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Structural Change Forecasts for India: How Big of a Bang Can a Big Bang Have?

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Abstract

India's political environment exhibits a new determination to "transform India into a global manufacturing hub," and in the process raise manufacturing to 25% of GDP and create 100 million new manufacturing jobs. This would entail a structural change comparable to that witnessed by several East Asian countries beginning in the 1960s. The study projects a formal-sector manufacturing boom out 20 years at the sectoral level, assuming India can make the necessary reforms to initiate such a boom. Projection parameters are carefully constructed based on Indian and East Asian historical experience. The projections break out the key growth areas of formal-sector manufacturing and modern services to capture their unique characteristics. The results show large positive gains to aggregate output and employment from initiating an East Asian-style manufacturing boom in India. Reflective of the small size of formal-sector manufacturing employment currently, the government's specific employment goals appear unattainable in the next 20 years.

Keywords: structural change; India; economic growth; productivity; employment; Asian miracle

JEL Classification: O11, O14, O25, O41

1. Introduction

The question of structural change in India has returned to the forefront of policy debates with Prime Minister Narendra Modi's high-profile "Make in India" campaign to "transform India into a global manufacturing hub."[1] Structural change involves shifting economic activity — including its labor force — towards higher-productivity activities. Almost half of India's labor force works in extremely low-productivity agriculture, and most of the rest works in low-productivity informal activities. The potential for welfare improvements from successful structural change strategies has always been massive, and the political environment exhibits a new determination to take the necessary steps.

The Indian economy has already achieved one structural transformation goal of shifting output — if not employment — away from agriculture. At about 15 percent of GDP, agriculture's share is half of what it was twenty years ago, and a quarter of what it was sixty years ago. However, the economy deviated from the classical pattern by relying on services rather than manufacturing to achieve this shift. The reliance on services to fuel growth so early in its economic development causes India to stand out, particularly relative to East Asia.

The Indian economy's pattern of structural change also stands out in contrast to standard Heckscher-Ohlin theory. India's obvious factor abundance in labor implies comparative advantage in labor-intense activities. Instead, services growth has proven less labor-intensive than manufacturing growth.

Even manufacturing has grown in a surprisingly capital-intensive fashion. The labor intensity of formal-sector manufacturing, a source of structural transformations elsewhere, is declining in India, in contrast to several other Asian economies (Kochhar et al. 2006; Das, Wadhwa, and Kalita 2009; Kapoor 2014). Indian firms operate in more capital-intensive industries than predicted from the experience of other countries with similar labor supplies, development levels, and institutional quality (Hasan, Mitra, and Sundaram 2013). For instance, the three least employment-intensive manufacturing industries are among the four largest industries by output; they comprise nearly half of all formal manufacturing output.[2] Even within the same industry, Indian firms use more capital and less labor than comparable firms in other countries (Hasan, Mitra, and Sundaram 2013). One can infer from the size of capital-intensive industries that their firms grow faster, and that is born out in the data. Capital intensity helps explain the economy's much weaker progress at shifting labor out of agriculture than at shifting output.

[1] The Make in India campaign is described at www.makeinindia.com.
[2] This uses the 14-industry aggregation used in Indian national accounts. From largest to smallest the three are chemicals and pharmaceuticals, basic metals and transport equipment, according to National Sample Survey Office (2013) and national accounts data.

Shifting industries towards formality — reducing the dualism in the economy — constitutes another important form of structural transformation. Careful studies have documented large efficiency gaps between comparable manufacturing firms in the formal and informal sector, implying large potential efficiency gains from growth of the formal economy (Kathuria, Raj, and Sen 2013; Mazumdar and Sarkar 2008).[3]

Similarly, the service sector contains sharp distinctions in productivity levels between what are known as "modern" and "traditional" services. Modern services are technology-enabled, transportable, and tradable. They include financial intermediation, communication, computer services, business services and professional services.

Because of links to technology and trade, modern services perform much more like manufacturing: characterized by fast productivity growth and potential to leverage export markets for growth. In India, communications, finance, and computer-related services yield five or more times the output per worker than most traditional services.[4] The modern/traditional distinction has been found across broad swaths of developing economies (Eichengreen and Gupta 2011b) and in India in particular (Eichengreen and Gupta 2011a; Ghose 2014), although Ghose finds less distinct differences.

Successfully re-orienting India's labor force towards higher productivity sectors would directly boost economic growth. Indeed, McMillan, Rodrik, and Verduzco-Gallo (2014) find that the main difference in the growth experience of Asia with that of Latin America and Africa has been due to Asia's superior success at structural reform.

The productivity gains imply large welfare gains for some of India's poorest workers. The McKinsey Global Institute has estimated that an illiterate worker who moves from agriculture to light manufacturing can expect a wage increase of 40 percent. A worker with basic literacy can expect even better: a wage increase of 70 percent should he move from agriculture to heavy manufacturing (Gupta et al. 2014). Other studies show similar results regarding moves from rural areas to urban centers, finding that urban households make two to three times more annually than comparable rural households (Shukla 2010).

[3] Whether that growth comes from informal firms formalizing, or from new entry and growth within the formal sector is another matter. Nataraj (2011)and Green (2014) suggest the latter.

[4] Author's calculations based on NSS and national accounts data. Business services productivity stands out less clearly because high-productivity workers like call center workers are far outnumbered by security guards and errand boys with productivity that compares more closely to hospitality workers.

How should this structural transformation pulling labor into higher-productivity sectors occur? Economists have debated whether the best strategy for job creation in India lies in developing its service or manufacturing sectors.[5] Green (2014) argues that the Indian manufacturing sector holds more growth potential in response to policy changes, and Ghose (2015) shows more employment potential for low-skilled workers in manufacturing. This study likewise focuses — as does the Indian government at present — on efforts to boost the manufacturing sector.

To achieve this goal requires structural reforms that encourage existing industries to raise their labor intensity. It also requires intra-sectoral shifts, meaning helping labor-intensive activities expand faster.

The structural transformation also requires a second component, reducing dualism in manufacturing. Informal firms comprise 81 percent of manufacturing employment, but only 29 percent of value added, according to National Sample Survey Office (2013) and national accounts data. This implies large aggregate productivity gains are available from shifting activity and employment into formal sector firms.

The Indian government will need to take many steps to achieve its goals of leveraging the manufacturing sector to create tens of millions more high-quality jobs. Indian papers overflow daily with suggestions about the most effective course of policy reform. While academic consensus points to reducing labor market reforms and improving infrastructure, the ground reality will require a much more nuanced and creative approach.[6]

This study abstracts from the details of what needs to be done, and assumes the necessary structural reforms will occur quickly. It asks the question, what could happen if India's government implemented big bang reforms sufficient to achieve East-Asia-style manufacturing growth? For example, is it realistic that the economy could hit Modi's goal of creating 100 million new manufacturing jobs by 2022?

The approach is to apply rigorously derived but ambitious parameters to a simple model forecasting economic growth. With assumptions about sector-level growth

[5] Recent examples of pro-service sector positions include Amirapu and Subramanian (2014), Bhattacharya (2014), Economist (2014), and Pack (2009). Advocates of focusing on manufacturing sector development include (OECD 2014) and the Vice Chairman of India's *Niti Aayog* or Policy Commission think tank, Arvind Panagariya (2013). The 2014-15 *Economic Survey* also takes up the issue, but does not conclude in favor of one or the other (Ministry of Finance 2015).

[6] Recent evidence on labor market regulation includes Dougherty, Herd, and Chalaux (2009) Hasan and Jandoc (2013) Hasan, Mitra, and Sundaram (2013) and Hasan, Mitra, and Sundaram (2013). Evidence on the impact of infrastructure includes Donaldson (forthcoming) Hulten, Bennathan, and Srinivasan (2006) Jensen (2007) Rud (2012).

and employment elasticity, this study projects sectoral employment, productivity and output patterns out 20 years.

The projection exercise presented here assumes a structural break in the manufacturing sector due to major policy changes. This implies two important shifts from the usual analysis of structural transformation in India. First, it implies that past patterns of the utilisation of labor (e.g. labor intensity and skill intensity) will be broken, and therefore do not serve forecasts of the future.[7] The experience of five East Asian economies that witnessed manufacturing-led growth booms provides a better benchmark for the parameterization of the projections. [8]

Second, because of the assumed structural break, the model benefits from simplicity to avoid indulging in false precision. The number of parameters and assumptions is kept to a minimum. The projections provide a rough upper bound of possible outcomes from structural transformation. This may inform efforts to develop India's structural change agenda.

Unlike other projections of sectoral employment—e.g. Rangarajan, Kaul, and Seema (2007), Planning Commission (2012), Papola and Sahu (2012), Timmer, de Vries, and de Vries (2014) and Gupta et al. (2014)—this one breaks down the broad industrial groupings into important sub-groups, allowing distinctions between manufacturing and other industry, for instance, and modern versus traditional services.[9] It also breaks down manufacturing between informal and formal sectors, to distinguish between fundamentally different segments of the economy that are often blended together.

The next section describes the methodology used in detail, including a detailed discussion of the key output growth and employment elasticity assumptions. The third section presents the results of the simulations, and the final section concludes.

2. Developing the Projections

The core of the projection is a sector-wise GDP forecast. Employment figures then derive from an assumption of constant employment elasticity. Hence, the most important parameters for the exercise are the assumptions of future growth and employment elasticity. The methodology can be broken down into three key

[7] This is a point missed by most evaluations of manufacturing versus service sector-led growth, like Ministry of Finance (2015).
[8] Ghose (2015) also makes this point.
[9] Rangarajan, Kaul, and Seema (2007), Planning Commission (2012), Papola and Sahu (2012), and Gupta et al. (2014) break services into sub-sectors, but they follow a common national accounts breakdown in which communications — a modern service industry — is grouped together with transportation — a traditional service industry — hindering a modern/traditional distinction in their results.

components: the data used, the growth assumptions, including growth projection equations and assumptions about employment elasticity.

Data

Employment data comes from several different sources. The most comprehensive data on sector-wise employment is the National Sample Survey (NSS) conducted by the National Sample Survey Office (NSSO) in the Ministry of Statistics and Programme Implementation (MOSPI). NSSO publishes employment data at the 4-digit level of India's National Industrial Classification. It also breaks out informal sector employment at the 1-digit level.[10] This study uses the NSS 68th (2011-12), 66th (2009-10) and 61st (2004-5) rounds. These are matched to sectoral value added data from the National Accounts such that detailed employment elasticities and productivity data can be constructed.[11]

Formal sector manufacturing data on employment and value added also comes from MOSPI's Annual Survey of Industries (ASI), which provides an alternative source to compare with for key parameters. Unfortunately, outside of manufacturing the national accounts data only distinguishes between formal and informal manufacturing for net value added, not gross value added.[12] Future analysis may examine the formal/informal distinction across all sectors using net value added.

The data for the East Asian countries comes from the Groningen Growth and Development Centre (GGDC) 10-sector database that has annual sector-level value-added and employment data that match the Indian sectoral breakdown fairly well. The main inconsistency is the inability to distinguish between the formal and informal sector in the East Asian value-added data. [13]

Output Growth

The key units of observation are broad sectoral categories: manufacturing, other industry (construction and utilities), services and the primary sector (agriculture and mining). Manufacturing is further divided between formal and informal segments. Services is divided between modern services (communications, financial services

[10] From the 68th round, for example, NSSO (2013) contains overall employment data and NSSO (2014) contains informal employment.

[11] See (Eichengreen and Gupta 2011a) for a useful discussion of the reliability of national accounts data for the various service sectors.

[12] In addition, there is a definitional distinction in the classification of non-manufacturing informal enterprises that affects approximately 4% of non-manufacturing employment. Manufacturing enterprises with more than 20 employees (10 employees if power is used) must register with the government, and so are considered formal regardless of incorporation. No equivalent registration exists for the service sector. Hence, unincorporated services firms that meet the employment threshold would be considered formal if they engaged in manufacturing, but instead are classified as informal.

[13] The modern/traditional services split in the GGDC data suffers from the same problem noted in footnote 9, that modern-sector communications is aggregated with the traditional-sector transport and storage industries. Hence it is not strictly comparable to the Indian data.

and business services and real estate) and traditional services (trade, transportation, public administration, hospitality, education, health care, entertainment, household services and other).[14]

A baseline scenario is constructed first to establish a "no change" scenario, in which current policies influencing sectoral transformation are held constant. It therefore relies as much as possible on parameters as currently observed in India.

The IMF estimated India's potential growth to be 6-7 percent, so the projection pegs growth over the next 20 years at 6.5% (Anand et al. 2014). The more difficult task is to match that growth rate to reasonable assumptions about sectoral growth. The approach here is to base sectoral growth rates on historical rates from 1994 to 2012.

The reforms initiated in 1991 yield above-trend GDP growth starting in 1994, corroborated by the structural breaks in the growth rate found by Balakrishnan (2010). The high-growth period ends in 2012 when investor confidence and GDP growth collapses in the wake of government paralysis. In addition, the most recent available employment data comes from the National Sample Survey of 2011-12. Hence 1994-2012 spans the most appropriate sustained, high-growth period for this study.

The initial growth rate for each sector was taken from each sector's compound annual growth rate (CAGR) from 1994-2012, which witnessed aggregate growth just above potential growth at 7.1%. By trimming each sectoral growth rate by 21%, the aggregate rate equals 6.5% and sectoral rates are proportional to their historical pattern.

The construction and utilities and traditional services sectors begin at a 6.1% growth rate, below the rate of the general economy. Industries like construction, trade and transportation tend to grow at the same pace as the overall economy. To account for this, an error-correction term is included in their growth projection to pull their sectoral growth rates towards the aggregate. For the baseline projection, their growth rate is adjusted by half of the distance between their last-year growth rate and the general economy growth rate.

As time progresses in the projection, the faster-growing sectors occupy a larger share of the total economy. This means either the aggregate growth rate will climb over time, or the individual sectoral growth rates must fall. The latter seems more realistic, given the torrid pace of growth during 1994-2012, and given that the baseline assumes no change in the policy mix to facilitate structural adjustment. The individual sectoral growth rates γ_t^i therefore decline each year by a factor δ, constant

[14] Indian national accounts data includes a breakout for value added from services of owner-occupied dwellings. Since these entail no employment component, they were excluded from value added attributed to modern services (typically lumped with business services).

across time and sectors, which keeps the aggregate growth rate from exceeding 6.5% per year. The difference between the initial and average growth rates in Table 1 is due to this compression.

Annual growth rate for sector i therefore evolves according to the following process:

$$\gamma_t^i = \gamma_0^i(1 - \delta t),\ t \in [0, T]. \quad (1)$$

The exception noted above is for construction and utilities and traditional services, which evolve according to the equation for sector j:

$$\gamma_t^j = \left[\gamma_0^j + \lambda\left(\gamma_{t-1} - \gamma_{t-1}^j\right)\right](1 - \delta t),\ t \in [0, T], \quad (2)$$

where λ is the catch-up coefficient. For the baseline scenario, $\lambda = 0.5$ and $\delta = 0.065\%$. With these processes, the sectoral growth rates average out to a level slightly lower than their initial rates, presented on lines 2.1 and 2.2 in Table 1.

Table 1. Sectoral Growth Rates

		formal manuf.	informal manuf.	construction & utilities	modern services	traditional services	ag. & mining	**total**
1.	CAGR 1994-2012	8.7%	5.9%	7.7%	13.5%	7.7%	3.2%	**7.1%**
2.1	Baseline scenario initial growth rates	6.8%	4.6%	6.1%	10.6%	6.1%	2.5%	**6.5%**
2.2	Baseline scenario average growth rates	6.1%	3.9%	5.7%	9.8%	5.7%	1.7%	**6.5%**
3.1	Policy Change scenario initial growth rates	16.0%	5.9%	7.7%	13.5%	7.7%	3.2%	**9.1%**
3.2	Policy Change scenario average growth rates	13.9%	4.0%	7.4%	11.5%	7.4%	1.3%	**9.1%**

Source: Author's calculations using NSS and national accounts data.

For the policy change scenario, the fundamental assumption is that the Indian business climate for formal sector manufacturing alters sufficiently to ignite an East Asian-style growth spurt. Therefore, India's historical pattern is not as relevant as East Asia's.

This study compares India with the experience of Korea, China, Indonesia, Malaysia and Thailand, five of the eight High-Performing East Asian countries that experienced 20-year booms in manufacturing value added. Singapore and Taiwan were dropped due to their small population, and Japan due to its far more developed status at the time of its postwar boom. The five countries examined all had large agrarian populations at the time their manufacturing boom began.

The booms are measured to identify a 20-year period that followed a big bang of reforms comparable to what India might achieve. Therefore this study dates them to start at the time of major events that admittedly can be somewhat arbitrary relative to a continuum of reform initiatives. However, the basic results are robust to small adjustments in the timing used. Korea's boom is measured beginning with the election of Park Chung-hee in 1963. China's reform period begins under Deng Xiaoping in 1978. Indonesia begins with the major devaluation and banking reforms

in 1978. Malaysia took major steps towards export-oriented industrialization in 1985 and 1986, so this study uses 1985 as the start period. Thailand's major reforms began in 1985 and continued into the next year.

For comparison, India's experience beginning in 1994 is included in Table 2. Since this study involves a formal/informal breakdown, it presents India's experience in the most recent 20-year period for all manufacturing activity as well as for just the formal sector. The difference in the output growth experience of the two is not materially different.

Table 2. Booms in Manufacturing Value Added Growth: Select East Asian Economies and India

		share of GDP			annualized growth rate	
	start year	initial share	10-year change	20-year change	10-year rate	20-year rate
Korea	1963	4%	7%	15%	19%	16%
China	1978	20%	2%	15%	11%	13%
Indonesia	1978	13%	10%	13%	11%	10%
Malaysia	1985	15%	10%	13%	13%	10%
Thailand	1985	21%	8%	15%	13%	9%
India-total	1994	15%	1%	0%	7%	7%
India-formal	1994	9%	1%	2%	7%	8%

Source: Author's calculations using GGDC 10-Sector Database, Version 2014 (Timmer, de Vries, and de Vries 2014)

In terms of the initial share of manufacturing in GDP, India's full manufacturing sector falls in line with its Asian peers. Even the formal sector does not have a smaller share of GDP than Korea in 1963. However, during the subsequent 20 years, the manufacturing sector in the other Asian countries gained on average 14 percentage points of GDP share, while Indian manufacturing only kept up with overall GDP.

For the projections, India's future formal-sector manufacturing growth rates mimic those of Korea, the country with the highest 20-year growth rate. Two reasons justify this choice. First, this study focuses on the formal manufacturing sector, which should grow faster than the overall manufacturing sector when structural reforms remove some of the barriers that previously forced firms into the informal sector. Since the other country data is for the overall manufacturing sector, the highest-growth country — two percentage points above the average growth rate — provides a precedent for possible growth rates that India's formal manufacturing sector might achieve. Second, the scenarios aim to present the potential impact of structural reforms on India's manufacturing sector. Replicating the highest-growth country establishes a plausible upper bound of the impact on the manufacturing sector of sufficient reform treatment.

Every other sector presents positive and negative factors that could cause growth to rise or fall in response to big bang manufacturing-oriented reforms relative to the historical pattern. These are discussed in detail below. Without a strong reason to expect one factor or another to dominate, the simulation takes the simplest approach and bases growth on historical patterns shown in Table 1.

The link between formal and informal manufacturing growth rates has been examined more thoroughly than between any of the other sectors. The correlation between informal and formal manufacturing growth rates is positive and has strengthened recently, as seen in Table 3. This is consistent with other research that finds the two sectors are compliments (Sundaram, Ahsan, and Mitra 2013; Ghani, O'Connell, and Sharma 2013).

Table 3. Correlation of Growth between Formal Manufacturing and Other Sectors

	1994-2004	**2005-2014**	**1994-2014**
informal manufacturing	0.58 (0.061)	0.72* (0.020)	0.64** (0.002)
construction & utilities	-0.44 (0.177)	0.61 (0.060)	0.20 (0.376)
all services	-0.09 (0.799)	0.74* (0.015)	0.36 (0.113)
modern services	-0.54 (0.090)	0.65* (0.040)	0.04 (0.861)
traditional services	0.16 (0.632)	0.70* (0.025)	0.46* (0.037)
agriculture & mining	0.11 (0.743)	0.28 (0.440)	0.17 (0.462)

Note: Figures in parentheses are p-values.
Source: Author's calculations using National Accounts data.

However, this does not answer the question of what would happen in the face of structural reforms, which presumably would favor formalization as the cost of operating in the formal sector falls. Rani and Unni (2004) find that the reforms of 1991 as well as infrastructure growth helped expand informal manufacturing growth. Similarly, Sundaram, Ahsan, and Mitra (2013) find increasing labor market flexibility and trade liberalization increase the complimentarity between informal and formal manufacturing.

Nataraj (2011) finds evidence that trade reform causes exit of smaller informal firms, consistent with findings that smaller (typically home-based) informal firms do not

have complimentary relationships with formal manufacturing (Moreno-Monroy, Pieters, and Erumban 2012). It also fits with the findings of Martin, Nataraj, and Harrison (2014), that formal sector firms begin to outcompete informal ones when entry barriers are removed.

For the other sectors, further sources of data can help discern a relationship with manufacturing. Using the input-output matrix from India's national accounts data Table 4 presents the proportion of each sector's output is consumed by the manufacturing sector.[15] This provides insight into the historical first-order relationship, but does not capture second-order effects through aggregate demand that might be present in the growth correlations. Further, the East Asian boomers' experience (Table 5 and Table 6) provides another suggestion for sectoral performance in the policy change scenario.

Construction and utilities will most likely receive a positive boost from affiliated construction and infrastructure needs, as suggested by Ghose (2015). However, the historical correlation shown in Table 3 is not strong.[16] In the experience of the East Asian comparison group, Table 5 and Table 6 indicate that Korea and China experienced commensurate booms in construction and utilities, while Indonesia and Malaysia did not. Thailand experienced a boom in construction and utilities, but it disappeared by the 20-year horizon. The general pattern suggests construction and utilities in East Asia most often tracked the overall economy rather than manufacturing in particular.

[15] The input-output matrix does not break down formal and informal manufacturing, but since informal manufacturing accounts for less than a third of overall manufacturing value added, and is probably much less service consumption-intense, the data probably represent formal-sector manufacturing reasonably well.

[16] Table 4 shows manufacturing directly consumes a surprisingly small share of construction and utilities output. This is likely distorted *inter alia* by the classification of municipal water supplied to manufacturing as government final consumption (GFC). The input-output matrix shows GFC implausibly accounts for over 50% of India's water supply.

Table 4. Sector Input to Manufacturing as a Share of Its Total Output

Value Added, 2008	
construction & utilities	7%
all services	18%
modern services	13%
traditional services	21%
agriculture & mining	47%

Note: Modern services includes communication, finance, real estate, business services, IT, legal services and equipment rental.
Source: Author's calculations using National Accounts data.

Table 5. 10-Year Sectoral Growth Rates in Select East Asian Economies and India

	start year	manuf.	const. & utilities	services	ag. & mining	overall
Korea	1963	19%	17%	7%	1%	8%
China	1978	11%	12%	14%	5%	10%
Indonesia	1978	11%	6%	7%	4%	5%
Malaysia	1985	13%	9%	9%	3%	8%
Thailand	1985	13%	12%	9%	4%	9%
India-total	1994	7%	7%	8%	3%	6%

Source: Author's calculations of compound annual growth rates using GGDC 10-Sector Database, Version 2014 (Timmer, de Vries, and de Vries 2014)

Table 6. 20-Year Sectoral Growth Rates in Select East Asian Economies and India

	start year	manuf.	const. & utilities	services	ag. & mining	overall
Korea	1963	16%	14%	5%	1%	7%
China	1978	13%	10%	11%	5%	10%
Indonesia	1978	10%	9%	8%	3%	6%
Malaysia	1985	10%	5%	8%	3%	6%
Thailand	1985	9%	4%	5%	4%	6%
India-total	1994	7%	7%	9%	3%	7%

Source: Author's calculations of compound annual growth rates using GGDC 10-Sector Database, Version 2014 (Timmer, de Vries, and de Vries 2014)

Both modern services and traditional services would benefit from formal-sector manufacturing growth, as firms use modern services to increase competitiveness and traditional services like transport to support greater output. However, there is reason to believe the impact will be modest.

The correlation with formal-sector manufacturing growth has been strong over the past 10 years, but had no relationship in the decade prior. The input-output matrix shows the services sector sells a relatively small share of its output to the manufacturing sector. Nonetheless, service sector growth has been aided in the past by the 1991 reforms (Kotwal, Ramaswami, and Wadhwa 2011) and state-level labor market liberalizations (Dehejia and Panagariya 2013).

Of the East Asian comparison group, only China and perhaps Malaysia saw service growth rise along with manufacturing (Table 5 and Table 6). Again, it appears service sectors most often tracked the general economy rather than manufacturing in particular during the East Asian booms. Modern services in India might be expected to grow slower than its historical growth pattern over the next 20 years due to weak growth, market saturation and rising competition in the primary IT/software export markets (Green 2014).

Finally, agriculture and mining have no significant correlation with formal manufacturing in India. Neither did it experience a boom in any of the East Asian comparison economies. On the other hand, almost half of agricultural and mining output depends on consumption by the manufacturing sector. In addition, high job growth outside of agriculture may create opportunities for consolidation and modernization in agriculture that could greatly boost productivity.

With this array of possible responses to faster formal-sector manufacturing growth, the projection chooses the starkest point of contrast, assuming the remaining sectors follow their historical pattern, shown in line 3.1 in Table 1. The informal manufacturing, modern services, and agriculture and mining sectors are assumed to grow according to equation 1. Because the construction and utilities and traditional services sectors are more likely to benefit from manufacturing growth, they are assumed to grow according to equation 2 with $\lambda = 1$. This value of λ means these two sectors grow at the same rate as the total economy, about 1.4% higher than their sectoral historical rates.

The policy change scenario requires a higher level of δ than the baseline because it has two high-growth sectors. All the sectors are compressed by $\delta = 0.125\%$ to ensure the total economy growth rate remains constant at about 9% per year over the 20-year projection. Despite this limitation, the scenario is aggressive relative to historical growth experience. The overall rate at 9% slightly exceeds India's highest 5-year growth period 2003-2008 and exceeds the 20-year growth rates of all the East Asian boom economies except China. The average growth rate for each sector appears on line 3.2 in Table 3.

Employment Elasticity of Growth

The economic growth rates combine with the employment elasticity of GDP to generate the core forecast of future employment. While GDP growth is quite commonly understood, the employment elasticity of GDP merits discussion to help apprehend the related assumptions in the projections.

The employment elasticity of GDP is the percent change in employment for a 1-percent change in GDP, so it relates to — but does not equal — a simple measure of *average* labor productivity, output per worker. In fact, the elasticity is the inverse of marginal productivity, the change in aggregate productivity from adding one worker. Most often the elasticities are calculated from employment and GDP across several years, so they come close to the inverse of average productivity. The marginal/average distinction has two important implications.[17]

First, high-productivity industries will by definition have a lower elasticity than low-productivity industries. Hence, a low elasticity does not indicate a bad industry for job creation, since ultimately productivity growth raises living standards. If a high-productivity (low elasticity) industry grows fast enough it can provide a welcome source of high-quality jobs. Accordingly, very high elasticities can indicate problems with falling productivity.

Second, because elasticity is the inverse of marginal productivity, and average productivity rises through high marginal productivity, average productivity advances in the projections by adding new workers at lower elasticities. With positive productivity growth, a faster-growing sector will have greater productivity growth than a slower-growing sector when both have identical elasticities, simply by adding more workers.

Positive structural change means that higher-productivity (lower elasticity) industry output grows faster. The marginal productivity effect described above will cause productivity to grow faster too.

Elasticity is typically measured as the ratio of growth rates of employment and output or as the coefficient of a log-log regression. For India, Misra and Suresh (2014) provide the best elasticity measures for this time period. Misra and Suresh uses KLEMS methodology to construct an annual employment time series to match GDP data frequency from 1994–2012 and perform log-log regressions for various sectors. It also uses ASI data to perform industry-level panel log-log regressions to generate point estimates of employment elasticity in the formal manufacturing sector.

[17] See McMillan, Rodrik, and Verduzco-Gallo (2014) for further discussion of interpreting average versus marginal productivity across sectors.

Unfortunately, Misra and Suresh do not match the modern/traditional services distinction and do not address informal manufacturing. Their elasticities can only be used for formal manufacturing, construction and utilities and agriculture and mining. For other sectors the ratio of the CAGR for sectoral employment from NSS data and the CAGR for sectoral value added provide a commonly used measure of employment elasticity in India.[18]

A comparison of available elasticities provides perspective on the final parameters used in the projections. Globally, economy-wide employment elasticities ranged from 0.1 (East Asia) to 0.7 (Middle East) during 2004-08 according to ILO data, versus 0.01 for India during 2005-10 (Misra and Suresh 2014). Within that range, individual sectors see wider variation.

Table 7. Estimates of Employment Elasticity

source	method	time frame	manuf.	formal	informal	const. & utilities[1]	services	modern[2]	traditional[2]	ag. & mining[1]
author's calculations	NSS CAGR	2005-12	0.17	0.48	**0.15**	1.18	0.23	**0.33**	**0.26**	-0.48
Misa & Suresh (2014)	NSS CAGR	2005-12	0.10			1.13		-0.45	0.23	-0.41
Misa & Suresh (2014)	ASI industry panel	2002-12		**0.57**						
Ghose (2015)[3]	NSS CAGR	2000-12	0.37	0.63	0.31		0.33			
Misa & Suresh (2014)	NSS log-log data	1994-2012	0.29			**0.99**	0.30			**-0.02**
Papola & Sahu (2012)	NSS CAGR	2005-10	-0.11			1.19	0.14	0.47	0.12	-0.52
Planning Commission (2012)	NSS log-log data	2000-10	0.09			1.10		0.66	0.16	0.04
Rangarajan et al (2007)	NSS CAGR	2000-05	0.34			0.85	0.49			1.51

Notes: The baseline projection uses the bolded estimates.
1) For Misra and Suresh (2014), Papola and Sahu (2012) and Rangarajan, et al (2007) we take employment-weighted averages of the studies' sub-sector elasticity estimates to create elasticities for construction and utilities and agriculture and mining.
2) As noted in footnote 7, the cited studies incorrectly place communications in the traditional services sector. Because communications has low elasticity, this marginally widens the gap in elasticity between modern and traditional sectors.
3) Ghose (2015) calculates employment elasticity of net domestic product (value added net of depreciation), but for consistency this table recalculates them using GDP (gross value added).

[18] For instance, Rangarajan, Kaul, and Seema (2007) and Misra and Suresh (2014) present results using this methodology.

In recent years formal manufacturing in India has witnessed elasticity on the high end of the spectrum—only construction and utilities (primarily construction) is higher—justifying the policy focus on this sector for job growth (see Table 7). The Misra and Suresh estimate utilizes industry-level data and represents the middle value. This estimate is also close the high end of the elasticities seen in most of the East Asian boomers shown in Table 8. However, those elasticities include the informal sector. When India's informal sector is included, as in Table 8, India is an outlier in the other direction. The unusual amount of employment in the informal manufacturing sector in India generates this result. Assuming a similar but smaller effect in the East Asian economies, a slightly high estimate for the formal manufacturing sector in India appears appropriate.

The policy change scenario assumes employment elasticity in formal manufacturing will rise slightly, to 0.7. Elasticity could theoretically rise through two channels. First, a lower effective cost of labor relative to capital because of labor market reforms could induce industries to raise their labor intensity. Second, reforms resulting in lower cost of labor or improvements in infrastructure could improve the comparative advantage of labor-intensive industries, giving them relatively higher growth. Shifting the rates of growth *between* sectors in favor of labor-intensive industries can raise the overall sectoral elasticity. The historical range of elasticities among manufacturing industries is wide enough for the between effect to move the elasticity about +/- 0.2 without making unreasonable assumptions about long-run industry growth rates.

Informal manufacturing has a lower elasticity than formal manufacturing, and formal manufacturing sector growth has been shown to lower the share of employment in informal manufacturing (Ghani, Kerr, and O'Connell 2013). Indeed, Unni (2003) finds that the growth of informal manufacturing employment after the 1991 reforms occurred because formal firms were restrained by labor laws. As the organized sector offers more jobs, disguised unemployment in the informal sector should decline.[19] Of the two available estimates of informal manufacturing elasticity, the projections use the lower one of 0.15.

[19] Studies of informal manufacturing productivity (related to the inverse of elasticity) have shown trade reform to have both negative (Kathuria, Raj, and Sen 2013) and positive (Nataraj 2011) impacts. Hence, the experience of trade reform provides little guidance for this exercise.

Table 8. Employment Elasticity in Select East Asian Countries and India

	start year	manuf.[1]	const. & utilities	modern services[2]	traditional services[2]	ag. & mining
Korea	1963	0.55	0.50	1.70	0.65	8.61
China	1978	0.30	0.80	0.29	0.55	0.73
Indonesia	1978	0.55	0.64	0.54	0.56	2.31
Malaysia	1985	0.52	0.64	0.51	0.47	1.91
Thailand	1985	0.59	1.35	0.85	0.86	1.43
India[3]	2014	0.23	0.99	0.33	0.26	-0.02

Source: Author's calculations using GGDC 10-Sector Database, Version 2014 (Timmer, de Vries, and de Vries 2014).
Notes: 1) The GGDC data does not allow a formal/informal distinction, so the India data is the employment-weighted average of the formal and informal manufacturing elasticities used in the projections.
2) The GGDC data also groups communications with transportation, so the modern/traditional services split is imperfect for the East Asian countries.
3) The India figures are the elasticities used in the baseline projection.

The construction and utilities sector has high elasticity because construction is labor-intensive. Gupta et al. (2014) argue that income from National Rural Employment Gurantee Act (NREGA) programs have generated a building boom in rural areas, meaning a greater share of construction takes place in low-wage, low-productivity areas. This has caused the elasticity of construction to rise. Notice the Rangarajan, Kaul, and Seema (2007) estimate, which pre-dates the NREGA program, is the lowest. The NREGA-induced trend may not persist indefinitely, so the projection uses the Misra and Suresh estimate using log-log regressions, which at 0.99 is on the lower end of the range. This is not exceptionally low by the experience of the East Asian boomers shown in Table 8.

For modern and traditional services, this study's estimates provide the only elasticities that distinguish between the two sectors appropriately. Most other estimates for modern services in India or East Asian economies are likely too high due to the exclusion of low-elasticity communications. Accordingly, the traditional services estimates are likely too low. Compared to the other studies from which modern/traditional sector elasticities can be approximated, this study's estimates appear appropriate. The East Asian boomers' elasticities are much higher, but this study matches Indian estimates when they conflict.

Agriculture and mining display declining elasticity for the same reason as informal manufacturing, namely shedding of surplus workers. Again, the East Asian boomers' elasticities are much higher, but the Indian estimates are roughly declining over time, with the trend giving additional confidence that the pattern is not a fluke. The baseline estimate uses the Misra and Suresh estimate. For the policy change

scenario, a better supply of non-agricultural jobs will presumably pull excess workers out of agriculture faster, so the author's estimate of -0.48 is applied.

3. Results

The simulation extends from 2014, assuming the employment situation is unchanged from the 2012 NSS survey. The initial values for the projection are given in Table 9.

Table 9. Initial Values for the Projection

	formal manuf.	informal manuf.	const. & utilities	modern services	traditional services	ag. & mining	**total**
GDP 2014 share	**11%**	5%	10%	22%	36%	16%	**100%**
Rs tril							***100.4***
employment 2014 share	**2%**	10%	11%	3%	24%	49%	**100%**
mil							***473***
employment elasticity baseline scenario	**0.57**	0.15	0.99	0.33	0.26	-0.02	**0.20**
employment elasticity policy change scenario	**0.70**	0.15	0.99	0.33	0.26	-0.48	**0.05**
productivity 2014 Rs thou/worker	**958**	95	186	1490	326	71	**212**

Source: Author's calculations using NSS and national accounts data.

Running the simulation out 20 years produces dramatic differences between the baseline no-change scenario and the policy change scenario (Table 10). Simple compounding of the assumed growth differential yields overall GDP that is 70% higher than what it might be without reform. Productivity (which should correlate with wages) also grows faster with reform. Relatively higher growth rates in formal manufacturing cause it to grow 4.5 times larger than the no-reform scenario, yielding a substantial rise in its share of GDP. [20]

[20] Please see Table A1 and Table A2 in the appendix for more details.

Table 10. Difference between Policy Change and Baseline Scenarios

	formal manuf.	informal manuf.	const. & utilities	modern services	traditional services	ag. & mining	**total**
average GDP growth rate 2015-2035 (reform – baseline)	**8%**	0%	2%	2%	2%	0%	**3%**
GDP share 2035 (reform – baseline)	**17%**	-1%	-1%	-7%	-5%	-3%	
GDP ratio 2035 (reform/baseline)	**4.5**	1.0	1.4	1.4	1.4	0.9	**1.7**
cumulative new jobs 2035, milions (reform – baseline)	**58**	0	65	3	14	-27	**114**
employment share 2035 (reform – baseline)	**7%**	-1%	5%	0%	-2%	-9%	
productivity ratio 2035 (reform/baseline)	**1.3**	1.0	1.0	1.2	1.3	1.0	**1.4**

Source: Author's calculations.

Not only does each sector expand productivity, but because employment shifts toward higher-productivity sectors, aggregate productivity also expands faster than any individual sector. This can be seen by decomposing productivity as in McMillan, Rodrik, and Verduzco-Gallo (2014).

$$\Delta Y_t = \sum_{i=n} \theta_0^i \Delta y_t^i + \sum_{i=n} \Delta \theta_t^i y_t^i, \tag{3}$$

where Y_t is overall economy productivity, y_t^i and θ_t^i are respectively productivity and the share of employment of sector i. The Δ operator denotes the change from the start of the projection (period 0) to t. Like with elasticity, productivity can change through two channels. The first term on the right-hand side is the change in productivity resulting from improvements in productivity *within* sectors. The second term represents changes in productivity due to inter-sectoral reallocation of labor, a form of structural change.

As shown in Table 11, some productivity change due to the intra-sector labor shifts occurs in both scenarios. However, the difference in the productivity growth between the two scenarios is mostly due to a higher degree of structural change in the policy change scenario.

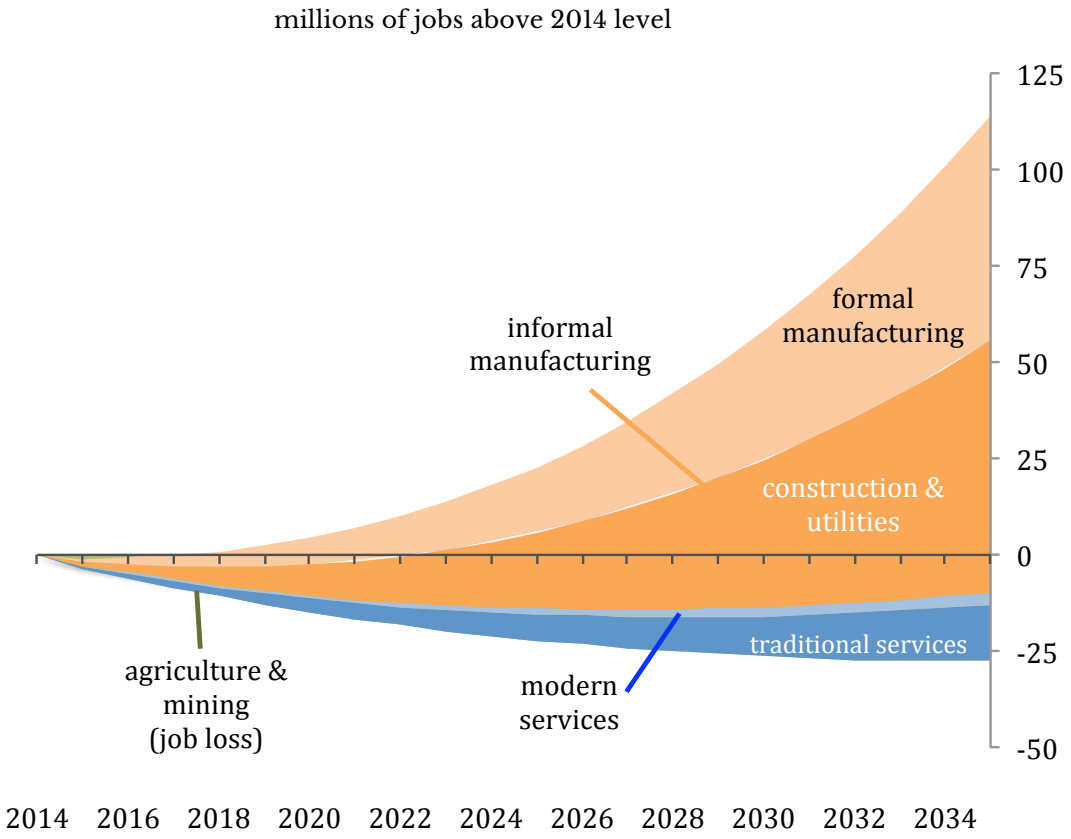
Table 11. Decomposition of Productivity Change 2014-2035: Rs thousands and percent

	baseline		policy change		difference	
	change	share	change	share	change	share
within sector change	270	75%	372	63%	103	44%
inter-sector labor shifts	90	25%	223	37%	133	56%
total	360		595		236	

Source: Author's calculations.

Perhaps most importantly, job growth would be substantially higher in the policy change scenario (Figure 1). Formal manufacturing employment would grow to exceed informal manufacturing (11% of employment versus 7%). The two together, however, only add 58 million new jobs. So in a realistic but ambitious growth scenario the Make in India employment goal of 100 million new manufacturing jobs remains unattainable even after 20 years.

Figure 1. Additional Job Growth with Policy Change, 2014-2035



Source: Author's calculations.

Construction has a very high need for manpower, so employment in that sector would also expand rapidly. Agriculture sheds jobs, but the other sectors of the economy exhibit plenty of capacity to absorb those workers.

In particular, Green (2014) calculates need to create 10 million new jobs each year on top of what is needed to recoup manpower shedding in agriculture. The Indian economy does not currently meet that mark, creating a job gap that pushes people into fallback employment, underemployment, unemployment or out of the labor force. The baseline scenario does not reach a pace of creating 10 million jobs per year until 2030. This creates a backlog of workers (the cumulative historical gap), counting from 2014, that do not find a job.[21] The policy change projection hits a pace of 10 million new jobs per year by 2022, and completely covers the job gap backlog by 2027.

4. Alternative Specifications

The Indian economy is in a constant state of transformation, typical of developing economies with high growth rates. This makes any 20-year extrapolation risky. The data that founded the parameters is not perfect either. Employment is not a well-defined concept, especially in an economy characterized by high rates of informality. There may be short-run phenomenon such as drought years that create misleading patterns.

The projections are simple enough that almost any outcome can be achieved by selectively choosing high or low growth rates and employment elasticities. For this reason this exercise has utilized mid-range parameters from recent estimates compared with historical patterns in India and East Asia. Nonetheless, it remains worthwhile to carry out some alternative specifications to explore how sensitive the projections are. This section will focus only on the formal manufacturing sector — the main sector of interest — to limit the number of permutations explored.

The Make in India goals provide useful targets to structure alternative specifications around. The vision for Make in India includes goals to increase the GDP share of manufacturing (formal and informal together) to 25% by 2022 and to create 100 million additional manufacturing jobs by 2022.[22] Structuring scenarios around

[21] In India the informal sector (including agriculture) employed 86% of workers in 2012 according to NSS data, so most workers already have not found formal-sector jobs.

It is also worth noting that the informal segments of the construction and utilities and service sectors employed 70% of workers in those sectors. A good number of the 82 million extra new jobs created in the policy change scenario in those sectors would likely be in the informal sector. Hence there is some blurring in the projections — as in most discussion of employment in India — between the employed, underemployed and unemployed. Nonetheless, this construct is useful for illustrative purposes.

[22] These goals date back to a similar initiative in 2011 (Department of Industrial Policy & Promotion 2011).

meeting these targets allow a measure of the sensitivity of the projections to both growth and employment elasticity assumptions. Presented below are scenarios for each goal separately, and a third combined scenario.

25% of GDP by 2022

The first alternative scenario asks what growth rate of formal manufacturing would be required for formal and informal manufacturing combined to reach 25% of GDP by 2022, or in 8 years. In the original policy change scenario manufacturing comprises 21% of GDP in 2022 and does not reach 25% of GDP until 2030.

As described in section 2, growth rates in several other sectors may get pulled higher by faster growth in formal manufacturing. This would create headwinds for attaining a share-of-GDP target. For the purposes of simplicity, this scenario ignores such effects and assumes growth rates in the other sectors — including informal manufacturing — remain identical to the policy change scenario.

Making the single change of adjusting the formal manufacturing growth rate to meet the target, the projections indicate the formal manufacturing sector would need to grow 20% per year for overall manufacturing to reach 25% of GDP by 2022 (Table 12). This is about 6 percentage points higher than the growth rate assumed in the policy change scenario and 4 percentage points higher than the highest annual growth rate of formal manufacturing in the last 20 years.

The Korean manufacturing sector achieved a string of years from the late 1960s through the early 1970s with several 8-year spans averaging 20% growth or more. This goal is ambitious for India, but not unprecedented. If that growth rate continued until the end of the projection in 2035 — a less realistic outcome — manufacturing would reach 53% of GDP compared to 29% in the policy change scenario.

Table 12. Comparison of the Alternative Specifications

scenario	formal manufacturing		overall manufacturing, 2022			overall manufacturing, 2035		
	growth rate of output	elasticity	share of GDP	cumulative new jobs, millions	avg. annual productivity growth	share of GDP	cumulative new jobs, millions	avg. annual productivity growth
policy change	14%	0.70	20%	17	4%	29%	76	9%
25% of GDP	20%	0.70	25%	24	12%	53%	170	11%
100 million new jobs	14%	2.16	20%	100	0%	29%	2,901	-7%
combined goals	20%	1.64	25%	100	3%	53%	4,103	-4%

Source: Author's calculations.

As an aside, the average annual productivity growth displayed by overall manufacturing in the first two scenarios in Table 12 is more than double the productivity of either formal or informal manufacturing. This is a perfect example of the *between* effect specified in equation 3, as the higher output growth rate in formal manufacturing shifts the proportions of economic activity from a low-productivity to a high-productivity sector.

100 Million Manufacturing Jobs by 2022

The second scenario asks what parameters could yield 100 million new manufacturing jobs by 2022, compared to 17 million by the same date in the policy change scenario.[23] For illustrative purposes, the second scenario assumes growth remains unchanged from the policy change scenario, so only the elasticity of formal manufacturing is allowed to adjust.

In this case the elasticity would need to be 2.16. By almost tripling the elasticity from 0.70 in the policy change scenario, the projection produces a nearly six-fold rise in the number of new jobs created in the first 8 years. By the end of the 20-year projection, the high elasticity yields a 38-fold increase, the product of compound growth rates of output.

Such a rise in elasticity implies a completely unprecedented jump — by Indian or international standards — in labor intensity in formal manufacturing. As described above, theoretically this could occur through either the *within* or the *between* channels. However, the between channel has only limited range to impact

[23] For the exercises presented here "new jobs" means a rising headcount, net of replacing workers who leave through normal attrition.

elasticities. This would mean the labor intensity within industries would need to bear the burden of adjusting for manufacturing elasticity to quadruple.

A rise in elasticity necessarily impacts average productivity. Applying such large quantities of labor on the same amount of output implies formal manufacturing productivity falling by more than 12% per year across the projection period.

Combined Goals
As a final exercise the two goals can be combined. If manufacturing reached 25% of GDP by 2022, what elasticity would formal manufacturing require to also reach the goal of 100 million new manufacturing jobs? This scenario repeats the assumption that other sectors' growth rates and elasticities remain the same as the original policy change scenario.

In this case, the growth rate of formal manufacturing again reaches 20% per year to attain 25% of GDP for manufacturing. With that growth rate, a lower employment elasticity can achieve the same employment goal. Hence, the necessary elasticity falls to 1.6, still an unprecedented figure. If this growth rate and elasticity extended the full 20 years of the projection, manufacturing would create 4,103 million new jobs, a 54-fold increase over the original policy change scenario. Formal manufacturing productivity would fall 9.5% per year in this case.

5. Conclusion

This study has attempted to apply a rigorous approach to developing a simple 20-year projection of growth and employment in India. A reasonable parameterization of a simple projection demonstrates the potential impact if India can establish a sufficient environment to launch an East Asia-style manufacturing boom. Growth, employment and productivity would all improve. This occurs because the central projection simulates the formal manufacturing sector growing to attain 27% of GDP from the current 11%. Two implications of these results are worth noting.

First, the policy change scenario forecasts that 15% of the work force could be employed in high-productivity industries in the formal manufacturing sectors and modern services. As a comparison point, (Green 2014) estimates that almost half the Indian workforce will have finished high school by 2035, double the share today. This would represent a dramatic improvement over the the current workforce.

Compare this to the profile of the industries most likely to need workers with at least a high school education. Currently, 48% of workers in organized manufacturing have at least a high school education, 88% of modern service workers and 60% of

traditional service workers.[24] Those sectors employ 29% of workers, and other sectors utilize a much lower share of skilled labor.

The potential rise in education levels above current industry need raises the question of where these workers will find work that will take advantage of their superior education. Another way to look at the potential mismatch is via Say's Law that supply creates its own demand. It would suggest that businesses that can effectively utilize a better-educated workforce will grow faster on the back of a growing skilled labor supply. Expectations of much better educational attainment would suggest that the projections presented here may be too pessimistic.

Second, the main conclusions of this study could be established with a relatively casual parameterization, as the basic results could be attained from a range of realistic assumptions. One point of rigorously parameterizing the model is to rigorously rule out what is not realistic. The Make In India goals of manufacturing reaching 25% of GDP and creating 100 million new jobs by 2022, while worthwhile for inspirational purposes, do not appear realistic. The latter does not even appear realistic in a 20-year time frame.

Nonetheless, "big bang" reforms could generate a significant dividend for India under plausible assumptions. This study should provide motivation to the political leadership in state and central governments in India to pursue reforms ambitiously to remove barriers to labor-intensive manufacturing.

[24] Author's calculations using data from Goldar (2014) and National Sample Survey Office (2011).

6. Appendix: Projection Details

Table A1. Results of the Baseline Scenario, 2035

	formal manuf.	informal manuf.	construction & utilities	modern services	traditional services	ag. & mining	**total**
average GDP growth rate 2015-2035	**6%**	4%	6%	10%	6%	2%	**7%**
GDP share 2035	**10%**	3%	8%	42%	31%	6%	**100%**
cumulative new jobs 2035, milions	**12**	6	114	14	40	-1	**185**
employment share 2035	**4%**	8%	25%	4%	23%	35%	**100%**
productivity 2035 Rs thou/worker	**1,615**	188	187	5,577	767	102	**575**
productivity growth 2014-2035	**3%**	3%	0%	6%	4%	2%	**5%**

Table A2. Results of the Policy Change Scenario, 2035

	formal manuf.	informal manuf.	construction & utilities	modern services	traditional services	ag. & mining	**total**
average GDP growth rate 2015-2035	**14%**	4%	7%	11%	7%	1%	**9%**
GDP share 2035	**27%**	2%	7%	35%	26%	3%	**100%**
cumulative new jobs 2035, milions	**70**	6	180	17	55	-29	**299**
employment share 2035	**11%**	7%	30%	4%	22%	27%	**100%**
productivity 2035 Rs thou/worker	**2,098**	191	187	6,840	977	106	**811**
productivity growth 2014-2035	**4%**	3%	0%	7%	5%	2%	**7%**

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