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Abstract

This article analyses relationships between the implementation of state-level industrial policies in India and manufacturing sector economic performance (employment and gross value added), utilising data from the Annual Survey of Industries conducted by the Government of India. I employ panel data fixed-effects regression models to evaluate the associations between the industrial policy and state-industry specific performance over the 2007-08 to 2014-15 period, incorporating potential effects of the state government's political alignment, infrastructure provision and educational expenditure in the state. The results provide evidence of a positive correlation between industrial policy implementation and firm output and employment, by around 12.6 - 14 per cent. However, subsequent introductions of an industrial policy are negatively associated with employment and are uncorrelated with industrial GVA. This analysis has implications for economic policy in light of the Central Government's plans to implement a revised industrial policy at the national scale.

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Introduction

India is a lower middle-income country with an annual per capita income of USD 2,016 and an average annual per capita income growth rate of 7.5 per cent between 1991-92 and 2017-18 (World Bank Databank, 2018). The challenge of productive job creation in India has grasped policy attention in the last few years. With 66 per cent of the population under the age of 35, India's demographic dividend is set to peak by 2020 (Census of India, 2011; Ministry of Finance, 2017). In this light, creating sustainable and productive jobs for the youth assumes importance. While the number of young people entering the workforce, estimated at two million per annum between 2004-05 and 2011-12, is on the rise, literacy levels remain low, with only 22 per cent of women and 30 per cent of men having completed 12 or more years of school education (Gandhi, Parida, Mehrotra and Sinha, 2014; National Family Health Survey, 2015-16). This is further exacerbated by the disproportionately large share of employment in agriculture, at 43 per cent in 2017, despite the sector's low contribution to GDP (16 per cent for agriculture, forestry and fishing) (World Bank Databank, 2017). The industrial sector, particularly manufacturing, can absorb large numbers of India's low and semi-skilled youth, thus offering a solution to this policy conundrum.

In 1991, a number of economic reforms were implemented, which paved the way for de-regulation of industrial controls. An elaborate trade and industrial policy focused on liberalisation of the country's borders, reduction of import tariffs leading to higher foreign direct investment, integration of Indian firms into global supply chains, and expansion of the share of the private sector in Indian manufacturing. Over the last three decades, however, economic growth has been led largely by the services sector, with the share of manufacturing in India's GDP averaging at around 16 per cent between 1990 and 2015 (National Accounts Statistics, 2017 and 2015, MoSPI). In this context, the union government implemented the National Manufacturing Policy in 2011 to boost the share of manufacturing in GDP to 25 per cent and create 100 million jobs by 2022 (Department of Industrial Policy & Promotion (DIPP), 2011). The policy further regarded state governments, in the spirit of competitive federalism, as being instrumental in carrying out reforms to achieve this target.

The Industrial Policy, 1991 and the National Manufacturing Policy, 2011 at the central levels have been supplemented by numerous state-level industrial policies implemented at various points in time. These policies range from targeting specific sectors, such as textiles or the chemicals industry to reforming all sectors by providing adequate infrastructure and tax incentives to spur growth. While the importance of an industrial policy and its effectiveness in its potential for job creation and formalisation of enterprises has been widely debated, there is a need for empirical assessment of the correlations between implementation of these policies and resulting output and employment levels at the Indian state-level, in the academic and policy literature. This study attempts to bridge this gap by examining associations between state industrial policies, implemented at different points in time between 2007-08 and 2014-15, and employment and gross value added at the state-industry level in India's organised manufacturing sector, using the published statistics of the Annual Survey of Industries (ASI) database.

Background on India's economic reforms

In 1991, India experienced a balance of payments (BoP) crisis, precipitated by a number of factors including high fiscal deficit, rising import bill due to an increase in oil prices in the Gulf region, declining exports and political instability, which led to an outflow of private investment. In response, a series of economic reforms on various fronts were undertaken. The

first of these was devaluation of the Indian currency by 18 per cent and an exchange rate liberalisation scheme to make the rupee partially convertible (Basu, 1993). Next, the average import duty rates (or tariff barriers) were lowered from 72.5 per cent in 1991-92 to 29 per cent in 2002-03 (Ahluwalia, 2002), as part of a liberalised trade policy. The third important reform was industrial policy, which reduced the sectors of economic activity reserved for the public sector from 18 to 3 – the remaining ones largely comprising defence and industries of strategic importance (Joshi and Little, 1996; Ahluwalia, 2002). Additionally, the consumer goods industries were largely relegated to private enterprise.

Large inefficiencies recorded by public sector enterprises as opposed to private ones, made a strong case for privatisation in industry. For instance, in the manufacturing sector, the public sector's returns on investment averaged 3-5 per cent compared to 17-23 per cent for the private sector, over the 1976-77 to 1986-87 period (Joshi *et al.* 1996). A number of central public-sector enterprises (CPSEs) recorded negative net worth, being termed 'sick' units. An exit policy was designed for the closure of these 'non-performing' and 'sick' industrial units (Joshi *et al.* 1996). Rather than privatisation, a disinvestment policy was adopted, initially with 10 per cent equity in 30 state-owned enterprises being divested by 1992 (Basu, 1993). In tandem with disinvestment of public enterprises, the industrial policy raised the equity limit to 51 per cent for foreign companies in a large number of sectors (and 100 per cent foreign ownership for some industries), thus spurring the inflow of foreign direct investment in the country (National Council of Applied Economic Research (NCAER), 2001).

In order to facilitate industrialisation, particularly the setting up of new manufacturing plants, the industrial licensing regime which mandated a license requirement for firms to set up plants, expand production, add new verticals to production or change location, established through the Industries (Development and Regulation) Act, 1951, was abolished for all but a handful of sectors (NCAER, 2001; Gupta, Hasan and Kumar, 2009). In addition to de-licensing, the Monopolies and Restrictive Trade Practices (MRTP) Act, 1970, which earlier hindered the expansion of large firms with an aim to prevent monopolisation of industry, was scrapped (Ahluwalia, 2002). An area in greater need of policy reform was small scale industries. For most of the latter part of the twentieth century, the small-scale sector was protected from both domestic and foreign competition by large firms, through a number of policies such as reservation of items to be produced, excise duty exemptions and rebates. This, however, prevented small firms from expanding and the manufactured products were found to be of lower quality than corresponding ones in larger and global firms (NCAER, 2001).

NMP 2011

The National Manufacturing Policy (NMP), 2011, refined the Industrial Policy of 1991, with the primary objectives of output growth and employment creation in the manufacturing sector as a development model for India. Under this larger umbrella of output and employment generation, a number of smaller objectives were identified as part of the policy. These entailed creation of skill sets for workers to increase their employability prospects, particularly for rural-urban migrants to achieve inclusive growth; greater value addition and technological depth or penetration in the manufacturing sector, both domestically and globally to achieve competitiveness of industrial exports. Lastly, the policy laid emphasis on the sustainability of growth, in order to make industrial expansion more environment-friendly by increasing energy efficiency and optimising the use of natural resources, along with plans for restoration of degraded eco-systems (DIPP, 2011).

The policy outlined a number of channels through which these goals would be met. First, to take advantage of agglomeration effects, the government prioritised the development of industrial clusters through 'National Investment and Manufacturing Zones' (NIMZs). These were to reduce logistics and transportation costs as well as create industrial hubs with high-quality infrastructure and ready access to a skilled workforce residing in nearby towns and cities (DIPP, 2011). An illustrative example is offered by the state of Gujarat, which is a hub of chemical production in India, accounting for 62% of India's petrochemical production, 35% of other chemicals production and 18% of India's chemical exports (Government of Gujarat, 2017). The Gujarat government has specifically designated a region spread across 450 sq. kms for the production of petroleum, chemicals and petrochemicals (PCPIR). The PCPIR region facilitates promotion of the chemical industry, through storage facility at sea ports, well established infrastructure in terms of road, rail and air connectivity, flexible labour markets that help lower costs for entrepreneurs and availability of natural resources by creating petrol and chemical estates in each district (Government of Gujarat, 2017).

The creation of skill sets, in order to foster employment growth, was to be facilitated through the expansion of Industrial Training Institutes (ITIs), with the aim of providing skills training to workers in the industrial sector. Along with ITIs, the development of Polytechnic Institutes, which were to offer specialised training in a few sectors such as automobiles and electronics were also put in place to spur innovation and high-tech manufacturing. A 'Technology Acquisition and Development Fund' was also set up to encourage international technology transfer and innovation in the country. A number of measures were further taken to encourage 'Green Manufacturing', through renewable energy systems, design of green buildings, water conservation measures and conduct of environmental audits, as part of the NMP, 2011 (DIPP, 2011).

Box 1. The industrial expansion of Tamil Nadu

The automobile industry in Tamil Nadu is an epitome of effective government policy as a catalyst to industrial growth. The manufacture of motor vehicles, trailers and semi-trailers, witnessed a 170 per cent increase in GVA and a 123 per cent rise in employment over 2007-08 to 2014-15. Growth in this sector also led to a shift in the composition of industries in the state. The share of this sector in the state's manufacturing gross value added increased from 14 per cent to 23 per cent between 2007-08 and 2014-15. Correspondingly, the sector's share of total employment in the state grew from 7 per cent to 12 per cent over the same period (Annual Survey of Industries - Published Reports, 2007-08 to 2014-15).

This was facilitated by the development of various centres of excellence, such as the Automotive Industrial Development Centre, with the aim of providing investment facilitation services to companies, supply chain development and providing skills development and training. Another key strategy was the development of new auto cluster districts and strengthening of existing ones in places like Tiruchirappalli, Tirunelveli and Coimbatore. The development of auto cities with logistics hubs, design and technology parks and shared infrastructure facilities also enhanced growth in this sector through the effect of agglomeration economies. Further, establishment of Automotive Suppliers Parks (ASP) helped improve the logistics competitiveness of the units and further provided shared business services and optimised logistics services (Government of Tamil Nadu, 2019).

The state further developed infrastructure capacity in the form of expansion of roads, railways, ports and power availability, and invested in Research & Development, particularly the National Automotive Testing and R&D Infrastructure Project (NATRiP) and the Global Automotive Research Centre (GARC), to create high-quality testing, validation and R&D infrastructure in the country. The government further created a mechanism for waste management through the identification of land for hazardous waste disposal at subsidised rates and provision for a solid waste disposal yard, waste water treatment plant and so on. Lastly, the establishment of an 'Auto Industry Training Institute' on public-private partnership basis and the formation of 'Industry-Institution Interaction Cells' in Polytechnic Colleges have been efforts on the state's part to improve the availability of skilled manpower in the state (Government of Tamil Nadu, 2019).

The Government of India is in the process of revising the Industrial Policy of 1991 and strives to address a number of key bottlenecks which have hitherto stymied industrial expansion. For instance, existing infrastructure remains deficient and is utilised sub-optimally, resulting in high logistics costs and adversely impacting the global competitiveness of Indian industrial exports. In addition, rigid labour markets restrict firm productivity, with rising informalisation of the formal sector, suggesting a counter-productive effect of existing worker protection laws. Another area for reform is the simplification of tax procedures and other regulatory clearances for industrial activity. A single-window clearance system for obtaining industrial licenses has been established in the last few years. Lack of technology adoption and insufficient public investments in the Research & Development sector continue to pose challenges for acquisition of advanced technology for production (DIPP, 2017).

The advent of advanced technologies, enabled through artificial intelligence and machine learning have galvanised the fourth industrial revolution. With both routine and non-routine tasks being automated, there is an imminent threat to the displacement of jobs, particularly middle-skill ones (The World Bank Group, 2016). The manufacturing sector and more specifically, capital-intensive industries such as automotive, electricals and electronic products, have a higher propensity to be automated. This has brought into question the prospects for large-scale job creation by the manufacturing sector in highly productive sectors which are evidently more capital-intensive in nature.

Despite the rising use of capital vis-à-vis labour in production, data for India from the International Federation of Robotics (IFR) show that the utilisation of robots has been concentrated in a few industries, namely, automotive, metal products, rubber, plastic & chemical products, and electrical & electronics products over the 2011-16 period (IFR, 2017). Further, India severely lags behind several advanced and emerging economies in the adoption of industrial robots, employing merely 4.8 industrial robots per 10,000 workers, against a world average of 99 robots (IFR, 2019). The slow adoption of these technologies offers a time frame within which to augment the share of Indian industry in world output, prior to major restructuring of global value chains, in order for India to be a major stakeholder in determining global industrial output.

Finally, the industrial policy lays emphasis on green industrial growth by enhancing the sustainability of production, through increased energy efficiency and the use of cleaner production technologies.

Literature Survey

The recent academic and policy literature in the Indian context has been concentrated on analysing the enabling factors that drive growth at the state-level. Empirical analyses reveal that employment growth is higher in states with more flexible labour market regulations, adequate power infrastructure, well-regulated product markets and an overall attractive investment climate (Kapoor, 2015). Past research has also focused on the impact of 'de-licensing' as part of the economic reforms of 1991, in consequence, obviating the need for a firm to obtain a license from the state government prior to setting up an industrial plant (Gupta *et al.* 2009). The evidence shows that more labour-intensive industries have experienced smaller payoffs from the de-licensing reform compared to industries located in states with better regulated product markets, which witnessed higher economic gains.

In a similar light, Besley and Burgess (2004) examined the role of labour market regulation, particularly, state-level amendments to the Industrial Disputes Act, in influencing output, employment, productivity and investment in the formal and informal manufacturing sectors in India, over the 1958-92 period. They found that amendments designed to protect workers, at the cost of reduced flexibility in hiring and retrenchment decisions for firms, led to lower output and employment levels in the formal sector. Instead, these regulations caused an expansion of the informal sector, as reflected in an increase in the output of the unregistered manufacturing sector. Besley *et al.* (2004) and Gupta *et al.* (2009) employed a panel data approach, introducing a dummy variable to capture the effect of the relevant policy parameters on the economic variables of interest. Analogously, this paper also employs a panel regression, dummy variable approach to understand the association between state industrial policies and manufacturing sector employment and output levels.

Using the difference-in-differences method, Melecky, Sharma and Subhash (2018) estimate the impact of improvements in road infrastructure on economic welfare, environmental quality and social inclusion in the farm and non-farm sectors at the district level in India and China over the 1994-2011 period. Analogously, Edmonds, Pavcnik and Topalova (2010) examine the impact of industry-level tariff reform in India in 1991, on children's school attendance, through various channels, but most notably, that of higher poverty among workers employed in the formerly protected industries. While international trade raises overall economic output and welfare by exploiting the comparative advantage of specific sectors within an economy, it inevitably benefits certain sectors, while making others worse off.

In case of the Indian 1991 reforms, the reduction of import tariffs, with the aim of fostering competition among firms, disproportionately benefited industries with smaller declines in tariff rates, compared to industries with previously high levels of protection from global competition (Edmonds *et al.* 2010). Exploiting district-level heterogeneity in the tariff reforms, the authors find that the relatively higher poverty levels of families engaged in industries with higher absolute declines in tariff rates, led to lower child school attendance due to unaffordable costs of schooling, by 2 percentage points, compared to households employed in industries with smaller absolute tariff declines due to the reforms. The analysis highlights the importance of spill-over effects across various dimensions of growth and development, in particular, the link between trade policy and human capital accumulation.

The case for industrial policy

The Lewis model of development advocates for a transition from the traditional or primary sector to the industrial or modern sector, with the latter serving as an engine of growth. In this context, industrial policies can play an important role in facilitating this transition and fostering innovation in the economy. The objectives of such policies can be manifold. First, active governmental intervention can help create entrepreneurs in a handful of high-productivity sectors, thus creating positive spill-overs for the entire economy. Second, "horizontal" policies can provide additional support to these sectors through provision of infrastructure, access to finance or subsidised credit, skills' training to workers and creation of specialised export promotion zones. Further, state intervention may be welfare-improving if there exist coordination failures among various sectors or market failures that prevent an optimal level of production in the economy. Lastly, an industrial policy and related trade measures may be implemented to protect nascent industries from foreign competition with the aim to develop such industries over a period of time and capture dynamic efficiency gains from future trade.

The theoretical justification for industrial policies is based largely on the existence of Marshallian externalities and latent comparative advantage in the industrial sector and a need for protection of infant industries in the economy. Harrison and Rodriguez-Clare (2010) present an economic model to highlight the role of comparative advantage and industry externalities in the process of industrialisation. Consider an economy with two sectors, agriculture and industry, with productivity parameters λ_1 and λ_2. The industrial sector exhibits Marshallian externalities or benefits from clustering such that sectoral productivity is enhanced to $\theta\lambda_2$, with $\theta > 1$. Further, assume that the relative price of the agricultural to the industrial good is determined internationally and the economy under consideration does not influence it. Then, this economy would have a comparative advantage in the production of the industrial good if the productivity of the industrial sector relative to agriculture exceeds the relative price of its good, and vice-versa.

$$\frac{\theta\lambda_2}{\lambda_1} > \frac{p_2}{p_1}$$

In the presence of both clustering effects and comparative advantage of the industrial sector, an industrial policy could be introduced to promote specialisation of the economy in the production of good 2, raising wages in the process. The question of the timing of this switch from specialisation in sector 1 to sector 2 is pertinent, due to a gap in sector productivity between the economy in question and the global frontier. Insofar as there exists a significant gap, temporary trade protection through an import substitution strategy of the industrial sector for a specified period of time can help attenuate this gap through a "catch-up" process. In this scenario, the temporary costs of protection from international competition, i.e. the loss in consumer welfare due to higher prices of goods will be outweighed by the benefits from trade in the future, assuming the existence of a comparative advantage in production of the industrial good.

A second scenario is one in which the industrial sector does not exhibit a comparative advantage relative to the world economy, but creates externalities and positive spill-overs for other sectors within the economy. These "inter-industry" externalities extend beyond Marshallian externalities or the typical benefits of clustering as they are not restricted to the industrial sector. In this scenario, a switch to production of good 2 could be welfare-enhancing for the economy and an industrial policy could facilitate this transition. The exposition by Greenwald and Stiglitz (2006) corroborates these results. Their economic model, while analogous to that described above, differs in that the agricultural rather than the industrial sector observes a comparative advantage in production in the developing economy. Assuming that the industrial sector is the key to innovation and confers positive spill-overs to the agricultural sector within the economy, the analysis shows that protection of infant industries and the subsequent productivity catch-up would confer benefits to the economy in later trade. Moreover, these benefits would outweigh the costs of protection.

Instruments of trade policy, particularly in early stages of development, can be categorised into import substitution (tariffs and quotas on imports) and export promotion strategies (subsidies on electricity and credit, creation of special economic zones and so on). Given that free trade creates winners and losers in the economy, despite conferring a net increase in welfare, an import substitution policy might be preferable to free trade in order to prevent these losses arising from immediate liberalisation and the threat from global competition. Which countries have successfully industrialised on account of a strong industrial policy? The evidence points largely to South Korea and Taiwan, which industrialised, largely in the 1960s and 1950s respectively, through export promotion. However, these economies were heavily influenced by Japanese colonialism in the early 20th century, which promoted industrial expansion. As early as 1940, the share of total GDP accounted for by industry was 28 per cent in Korea and 24 per cent in Taiwan, although industrialisation was more rapid in the former economy (Booth and Deng, 2017). Japanese policy, in the form of extensive financing in sectors such as wood products, ceramics, chemicals and machinery, was a significant contributor to this process.

Building on the success of industrialisation in the 1930s, South Korea initiated an industrial policy in 1961, targeting and promoting a handful of sectors which exhibited a comparative advantage in world markets. The government allowed free imports of raw materials for these industries and offered tax reductions, export subsidies and lower interest rates on loans (Westphal, 1990). To create incentives for entrepreneurs and encourage the inflow of technology, temporary monopolisation of the market for those select sectors was permitted.

These subsidies, however, were time bound, with firms facing penalties in cases of poor export performance despite availing these subsidies. Lastly, there was immense focus on upgrading product quality and achieving international competitiveness (Westphal, 1990). By promoting a few highly productive sectors, Marshallian externalities could be captured, with net returns to the entire economy.

While in theory import substitution can lead to dynamic efficiency gains over time, the empirical evidence highlights the difficulty in implementing an efficient protectionist policy and hence the need for complementary or alternative policies. Weiss (2013) shows that industrial policy in Korea and Taiwan in fact involved a mix of measures such as provision of direct and subsidised credit, favouring select sectors to create so-called "frontier" firms, along with import protection. Subsequently, the government promoted exports in advanced manufacturing from the 1960s onwards. Further, the Chinese experience provides the counterbalance argument to import substitution. Through exposure to foreign competition, creation of special economic zones, transfer of advanced technology to China and integration into the global economy through entry into the WTO, China was able to compete in advanced manufacturing, particularly in the electronics industry. Empirical evidence from China on firm-level productivity growth points to a number of policy reforms as the sources of an average total factor productivity (TFP) growth rate of 3 per cent for gross output and 8 per cent for value added in Chinese manufacturing plants over the 1998-2007 period (Brandt, Biesebroeck and Zhang, 2012). Some of these reforms included market liberalisation, net entry of new firms and adoption of technology for the productivity enhancement of new firms as well as upgrading of existing firms. Importantly, an effective entry and exit policy for firms, to promote the efficient distribution of resources at the industry-level, was a major contributor to TFP growth. The advanced economies of today had similar experiences, with countries such as France, Ireland and Finland embarking on technology policies to develop the capacity to compete in world markets.

On the other hand, a number of developing economies have suffered through protectionism, implemented in political and institutional contexts that lacked the capacity to raise sectoral productivity to the global frontier. Examples include India, whose extensive bureaucracy and license controls raised the costs of production; Sub-Saharan African countries such as Ghana and Zambia, as well as Southeast Asian economies like Indonesia, Malaysia and the Philippines, whose policies were mired in corruption and were inefficiently implemented.

Studies on the political economy of government policies brings another perspective to the debate on industrial policies. According to Robinson (2009), the success or failure of industrial policies hinges critically on the political environment in which they are implemented. The incentives faced by policymakers relate to the political equilibrium in society. In particular, if a society exhibits a high level of initial inequality, then an industrial policy may be implemented to favour certain industries with elite entrepreneurs or with the goal of preserving the existing distribution of wealth, resulting in suboptimal policies. Robinson and Torvik (2005) show through a theoretical model, that socially inefficient projects may be undertaken by the incumbent political party in order to increase the chances of re-election, particularly if they appeal to their community of voters. In such a scenario, the net gains derived from a public project may differ considerably for society vis-à-vis for the politician. They further show that the probability of socially inefficient projects being implemented is higher if the economic rents that accrue to the political party from being in office are larger. This is because these projects are used as leverage points by politicians to persuade voters, through a strategic advantage used by the incumbent party. Conversely, socially efficient or profit-making projects

would almost always be implemented by both the incumbent and opposition parties and hence cannot be used as points of bargain in elections.

The industrial policies of Ghana and Zambia exemplify this theory (Robinson, 2009). In Zambia, the Industrial Development Corporation (INDECO) made investments in public projects that were largely political in nature, favouring the political elite and with the lack of competitive tendering. Consequently, investments were not allocated to the most productive businesses. Further, the lack of cost-benefit analyses of projects prior to investment revealed the inefficiency of the industrial policy. Analogously, in Ghana, several inefficient investments were undertaken which raised the transport and logistics costs of production, for instance, in the meat and leather industries (Robinson, 2009).

While a strong case for industrial policy exists on theoretical grounds, the above country-level evidence and studies on the political economy of such policies show that oftentimes these policies are poorly implemented and are prone to political capture, with investments resulting in the creation of "white elephants" or inefficient public projects. This article contributes to the empirical evidence on the effectiveness of industrial policies in developing countries, drawing on the Indian experience.

Data and Descriptive Statistics

Data are drawn from the Annual Survey of Industries (published reports) for state-industry specific values of total persons engaged (employment) and gross value added[1] over the 2007-08 to 2014-15 period. Data on per capita availability of power in the state, as well as educational expenditure are taken from the Reserve Bank of India (RBI)'s Handbook of Statistics on Indian States, 2015-16 (RBI, 2016). Political Spectrum data are drawn from World Statesmen, which provides information on the incumbent political party in each state and year, as well as the ideology of the party using standard terminology such as "socialist", "centrist", "liberal" and so on. These terms are then used to segregate parties into left-wing, centrist or right-wing. Lastly, the industrial policy data are taken from the individual websites of the state governments or of their respective industrial corporations. The year of introduction of each industrial policy is recorded, distinguishing new policies from amendments to existing policies. These new policies are then coded using the method described in the next section.

Table 1. Summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Total Persons Engaged	2716	52600.7	355238.5	0	15767376
Real GVA	2716	2125.7	10711.6	0	443352.2
Per Capita Power Availability	2716	39635.0	30409.9	4412	133078
Expenditure on Education	2716	15.97	2.878	9	24.70
Political Spectrum		*Per Cent*			
1 (Left-wing)	143	5.5			
2 (Centrist)	1491	57.5			
3 (Right-wing)	961	37.0			
Industrial Policy		*Per Cent*			
0	894	34.45			
1	1334	51.4			
2	367	14.1			

Table 2. Pair-wise correlation matrix

	Total Persons Engaged	Real GVA	Power	Industrial Policy	Exp. Educ.	Political Spectrum
Total Persons Engaged	1					
Real GVA	0.9645*	1				
Power	0.1098*	0.1610*	1			
Industrial Policy	**0.0186**	**0.0281**	0.1609*	1		
Exp. Educ.	**-0.1355***	**-0.1170***	**0.1398***	**0.1232***	1	
Political Spectrum	-0.0361	-0.0171	-0.0129	-0.0798*	-0.1655	1

* $p<0.05$

Table 2 shows that there is no significant correlation between introduction of industrial policies and employment or output levels in a state. This is important for exogeneity of the policy variable in order to obtain consistent estimates in the regressions.

Estimation Methodology

In order to assess the association between state-level industrial policies and employment and GVA levels in the formal manufacturing sector, I employ panel data fixed-effects regressions, with state-industry specific heterogeneity. Although each of the states exhibits variation in the scope and incentives provided in their policies as well as the sectors targeted, the data on all state policies are pooled together to study their average effect across the states. I make the simplifying assumption that an industrial policy was introduced in order to augment employment and output across industries, although in practice, targeting specific industries may have had negative growth effects on other industries. Nevertheless, the average effect across all industries in the states is expected to be positive.

Econometric evidence on industrial policy has been inconclusive so far as the measurement of policies through tariff or subsidy rates (which respond linearly or uniformly to existing economic outcomes) do not present clear interpretations of the coefficients (Rodrik, 2008). Instead, I adopt a dummy variable approach for the implementation (or lack thereof) of an industrial policy, which encompasses different incentive schemes, bundled together with the objective of yielding net benefits to industry in the state.

In addition, endogeneity of policy is typically an issue as it may be expected that a policy would be introduced in the event of sluggish performance of industry and therefore, may not be truly "exogeneous". However, oftentimes, a policy is introduced for political reasons rather than economic ones, and insofar as the political environment or policy awareness levels in a state are controlled for, it can be reasonably argued that an industrial policy is exogeneous. The quantitative approach followed in this study attempts to sufficiently control for the political environment in the state through the constructed political spectrum variable.

An alternative methodology would be to employ difference-in-differences estimation since the combinations of state-year observations in which no policy was introduced could form the control group and the remaining observations, the treatment group. However, one would like to capture the effect of not only the first introduction of a policy but also its subsequent implementation. This mirrors a scenario in which multiple interventions would need to be evaluated, which poses a problem as there would be numerous treatment and control groups under a standard binary coding of the treatment variable.

The econometric model used to estimate the effects of the policies is:

$$\ln Y_{ist} = \alpha_{is} + \lambda_t + \beta_1 D_{st} + \beta_2 Political\ Spectrum_{st} + \beta_3 Power_{st} + \beta_4 Educ.Exp_{st} + \epsilon_{ist}$$

The above equation relates Y – employment or gross value added (GVA) at the NIC-2 digit industry level (industry *i*), within state (*s*) and in year *t*, to the implementation of an industrial policy in state *s,* year *t* and other covariates. The control variables include power infrastructure (per capita availability of power at the state level), state expenditure on education as a percentage of total expenditure, and political alignment of the incumbent government of the state. Similarly, the equation for gross value added is related to the industrial policy variable and remaining controls. Both equations include a time trend and state-industry fixed effects. In order to account for heteroscedasticity of error terms within states and industries, the standard errors are clustered by state-industry groups.

The industrial policy variable follows a numerical coding, wherein over the 2007-08 to 2014-15 period, a value of '0' is first assigned to all states prior to the introduction of a policy. Further, I make the assumption that the effect of a policy persists for up to five years. Hence, the state is assigned '0' if it did not introduce a policy in the five years preceding year *t*. In the year that a policy is introduced, the state is assigned a value of '1'. Carrying forward the earlier assumption of policy persistence, I continue to assign the state a value of '1' until the introduction of a subsequent policy, when it is assigned a value of '2'. Thus, the policy parameter takes on values in the range of 0-2. This gradual grading helps account for the effect of the introduction of the first policy, captured by the switch from '0' to '1', as well as the effect of a subsequent policy, captured by the coefficient value of '2' in the model estimation.

Another method of coding could be to assign the states a value of '0' for all years except those in which a policy was introduced, in which case they would be coded as '1'. However, the sudden drop from '1' to '0' in the following year would assume the lack of a persistence effect of the policy. Alternatively, one may adopt this coding and include sufficient lags of the policy parameter in the model to assess when the policy effect loses significance. However, these approaches are not followed as including successive lags would induce a high degree of correlation in the model, thus lowering its statistical power.

The political spectrum variable captures the role of political ideology of the incumbent government in a state at a point in time, in influencing employment and output. This is an attempt to control for the policy environment and awareness levels in a state, which would otherwise be dropped from the model, but might influence the introduction of an industrial policy in a state. In this approach, data on the incumbent political party in a state at different points of time over the last decade and its position on the political spectrum are obtained.[2] A broad classification is adopted, with parties being left, centre or right-wing, coded as '1', '2' and '3' respectively. It is traditionally understood that the centrist and right-wing ideologies are more oriented towards capitalism and market reforms, whereas left-wing parties are more oriented towards socialism. Hence, we code this variable in increasing order of "political willingness" towards industrial growth and market-oriented reforms.

Econometric Discussion

Prior to delving into the interpretation and discussion of the results, I present the results of a few robustness tests to assess whether the point estimates obtained are consistent and asymptotically normally distributed.

Asymptotic theory and the Central Limit Theorem (CLT) inform us that if the sample size is sufficiently large $(n \rightarrow \infty)$ and both the dependent and independent variables are identically and independently distributed (*i.i.d.*), then the variables converge asymptotically to a normal distribution. Consequently, the error terms would be normally distributed - a crucial assumption for hypothesis testing. However, despite the sufficiently large sample size of 2,595 observations, the Shapiro Wilk's W test and the kernel density plots reveal that the error terms from the regressions are not normally distributed (results presented in Appendix). Since the Annual Survey of Industries adopts a circular systematic sampling approach, the data collected are expected to be *i.i.d*. However, the normal distribution may not yield the best approximation for the model and the coefficients should be interpreted with this caveat in mind. Deaton (2018) discusses this lack of normality typically observed in standard household and firm surveys, despite robust sampling designs. An alternative approach and direction for future research could be to utilise firm-level data and use non-parametric or semi-parametric models for analysis, which do not assume normally distributed error terms.

Results and Discussion

The results of the panel fixed-effects regression models are now discussed. Table 3 shows the correlation between state industrial policies and employment levels (total persons engaged), with the successive addition of controls such as political spectrum, power availability and educational expenditure at the state level. The fully specified model (Column 4) shows that on average across the states, the introduction of an industrial policy was positively related to employment, in the range of 11.3 - 12.6 per cent. The successive implementation of a policy,

however, relative to no policy, was statistically negatively associated with employment, by around 14.4 - 16 per cent. These effects are statistically significant at the 1% level. A potential explanation is that frequent introductions of a policy may reflect policy and political instability in the state and indicate a poor business environment for investors, thus driving out investment. This can be gauged in a preliminary manner by examining the correlation between introduction of industrial policies and political spectrum of the incumbent government. Beyond the correlation matrix presented in Table 2, this can formally be gauged by performing a multinomial logit regression with fixed effects of the industrial policy on the political spectrum. These results are presented in Table 4.

Table 3. Panel fixed-effects regression results for *ln*(TPE) – *Total Persons Engaged (Employment)*

ln(TPE)	(1)	(2)	(3)	(4)
Year	0.0341***	0.0310***	-0.00449	-0.00538
	(0.00776)	(0.00837)	(0.0120)	(0.0109)
Ind. Policy. (=1)	**0.113*** **	**0.118*** **	**0.124*** **	**0.126*** **
	(0.0350)	(0.0359)	(0.0344)	(0.0334)
Ind. Policy. (=2)	**-0.148*** **	**-0.159*** **	**-0.144*** **	**-0.144*** **
	(0.0506)	(0.0502)	(0.0514)	(0.0514)
Political Spectrum (=2)	-	0.168**	0.170**	0.171**
		(0.0680)	(0.0676)	(0.0670)
Political Spectrum (=3)	-	0.164**	0.164**	0.165**
		(0.0762)	(0.0754)	(0.0749)
ln(Power)	-	-	0.509***	0.509***
			(0.126)	(0.125)
Exp. on Educ.	-	-	-	0.00272
				(0.00643)
Constant	-59.42***	-53.37***	12.84	14.59
	(15.60)	(16.79)	(23.09)	(21.08)
Observations	2,643	2,643	2,643	2,643
Number of panel clusters	337	337	337	337
R-squared	0.052	0.055	0.062	0.062

State-Industry fixed effects included; Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The multinomial logit regression[3] shows that as the political spectrum moves from left to centrist to right, there is a 31 per cent lower probability of a state implementing one industrial policy relative to no policy. However, there is a 79 per cent higher probability of the state implementing two policies rather than no policy. Therefore, there is a higher likelihood of centre or right leaning state governments to implement two policies rather than one or no policy in a given period of time. However, combining this finding with the earlier one that two industrial policies are statistically associated with lower employment levels compared to no policy, implies that while new industrial policies are announced from time to time with the intention of augmenting employment, the successive introductions of these policies potentially leads to lower employment. Lastly, the political ideology of the state plays a significant role in policy implementation, as these policies are typically introduced for political reasons rather than purely economic ones.

Table 4. Multinomial Logit regression with fixed-effects

Industrial Policy	(1)
1 (relative to 0)	
Political Spectrum	-0.687***
	(0.200)
2 (relative to 0)	1.792***
Political Spectrum	(0.529)
Observations	2,458
Wald chi2(2)	44.53
Pseudo R-squared	0.0424

State-Industry fixed effects included; Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The interpretation of the employment regression table is now continued. The political spectrum of the state government indeed plays an important role in not only policy introduction, but also in employment levels. While the relationship is correlational, we observe that state governments with a centrist or right-wing inclination tend to have statistically significant higher employment levels in their manufacturing sectors by around 17 per cent and 16.5 per cent respectively, relative to governments with left-wing ideologies. While this is expected, no significant difference is observed in employment levels between states with centrist vis-à-vis right-wing governments. The lack of detectable differences is important for policy debates revolving around elections of political parties with job creation as an important mandate.

The remaining covariates also play important roles in the regression analysis. A 1 per cent increase in power availability in a state leads to a staggering 51 per cent increase in employment. However, higher educational expenditure does not significantly raise employment, although there is a positive correlation between the two variables.

Table 5. Panel fixed-effects regression results for *ln*(GVA)

ln(GVA)	(1)	(2)	(3)	(4)
Year	0.0673***	0.0644***	0.0299*	0.0285*
	(0.0112)	(0.0117)	(0.0169)	(0.0164)
Ind. Policy. (=1)	**0.125****	**0.135****	**0.140****	**0.142****
	(0.0552)	(0.0571)	(0.0562)	(0.0557)
Ind. Policy. (=2)	**-0.153***	**-0.154***	**-0.141**	**-0.141**
	(0.0890)	(0.0915)	(0.0926)	(0.0926)
Political Spectrum (=2)	-	0.126	0.128	0.129
		(0.108)	(0.108)	(0.107)
Political Spectrum (=3)	-	0.154	0.152	0.154
		(0.122)	(0.122)	(0.121)
ln(Power)	-	-	0.498***	0.497***
			(0.173)	(0.172)
Exp. on Educ.	-	-	-	0.00427
				(0.0105)
Constant	-129.6***	-123.9***	-59.53*	-56.85*
	(22.54)	(23.39)	(32.74)	(31.64)
Observations	2,595	2,595	2,595	2,595
Number of panel clusters	337	337	337	337
R-squared	0.060	0.061	0.064	0.064

State-Industry fixed effects included; Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

We now proceed to analyse the results for real gross value added (Table 5). In the base model with only the industrial policy variable, the results for GVA are found to mirror those for employment. The introduction of an industrial policy is positively and significantly associated with gross value added at the industry level by around 12.5 – 14 per cent, across specifications. However, the subsequent introduction of a policy lowers GVA by an equivalent magnitude, although this effect is not statistically significant. This also further implies that a state with two industrial policies in place over a limited period of time (2007-08 to 2014-15 in this analysis) may not witness significantly higher GVA levels in its industries compared to a state with no industrial policy in place. Secondly, the political spectrum of the state government does not appear to affect the output levels in industries. On the other hand, GVA responds substantially to power availability in the state, with a 1 per cent increase in per capita power being correlated with higher GVA levels by almost 50 per cent. Lastly, higher educational expenditures do not appear to lead to higher output levels in manufacturing industries.

The above analysis reveals that the introduction of industrial policies in states at various points in time had mixed results for both employment and output. While the first introduction of a policy was positively related to both employment and GVA, the second or subsequent policy implementation was negatively associated with both parameters. One explanation could be that more frequent introductions imply policy or political instability in the state. This explanation is further examined by aggregating data for various states (Table 6). The distribution of policies introduced shows that the first industrial policy was implemented uniformly over the 2009-10 to 2014-15 period across different states. However, the introduction of two policies relative to one has been concentrated over the 2013-15 period. This period broadly corresponds to change in government at the centre (as well as expectations of a change in government) and so these

policies at the central and state governments appear much more aligned with political ideology than purely with industrial employment.

Table 6. Summary of the Industrial Policy Variable

Year	Ind. Policy - 0	Ind. Policy - 1	Ind. Policy - 2
2007-08	14	5	0
2008-09	13	6	0
2009-10	9	10	0
2010-11	7	11	1
2011-12	5	11	3
2012-13	3	13	3
2013-14	1	13	5
2014-15	0	10	9
Total	52	79	21

Policy Recommendations

Based on the above analyses and review of the literature, a number of policy prescriptions can be made for the Government of India's forthcoming industrial policy. A two-pronged approach can be adopted, focusing on specific sectors as well as providing horizontal support to all sectors.

First, the policy should promote a handful of highly productive sectors, which either exhibit a comparative advantage or have an ex-ante potential to grow and lead the economy. Identifying these high productivity sectors is an important area for future research. Within these sectors, however, there exist problems of asymmetric information regarding firm productivity. In case of high-productivity firms, offering production subsidies would reduce costs and thus help them expand in the sector, while the low-quality goods and corresponding firms would be driven out of the market. On the other hand, in order to facilitate the expansion of existing firms and raise their productivity levels, "soft" policy support could be provided through creation of supportive infrastructure, transport systems for goods and special economic zones or industrial parks in order to reduce logistics costs for firms, instead of providing firm-specific subsidies which may be inefficient.

This proposition is supported by Hevia, Loayza and Meza-Cuadra (2017), who show that in countries that lack the institutional capacity to obtain information on firms' productivity, the provision of a public good would be more efficient than providing subsidies to potentially low-productivity firms. In addition to infrastructure provision, financial support can be offered in the form of public funds through state industrial development banks to help firms expand production. Next, industrial policies should be designed to specifically promote these sectors through the acquisition of knowledge and technology, in the form of Foreign Direct Investment (FDI). Complementary policy support should be provided via skills training for the workforce to absorb specific technological capabilities beyond the production of intermediate goods in the value chain.

Second, industrial policy should facilitate the expansion of sectors that employ low- and semi-skilled workers to help absorb the existing large and surplus labour in the informal sector. The increasing usage of industrial robots and automation of production processes is expected to have an adverse impact on jobs, especially in countries with a large workforce. Frey and Osborne (2017) observe that even medium-skill jobs are susceptible to automation, whereas low-skill tasks that require creativity and social intelligence are at a relatively low risk of automation. In such a scenario, promotion of tourism and other such low-skill sectors could be a viable option for developing countries. In conclusion, industrial policies should target both the formal and informal sectors in developing economies, with an aim to create "frontier" firms in highly productive sectors through the transfer and acquisition of technology and supportive infrastructure, as well as cater to sector-specific requirements and absorb low-skilled workers into the formal economy.

In addition, the policy must be enacted taking into account the overall global economic context, the level of international economic integration and the present stage of India's development. For example, Nagaraj (2017) finds that while policies implemented to promote industrialisation created special economic zones (SEZs), encouraged commercial sales of land for private investment and liberalised Foreign Direct Investment (FDI), the land market was instead increasingly used for residential and commercial property development rather than industry, and FDI inflow took the form of short-term private equity funds, which could not sustain long-term industrial activity. Hence, these unanticipated effects of an economic policy would need to be accounted for during its design.

Given the challenge of mitigating climate change, embarking on green growth and sustainable development is an important policy objective for India. In this regard, a number of government initiatives, such as the National Action Plan on Climate Change, Jawaharlal Nehru National Solar Mission, the National Mission for Enhanced Energy Efficiency, the National Clean Energy Fund (which is financed by a tax on coal) and the Solar Cities Development Programme (Gopinath, 2016; Rodrik, 2014), aim to raise the share of renewable energy in the total energy mix to 40 per cent by 2030 (Press Information Bureau, 2018). An integrated industrial policy approach could help achieve the dual objectives of economic development and mitigation of climate change.

A rationale has further been discussed for a "green industrial policy". Rodrik (2014) expounds that the gap between the private and social returns to green technology leads to the latter's underutilisation and may require government subsidy to foster its development. Promotion of these "green" sectors could help with technology development and acquisition and hence, build global competitiveness in these industries. Achieving competitiveness and industrial expansion in sectors such as renewable energy can further assist with job creation. In summary, promoting a handful of highly productive sectors with a potential for employment generation (i.e. labour-intensive industries) and lower intensity of pollution, i.e. cleaner production processes relative to other sectors, can promote a sustainable industrialisation process. Identifying these sectors is a ripe avenue for future research.

Conclusion

This paper empirically evaluates the relationships between state-level industrial policies in India and manufacturing sector employment and output (GVA) levels over the 2007-08 to 2014-15 period. The results show a positive and significant correlation between one policy introduction and employment and gross value added levels, in the range of around 12.6 – 14 per cent. However, states with two industrial policy introductions in the time period considered,

witness lower employment and GVA levels relative to states with no industrial policy in place. The cause of this decline is hypothesised to be policy instability, on account of frequent implementations of new policies, which may impact business sentiment and drive out investment from the state. In addition, political instability may also contribute to the overall dampened investment climate, insofar as policy implementations are highly correlated with a change of government or conduct of elections in the same year at the state-level.

The empirical evidence further points to the importance of political alignment of the incumbent state government or its position on the ideological spectrum as a determinant of industrial employment levels. While states with incumbent political parties following a right-wing or centrist ideology experience relatively higher employment levels compared to state governments with left-wing positions, there is no statistically significant difference in gross value added (GVA) across the political spectrum. Further, employment levels in states with a centre-aligned government are 0.6 percentage points higher than in states with a right-wing government in power. These analyses contribute to the existing literature by first explaining the theoretical foundations of industrial policies and second, empirically examining the effects of such policies in the Indian context. This analysis is relevant in light of the Central Government's objective of revising the 1991 Industrial Policy, with implementation at the national-scale expected in the near future.

List of abbreviations

ASI – Annual Survey of Industries

DIPP - Department of Industrial Policy & Promotion

IFR - International Federation of Robotics

ITI - Industrial Training Institutes

NCAER - National Council of Applied Economic Research

NIMZ - National Investment and Manufacturing Zones

NMP - National Manufacturing Policy

PCPIR - Production of Petroleum, Chemicals and Petrochemicals

Declarations

The datasets used and analysed during the current study are available in the public domain from the Ministry of Statistics and Programme Implementation, Government of India and can also be obtained from the author upon request. The author declares no conflict of interest in the study. No funding was provided for this study.

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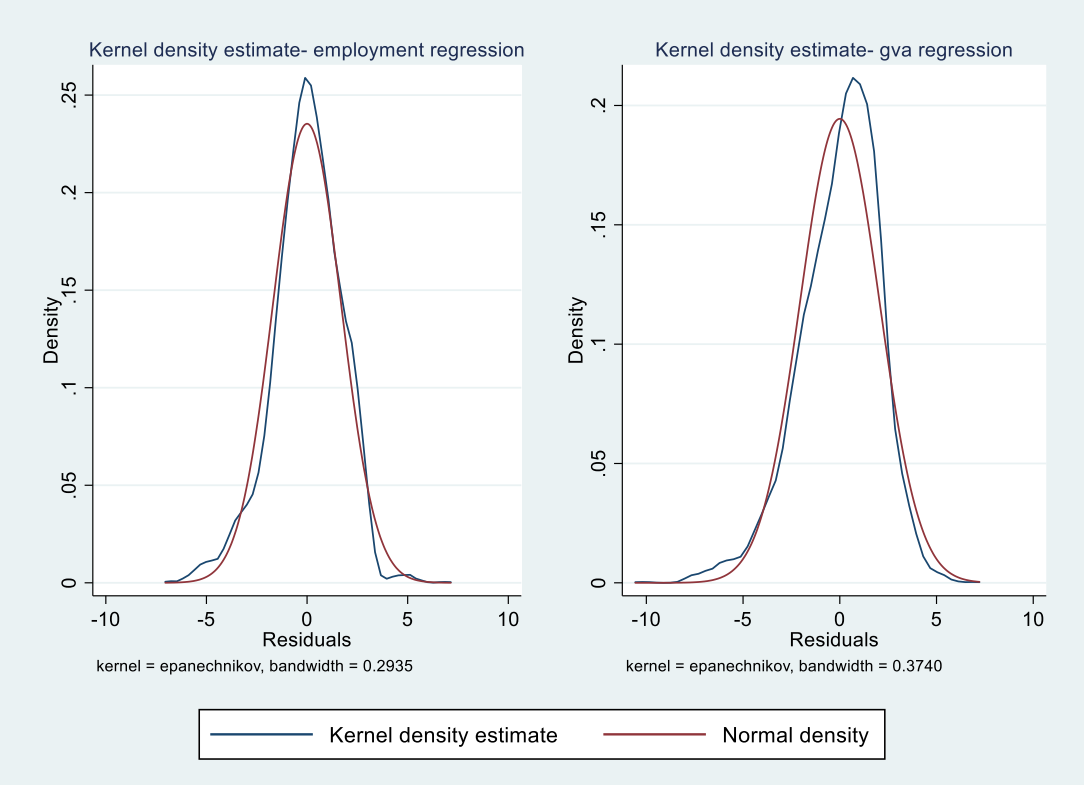
Appendix

Table 7. Shapiro – Wilk W test of normality (*residuals of regressions*)

Variable	Observations	W	V	Z	Prob > Z
Residuals (ln TPE)	2,643	0.9853	22.43	7.99	0.000
Residuals (ln GVA)	2,595	0.9762	35.79	9.19	0.000

Figure 1. Kernel density plots of regression residuals



[1] Real GVA was computed by deflating nominal GVA using the WPI 2011 series, which approximately maps to NIC-2008.

[2] http://www.worldstatesmen.org/India_states.html

[3] This was executed using the "femlogit" command in Stata.