basis, considering for each the questions posed above.

That said, there are also a number of examples where Aadhaar authentication is required to access benefits that are likely non-rival.[6] These include, for example, coaching classes for underprivileged students or agricultural clinics for farmers that are administered at the group level. As mentioned above, the case for Aadhaar use in these cases may not be as strong, since allowing an additional person to participate does not preclude participation by anyone else. There seems little downside to having unexpected guests at agricultural clinics, for example. The main argument for authentication here is likely to accurately track the number of people who benefit, as for example, when instructors are paid on that basis. The open questions are whether Aadhaar authentication does this more effectively than other simpler methods of tracking participation, and how susceptible it is to obvious scams such as registering passers-by as participants.

There are also cases in which the government issues documents to specific people—such as caste, residence, or education certificates—that are of value only to the person named on them. Here there is some risk of identity theft, as for example, if person A obtains person B's residence certificate and then uses it to pose as B, and also some risk of fraud, as for example, if A obtains a residence certificate specifying an address at which he does not live. Aadhaar authentication can help prevent identity theft if A is required to authenticate when he

6. At least five schemes, as per Table A1.

obtains or uses a certificate. It is less clear how it can help prevent fraud, except as a means of cross-referencing claims across administrative data sources.

In short, there are regularities in the ways Aadhaar has been deployed (despite the enormous number of use cases) that we can use to form some *a priori* sense of the likely benefits and costs of Aadhaar authentication in each. Yet what the *actual* benefits and costs are is almost always an empirical question. In addition to understanding the specific mechanisms, risks of exclusion, and so forth, one needs to match administrative data to a source of "ground-truth" in order to quantify leakage and exclusion, and to do this in representative samples to ensure that isolated anecdotes are not given undue prominence. We next turn to a review of the available evidence on these points.

4. Descriptive Evidence on Aadhaar

For a technology that now plays such a pervasive role in the life of the nation, it is striking how little rigorous research on Aadhaar is available. For instance, a Google scholar search of the terms NREGS or MGNREGS yields several times as many hits as a search for the term Aadhaar, despite MGNREGS being just a single welfare program whereas Aadhaar affects the delivery of *hundreds* of government services. One reason for the relative lack of evidence is that primary data has been difficult to obtain over the last decade, with the NSS either not releasing collected data or not conducting scheduled rounds.[7] It is critical that the NSS resume and that it should include questions that capture the impact Aadhaar is having on people's lives—a point to which we return in the conclusion.

Given the shortage of data it is not possible to paint a comprehensive picture of Aadhaar's impacts—yet several individual studies do give us useful insights. We begin in this section with insights from studies that are *descriptive* in nature, meaning that they capture what is happening but do not attempt to compare this to what *would have* happened in the absence of Aadhaar, at least not using methods of causal inference generally accepted in social science research. We then proceed in the following section to studies that conduct credible causal inference to try to assess how outcomes are *different* as a result of Aadhaar's use. We restrict ourselves, throughout, to studies that collected and analyzed primary data and that made some attempt to do so in samples that are representative of

7. Many authors have written about recent problems with data collection in India, including Pronab Sen, India's first Chief Statistician (https://www.indiatoday.in/magazine/up-front/story/20200323-the-unfolding-tragedy-of-indian-data-statistics-1654709-2020-03-13), Abhijit Banerjee, Pranab Bardhan, Rohini Somanathan, and T.N. Srinivasan (https://economictimes.indiatimes.com/blogs/et-commentary/from-being-world-leader-in-surveys-india-is-now-facing-a-serious-data-problem), and Pramit Bhattacharya (https://www.livemint.com/news/india/how-india-s-statistical-system-was-crippled-1557250292753.html).

a broader population of interest. Based on these criteria, we focus here on the following five studies:

- Two State of Aadhaar reports: The 2017–2018 report (Abraham et al. 2018) is based on individual surveys with 3,000 households across Andhra Pradesh, Rajasthan, and West Bengal; and the 2019 report, which has broad coverage, with a quick survey with 145,000 households across 28 States, and an in-depth survey with 19,000 households in 16 States and one Union Territory.
- Two distinct studies conducted by the Center for Global Development. The first (Gelb et al. 2018) examines the case of introducing *Bhamashah*, a digital platform for service delivery, in Rajasthan in 2018. It relies on surveys with 633 households across 7 districts of Rajasthan. *Bhamashah*, introduced in 2014, gives households a card and a unique *Bhamashah* family number; each household member's Aadhaar number is linked to the card, and it is needed to avail of any of the 150 schemes either wholly or partially funded by the State government. The second (Aadil et al. 2019) was conducted in Krishna district of Andhra Pradesh in 2018–2019, with surveys of 556 beneficiaries of one of three welfare programs, 53 FPS owners, and 45 business correspondents.[8]
- Dreze et al. (2017), who examine the use of Aadhaar in the PDS in Jharkhand. They surveyed 890 households attached to 32 FPSs across eight districts, with 18 of these FPSs using online Aadhaar authentication, 7 using offline Aadhaar authentication, and the remaining not using Aadhaar authentication.[9]

In examining these studies, we focus on outcomes that we described in Sections 2 and 3 as important for judging the appropriateness of Aadhaar integration: fiscal savings and leakage, exclusion, transactions costs, and beneficiary preferences.

4.1. Fiscal Savings and Leakage

Measuring leakage in transfer programs requires both administrative records on the amounts disbursed and a source of "ground truth" on the amounts received by beneficiaries. Claims about leakage reduction due to Aadhaar have often ignored this point, citing reductions in fiscal outlay as if they were *per se* evidence of reduced leakage. For example, the State of Aadhaar 2016–2017 report

8. Krishna is the richest district in Andhra Pradesh, so the results must be viewed in this light.

9. Three types of PDS outlets were discarded from the sample: (i) those serving more than one village; (ii) those with more than 250 ration cards on their list; and (iii) those operating under the "partial online" mode. The sample should thus be viewed as skewed towards smaller and more rural villages.

(Abraham et al. 2017) cites the DBT website in claiming that $2.1 billion in food subsidies and $3.9 billion in LPG subsidies were saved by removing 23 million and 35 million duplicates, respectively. However, without matched data on actual beneficiaries, it is difficult to know whether the removal also mistakenly included genuine beneficiaries. Of the studies we review in this section, only Dreze et al. make a more concerted effort to examine leakage: they report that the average PDS purchase-entitlement ratio was the same in online and offline FPSs at approximately 93 percent, suggesting that online Aadhaar usage did not change leakage. This is correct to the extent that the ratio of entitlements to actual disbursements was also the same across these types of shops, but the analysis is incomplete because the authors do not have data on disbursements from the government to PDS shops to verify this.

4.2. Exclusion

Most of the studies do have something to say about exclusion. The State of Aadhaar Report 2017–2018 notes that 0.8 percent of the respondents in Andhra Pradesh and West Bengal and 2.2 percent in Rajasthan reported exclusion in the case of PDS (which they estimate as being equal to 2 million people every month). However, they also note that in the latter two states, non-Aadhaar related problems contributed substantially more to exclusion than Aadhaar-related problems (0.3 percent, 6.5 percent, and 5.2 percent, respectively).

The 2019 report notes that individuals from minority religions (Muslims and Christians), historically disadvantaged castes, and homeless and third gender people are less likely to have Aadhaar than the national average. Turning to exclusion, 2.5 percent of the respondents experienced exclusion from a key welfare service because of Aadhaar (which disproportionately affects the homeless and third gender people), and 0.5 percent of children could not enroll in school because of Aadhaar-related problems. However, for the major social programs, the rate of exclusion because of Aadhaar-related errors is lower than exclusion because of non-Aadhaar related errors (1 percent versus 31 percent in NREGA, 0.5 percent versus 5.7 percent in pensions, and 1.5 percent versus 3.2 percent in PDS). The general picture that emerges is that Aadhaar authentication is one among several hurdles that disadvantaged people face when trying to access public benefits, but not necessarily the most common.[10]

In Krishna district, 2 percent of the beneficiaries reported being denied rations because of technology failure, though the authors report that these issues were resolved quickly. In addition, 5 percent of the pensions were temporarily stopped during the transition. The study notes that Andhra Pradesh officials did

10. With respect to private programs, it is notable that 3.3 percent of the people were denied bank accounts and 0.8 percent were denied SIM cards because of Aadhaar-related problems. Along with denial of access to education, these are denials that are illegal under the 2018 Supreme Court judgment.

not seek to remove bogus beneficiaries at the time of digitization. Further, they implemented strong fail-safes to deal with technological failures. For example, the State has entrusted village revenue officers (VROs) with the authority to authenticate transactions in cases of technology failure.

In Jharkhand, Dreze et al. report that 7 percent of the households did not have a single member with Aadhaar, including mainly small households with elderly couples or widows living alone. This would make it near impossible for them to obtain rations in the online-only system with no fallbacks, but there is no comparison with exclusion in villages that do not have Aadhaar.

4.3. Transactions Costs

Many reports point out the existence of authentication failures, although serious attempts at quantifying transactions costs in Rupee terms are lacking. In Rajasthan, less than a quarter of all program beneficiaries could authenticate in the first attempt (~96 percent could authenticate in four attempts or fewer). Meanwhile, 70 percent of those who were denied PDS rations because of authentication failures had to return the next day (sometimes with another family member) to reattempt authentication. Dreze et al. (2017) note that transaction costs were significantly higher in online villages (1.5 trips per month compared to 1.1 in offline villages), although they do not report whether these numbers are statistically distinguishable.

4.4. Preferences

All reports elicit beneficiary opinions on the integration of Aadhaar. The SOA 2017–2018 report notes that a large number of schemes (252) required beneficiaries to authenticate themselves to receive benefits, but that nevertheless 87 percent of respondents approved of the government's mandatory use of Aadhaar (and 77 percent approved of the private sector's use of mandatory Aadhaar). This may be related to the fact that, for example, over 60 percent of people preferred Aadhaar enabled PDS as they believed it reduced fraud. This number had increased further by SOA 2019: 92 percent of people say they are very or somewhat satisfied with Aadhaar. Strikingly, even among those who have been excluded from a service because of Aadhaar, 67 percent still say that they are satisfied with it.

In Krishna, which has a strong grievance redress mechanism to deal with exceptions or cases of technology failure, 70 percent of PDS beneficiaries viewed the new system (with Aadhaar) as better and 28 percent as worse, with few differences across gender, age, and other demographics. Interestingly, 80 percent of those who thought the new system was better, and 46 percent of those who thought it was not, believed that rations were no longer diverted. Conversely, 100 percent of those who thought the new system was not better, and 42 percent of those who thought it was better, agreed that authentication failures were frequent. Meanwhile, pensioners strongly favored the panchayat

office system of payment delivery using Aadhaar. Very few report skimming by officials, which was quite common in the manual system before Aadhaar. Note that all comparisons are simply with the system as it existed prior to Aadhaar; there is no contemporaneous counterfactual.

In Rajasthan, 40 percent of PDS beneficiaries found the new system to be better and 12 percent found it to be worse, with the rest remaining neutral between the two. The main reason for approval of the new system was that people felt their entitlement could no longer be diverted. Those who disliked the new system cited authentication failures as their main reason. In the case of pensions, nearly two-thirds of pensioners said they preferred the new system. Among respondents who were not below the poverty line about 45 percent said they preferred the new system, but among below poverty line respondents, over 75 percent did, indicating that the reforms benefited those who are most reliant on pensions. The most important reason seems to be that pensions had become more regular under the new system.

The picture was worse in Jharkhand. In online villages, 64 percent of transacting households said the ePoS should be discontinued, while only four out of eighteen dealers in online villages said the ePoS system should continue. Surprisingly, 70 percent of transacting households in offline villages—more than those in online villages—said that the ePoS should be discontinued, but again it is not clear if these numbers are statistically distinguishable.

We summarize the available descriptive evidence as follows. There is no credible data on leakage at all, a serious lacuna given that one of the main arguments for integrating Aadhaar into transfer programs in the first place was to reduce leakage. Exclusion risk may be small but it is real, and appears to disproportionately affect the most vulnerable. However, non-Aadhaar exclusion risk is also significant, in most cases higher than that attributable to Aadhaar. Transactions costs are again small but non-trivial, coming largely from authentication failures that result in beneficiaries having to make additional trips to obtain ration. In most cases, it seems reasonable to attribute these to Aadhaar. Opinions seem positive overall, but depend on context. Aadhaar seems like something that most people seem willing to accept even when it has caused them problems. The picture is of a population that is used to having a hard time getting things out of government that they are entitled to, and doesn't see Aadhaar as a major change-maker in that regard.

We next review studies that conduct causal analysis of the impact of using biometric authentication to deliver welfare programs.

5. Evidence of Impact of Biometric Authentication and Aadhaar

In addition to the descriptive work above, there are three studies on the impact of using biometric identification to deliver welfare programs that also have

a credible comparison group against which to assess impacts. These include Barnwal (2019) who studies the impact of Aadhaar-based DBT on leakage in LPG subsidies (using a natural experiment), and two of our own studies spanning MGNREGS, pensions, and the PDS (with randomised experiments). We summarize the findings and insights from each of these studies below.

5.1. Aadhaar-based DBT in LPG Subsidies

Barnwal (2019) uses the fact that DBT was rolled out across 89 districts in six phases, and then unexpectedly terminated, as a natural experiment. The paper has two main findings. First, it finds that the reform led to a significant reduction in LPG sales to households, and a corresponding reduction in the distributor-level sales data (using administrative data on distribution of LPG cylinders). It also finds that these reductions were reversed when the reform was rolled back. Second, the paper finds compelling evidence of diversion of subsidized LPG into the (illegal) private "black" market through an innovative approach of measuring black market prices during the reform and after the reform was repealed, which finds a significant reduction in these black market prices when the reform was stopped.

Quantitatively, the paper finds that after DBT is introduced in the treated districts, LPG purchases by eligible households go down by 11–14 percent, then converge back to the level in untreated districts once DBT is withdrawn. After DBT is removed, fuel prices in the black market go down by 13–19 percent (consistent with the supply of LPG cylinders and the resulting ability to divert to the open market having gone up again), while firms' purchases in the formal market go down by 9 percent. The evidence suggests that there is significant divergence of LPG from households to firms that buy in black in the old system (before Aadhaar). Finally, the paper analyzes the heterogeneity of impacts by the pre-program incidence of usage, and finds that the reductions in LPG purchase are concentrated among larger buyers, suggesting that the fiscal savings were less likely to be driven by the exclusion of genuine beneficiaries and more by reductions in "ghost" beneficiaries.

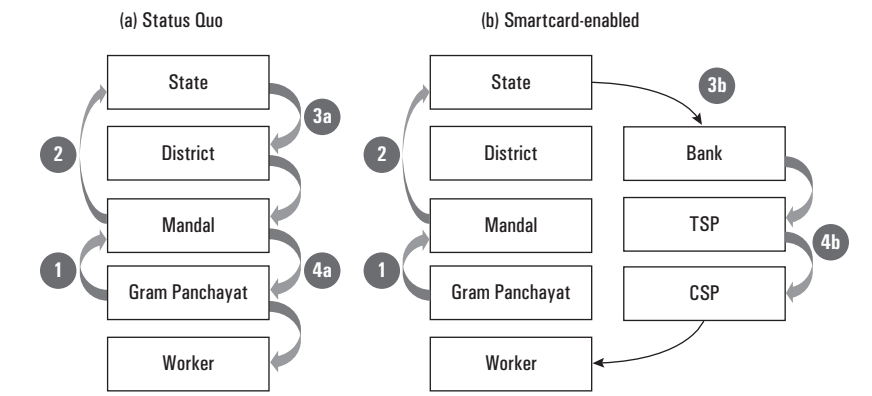
Put together, Barnwal (2019) provides compelling evidence that the use of Aadhaar to reform the way in which LPG subsidies were delivered led to meaningful reductions in leakage. However, there are two limitations in the study. The first is the lack of a contemporaneous control group (the study used a natural as opposed to a randomized experiment). Second, and more important, is the lack of matched data between administrative records of disbursal and household records of receipts. Thus, while there is compelling evidence of reduction in government spending and indirectly of reduced leakage (through the effects on black market prices), it is difficult to rule out the possibility that some part of this reduction may have come at the cost of increased exclusion error of households, especially those with low frequencies of purchases.

5.2. Biometric Smartcard-based Payments in MGNREGS and Pensions in (unified) Andhra Pradesh

The next two studies are based on our own work. Both feature: (i) large-scale randomized experiments of the rollout of linking biometric authentication to welfare payments, and (ii) *matched* data between disbursals and receipts to measure the extent to which these reforms affected *both* of these items of interest.

The first one studied the impact of biometric authentication and payments through local Customer Service Providers (CSPs) in MGNREGS and social security pensions across 8 districts in (unified) Andhra Pradesh between 2010 and 2012. This reform opened no-frills bank accounts for beneficiaries, which were accessed through biometric Smartcards. CSPs partnered with banks to make last-mile cash disbursals; accounts could only be accessed through the local CSP because they were offline and there was no portability, after biometric authentication through local PoS machines. Figure 1 describes the Andhra Pradesh Smartcards (APSC) reform for the case of MGNREGS payments; while the flow of information from the field to the State did not change, payments now

FIGURE 1. Status Quo versus Smartcard-enabled Payment Systems in Andhra Pradesh



Source: Reproduced from Muralidharan et al. (2016).

Note: This figure shows the flow of information (1 and 2) and funds (3a, 3b, 4a and 4b) for MGNREGS payments, pre- and post-Smartcards. "TSP'' is a Technology Service Provider, a firm contracted by the bank to handle details of electronic transfers. "CSP'' is a Customer Service Provider, from whom beneficiaries receive cash payments after authentication. The upward flow of information about work done is the same in both systems: (1) Paper muster rolls are maintained by the Gram Panchayat and sent to the *mandal* computer center, and (2) the digitized muster roll data is sent to the state financial system. However, the downward flow of funds is different. In the status quo model (3a), the money is transferred electronically from the State to the district to the *mandal*, and (4a) the paper money is delivered to the Gram Panchayat (typically via the post office) and then to the workers. In the Smartcard-enabled system (3b), the money is transferred electronically from the State to the bank to the TSP, and (4b) the TSP transfers cash to the CSP, who delivers the cash and receipts to the beneficiaries (both with and without Smartcards). Beneficiaries with Smartcards were required to biometrically authenticate identity before getting paid. Beneficiaries without Smartcards were issued "manual payments" with status quo forms of authentication and acknowledgment of payment receipt.

flowed through the Bank and CSP, as opposed to flowing through the same agent (field assistant) who reported the amount of work done.

In order to evaluate the impact of rolling out Smartcards in MGNREGS and pension programs, we worked with the Government of (unified) Andhra Pradesh (GoAP) to conduct a staggered roll-out of the programs in three phases in eight districts with a total rural population of ~20 million. We used a randomized lottery to allocate *mandals* (blocks) to each phase between 2010 and 2012. Thus, Phase 1 *mandals*, which got the program first, were the treatment group and Phase 3 *mandals* (which only got the program two years later) served as the control group.[11] We conducted nearly 16,000 baseline and endline household surveys that allowed us to match administrative data on payments and disbursals to rich beneficiary-level data on receipts, time delays in getting paid, and wages and employment (on both NREGS and other work). The combination of randomization of the rollout of Smartcards and matched data between administrative records and household data (across treatment and control areas) allows us to estimate the causal impact of the Smartcards program.

We found strikingly large positive impacts of Smartcards on almost every dimension of beneficiary experience. First, the payments process improved sharply. The Smartcard system reduced the lag between working on an NREGS project and collecting payment by 29 percent, and reduced the unpredictability in this lag by 39 percent. Further, it reduced the time workers spent collecting MGNREGS payments by 19 percent. Second, leakage fell significantly. NREGS beneficiaries in the treated *mandals* reported a 24 percent increase in weekly earnings, while fiscal outlays did not change, resulting in a 41 percent reduction in leakage (a 12.7 percentage point reduction relative to the average leakage of 30.8 percent in the control areas). Similarly, reported earnings on pensions went up by 5 percent, while official disbursements did not, leading to a 49 percent decline in leakage (a 2.9 percentage point reduction relative to average leakage of 6 percent in the control areas).

The APSC program was a bundle of two components: using biometrics for authentication, and moving payments closer to beneficiaries by hiring business correspondents (BCs) to have a payment point (through local customer service providers or CSPs). We find using a non-experimental decomposition of effects that the use of local BCs/CSPs was the key to improving the payments process, whereas the biometrics were the key to reducing leakage. Specifically, the benefits of faster, more convenient, and more predictable payments were seen even for those who had not obtained a Smartcard, as long as the village had hit the threshold of enrollment (typically 40–50 percent of the beneficiaries) at which point *all* payments in the village were "converted" to going through the BC/CSP

11. We included a Phase 2 of "buffer" *mandals* so that the GoAP could continue rolling out Smartcards there after Phase 1 but before Phase 3. These buffer *mandals* were not included in the study and we did not collect survey data there.

(even for those without Smartcards). However, we only found leakage reduction in the cases of beneficiaries who had enrolled for Smartcards. This leakage reduction was driven mainly by reduced over-reporting of work by intermediaries, since the money went directly into beneficiary bank accounts and could not be siphoned away by intermediaries.

Finally, we find that Smartcards were very cost-effective. The monetized value of time savings to beneficiaries (₹26 crores) alone was greater than the cost of the new system (₹24 crores) for NREGS. The reduction in NREGS leakage was nine times the cost of the program. Put together the returns from time saving and leakage reduction were nearly ten times the cost of the program. All estimates are only for the eight study districts, and would be higher if extended to all of Andhra Pradesh. Overall, the evidence suggests that Smartcards improved beneficiary experiences in collecting payments, increased payments received by program participants, reduced corruption, broadened access to program benefits, and achieved all these benefits without substantially altering fiscal burdens on the State. Consistent with these results, we find that 90 percent of the NREGS beneficiaries and 93 percent of the Social Security Pensions (SSP) recipients who were exposed to the Smartcard initiative reported that they prefer the new system to the old. Combined with the evidence of high cost-effectiveness, this was clearly a reform that made sense all around.

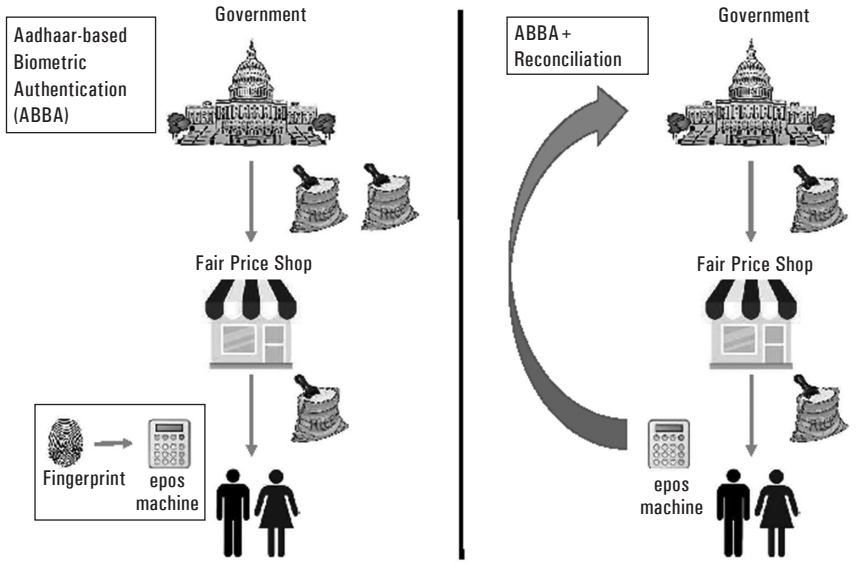
5.3. Aadhaar-based Biometric Authentication in the PDS in Jharkhand

Our second study was in partnership with the Government of Jharkhand (GoJH) to evaluate the impact of introducing Aadhaar-based Biometric Authentication (ABBA) in the PDS starting in 2016. This allowed us to test the impacts of biometric authentication in a different context (Jharkhand), with a different program (PDS), using a different technology (Aadhaar versus Smartcards-based authentication), and in a setting of weaker State capacity than unified Andhra Pradesh, which had made strong investments in technology-driven governance over the years.

The evaluation was carried out using a similar design to the Andhra Pradesh Smartcard study and featured a large-scale randomized evaluation. The roll-out of the biometric ePoS machines was done in a phased manner across 132 blocks in 10 districts where the blocks were allocated to treatment (receiving ePoS machines first) and control (receiving them last) groups using a random lottery. In order to measure impacts, we conducted over 14,000 household surveys (matched to ration cards) and collected data on PDS commodities received (quality and quantity), transaction costs of collecting benefits (time, number of trips), and beneficiary opinions of the program.

The intervention was similar to APSC in that biometric authentication was required to obtain grains at the last mile from the PDS dealer. However, one important difference was that the reform was rolled out in two stages. The first

FIGURE 2. PDS Reforms in Jharkhand



Source: Reproduced from Muralidharan et al. (2021a).

Note: This figure shows the two phases of the reform studied in Muralidharan et al. (2021a). The left panel shows the first stage, ABBA, which requires beneficiaries to authenticate transactions at the FPS in order to receive rations. The right panel demonstrates that transaction records from the ePOS machine are used to provide information in the "reconciliation" phase to adjust future disbursements of grain from the Government to the FPSs.

stage, which was randomized, involved the rollout of ePoS machines which enabled ABBA of beneficiaries attempting to collect food. In the second stage ("reconciliation"),[12] GoJH used data from ePoS devices to determine monthly food distribution to the FPSs, by adjusting the amount of new grain disbursed based on electronic records of authenticated transactions. This was introduced in all blocks at the same time, so we evaluate this using a pre-specified event study framework, a placebo group of PDS commodities not subject to reconciliation, and experimental variation in the duration of exposure to ABBA prior to reconciliation. Figure 2 describes the two stages of reform.

The results in Jharkhand were different from those in Andhra Pradesh in important ways. We found that the first phase of the reform (requiring biometric authentication to collect PDS benefits) did not lead to any increase or decrease in either the value of benefits received or leakage. Further, there was a significant decline in the benefits received (of around 10 percent) for those beneficiaries who had not seeded their Aadhaar numbers into their ration cards. Finally, there

12. Note that in Andhra Pradesh, reconciliation was much more straightforward since bank accounts were automatically settled upon uploading of the transactions records from the electronic point of sale (ePoS) machine. Moreover, payments were sent out only upon receiving information of what was due based on the work done that was uploaded by the *mandal*.

was also an increase in transaction costs for beneficiaries in the treated areas with a significant increase in the number of unsuccessful trips made to the FPS for collecting rations. We also found that leakage (defined as the gap between the value a beneficiary was entitled to and the value they received) continued to be high, at around 20 percent in both the treatment and control areas. This was likely because Aadhaar only solves the problem of identity fraud and not the problem of quantity fraud, where the dealer takes beneficiary fingerprints but provides them with less than the value to which they were entitled. Overall, these results are consistent with the critique that biometrically authenticating transactions caused at least some "pain without gain" (Dreze et al. 2017).

Yet, there were reductions in leakage in the second phase of the reform, when the government started to reconcile its monthly shipments of grain to each FPS against transaction data for the previous month. Roughly speaking, this meant that a ration shop owner responsible for distributing 100 kg of grain each month who distributed 70 kg in July would receive only 70 kg from the government in August rather than the full 100 kg he would previously have received. Our data suggest that reconciliation had a meaningful impact on fiscal savings for the government.

In particular, the ABBA data from the electronic point of sale (ePoS) machines during the months prior to reconciliation allowed GoJH to see the undisbursed balance of grain for each dealer, and correspondingly reduce disbursals under reconciliation. When reconciliation started, we saw a 31 percent drop in the value of grains disbursed by the government for the reconciled commodities (rice and wheat) in the first month of reconciliation (July 2017). Combined with matched household survey data, we estimate that around 70 percent of this drop in value was a reduction in leakage. Another striking piece of evidence of lower leakage is that FPS dealers in treated areas reported a 72 percent lower expected future bribe price for FPS licenses, suggesting that they expected a substantial fall in the potential for making money from diverting PDS grains.

However, this reduction in leakage came at the cost of increased errors of exclusion: the remaining 30 percent of the reduction in value disbursed represents value lost by legitimate beneficiaries. The probability that a household received no rice or wheat increased by 10 percentage points after reconciliation. This sharp decline in benefits also had political costs and the government temporarily rescinded the reconciliation policy entirely, citing complaints from both dealers and beneficiaries. As we discuss further, the exclusion was likely exacerbated by GoJH's decision to hold dealers responsible for undisbursed stock over several (8–10) months, corresponding to the period of ABBA but before the onset of reconciliation. In practice, some or much of this grain would have already been diverted (or spoilt). Thus, when GoJH sharply reduced disbursements in July 2017, many dealers likely did not have the grains in stock that they were supposed to have (based on ABBA records). The reduction in disbursal thus also led to a reduction in grain to beneficiaries.

Over time, GoJH has brought back the reconciliation process with improvements (such as reconciling stocks every 1–2 months as opposed to doing a one-shot cumulative reconciliation for several months). However, the discussion above highlights a deeper structural problem.

In an ideal world, the government would like to reduce leakage (by reducing dealer corruption) without increasing exclusion. However, the structural problem is that while the government can reduce disbursals by only replenishing stocks for authenticated transactions, it is much more difficult to prevent the dealers from passing on some of their pain (of having lower stocks) to the beneficiaries. These results highlight that efforts to control corruption can have negative consequences, too. Overall, the results from Jharkhand suggest that while there may have been reductions in leakage in the PDS due to ABBA, some of this reduction came at the cost of increased exclusion errors.

5.4. Discussion

Methodologically, the discussion above highlights the centrality of matched data (between administrative records and beneficiary receipts) and a credible control group for quantifying and understanding what is actually going on. In the Andhra Pradesh Smartcards case, it would have been easy to think that there was no impact on leakage because there was no change in government expenditure on MGNREGS and pensions. It was only with the matched data between administrative records and household surveys (and the existence of a control group) that we could see that leakage had fallen sharply and that more benefits were reaching people. Conversely, in the case of ABBA in Jharkhand, it would have been easy to interpret the reduction in disbursals as evidence of reduced leakage (and indeed, officials often claim this exact point). However, it was the matched data using household surveys which clarified that at least some of the reductions in disbursal were coming at the cost of exclusion errors.

Such visibility is also essential for political economy reasons. It is very difficult for senior policymakers to distinguish between genuine issues and vested interests. In the Andhra Pradesh case, despite the strong evidence of positive impact, the feedback on the program through political channels was often negative, to the extent that the political leadership of GoAP almost considered scrapping the Smartcard program. This is because the lower-level officials, who could no longer make money from MGNREGS as easily as before, would try to highlight cases of system malfunction and beneficiary inconvenience to get the program scrapped (since they could not publicly complain that "they were no longer able to make money"). Thus, in this case, the opposition to the program was being driven by vested interests that the political leaders almost listened to, nearly scrapping a highly effective program because they could not be sure that the beneficiaries were not genuinely worse off.

Conversely, in Jharkhand, Right-to-Food activists routinely highlighted the exclusion errors from imposing Aadhaar-based authentication. But many officials

believed that a few cases of adverse effects were being exaggerated by activists because of ideological opposition to Aadhaar and did not take these concerns as seriously as they perhaps should have. Ground-level data like the one we collected in our studies allows officials and citizens to have better visibility on multiple crucial aspects of the program and enable them to make better informed decisions.

Substantively, in understanding why the outcomes were different between the two studies, it might be helpful to consider the structural differences in the two contexts. The technology itself was, of course, different, with Andhra Pradesh relying on offline Smartcards, while the Jharkhand reform used (mostly) online authentication via Aadhaar. Another difference that ex-ante a lot of people thought was important was state capacity—Andhra Pradesh usually performs well on measures of governance (third out of 19 in one such indicator), while Jharkhand does not (17th out of 19).[13] Indeed, understanding whether biometric technology would work in a context with low state capacity was one of our own motivations while undertaking the ABBA evaluation in Jharkhand.

However, neither of these factors appears to be the main reason for the differences in outcomes. For instance, in Jharkhand, we found no significant differences between FPSs that were fully online and fully offline (in contrast to the results of Dreze et al. 2017). In addition, Jharkhand ended up implementing the reform more comprehensively and faster, managing to converge to more than 90 percent implementation in less than six months, suggesting that the capacity to implement *per se* was not necessarily a constraint. Andhra Pradesh deployed Smartcards incrementally, having previously piloted them for four years in other districts, and also rolled them out slowly in treatment *mandal*s.

Rather, our experience of evaluating the two programs suggests that the main reason for the differences in impacts was the *difference in political priorities* around the use of biometric authentication technology. Specifically, the Andhra Pradesh Smartcards program focused on improving the beneficiary experience, while ABBA in Jharkhand focused on fiscal savings.

A key point to note is that *both* programs (Smartcards in Andhra Pradesh and ABBA/reconciliation in Jharkhand) reduced leakage. However, in the case of the NREGS and pensions in Andhra Pradesh, the benefits of reduced leakage were passed on to the beneficiaries in terms of more money received (displaced from corrupt intermediaries), while there were no savings with the government. In contrast, in the case of Jharkhand, the reduced leakage in the PDS led to reduced disbursals from the government but did not improve the beneficiary experience in any way (and worsened it in some ways).

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13. The index of governance was compiled by Mundle et al. (2012), and includes indicators of performance of the executive, judiciary, and legislature, with particular emphasis on the delivery of infrastructure, social services, fiscal performance, and maintenance of law and order by the executive branch.

In other words, the technology of biometric authentication "worked" in both settings, in terms of reducing leakage. But the question of how the benefits of this leakage reduction should be shared between the government and beneficiaries is ultimately a design question, as well as a political one. Thus, the biggest reason for the difference in results (in our assessment) was not because of the technology (Smartcards versus Aadhaar) or the context (Andhra Pradesh versus Jharkhand) but because of differences in program design and priorities. Andhra Pradesh focused on the beneficiary experience, while Jharkhand (implementing the policy decision of the Government of India) emphasized fiscal savings.

This difference in emphasis was also reflected in the speed of rollout, which itself may have mattered for outcomes. GoAP rolled out Smartcards gradually, over 3–5 *years* during which GoAP had a lot of time to learn, adjust, and improve field protocols. Importantly, at no point during this period did GoAP *mandate* the use of Smartcards to receive payments. Rather, GoAP aimed to encourage Smartcard adoption by making it more convenient to do so. On a related note, GoAP also provided liberal override mechanisms even for those who did have Smartcards and were not able to authenticate. The combination of gradual rollout, and generous override mechanisms all reflected the focus on beneficiary experience as opposed to fiscal savings, and likely led to lower exclusion.

In contrast, GoJH (reflecting the priorities and push from the Government of India) aimed to implement ABBA rapidly and did so, achieving over 90 percent coverage of ePoS devices within six months of the program rollout. While on one hand, this is a sign of "successful" implementation, the speed may have also contributed to the increased exclusion we find, including decisions such as mandating ABBA at a time when around 23 percent of the beneficiaries had not yet seeded their PDS ration cards with Aadhaar, and not having effective manual override systems to protect the most vulnerable. For instance, mechanisms like OTPs sent via text message were in place as a back-up against authentication failure, but were likely inaccessible to those without cell phones. More generally, relying on technology-based backup procedures for Aadhaar-related challenges may not work as well for the most marginalized and vulnerable members of society.[14]

Many of the challenges we documented with ABBA in Jharkhand were likely to be transitory and not permanent. For instance, Aadhaar-seeding rates are now over 98 percent as compared to 77 percent at the start of the ABBA rollout. Similarly, our estimates suggest that much of the exclusion at the onset of reconciliation can be attributed to GoJH's decision to hold dealers

14. For a recent example, see this article which discusses how a poor widow in Bihar was unable to access her benefits because she had lost her Aadhaar card and could not easily recover her Aadhaar number because most of the procedures for retrieving her Aadhaar number required a registered e-mail or phone number, which she did not have: https://indianexpress.com/article/opinion/columns/flaw-in-aadhaar-architecture-uidai-card-enrolment-7389133/

accountable for *cumulative opening balances* of grains as recorded on the ePoS machine and sharply reducing disbursals in line with this. Since much of this grain may have been already diverted or spoilt, increased exclusion was much more likely since the dealers did not have the grains that the ePoS records suggested that they did. Our estimates suggest that starting with a "clean slate" zero opening balance and using ePoS and ABBA to reconcile stocks on a monthly basis would likely have reduced leakage (albeit by less) and also avoided the increased exclusion. Yet, our results also suggest that nearly two million beneficiaries were denied access to their PDS benefits at some point during ABBA and reconciliation in Jharkhand, and the discussion above suggests that *the focus on fiscal savings and speed of implementation may have contributed to the increase in exclusion.*

Note that the decision to focus on fiscal savings as opposed to beneficiary experience is a legitimate political choice. Consistent with political orientation around the world, the Centre-Left UPA Government (at the Centre and in Andhra Pradesh, in 2006–2012) chose to emphasize the beneficiary experiences, while the Centre-Right NDA Government (at the Centre and in Jharkhand, in 2015–2018) chose to emphasize the fiscal savings in both their policy choices and their public messaging regarding the benefits of the program. After all, fiscal savings to the "government" also belong to the people in that it frees up the budget for other programs that would also be implemented by a democratically elected government. Conversely, focusing only on the beneficiary experience without regard to fiscal costs is likely to limit the budget for other productive investments.

Citizen and voter support for this idea is seen in both our data and in the State of Aadhaar reports where respondents report favorable opinions on Aadhaar despite having been personally inconvenienced by it, reflecting their view that it is good for the government to curb fraud and leakage even if it comes at the cost of some inconvenience. Thus, going forward, a key question to ask is how can we as a society realize the benefits of Aadhaar, while minimizing the risk and damage from exclusion? In the conclusion below, we discuss practical steps for doing so.

6. Conclusion and Recommendations

While the use of Aadhaar in various welfare schemes has been controversial, in practice, all indications are that Aadhaar is here to stay. Its use is widespread and representative data from the State of Aadhaar reports suggest that the overall incidence of exclusion is low. At the same time, given the large population of India, even a 2 percent exclusion rate (as documented in the State of Aadhaar reports) affects over 20 million people. As a society, this number ought to be considered unacceptably high, especially since those excluded are disproportionately more

likely to be vulnerable and most in need of their welfare benefits. Further, even governments that focus on fiscal savings would not wish to impose harm on genuine beneficiaries, and officials we met in both Andhra Pradesh and Jharkhand were quite sensitive to wanting to avoid genuine exclusion errors. Based on our decade-long field research on the impact of biometric authentication in welfare programs in India, we have five broad recommendations for the way forward.[15]

First, it is essential to build in safeguards against exclusion in the cases of authentication failure, including providing options for offline authentication in the local POS machine. Such offline options were likely an important reason as to why we find no evidence of exclusion in our study of the impact of biometric Smartcards on NREGS and Pensions in (unified) Andhra Pradesh. In cases where beneficiaries do not expect to travel outside their assigned PDS shop (and opt to not avail of the portability of benefits), it may even be enough to conduct online authentication only once a year to verify the continued existence of beneficiaries, and allow offline authentication during the year with the dealer being required to upload records of offline authentication on a monthly basis. Finally, the burden of proof on the government for card deletions should be high and should ideally be conducted with a combination of field verification, as well as ABBA records of continuous non-use of a seeded card for at least 12 months in a row.

Second, the larger goal of improving the design and delivery of welfare programs in India will be better served by focusing on using ABBA to improve the beneficiary experience rather than fiscal savings *per se*. Examples of such ABBA-enabled reforms include portability of benefits across the country, and potentially even offering beneficiaries a *choice* between receiving subsidized PDS grains versus a direct transfer of the subsidy amount into their bank accounts. Such reforms can meaningfully empower beneficiaries by giving them additional options for holding dealers accountable and accommodate diversity of preferences better. However, this would not be possible without ABBA, because portability and choice of benefits require a connected technological backend combined with authentication to keep track of where and how benefits have been collected each month. Thus, it would be both politically and ethically prudent to focus on such empowerment instead of fiscal savings *per se*. The fiscal savings will come over time, but putting the beneficiary experience at the center of the design of reforms will provide sounder and more broad-based support for such reforms.

Third, it is essential to implement solutions for real-time measurement of beneficiary experiences to quickly detect problems of exclusion and address them promptly. One promising way of doing this may be to use outbound call

15. The discussion here draws on material and language used by Karthik Muralidharan in this interview in *The Indian Express*: https://indianexpress.com/article/governance/karthik-muralidharan-to-an-extent-both-supporters-and-critics-of-aadhaar-for-service-delivery-are-correct-6283226/.

centers to make thousands of short calls each day and directly measure beneficiary experiences in accessing their benefits. We tried this approach recently in Telangana and found that such improved measurement significantly raised the quality of service delivery (Muralidharan et al. 2021b). Regardless of whether such measurement is based on field surveys, phone surveys, or analysis of Management Information Systems (MIS) data, the government should invest in the technical capacity (in-house or through partnerships) to be able to do so.

Fourth, we recommend that representative household surveys like the NSS start including questions about Aadhaar use, in general and, also, regarding specific applications. In addition, given the non-release of NSS data from the 2017–2018 Round, and the risk of relying on a single source of representative data, we also recommend that alternative sources of regular data like the CMIE consumer pyramids survey consider including a few questions on Aadhaar. Of course, space is short in these surveys and choices have to be made; but the ubiquity of Aadhaar use across India and the importance of protecting the vulnerable from being excluded from their legally-entitled benefits makes it essential to track the incidence of exclusion in representative data and use both the aggregate data and case studies of exclusion to design protocols to minimize such risks.

Fifth, and more broadly, navigating the complex issue of trading-off the benefits from improving state capacity for program delivery and the resultant fiscal saving and the costs of the risk of increased exclusion requires more trust between the government and civil society. If critics are seen as wanting to shut down Aadhaar regardless of its benefits (including a meaningful reduction in leakage), the government may tune out legitimate concerns as being "motivated." Critics need to recognize that reducing corruption and leakage is especially important, given India's low tax/GDP ratio, and resource constraints make cost-effectiveness in service delivery as much a moral imperative as reducing exclusion. On the other hand, the government is ill-served by simply asserting that all reduction in program spending is leakage reduction, without recognizing the possibility of exclusion, which our data suggest is very real. Publicly acknowledging this concern and making consistent and visible efforts to mitigate exclusion can help bridge a trust deficit. Transparently collecting and reporting data on beneficiary experiences in representative samples, and acting on this data, is an important first step in this process.

More generally, the discussion above highlights that a lot of genuine disagreement regarding policies in India (and around the world) comes from people arguing from different parts of the distribution of outcomes. The same reform can have positive impacts on some and negative impacts on others, and it is impossible to assess the overall impact without understanding the magnitudes of these effects (and how different groups are affected). One promising way to improve public discourse and reduce disagreement is to ask: "What data do we need to narrow down the range of disagreement?" Having visibility into the beneficiary experiences with public programs and policies in a regular and transparent way

can thus play an important role, not just in policymaking but in improving public trust and "public reason" that is so essential to a well-functioning democracy.[16]

Finally, we note that the focus of this paper has been limited to the specific case of studying the impacts of integrating Aadhaar into welfare programs. This is by design, since the Aadhaar Act was passed by Parliament as a "money bill," with the primary justification being that the use of Aadhaar would reduce leakage to the exchequer in the delivery of welfare programs. However, as we document in Section 3, the use cases of Aadhaar have increased dramatically and extend well beyond the delivery of welfare schemes. This increases the importance of additional and ongoing research and evaluations regarding the impacts of Aadhaar use in other use cases. It may also make sense to debate and modify the legislative framework for Aadhaar to reflect both the opportunities and risks from the increased use of Aadhaar in the daily lives of Indian citizens. We hope that the evidence and principles presented in this paper can contribute to this discussion.

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To view the entire video of this IPF session and the General Discussion that ended the session, please scan this QR code or go to
https://youtu.be/cdNbjv4Ol_4

Comments and Discussion*

Chair: **Arvind Subramanian**
Former Chief Economic Adviser, Government of India

Stuti Khemani

World Bank

The paper by Karthik Muralidharan, Paul Niehaus, and Sandip Sukhtankar deals with how to leverage India's remarkable achievement of providing a digital ID to more than one billion people, almost its entire population, to improve welfare programs. I am going to structure my comments around a series of questions about what Aadhaar means for welfare programs and beyond:

1. What is the potential of Aadhaar?
2. How can Aadhaar improve the design of welfare policies?
3. What does Aadhaar teach us about state capacity, which has come to the fore in recent times as critical for sustained economic development?
4. What is the danger of Aadhaar? The constitutional concerns about the Aadhaar Act, as a threat to freedom and privacy of citizens, requires attention.

On the first question: The potential of Aadhaar for inclusive growth is likely to be much larger than the specific application that MNS examine—of targeting beneficiaries of welfare programs. The developers of Aadhaar described it as: "*We answer the question, 'Who am I?' And then we expect innovations to be built on top of this…Hopefully in the next 5–10 years there will be a whole ecosystem of apps that will bring more and more benefits to people who don't have an ID.*" (Nandan Nilekani, Chairman of UIDAI, April 24, 2013). This paper takes up one, rather narrow, application: how Aadhaar can be used to more accurately target welfare benefits to eligible beneficiaries, and save fiscal resources that "leak" to ineligibles. However, Aadhaar's potential to enable poor people to participate in economic markets goes well beyond targeted welfare benefits. Lack of a credible ID can create large transactional costs for poor people to engage in economic activity—from accessing financing, healthcare, education, housing, to gainful employment. A broader approach is needed on the policy potential and research

* To preserve the sense of the discussions at the India Policy Forum, these discussants' comments reflect the views expressed at the IPF and do not necessarily take into account revisions to the conference version of the paper in response to these and other comments in preparing the final, revised version published in this volume. The original conference version of the paper is available on NCAER's website at the links provided at the end of this section.

around ID programs like Aadhaar. Future research could address questions like: now that Aadhaar exists, does it help poor people to better navigate migration to urban centers and labor markets; obtain housing; reduce credit constraints; and thus enable long-term investments, such as in their children's education?

On the second question: even within the scope of welfare programs, the focus of the paper on reviewing available research on the use of biometric authentication in existing programs like the PDS and MGNREGS, is too narrow. A policy paper on Aadhaar could say much more about the *design* of public policies, now that the Indian State has achieved the huge outcome of providing a digital ID to its people. For example, Aadhaar has likely made it more feasible to implement a new type of food security policy which could replace the old PDS system—delivering food coupons directly to households (and even within households, targeted to the women of the household, because of research evidence that intra-household bargaining would improve outcomes), which can be used to purchase food at any shop (Basu 2011).

Examining how Aadhaar was used in the Jharkhand PDS, as Aadhaar-Based Biometric Authentication (ABBA), the authors report "*a significant decline in benefits received (of around 10%) for those beneficiaries who had not seeded their Aadhaar numbers into their ration cards. Finally, there was also an increase in transaction costs for beneficiaries in treated areas with a significant increase in the number of unsuccessful trips made to the fair price shop (FPS) for collecting rations*." MNS use this finding to offer the following policy advice: "*the larger goal of improving the design and delivery of welfare programs in India will be better served by focusing on using ABBA to improve the beneficiary experience rather than fiscal savings per se."* It seems that this advice could have been offered to the policy-makers in Jharkhand at the outset of the researchers' engagement with the government, using the ideas laid out in Basu (2011), for example. One lesson that seems to emerge from this work in Jharkhand is a meta-lesson about how researchers might more fruitfully engage with policymakers, offering ideas on policy design rather than only seeking to evaluate impact of *any* policy through randomized experimental methodology. Of course, the decision to use economic-theory-based ideas in policy design is the government's, and researchers have no mandate or power to "force" anything. All I am suggesting is that in future engagement, some hypotheses be laid out about *a priori* expectations, given how the government has designed any program, and how these hypotheses would change if the policy design is changed in certain directions. It is within the scope of a policy piece recommending future research on Aadhaar to have some more discussion about how to guide such future research. I am suggesting that much more economic theory and mechanism design needs to be used.

On the third question: The achievement of Aadhaar shows (among other things, such as the successful administration of the largest elections in human history) that the Indian State has tremendous capacity. State capacity has come to

the fore in economics research as the necessary (and even sufficient!) condition for economic prosperity, as illustrated in the following quote attributed to Adam Smith: *"Little else is requisite to carry a state to the highest degree of opulence from the lowest barbarism, but peace, easy taxes, and a tolerable administration of justice; all the rest being brought about by the natural course of things"* (Attributed to Adam Smith in Besley and Persson 2011). The "natural course of things", which would presumably bring "all the rest" appear to be gainful economic exchange and entrepreneurship, which would be supported by a state which protects property rights, creates a level playing field for competition to thrive, and enables trustworthy contracts to be established and enforced.

However, despite its proven capacity to undertake some really difficult tasks, the Indian State appears to regularly fail to deliver basic services like health and education to its poorest citizens. This point is linked to the argument that the critics of Aadhaar make, which is taken up by the authors—the lack of trust in government to serve objectives of fairness and justice in a country with entrenched, debilitating poverty. The critics argue that the Government in India cannot be trusted to serve the poor, and therefore, there is a role for civil society to scrutinize policy initiatives and take action (launch protests, mobilize people, make demands on government) when it appears that policy changes are going to adversely affect poor people. The paper provides a response to these critics by emphasizing the need to build trust in government through more credible empirical research on how benefits can be provided to the poor along with fiscal savings, presumably through more precise targeting and reductions in "leakages." This response treats too lightly and simplistically the role of trust, where and how it can or should be built, and where lack of trust might play an appropriate role of scrutiny and accountability, to strengthen incentives of governments.

A burgeoning economics literature on institutions is dealing with the concept of "trust" (reviews in Alesina and Giuliano 2015; Algan and Cahuc 2014; Khemani 2020; and application to Bihar in Khemani 2021). On the one hand, trust plays a role in enabling private economic transactions in markets, to which credible identification programs like Aadhaar can contribute. On the other hand, the role of trust in public sector organizations is more complicated. Economic theory suggests that there is a role for trust in professional norms of certain bureaucracies which are tasked with serving the public interest. However, building that trust, when it is missing to start with, requires reducing harmful political interference in the functioning of bureaucracies. The story of how social movements in the United States reduced the influence of "machine politics" and helped establish professional bureaucracies is a case in point (Khemani 2019).

This leads directly to my fourth question: Can the people of India trust a bureaucracy that is tasked with managing Aadhaar to use it in the public interest, and without political manipulation to serve ideological political objectives? The dissenting opinion of Justice D.Y. Chandrachud in Supreme Court decisions of 2021 and 2018 on the constitutionality of the Aadhaar Act focused on issues of

privacy and freedom of citizens because Aadhaar is a technology that can be misused. Questions were raised about whether the Aadhaar Act had been passed without appropriate legislative debate, by being characterized as a "money bill." These are the larger issues of trust that matter in the context of Aadhaar which future research should address.

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Arghya Sengupta
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In the public discourse, people talk past each other on Aadhaar—it causes exclusions (on the one hand) versus it makes savings (on the other). It can do both (as seen in Jharkhand) and so it is important to narrow down the disagreements with data (as is being done in Andhra Pradesh). The paper raises both these points. The paper should also play up this aspect of people talking past each other by bringing out these false binaries.

My point of departure is the very significant finding of the paper that Aadhaar should focus on citizen-centricity rather than fiscal savings. Perhaps the paper can unpack this in the following two ways:

A. **Aadhaar as a single sign-on for government-resident interaction:** A live example of where citizen-centricity is being thought about but cannot be implemented owing to legal issues is in labor. The Supreme Court in the wake of the migrants' crisis has instructed the government to set up a National Database of Unorganized Workers. No such centralized database exists. Now the Ministry of Labor has two options—first, do a fresh data

collection exercise which is both onerous and time-consuming for citizens; get the data from another database with significant overlap, adopt simple secondary eligibility criteria if necessary, and populate the database. But at this time, it cannot do the latter because sharing of Aadhaar numbers across databases is not permissible except for purposes originally indicated to the user. This is a major problem and defeats the purpose of Aadhaar to provide ease of access for residents in obtaining subsidies. If citizen-centricity is to be central and has to be complementary to savings, then every citizen should have to provide his basic demographic and biometric information to the government once and using Aadhaar as the common identifier one department should be able to migrate the information. This should only be for government welfare schemes based on individual consent. Although tangential to the argument of the paper, the authors may like to look into it.

B. **Consensual use of Aadhaar:** The paper makes a very important recommendation that the use of Aadhaar should be consent-based with alternate offline options provided. This is critical because exclusion errors (at least of the biometric mismatch variety) are not a consequence of using Aadhaar but using Aadhaar exclusively. In fact, as long as it is voluntary, whether the use is by a government or a private sector body should not matter. In the Supreme Court, the main cleavage seemed to be that Aadhaar is allowed for public sector use but is not allowed for private sector use unless it is backed by law. There was an implicit understanding that private sector use meant commercialization. I think this paper's recommendation of consensual use with alternate options should be the main determinant of future uses and not whether use is by the private or the public sector. The paper should incorporate a richer discussion of the Supreme Court case only in this context (and not in the context of privacy as the other discussant had mentioned), as that is something which is quite extensively written on.

Overall, I think this paper makes an inordinately valuable addition to the literature on the subject. I commend the authors wholeheartedly.

General Discussion

The chair, Arvind Subramanian, praised the comments by the discussants and opened the General Discussion by reading out a question from Sandhya Garg, about the last mile challenge: "How easy was it for people to withdraw money using smart cards or Aadhaar-based systems?"

Devesh Kapur suggested exploring the one other pan-India identification, the Voter ID. It is a valid government ID though only individuals above the age of

18 years are eligible to get it. However, it might still be useful for the authors to look at that ID and the problems of exclusion and inclusion relating to the most long-standing national ID system in India since Independence. He cited reasons as to why that cannot be used as a fallback option when there are problems of authentication of Aadhaar, because after all, it is a government ID, and it is ostensibly quite universal. There is an issue that voter IDs are location-specific. But now that the PDS, which was also location-specific, will be replaced with the "One Nation One Ration Card" scheme, that is likely to change. Additionally, the Election Commission has now begun to shift from a paper-based voter ID to an electronic voter ID, which can be downloaded on one's phone.

Responding to the Discussants' comments, Sandip Sukhtankar clarified that the authors had never forced governments to implement a scheme or a program that they are not planning on doing. In fact, in every single case, the government had already taken a decision on what to do and how they were going to do it, and the authors simply persuaded the officials to roll it out in a randomized fashion.

Regarding the questions on the last mile challenge, and payments through smart cards, Sandip Sukhtankar thought that the smart cards did well to enable making of the payments in cash at the village level. This was also one of the reasons why transactions costs had gone down and people found it easier to collect their payments. He said that it is a fantastic idea to think about using the voter ID as a fallback but raised concerns about the veracity of the database. He hypothesized that the problems may not be of exclusion, but instead of inclusion.

Arghya Sengupta expressed the need for an Aadhaar 2.0 legislation. He asserted that the experience of the last five years, in terms of what has worked and what has not, will help design the new legislation. The Aadhaar needs to have some of the features that the paper pointed out, such as consensual use and fallback options. There is also a need to facilitate private sector use and to ensure privacy protections. Such an Aadhaar 2.0 legislation can become a firmer backbone given the fact that Aadhaar is here to stay.

The session video and all slide presentations for this IPF session are hyperlinked on the IPF Program available by scanning this QR code or going to
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Moderator

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NCAER

Panelists

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Ministry of Finance, Government of India

MONTEK SINGH AHLUWALIA
Former Deputy Chairman, Planning Commission of India

VIJAY L. KELKAR
Former Adviser to the Finance Minister of India

ASHOK CHAWLA
Former Chairman, Competition Commission of India

POLICY ROUNDTABLE 1

Future of India's Economic Reforms: 30 Years after "*Bata Teri Raza Kya Hai (What's Your Wish?)*," Looking Back to Look Ahead

Introduction

In the first of the IPF 2021 Policy Roundtables, four esteemed panelists explored and drew lessons from the reforms in the year 1991, which marked a paradigm shift in India's economic policies, and identified core areas of reforms for the future. After their initial remarks, the panelists were joined by other participants in a lively discussion. This is a short summary of the Roundtable. For a complete rendition, please view the session video hyperlinked at the end of this summary.

K.P. Krishnan

Moderator

K.P. Krishnan kicked off the Policy Roundtable by quoting the famous line from Allama Iqbal's *shayari* "*Khudī ko kar buland itnā ki har taqdīr se pahle ḳhudā bande se ḳhud pūchhe batā terī razā kyā hai*" that Dr Manmohan Singh,

the then Minister of Finance, had cited at the conclusion of his 1991 Budget speech. The quote may be translated as "*Make yourself so strong that the Lord himself will ask you, the human being, 'please tell me what is the fate that you desire*?'" He acknowledged that 1991 marked a paradigm shift in the Indian policy reforms—a country which had steadfastly avoided markets and embraced the "socialist model", with the State playing a dominant role in the economy, had made a decisive shift. Following are the four major changes that he highlighted:

a. Exchange rate flexibility,
b. Opening up to foreign trade,
c. Giving up industrial licensing, and
d. Reforming the equities market.

These reforms were actually announced without any immediate pre-consultations or consensus-building. One could argue in retrospect that there appeared to be, or there was perhaps, a majority view, and perhaps a lot of debate on these issues for the entire decade preceding the actual announcement, but formally, the Prime Minister, the Finance Minister, the then Commerce Minister, and the then Principal Secretary to the Prime Minister decided and announced these reforms. If one looks at current growth rates even after excluding the pandemic period, and if they were to have been high and comparable with the average of the decade till 2014, perhaps most of us would not be bothered and one could say that the process does not really matter, as long as there are outcomes. However, we now have a situation where outcomes do not appear to be entirely satisfactory, in terms of growth, in terms of employment, in terms of private capital investment, and a process that does not *prima facie* seem inclusive, participatory, or consultative.

Perhaps, even worse, we seem to be going back on some of these reforms. For instance, there appear to be signs of greater protectionism, shutting off of international competition, and perhaps, almost no serious financial sector reforms. Now, to give the present Government of India credit where it is due—the Constitutional amendments and legislations on GST are an excellent example of cooperative federalism. The Insolvency and Bankruptcy Code is a second example. Inflation targeting for the Reserve Bank of India (RBI) through an amendment of the legislation were tough reforms. The point of worry is the sustainability of the reform momentum. For example, the recent pushback on GST and the pushback on farm reforms are matters of concern.

The key questions posed to the panelists were: Do they agree with the mentioned characterization of poor outcomes, broken process, and unravelling of the reform process which began early in this regime, in 2014? What are the learnings, if any, from the past reforms exercise and what is likely to be useful going ahead? Why did the Government ignore the farm sector, education, health, and governance, and the required State capacity to handle these sectors back in 1991?

T.V. Somanathan

What may seem impossible at one time may become feasible later

T.V. Somanathan was convinced that there is actually no Gresham's law in reform—bad ideas do not necessarily drive out the good. The good ideas survive and come back from time to time. Speaking for the people who work within the system, he mentioned that the sense of hope that it is worth trying something and pushing the horizon is both useful to have and true. According to him, there are two main buckets of reform that India needs presently. First, the fiscal house needs to be set in order, and should also provide for the many things that governments should legitimately provide. Subsidies—farm, food, fertilizer, and others—need to be reformed. The second need is to improve the efficiency of public expenditure on education, health, and infrastructure. In his opinion, these are areas where the system faces the most difficulties in terms of getting things done.

On the first reform area, he highlighted that while subsidy reforms may be easy to carry out from the administrative point of view, these are, however, difficult political decisions. On the other hand, the second area of reform, which is improving the efficiency of public expenditure and getting better value for what is spent on education, health, and infrastructure, is easier political decisions. While no political party is opposed to these reforms, they are difficult to execute in terms of generating better efficiency of education expenditure, providing better quality education in schools, and using expenditure on health to generate better health outcomes. Further, making doctors, nurses, and teachers turn up in clinics, hospitals, and schools, respectively, is hard to do partly because it is not something that can be done by the Central Government alone. It requires collaboration across the range of the Central, State, and local governments, implying that the number of agents who have to coordinate amongst each other is much higher. As such, there is a paradox regarding the two categories of reforms: easy-to-announce but hard-to-do reforms, the ones that governments keep announcing but that are not seen through, and the hard-to-announce but easy-to-do reforms, which are never announced.

The other dimension that he emphasized upon, as compared to the situation in 1991, is the increasing dependence on State and local governments for success. These are not things that the Centre can simply lead by example, or announce a policy or start a Centrally-sponsored scheme for it to happen magically.

On the issue of prior consultations and the general decision-making processes, he stated some lesser-known facts. Before each of the last two Budgets, the Prime Minister and the Finance Minister interacted with 30-40 economists in an open house session organized by the NITI Aayog, where every attendee got a chance to highlight their opinions for three to four minutes each. Prior to the Atmanirbhar Bharat announcements in the months of May and June 2020 also, the Prime Minister personally attended video conferences with experts across India

and outside India on a variety of subjects. The second point he made is that India's health and agriculture policies have benefited from in-house experts, such as members of the NITI Aayog. The Monetary Policy Committee and Committee on the inflation targeting system are two other expert committees. In sum, experts are consulted, but are often not unanimous in their suggestions. Ultimately, the final call is that of the elected executive.

Montek Singh Ahluwalia

Look at what the young people are saying, they are the ones that have to inherit the future

Montek Singh Ahluwalia disagreed on the proposition that the Government never focused on farm problems. One of the things that was quite categorically said during the reforms was that reduction of protection for Indian industry would actually favor Indian agriculture because a high level of protection for industry, in effect, amounts to dis-protection of agriculture. It is also a penalty on exports and both these points were emphasized at the time. Rather than focusing on smaller schemes, it was felt that interventions such as the devaluation of the rupee, combined with the shift to a flexible exchange rate, would hugely increase the profitability of agriculture and so it did. In the period after the reforms, agriculture did quite well and agricultural exports began to grow. In essence, the government at the time did have a view on farm sector reforms and it addressed a very critical part of the whole picture, though it was not continuously emphasized as such. The impact of lower protection and a market-determined exchange rate on agriculture was a very important part of the whole reform process. Health and education, however, were not at the top of the reforms list. The focus on these came much later, after Amartya Sen began sensitizing everyone that India's performance on education and health was a serious impediment to good growth. This further led to the emphasis on strengthening primary education.

Manmohan Singh was the principal architect, and Narasimha Rao was actually the political underpinning of the reforms process. The economy had been stabilized by 1993 but the reforms continued in a bit of a gradualist kind of way. The consequence of such gradualism was that it allowed a lot of time for discussion after the reform ideas were unveiled. Manmohan Singh took on the task of laying out the reforms, debating them in the Parliament and explaining them to people and the bureaucratic levels quite extensively. During this time, he delivered a lot of lectures in Indian universities. The faculty, which would be opposed to the reforms prior to his lectures, would vote in favor after. Montek Singh recommended that one should always look at what the young people are saying because they are the ones who have to inherit the future and have a better sense of what needs to be done.

He said that India needs to get away from the long list of reforms approach and try to identify the critical reforms, given the current state of the economy. In his opinion, banking reforms are critical at present. Financial sector reforms were part of the agenda, but the more difficult part, which is putting the public sector banking system at par with private sector banking, was not done. Nevertheless, private sector banking was liberalized and allowed to expand. The public sector banks remained under strict government control. This feature merits rethinking now. A midway agenda may be needed–one that would reduce the control of the Finance Ministry on public sector banks. Such an agenda also ought to bring the regulatory powers of the RBI in relation to public sector banks on par with that of private sector banks. This is not politically complex and if the Government were convinced that it could do it, it is a sufficiently technical thing—its effects would become evident only over a longer time period. The second big reform that needs attention, according to him, is fixing of the GST. He suggested that there ought to be a system where the GST Council takes a look at a pretty comprehensive agenda of reforms of the GST, so that it can really be put on a very firm basis.

Vijay Kelkar

The politics, the political masters, are really what drive the reforms

Vijay Kelkar began with the example of the petroleum industry. He said that his Minister was clear in his mind that he wanted to make the Indian industry competitive. He thanked Mr Ahluwalia for reforms which led the economy to boom. Growth started taking place, leading to a rapid increase in the demand for energy, because of both the increase in income and structural change in the sector. He also recognized that in all the crises in India, the macro crash came from oil prices and oil dependency. This was so in 1970-1974, 1981, and pre-the 1991 reforms, when the crisis came from the oil sector. He remembered the lines he had then quoted to his Minister, "Mr Minister, to my mind, the binding constraint is India's private sector and public sector, and the monopoly. If you want to really get going, you must wholeheartedly agree to put your support." He remembered that the Oil and Natural Gas Corporation Limited (ONGC) was most reluctant to agree. The same was true of oil companies and their complete monopoly or oligopoly status. Certain markets had a complete monopoly. For instance, in the entire North India, the Indian Oil Corporation had the monopoly. They were also opposed to reforms. So were the unions. It was essentially a political issue. He confessed that the greatest supporter was the Finance Minister, Dr Manmohan Singh. So, if the government is not willing to commit capital, the reforms cannot take place.

On the tax reforms, he expressed appreciation for the then Finance Minister, Mr Jaswant Singh, who wanted India's taxes to be comparable with those in rest

of the world. Mr Singh did not care if there was a strike, he was only concerned that tax rates should not become the instrument of tax policy. He wanted to use the tax machinery at par with rest of the world. Hence, reforms are essentially driven, in Kelkar's view, by political entrepreneurs or change agents.

Coming to the product market reforms, Dr Kelkar said that the impetus came from Mr Jaswant Singh. India had become a member of G-20 and the idea was that India's Minister of Finance can be no less than other contemporaries or those of the G-20. This led to a thin and simple report, called "Ministry of Finance for the 21st century" (2003-2004), which was based on only three points: first, to identify the functions that the Ministry was not doing and delete them; second, to identify the functions which it should be doing and add them; and third, to get rid of the others because the Ministry of Finance was a policymaking body, not an administrative one. Unfortunately, this report was never even considered, because Mr Jaswant Singh left and successive ministers have probably never had any sense of urgency or real desire for making these big changes in the various financial organizations.

Ashok Chawla

As one looks ahead, there is sufficient maturity in the equity market, but the banking sector needs a total makeover

Ashok Chawla recalled the Big Bang Reform of 1991 as the abolition of the Office of the Comptroller of Capital Issues (CCI) and setting up of Securities and Exchange Board of India (SEBI), first as an executive body and then as a statutory body. He was a part of the Office of the Comptroller of Capital Issues, the CCI, in the mid-1980s and 30 years later, he is in another CCI, the Competition Commission of India. According to him, this, in essence, is what is important—looking back to look ahead. He highlighted the changes in the securities market, including the setting up of the National Stock Exchange (NSE), the development of the National Securities Depository Limited (NSDL), and derivatives trading, among other things.

As far as the other changes in the Indian economy, other than those in the stock market, were concerned, the major change was that the insurance sector opened up and banking did so in a limited way. After 10-15 years down the path of liberalization, it was becoming increasingly evident that the financial sector, as it existed, was not equipped to respond adequately to the needs of a high-growth real sector, more so, since the period from early 2000 to 2008 was one where both globally and in India the growth levels were elevated. So how does one handle a financial sector which is not keeping pace with the real sector, particularly in relation to infrastructure financing, where the reliance was either on Development Financial Institutions (DFIs) or banks? For banks, lending for infrastructure is not easy, as everybody knows. The best way to

go about it is through the tenor of lending and the tenor of requirement for the infrastructure projects.

He then talked about the ULIP controversy, which was an unfortunate battle between two regulators, one regulating the stock market and the other regulating the insurance sector. The question at hand was as to who should regulate such a product. Eventually, they went to the court since the matter was not getting settled. The Government intervened, with an ordinance, settling that in such a dispute between two regulators, the government will step in to take charge and decide. This controversy had a silver lining to it—the Financial Stability and Development Council (FSDC) was set up as a consequence, with the Finance Minister as the Chair, and financial stability, even otherwise apart from this issue between the two regulators, led to a trigger for this thing to happen. Financial stability was not really high on the agenda earlier, because the general perception used to be that if there is macroeconomic stability, and if there is price stability, financial stability is somewhat covered. However, the events of 2008 burst that myth and there had to be, necessarily, a focus on financial stability not just in India, but in the major economies of the world. Further, with the G-20 stepping in, the major focus was on financial stability. Twenty years down the road in 2011, it was time to look at the entire financial sector architecture as a whole and see what needed to be done.

The Budget announcement in 2010 took a holistic view of the financial sector. India already had three financial sector regulators–RBI, SEBI, and the Insurance Regulatory and Development Authority (IRDAI), while the Pension Fund Regulatory and Development Authority (PFRDA) was in the offing. The idea was to dive deep into financial sector legislation with the objective of making the sector more competitive and inclusive. It led to many things which are now part of the formal architecture—the focus on consumer protection, the merger of the forward market commission with SEBI (realizing and accepting that all transactions are financial in nature, be it in the securities market or the commodities market), inflation targeting and the Monetary Policy Committee, amendments to the Foreign Exchange Management Act (FEMA) (the equity capital part moved from RBI to the Government of India), and the separation of the Public Debt Office from the RBI.

As one looks ahead, there is sufficient maturity in the equity market, both in terms of regulation and operation, but the debt market, which serves the need of the real sector of business industry, is not that robust. As regards the banking sector, it needs a total makeover, in terms of both asset quality and the way it is governed. Next comes regulatory governance and accountability. In his opinion, these are very important features because of the nature of powers enjoyed by regulators—they perform legislative, executive, and judicial functions, and therefore, how they execute these functions is extremely important. Mr Chawla maintained that regulators ought to be transparent and have a high degree of acceptability and predictability.

Open Discussion with the Roundtable Panelists

The remarks by the five panelists were followed by a rich discussion led by participants in the Roundtable with prominent questions and interventions by **Karthik Muralidharan** on gradualism working better where he suggested that for something like fertilizer subsidy reforms, a glide path could be announced of say a 1-2 percent reduction over a 10-year period, which is then balanced off with Direct Benefit Transfer (DBT), so that people can see that this is fiscally neutral and not trying to hurt the farmer. He felt that building trust is as important as the policy itself. The second intervention that he made was that markets and citizens need a certain process of predictability so that they can optimize behavior in anticipation, as opposed to waiting for the next surprise that is going to come. So his broad single principle was transparency, gradualism, and predictability in some of the more difficult reforms. **Arvind Subramanian** asked what the current Finance Secretary would like to take with him following the discussion. **Deepti Bhaskaran** made a point about health insurance—the Government should prioritize the insurance sector primarily to strengthen health insurance.

The session ended with closing remarks on the Roundtable, and deep appreciation for the team at NCAER that had put together this virtual version of the IPF 2021.

For the full flavor of the richness of this Roundtable discussion, we invite you to view the video of this session using the links mentioned in the box below.

To view the video of this IPF Roundtable, please scan this QR code or use the following URL:
https://youtu.be/SnA2Stc6KnA

Moderator

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Ashoka University

FARZANA AFRIDI
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LANT PRITCHETT
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Self Employed Women's Association

POLICY ROUNDTABLE 2

India Emerging from the Long Shadow of COVID-19

Introduction

The second of the two IPF 2021 Policy Roundtables brought together four esteemed panelists and thinkers with diverse backgrounds to discuss the pathways for emerging from the deep scarring in the wake of the two waves of the COVID-19 pandemic in India. Adopting different disciplinary approaches, the panelists highlighted different aspects of the pandemic and its impacts that deserve policy attention. After their detailed presentations, the panelists engaged in a lively discussion moderated by Sonalde Desai. This is a short summary of the Roundtable. For a complete rendition, please view the session video hyperlinked at the end of this summary.

Gautam I. Menon

Many 'known unknowns' and the 'unknown unknowns' about the Indian pandemic

A specialist in modeling the spread of infectious diseases, Gautam Menon set the stage for the Roundtable by describing the course of the Coronavirus pandemic

in India and the possible directions it may take, going forward. Quoting Donald Rumsfeld about the difficulties of making decisions under uncertainty, Menon's remarks categorized public health challenges in *known unknowns* and the *unknown unknowns*. According to official figures regarding the number of cases registered every day, the first wave peaked at a little less than 98,000 cases, and the second wave at a little more than 410,000 cases per day. In total, there were around 31 million cases in India by July 2021.

However, this number is widely questioned. The question one could ask is as to how many were actually infected at the end of the first and the second waves. The number of 31 million recorded cases seems a fairly small fraction of the total Indian population of over 1.4 billion. Is that really the right number that we should consider? The only way to access the real number is by using what has come to be called the "serosurvey." The serosurveys conducted by the Indian Council of Medical Research (ICMR) at the end of 2020 when the first wave had passed suggest that around 20 percent of the country's population had been infected by then. That is certainly much larger than just the 30 million odd recorded cases. And a more recent, relatively limited study by AIIMS and WHO found that about 80 percent of urban and 62 percent of rural Indians had been infected by the end of the second wave. That's a much larger number. Hence, the multiplying factor to be taken between the 31 million registered cases and the actual cases, which can be anywhere between 600 million and 800 million, is really the key number here. It is important to know this because this has very different implications for what might happen in a potential third wave. One gets some level of protection from a prior infection, which is expected to last somewhere between six months to a year. However, even this is a little complicated because new emerging variants can potentially evade immunity granted by a prior infection or by vaccinations. So, in order to fully understand the implication, we must know this number better, and the only way to do that is through a combination of good surveys and good models.

The situation across India as a whole is much more complicated. While most States have seen a fairly clear end to the second wave, Kerala is an outlier, as its numbers have not come down as sharply as those of other States. Kerala and some States in the North-east, and to some extent Maharashtra, show deviations from the observation that the second wave has more or less ended in India. That isn't completely true. [As of July 2021] we are still recording around 40,000 cases per day. The second wave, as far as we know, has been driven by a more transmissible variant of the virus, namely, the Delta variant, which is two-and-a half times more infectious than the original variant, and has completely covered the entire country.

Another interesting question is: How many people died at the end of the second wave? The official number, as of 13 July 2021, is 410,816. But again, a multiplier must be applied to that number to determine the actual number. Given the manner in which deaths are recorded and the fact that on average, only about

80 percent of the deaths are registered, other measures need to be used to gain better estimates. For example, excess deaths point to fairly large under-counting, say, anywhere between 5 and 10 times the recorded number. The one number that researchers seem to be converging on, with a very large error bar, is that approximately 2.5 million people have died of COVID so far—a much larger number than the recorded one of 410,000. This shows that India's COVID experience has been pretty much like that of any other country. The only silver lining is the fact that Indians are, on average, younger than the typical European or North American population and the death rate is higher among the older population.

On the subject of vaccinations, about 380 million in India have been vaccinated with at least one dose [by July 2021], including 306 million with the first dose and 74 million with both doses. But the number of people being vaccinated per day has stagnated, after having peaked at 8-9 million. Moreover, at 1.5-3.5 million tests per day, we are also not testing as much as required to keep track of the epidemic. Most of the vaccines being administered are Covisheld, which is the Astra Zeneca vaccine, and only about 10 percent are being vaccinated with Covaxin, the Indian vaccine, developed by Bharat Biotech, and a still smaller fraction with Sputnik V, developed by the Russian Lab.

Some of the questions confronting us are: What is the possibility of a third wave? How serious will that wave be? What should be the pace of vaccination because we are certainly not vaccinating enough? Have we reached a point where vaccine hesitancy becomes a problem, particularly in the 60-plus age group, where vaccinations have gone down, and currently stand at 60-70 percent? What is the level of risk faced by children and young people? What happens with the issue of schools re-opening, certainly an issue that we should be thinking about as children have been out of schools for the better part of a year-and-a-half? Can modeling be used to assess the risks with schools re-opening? What are the early warning signals that we could pick up? How does one prioritize vaccination? And another significant question is about getting the data, which mostly sits with the government, and which has been difficult to get. It is important to find answers to these questions because only then will modeling be able to optimize its potential and we will be able to understand how the pandemic unfolded in India.

Farzana Afridi

Pandemic will exacerbate inequalities and economic recovery may taper off

Farzana Afridi focused on two aspects of the pandemic: *first*, the effect on the labor market and livelihoods, and, *second*, the psychological effects of the pandemic itself. She also discussed the differences between men's and women's experiences, both in the labor market, and in terms of the psychological impacts of the pandemic.

Labor markets experienced a sharp setback when the nationwide lockdown was imposed in March and April 2020 and individuals could not get to work.

While the labor markets began to recover after the lockdown was gradually lifted, full recovery did not take place. Moreover, there were substantial regional differences in the impact of the lockdown. In the first wave of the epidemic, urban areas were much more adversely affected than the rural areas. Many more men lost their jobs than women since more men were employed. While there was a recovery after the early employment loss during the lockdown, the pre-pandemic levels of employment in the labor market have not been regained.

An analysis of a micro study of informal sector workers in Delhi, one of the worst affected areas in the second wave of COVID, shows that the employment shock is tapering off. Employment decline in the first wave was very large due to the stringent lockdowns, while in the second wave, less stringent constraints on economic activity reduced the impact. Interestingly, the findings suggest that women's employment status tends to be counter-cyclical, i.e., women may be joining the labor force as many of the male breadwinners lost either their work or their lives due to the pandemic. The monthly earnings have also been halved, which signifies a much more negative impact for male workers as opposed to female workers.

Inequality has possibly been exacerbated due to the pandemic because certain sections of the population have been affected much more adversely. The effect has been much worse on the casual laborers and those who are self-employed in petty businesses, both for males and females.

Coming to the *psychological distress*, it is alarming to see very high levels of self-reported stress and psychological distress due to financial concerns, health-related anxiety, depression, sleep-related disorders, and so on. This psychological distress is higher among women than among men. It has also increased post the second wave for both men as well as women. While the economic effect of the second wave has not been as high as that of the first wave, the psychological effects continue to remain very high and have actually increased in recent months. This raises concerns about human capital and the potential long-term issues related to productivity and risk aversion.

One of the pathways to recovery is the implementation of social protection programs, such as the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). The initial effect of the first wave was relatively higher in urban than rural areas. However, this is probably not true for the second wave of the pandemic. The focus of the government on tackling the loss of livelihoods and loss of incomes has been greater in the rural areas, but there is a need for rebalancing and providing social protection in urban areas as well.

There are concerns about the risk of recovery tapering off due to the possibility of a third wave. Hence, the focus has to be on vaccination as the centerpiece of the government's response. Unfortunately, the vaccination rates have not been as high as desired. They have also been slower in take-off as our capacity for vaccine production is just being ramped up now. Hence, there is a high possibility of the third wave. The longer-term implications not just for human capital

but also for inequality in the country are particularly worrying. There is a need for substantive cash and in-kind transfers. The government can do much more than it has done in terms of the proportion of GDP used for compensating for livelihoods that have been lost. The government can also do more for the public investment stimulus needed, which will ultimately also help stimulate domestic demand and private investment.

Lant Pritchett

Huge risk of the long-term learning losses for children due to COVID

Lant Pritchett addressed the long shadow of learning losses while noting that coping with the second wave of COVID infections required rallying around the immediate effect of the shocks. He argued that the risk of long-term learning losses for children due to COVID would be much larger than the immediate loss of their being out of school. Everyone recognizes that with kids being out of school since the advent of COVID, they have lost a year's worth of learning. However, the long shadow is that by losing a year's worth of learning, even if schools resumed roughly on the same grade track and tried to put children back into school, the overall loss could be 3-5 times larger than the immediate one. This would be the result of a mechanism he called the "negative consequences of an over-ambitious curriculum," which has already created tremendous heterogeneity in the classroom. Staying out of school would increase the risk for children who are already behind, because instead of making adjustments for the period of loss, they might be moved ahead to a class where they may be expected to face an even more demanding curriculum. An over-ambitious curriculum already makes for a challenging classroom environment where teachers struggle to teach children of different ability levels. Returning from COVID may exacerbate the effect of the over-ambitious curriculum. As a result, the cumulative effects of school closure can actually be much larger than the short-run effects.

The learning of a given child exposed to a year's worth of instruction depends on the relationship between what the child already knows and the level at which the instruction is centered. A child's learning is maximized when it's exactly targeted at her level of skills while the learning tends to depreciate the further the instruction is from the child's existing skill level. The way to maximize learning is by centering the teaching on the level of the children. Therefore, an over-ambitious curriculum indicates that if the level of teaching is centered at a level above that of the students' ability, children are going to learn less because they are no longer in the mainstream of the teaching. And when children learn less, that sets off a cumulative dynamic of lower levels of learning in each successive grade.

This suggests that COVID-related school closures may have a long-term impact on learning. All the evidence suggests that skills depreciate as children

forget some of the lessons learnt when they take a break. If the kids re-enter school, and the curriculum continues to be taught as it had been in the pre-pandemic period, not taking COVID into account, then since those kids are further behind, they would assimilate and learn less.

In this simple and parameterized model, just losing three months of schooling leads to a cumulative loss of an entire year's worth of schooling. So the learning loss from a negative shock actually does not go away. But the negative shock that even a three-month drop produces is huge—three months out of school produces three years of cumulative learning loss. The experience of other researchers about remedial education proves that children often have learning deficits which can be quickly remediated but which are not being remediated in school because the curriculum is not paying attention to where they actually are.

The upshot is that when Indian children go back to school, a radically different approach needs to be adopted, or else Indian children would face a nightmare scenario. There will be an entire cohort that has lost much more than just a year-and-a-half or two years of schooling. Thus, if the attempt is made to return to the existing teaching practices at the existing curricular sets and standards, and the existing examination and assessment protocols, it is going to be a disaster.

Karthik Muralidharan added to Pritchett's remarks by referring to a study on the Pakistan earthquake of 2006. The study showed that after a year, nearly all the earthquake-affected households were roughly back to their pre-earthquake earnings and status. But the cumulative effects on the children affected by the earthquake were much larger than the immediate effects. They had been out of school for three months but had lost over a year's worth of schooling in the long run.

Hence, schools need to reopen in a fundamentally radically different way than they have been operating in the past. Rukmini Banerjee has been already raising the concern that some really simple steps need to be taken when schools reopen. Each child needs to be assessed individually. There has to be some way of planning for how we are going to cope with the range of abilities that we actually have with children re-entering school. And how is that instruction going to happen? The answer lies in taking long-term measures for the Indian education system that were needed anyway, irrespective of the pandemic. One of the approaches, which some State governments are working on, is to focus on and plan for the curriculum in the first 150 days after children return to school, which is a critical period.

Sonalde Desai

Moderator

Sonalde Desai added to the topic of education in Indian schools post-COVID based on some of the research being done at NCAER. The natural dispersion of ability within a population has actually been exacerbated by COVID because

only some children have access to digital learning being offered by their schools while some have found it difficult to even enroll. If a student cannot enroll, she cannot get any study material. The NCAER study estimates that in the Delhi-NCR region, about 8 percent of the children have not even managed to enroll. So they did not get any learning-teaching materials. Now when schools reopen, children coming into school will come with far greater inequality in learning outcomes than they had before the pandemic. And they would be affected by the Right to Education Act (RTE) requirement that children should be placed in grades that are age-appropriate for them. So, a situation may be created wherein 10-year olds would be coming into the school for the first time, whereas some of these children may have been getting fairly good training material during online education through a variety of means, and others would have been left out of learning systems altogether. This issue needs to be addressed even more seriously now than was needed in the pre-pandemic period.

Renana Jhabvala

COVID heroes: Digital literacy, local leaders; micro-entrepreneurs the worst affected

Renana Jhabvala spoke about the informal economy and the experience of her organization, the Self Employed Women's Association (SEWA), particularly with women in the informal economy. She also discussed some of the findings from their last survey that was conducted during the lockdown in the second wave.

Certain trades in the informal economy have been very badly hit. Casual workers, and among the women, the domestic workers, have not been able to work not only because of lockdowns, but also because of the fear of COVID in middle-class households. Street vendors have been affected because street markets have not opened up even when malls and shops have. Those involved in the food industry returned to work quickly, but weavers and home-based workers of all kinds are still not going back to work as there is very little work for them. It is interesting to note that even though farmers are better off in the rural areas, more women farmers have been disadvantaged. This has been especially true during the lockdowns and slowdowns as women farmers use public transport to carry the goods. So, the informal economy has been negatively affected in two ways. According to NSSO, there are six crore micro-entrepreneur enterprises in India, of which 20 percent are run by women. These small enterprises have almost completely lost their capital, as they have had to use it for buying food or for daily expenses. Women not only have less employment than men when they return to work but they receive lower earnings too. During the second lockdown, 55 percent of the women took loans just for daily expenses, whereas in the first lockdown, this figure was less than 18 percent. Nearly 80 percent of the people are eating much less nutritious food and also consuming less food. It is a very dismal picture.

The second important finding was that the heroes during the lockdown were the local leaders. They supported the weaker members of society by linking them to governments and organizations. They also disseminated a lot of information. In the first lockdown, there was real confusion about the regulations, health advisories, and COVID protocols at the household level. In the second wave, there was very high vaccine hesitancy. A SEWA study of March 2021 found that only 17 percent of the women were willing to take a vaccine. This figure has since gone up partly due to the fear among people of losing a lot of the benefits if they remain unvaccinated. This was another message spread by local community members.

The third finding pertains to the growing importance of digital communication. Most of the families engaged in the informal economy, especially the women, were not used to any kind of digital communication except phone calls. Many of them have now learnt to operate WhatsApp, understand what an SMS is, and take and send digital messages.

Digital literacy has gone up and has been playing a critical role during the lockdowns. In collectives or any kind of organized systems, people were able to get access to government schemes much more easily. This also applied to access to loans. And there was a real demand for loans because their capital had been exhausted, which the self-employed really need. Digital marketing was also crucial for the self-employed. Those who were involved in textile production had lost their markets. Although they were not able to link up with sophisticated marketing channels like Amazon, they were able to reach out to individual customers digitally. This is an area that needs to be extended to micro-enterprises because the existing mechanisms are not reaching out to them. Unfortunately, however, despite the importance of digital awareness, there seems to have been a decrease in the number of smartphones. Last year 24 percent did not have smartphones, and currently, this figure has gone up to 31 percent. Part of the reason for this is that people have had to either sell their smartphones, or the devices were damaged and they chose not to buy a new one to save money. Unfortunately people without smartphones are left out, leading to inequality in the digital marketing space.

While the timing and intensity of the third wave of COVID infections remains uncertain, we do know the way that governments have learnt to react to waves and lockdowns. This would mean more lockdowns, and the economy would likely go down again, especially for informal workers. There will also be food shortages in their homes due to lack of money. Hence, it is important to take pre-emptive measures to prepare for the government support that would be needed.

The street markets are still not open although they should be. Women, especially farmers in the rural areas, should be allowed to travel to the shops and markets in public transport. Although public transport did not completely shut down during the second wave, people who did not have identity cards or curfew passes were not allowed to travel. And women usually have no identity cards

showing that they are employed somewhere. This has been a big problem and needs to be resolved before the next wave.

First, as far as the government is concerned, cash transfers have been extremely useful. The construction workers have been receiving cash transfers in their accounts. During the first lockdown too, a small cash transfer was made to the Jan Dhan account holders. This was extremely helpful because most of these people had no incomes during that period.

Second, ration shops are now operating as usual and ration is not free any more. But both for ration cardholders and non-ration cardholders, at least during the lockdowns and slowdowns, rations need to be offered either free or at very subsidized rates.

Third, a mechanism is required for supporting micro-entrepreneurs and the self-employed who have received loans. These people have lost capital and the banks are not giving out loans to very small enterprises like street vendors, small shopkeepers, weavers, or home-based workers. The microfinance system gives very small loans, which are usually used for consumption. It is not just during COVID, but generally, there is a missing piece in the finance system, wherein capital needs to be given to very small enterprises and there are about six crores of them. Could there be a method or a system of financing these very small enterprises? This issue needs to be addressed in general, but especially during this time.

Open Discussion with the Roundtable Panelists

The remarks by the five panelists were followed by a rich and lengthy discussion among the panelists and the IPF co-editor **Karthik Muralidharan**. The Roundtable's moderator, **Sonalde Desai**, posed important questions taken from the participants of the Roundtable on the topics of micro-entrepreneurs and re-opening of schools.

For the full flavor of the richness of this Roundtable discussion, we invite you to view the video of this session using the links mentioned in the box below.

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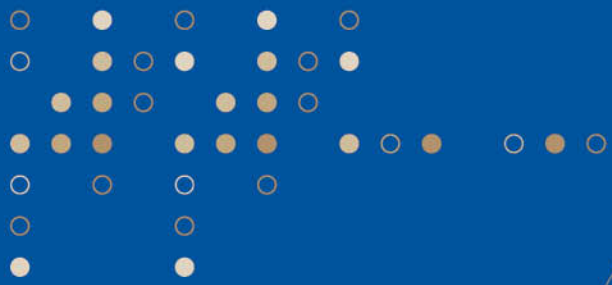

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