Revisiting the Nehru-Mahalanobis Industrial Policy: India's State-Led Heavy Industry Drive*

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Abstract

Influenced by Soviet industrialization and the post-World War II emphasis on state-led development, India sought to shift production towards capital goods sectors. To what extent did the Nehru-Mahalanobis focus on heavy industries during India's Second Five-Year Plan (1956–61) foster their growth? To answer this question, I compile a unique dataset tracking large-scale industries from 1951–1965, roughly spanning the first three Five-Year Plans. This dataset harmonizes industrial production, prices, and input-output data from pre-digital data books. Previous studies showed positive effects, but my analysis, which adjusts for an industrial classification change using detailed annual data, does not find a statistically significant impact of the policy on the development of targeted heavy industries. I discuss this episode within the context of development theory from the 1950s and 1960s. I find no learning-by-doing effects emanating from this heavy industry push to targeted industries, highlighting the importance of the quality of state intervention. Weak production linkages between targeted and non-targeted sectors restricted spillover opportunities for broader industrial development.

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1 Introduction

> If you want India to industrialize and to go ahead, as we must, as is essential, then you must industrialize, and not potter about with odd factories producing hair oil and the like... Therefore it is the heavy industries that count, nothing else counts, excepting as a balancing factor which is of course important
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> - excerpts from Prime Minister Nehru's speech at the Meeting of the National Development Council on January 20, 1956.

A heavy industrialization policy was instituted as part of the Second Five-Year Plan in India (1956–61). The architects of this policy were the first Indian Prime Minister, Jawaharlal Nehru, and the famous statistician and founder of the Indian Statistical Institute, Prasanta Chandra Mahalanobis. At the time of Indian independence in 1947, the most important industries in terms of value added and value of production were cotton and jute textiles. The industrial policy intended to move the structure of production in the country towards capital-goods industries. The theoretical rationale for heavy industrialization was drawn from the Mahalanobis model (Mahalanobis 1953 and Mahalanobis 1955). This model suggests that a developing country should give priority to the development of the capital goods sector. Even though it would lead to a decline in production of consumption goods in the short run, output in consumption goods sectors would catch up in the long run because production of consumption goods also depends on the level of investment in the economy.

Although there exists substantial scholarship covering several aspects of India's first three Five-Year Plans (1951–56, 1956–61, and 1961–66 respectively), there is no rigorous empirical examination of the performance of the Second Five-Year Plan in enhancing industrial development in the country. The first contribution of this paper is to compile a novel dataset that tracks industries in the organized or large-scale manufacturing sector for a period of 12 years (1951–53 and 1957–65). I build upon the foundational empirical exploration of Indian industrial performance during the first three Five-Year plans (1951–1966) undertaken by Bhagwati and Desai (1970) and in two companion papers by Desai (1969a) and Desai (1969b). I use the compiled dataset to study the impact of the heavy industry drive that was part of the Second Five-Year Plan.

Previous research (Desai 1969b; Bhagwati and Desai 1970; Bhattacharjea 2022) has argued that were positive effects of this industrial policy on industrial development outcomes, but it inadequately addressed the 1959 industrial classification change. My second contribution is to revisit this research by showing that the change in industrial classification presents significant challenges, both in terms of harmonization and differences in sampling design. Using annual data on industries, I devise a method to deal with this issue which allows me to circumvent some of the problems caused by industrial classification change. My analysis challenges the conclusions drawn in previous research — I find that the heavy industry drive did not have a significant impact in improving industrial development outcomes for the targeted heavy industries.

My third contribution is to position this case study of India's early industrialization attempt within the burgeoning development economics literature of the 1950s and 1960s. The ideas of learning-by-doing (Arrow 1962) and inter-sectoral linkages (Hirschman 1958) provide conceptual justification for industrial policy. I explore both these justifications in the Indian case.

My work contributes to the modern revival of academic literature focused on revisiting historical industrial policy episodes. For instance, Pons-Benaiges (2017) explores industrial policy and economic growth in post-World War II

Japan. Juhász (2018) examines the impact of the Napoleonic blockade on the economic development of the French Empire. Lane (2022) delves into South Korea's Heavy Chemical Industry (HCI) drive initiated by President Park in 1973. Bhattacharjee (2022) investigates trade protection policy in inter-war colonial India. Beyond academic circles, the beneficial role that industrial policy played in the East Asian case has been identified by institutions like the IMF who are rethinking their long-held beliefs on the issue (Hasanov 2019). By studying independent India's only experiment with state-led industrialization, my work offers another institutional context to situate the debate on the efficacy of industrial policy and also contributes to existing social science literature that studies state capacity and industrial transformation in various countries in the Global South (Amsden 1992; Evans 1995; Chibber 2003; Kohli 2004).

To investigate the causal connection between the targeting of heavy industries during the Second Five-Year Plan and its impact on promoting their industrial development outcomes, I use a difference-in-differences (DD) research design. The treatment period is the Second Five-Year Plan (1956–61). The pre-treatment period is 1951–1953 and the period 1962–65 is part of the Third-Five Year Plan. My empirical design closely follows Lane (2022)'s exploration of the impact of HCI policy on industrial development under President Park's regime in South Korea. I compare the change in several development outcomes (gross output, gross value added, material input, number of workers, employees, and factories) between targeted industries (treatment group) and non-targeted industries (control group) before and after the treatment period. I also use a dynamic difference-in-differences specification where differences in outcomes for targeted versus non-targeted industries are estimated for each year. Following the plan documents and literature, I define targeted industries as those industries whose development was the major focus of the heavy industry drive (I discuss this definition in Section 4.2). The control group comprises all other industries in my sample.

This analysis involves a panel of industries harmonized across two distinct industrial classifications — the Sample Survey of Manufacturing Industries (SSMI), which was conducted from 1951–1958, and the Annual Survey of Industries (ASI), initiated in 1959. However, the harmonization process relies on some subjective assessments for mapping sectors from one classification to another. Therefore, I also utilize a non-harmonized pooled dataset that combines the SSMI and ASI panels. The analysis of the non-harmonized pooled dataset reveals a significant jump in the point estimates when the industrial classification changed (the year 1959). This suggests that the panel results, which have undergone harmonization, are affected by the challenge of aligning two distinct industrial classifications. To address this, I adopt a first difference regression design, focusing on growth rate differences between targeted and non-targeted industries. The change in industrial classification affects the estimate for the year in which the classification changed (i.e., 1959), so I exclude the growth rate from 1958 to 1959 from the analysis.

I find small and insignificant effects with my harmonized panel specification. The point estimates suggest about 32% growth in output and 37% growth in material input cumulated over 1957–65 for targeted industries as compared to non-targeted industries but the 95% confidence interval includes zero. Adjusting for industrial classification change, the point estimates from the first difference regression are small and statistically insignificant and in several cases, they turn negative. The highest point estimate that can be drawn in favor of the policy from the first difference regression is a 35% cumulative growth in gross value added of targeted industries as compared to non-targeted industries over the period 1957–65. In contrast, Lane (2022) finds large and statistically significant growth in output (about 123%) and variable costs (about 134%) for targeted industries as compared to non-targeted industries in South Korea as a result of the HCI drive.

Literature on successful industrial policy episodes like the East Asian case suggests that dynamic externalities (in particular, unleashing intra-industry learning-by-doing forces) are a key aspect justifying selective government intervention (Amsden 1992; Redding 1999). As another test of the efficacy of this heavy industry drive, I explore the learning-by-doing channel in the Indian case. If active learning-by-doing forces were unleashed by the heavy industry drive in India during the Second Five-Year Plan, then one should expect a significant impact of the experience gained during the drive in boosting the productivity of targeted industries. I measure experience as per-period cumulative labor productivity and the outcome variable is labor productivity. Controlling for static scale effects (plant size) and per-worker intermediates that might capture embodied technological progress, I do not find any evidence that experience gained during the heavy industry drive boosted labor productivity in targeted industries. Hence, the quality of state intervention matters. India and South Korea offer interesting contrasts in this regard, with India exemplifying a lower quality of intervention and South Korea representing a higher quality.

To ensure validity of the research design, I provide tests for the parallel trends assumption and the Stable Unit Treatment Value Assumption (SUTVA). The estimates capture a causal effect only if the parallel trend assumption is satisfied (i.e., in the absence of the heavy industry drive, differences between targeted and non-targeted industries would have evolved similarly). I provide visual and regression evidence to show that this assumption is satisfied. Inter-industry spillovers can violate the SUTVA because industries in the control group can get impacted due to their linkages with industries in the treatment group. To ensure that my results are robust to any violation of SUTVA and that the control group is not being contaminated by linkage effects, I offer two robustness checks. First, I re-estimate the baseline DD specification by keeping only those industries in the control group that have low linkages with industries in the treated group. Low-linkage industries are those industries in the control group whose direct backward or forward linkages are less than the average backward or forward linkage between a targeted industry and any other industry. For the second robustness check, I re-estimate the baseline specification controlling for direct forward and backward linkage spillovers to non-targeted industries. In both robustness checks, I get results qualitatively similar to my baseline DD specification.

India embarked on a heavy industry drive that sought to increase the production of capital goods. Such a heavy industry drive would lead to broad-based industrial development only if there exist relatively strong linkages between the targeted heavy industries and other industries. To gauge potential spillover benefits to non-targeted industries, I analyze pre-heavy industry drive supply-side linkages between targeted and non-targeted industries. Although the idea of promoting domestic industrial linkages may seem less relevant in the age of global production sharing (Durongkaveroj 2019), my analysis deals with mid-20th century when the literature used the concept of linkages to identify 'key' sectors in the economy.[1] Upon computing supply-side linkages from the 1953-54 Indian input-output table, I find that the most active linkages existed between the targeted industries themselves, and in contrast, relatively weak linkages existed between targeted and non-targeted industries. The most prominent connections are *loops* — input flows from an industrial sector to itself. Hence more than inter-sectoral *interdependence*, the industrial sectors represented *independence* before the heavy industry drive was initiated. If supply-side linkages between sectors are not strong to start off with, it is difficult to make a case for a heavy industry drive that targets certain key sectors in the economy because its spillover effects will be minimal.

The remainder of the paper is structured as follows. Section 2 offers a narrative account of development planning in India between the first three five-year plans, and the appraisals of the plans by different scholars. Section 3 gives a description of the dataset on industrial statistics for the organized manufacturing sector that I constructed and discusses challenges due

1. Hazari (1970) offers an example from India.

to change in industrial classification. Section 4 describes the key variables used in the econometric analysis and discusses the empirical specification. Section 5 analyses the efficacy of the heavy industry drive and discusses the identifying assumptions. Section 6 studies the inter-sectoral linkages between targeted and non-targeted industries before the heavy industry drive to understand potential spillover benefits to the non-targeted industries. Section 7 offers some conclusions. The details about construction of the dataset, descriptive statistics, and the results are shown in Appendices A, B and C respectively.

2 History of Development Planning in India and Appraisals of the Plans

The idea that industrialization could be achieved through state-led planning had seen important developments in pre-independent India. Soviet-style planning in the 1920s left a deep impression in the mind of Indian leaders. Nehru had visited Soviet Russia in 1927 to attend the tenth anniversary of the Bolshevik revolution and was very impressed by the idea of planning. The enchantment that Indian leaders had with Soviet-style planning led to the formation of the National Planning Committee in the Indian National Congress session of 1938. The idea of planning gained wider acceptance by other sections of the Indian society when a group of industrialists came together in 1944 to create a national plan (called the Bombay Plan) for postwar economic development in India. Following upon the developments in the sphere of economic planning in the last phase of British colonial rule, five-year plans were instituted in independent India which were to be managed by the Planning Commission established in 1950.

Though planning in India during the first three Five-Year plans (1951–66) drew upon the broad philosophy of balanced growth of sectors (Meier 2004), the plan documents and literature on the period seems to suggest that the first three Five-Year plans had shifting emphases (Rudra 1967). The First Five-Year Plan (1951–56) prioritized agriculture as it “was both stagnant and hard hit by Partition” and it was widely believed that “the tempo of development would depend, in the initial stages, largely on the volume of agricultural production and the surpluses that are available from it” (Hanson 1966, pp. 95). However, as shown in Table 1, investment allocations in the Second Five-Year Plan (1956–61) largely focused on the production of basic investment goods. In the chapter on “Approach to the Second Five-Year Plan”, the plan document lists four principal objectives of the plan and none of those are directly concerned with the agricultural sector (Rudra 1967). The Third Five-Year Plan (1961–66) gives a sense of a growing agreement among policymakers that agriculture had been neglected and needed to be re-emphasized. As Hanson (1966) puts it, “That in the distribution of investable resources much greater attention would have to be given to agriculture was several times emphasized. The actual list of aims gave it, in fact, pride of place. In essence, this was a partial return of priorities characteristic of the First Plan”. Nevertheless, the budgetary allocations for the industrial sector continued to prioritize heavy industries, thereby retaining the influence of the Second Five-Year Plan.

The Second Five-Year Plan marked a watershed moment in Indian planning history, primarily because of its ambitious goal to transform the country’s production structure. Bhagwati and Desai (1970) mention that “the allocations as a proportion of planned expenditures in industry, to the metal, machinery and chemical industries were 70 per cent for the Second Plan and 80 per cent for the Third Plan”. To illustrate the transformative impact that this had, consider some statistics. Before the Second Five-Year Plan, sectors like metal, machinery, and chemicals represented a small fraction of industrial output. However, they received significantly larger allocations during this plan. Using data for gross output from 1953, the allocation received in the Second Five-Year Plan as a share of total gross industrial output for these basic industries (metals, machinery, and chemicals) was 4.66, while it was only about 0.35 for other downstream industries.

Bhagwati and Desai (1970), and two companion papers (Desai 1969a and Desai 1969b) conducted a comprehensive study on the heavy industry drive, using industrial survey data for 1951, 1957, 1961, and 1963. They classified industries into use-based categories and calculated growth rates of gross output and value added during different sub-periods (1951–61, 1951–63, 1951–57 and 1957–63). Their findings revealed consistently higher growth rates in raw materials and intermediates, and investment goods compared to consumer goods industries across all sub-periods. Notably, there was a substantial increase in the average growth rate of raw materials and intermediates during the period 1957-63. However, their primary critique was that this capital goods production growth was "import-substituting", particularly in investment goods, making it inefficient.[2] Their analysis had several limitations — they used current prices due to a lack of suitable deflators, examined only 4 years because of data comparability issues, and employed a broad use-based classification for the large-scale manufacturing sector. My study addresses these limitations by using granular industry data for 12 years, a cautious approach toward industrial classification changes, and appropriate deflators to deflate output values.

Bhagwati and Desai (1970)'s results align with the common understanding that the 1950s and early 1960s marked a period of industrial dynamism in the Indian economy. This viewpoint is supported by the increased investment and output growth in machinery, metals, and chemicals industries as compared to consumer goods industries, as well as overall large-scale manufacturing growth (Chaudhuri 2002; Chandrasekhar 2015; Bhattacharjea 2022).

2. Modern trade theory has seen a move away from such static conceptions of efficiency and talks about dynamic comparative advantage where selective intervention by the government can be welfare-improving (see Redding 1999).

However, these analyses lack the granular data needed to assess the impact of the heavy industry drive in the Indian Second Five-Year Plan. Also, the thrust on heavy industrialization during the Second Five-Year Plan attracted criticism even while the policy was being enacted. Criticism focused on issues like the wage goods constraint,[3] lack of sectoral balancing and a misplaced optimism on the capacity of the state to deliver on the plans it made (Ghate, Gopalakrishnan, and Grover 2022). Other social scientists who later studied India's early attempt to industrialize have pinned down the lack of ability of the Indian state to discipline its capitalist class as the reason for the failure of a successful industrial take-off (Chibber 2003; Kohli 2004). The absence of detailed empirical research in this domain, coupled with criticisms of the heavy industry drive, justifies a reexamination of this episode.

3 Dataset on Large-Scale Manufacturing Industries and Industrial Classification Issues

In this paper, I construct a dataset covering the organized (large-scale) manufacturing sector for the Indian economy for the period 1951–53 and 1957–65. I combine three kinds of data from archival sources — annual industrial production surveys for the period 1951–53 and 1957–65, input-output data for 1953–54[4] and data on wholesale price statistics that are used to deflate the variables in the industrial production surveys. The main source of data per-

3. Wage-goods refer to food grains, agricultural products, or more generally consumer goods. The idea of the wage goods constraint was that promotion of capital goods industries would not promote employment because it would not provide enough supply of wage-goods (Vakil and Brahmananda 1956). Industrial stagnation in India that started in the mid-sixties inspired the literature on wage-led growth in heterodox macroeconomics (see the introduction to Dutt 1984).

4. Three 36 sector input-output tables for 1951–52, 1953–54 and 1955–56 were prepared by the Inter-Industry Unit in the Planning Division of the Indian Statistical Institute at Calcutta and were found in Rao et al. (1960), United Nations (1961), Chakraverti (1968) respectively. These input-output tables are available upon request.

taining to the organised manufacturing sector in India is the Annual Survey of Industries (ASI) which began in 1959. Prior to ASI, there existed two sources of annual industrial statistics — Sample Survey of Manufacturing Industries (SSMI) and Census of Manufacturing Industries (CMI). I have collected data across two different industrial production surveys — SSMI data for 1951–58 and ASI data for the period 1959–65.

The SSMI covered factories employing 10 or more workers if using electricity and 20 or more if not using electricity for 63 industry groups.[5] It provides information on the value of capital employed, output, inputs, value added, wages paid to employees, and the number of workers. The ASI data classifies factories in the frame into two sectors, namely the census sector and the sample sector. The ASI sample sector covers those factories that employ 10 to 49 workers and run with the aid of electricity and those that employ 20 to 99 workers but run without the aid of electricity. The ASI census sector covers those factories that employ 50 or more workers and run with the aid of electricity and those that employ 100 or more workers but run without the aid of electricity. The ASI provides information on number of factories, number and type of workers, value of capital, inputs, output, and wages paid to workers.

To analyze the industrial production statistics for the organized manufacturing sector as a panel for the period 1951–53 and 1957–65, one can harmonize values across the two different industrial classifications. An alternate way is to not harmonize data across different industrial classifications

5. The SSMI data has a lot of missing observations on several variables for many industries between 1954–56 and hence I have excluded the years 1954-56 from my analysis. Also, the coverage of SSMI on the non-electricity using factories is very scant. Around 80% of the total factories between 1951-58 were electricity-using and between 95% of total output and value added in the organised manufacturing sector during 1951-58 came from electricity-using factories but my coverage of industrial data between 1951–58 would nevertheless exhibit a downward bias because of missing data on non-electricity using factories. This shortcoming, I believe, is one reason why Bhagwati and Desai (1970) used data for only 1951 and 1957 in the period 1951–58. 1951 and 1957 had fairly good coverage of non-electricity using factories along with electricity-using factories.

and analyze industries as a non-harmonized pooled dataset that combines the SSMI and ASI panels. The ASI Sample, ASI Census and SSMI surveys follow different industrial classifications.[6] The following procedure was followed to harmonize the industrial production data — using Table A4, ASI Sample sectors were mapped into ASI Census sectors.[7] With a unique industrial code mapping between an industry in the Sample sector and in the Census sector, the Sample and Census sector values were added for all variables for each industry to get the values for the total Factory Sector.[8] To establish a correspondence between ASI Factory Sector industry coverage and that of SSMI, I refer to Malya et al. (1973) who develop a harmonization scheme to build a long time series on industrial statistics. Since there was significant divergence between industrial classification in ASI and SSMI surveys, only 36 industries could be observed consistently as a panel over the 12 year period (1951–53 and 1957–65) after harmonization of the two data sources. The harmonization process required aggregating existing industries into larger groups to map them across different classifications and that is why the number of industries in the panel shrinks. This correspondence is shown in Table A5 where SSMI sectors have been classified into ASI Factory sectors since ASI is the current classification.[9]

The harmonization process of industries across different classifications (SSMI and ASI) could be error-prone as it has to rely on some subjective judgment on which sectors to map from one industrial classification to another. Malya et al. (1973) also relied on some subjective assessments in creating a harmonization scheme. Responding to Bhagwati and Desai (1970)'s

6. SSMI classification is shown in Table A1, ASI Sample Sector classification is shown in Table A2 and ASI Census sector classification is shown in Table A3.

7. The ASI Sample sector followed Labor Bureau Classification which was not very different from the ASI Census sector classification. ASI Sample Sector reports carried this correspondence in their appendix. Table A4 is constructed using that correspondence scheme.

8. ASI Factory sectors follow the same industrial classification as the ASI Census sectors.

9. Bhagwati and Desai 1970 classified ASI sectors into SSMI sectors in Chapter 5 of their book.

empirical work examining industrial performance in India between 1951 and 1966 where they had tried to map ASI (1959–65) data to SSMI (1951–58) data, Alagh (1971) observed the difficulties that such a harmonization process would entail. According to Alagh (1971), the classification of industries into consumer goods, raw materials and intermediates, and investment goods in Bhagwati and Desai (1970) is problematic, as a single industry might potentially fall into all three categories. Alagh (1971) further noted that the SSMI had voluntary coverage, while the ASI had compulsory coverage, and it was well-known that the coverage of metal products industries was incomplete in the 1950s. With this information at hand, it will be important to treat the results derived using the industry panel that harmonizes the industries across SSMI and ASI classifications with some skepticism and this is where the non-harmonized pooled dataset of industries will be useful for the purpose of analysis.

Since the production surveys record data at current prices annually, they need to be deflated before they can be used for any further analysis. Chandhok (1978) builds a consistent wholesale price series for the period 1947–1977 taking into account revisions in base years. However, the industrial price sectors are available at a different classification than the industrial production survey data available from ASI/SSMI. There are two ways to address this issue — a researcher could either use a common deflator across industries to deflate different values in the industrial production surveys or industry-specific deflators could be used (see Table A6 for an example of a correspondence between industrial output and prices that uses industry-specific deflators).[10] I use the common deflators approach and utilize the wholesale price series for the base year 1961–62 = 100 from Chandhok (1978) to deflate values in the industrial production surveys. The input-output data is available at a much more aggregate level. It has 36 sectors of which only 15 relate to large-scale

10. Pons-Benaiges (2017) uses industry-specific deflators in his study of industrial policy in post-war Japan.

manufactures. To match those 15 sectors with the sectors in the industrial production surveys, another correspondence is constructed (Table A7) using the harmonization scheme developed in Chakraverti (1968) (pp. 109-111).

4 Key Variables and Empirical Specification

For the econometric analysis in this paper, I use the dataset that I have constructed in Section 3 to study the performance of the organized manufacturing sector in India. I utilize both the panel that tracks key industrial statistics for 36 industries for a period of 12 years (1951–53 and 1957–65)[11] giving me a total of 432 industry-year observations and a non-harmonized pooled dataset of industries that combines the SSMI and ASI panels for the same period. The variables whose data series were put together as part of construction of the dataset are listed below.

4.1 Outcome Variables

I use the natural logarithm of several industrial development outcomes as my outcome variables[12]:

- Gross Output: It is the ex-factory value of all finished goods produced together with the value of industrial services rendered by the factory during the reference year. The nominal values of gross output for each industrial sector were deflated by a common "All Commodities" deflator in the wholesale price statistics.

11. Data on 1954–56 were dropped for all variables owing to the large number of missing observations across industries.

12. The data on number of workers and material input are missing for ASI Census Sector in 1959 and are only available for the Sample sector. Hence, the data series for material input and number of workers is available for 11 years (1951–53, 1957–58 and 1960–65). For all other outcome variables, data are available for the 12-year period (1951–53 and 1957–1965).

- Gross Value Added: This is the value arrived at by deducting the value of input from the value of output and is gross of depreciation. The nominal values of gross value added for each industrial sector were deflated by a common "All Commodities" deflator in the wholesale price statistics.

- Number of Workers: The number of workers includes those employed by the factory as well as those employed through contractors. It excludes persons holding positions of supervision and management.

- Number of Employees: It is the total number of workers, and employees other than workers. It includes all persons engaged by the factory in work connected directly or indirectly with the manufacturing process and all administrative, technical and clerical staff as also labor engaged in the production of capital items for factory's own use.

- Number of Factories: It refers to the establishments in which production is carried out.

- Material Input: It is the sum of fuels and raw materials. This is an indirect outcome related to industrial policy. The rationale for including this as an outcome variable is that an active industrial policy will likely spur purchases of inputs and it might be reasonable to study material input as an outcome impacted by the heavy industry drive.

4.2 Treatment Variable and Other Covariates

To identify the industries that were the focus of the heavy industry drive, I rely on several secondary sources: the Second-Five Year Plan document (Planning Commission 1956), the discussion on industrial performance between 1951-66 in Chapter 5 of Bhagwati and Desai (1970), and Menon (2022). Given the emphasis on the development of heavy industries, I classify the following 5 as “targeted” (or alternatively, industries that are kept in the treatment group) from among the total of 36 industries in the panel data : basic industrial chemicals including fertilizers, manufacture of cement (hydraulic), iron and steel basic industries, non-ferrous basic metal industries, and manufacture of metal products and machinery.[13]

Targeted is a dummy variable that takes the value of 1 for those industries that were targeted by the heavy industry drive (industries in the treatment group) and 0 for those industries that were not targeted (industries in the control group). It should be noted that the word ‘targeted’ here is only used in the context of large-scale industries (i.e, industries in the organised manufacturing sector). The cottage and small-scale industries whose production was promoted during the Second-Five Year Plan to satisfy the demand for consumer goods are not part of my constructed dataset. The 36 large-scale industries which are part of the panel are listed in Table A5 under the column ‘Industrial Sector’. The industries that are part of the non-harmonized pooled dataset that combines SSMI and ASI panels are listed under the SSMI classification (Table A1) and the harmonized ASI classification (Table A4). The treatment term is the dummy variable *Targeted* which is interacted with another dummy variable *Post* (or the year fixed effects) that takes a value of 1 after 1956 when the Second Five-Year Plan begins. The treatment period is the period of the Second Five-Year Plan (1956–1961), 1951–1953 is the pre-treatment period and 1962–1965 is part of the Third-Five Year Plan.

13. In the pooled cross-section, as there is no harmonization between SSMI and ASI, the targeted industries are identified from both industrial classifications separately though the underlying industries in the targeted group are the same as in the harmonized panel data. From the SSMI classification that runs until 1958, the targeted industries are : chemicals (including drugs), turpentine and rosin, cement, aluminium, copper and brass, iron and steel, sewing machines, electric lamps, electric fans, general and electrical engineering, enamelware, textile machineries and accessories. From the ASI classification that runs from 1959–1965, the targeted industries are : basic industrial chemicals including fertilizers, manufacture of cement (hydraulic), iron and steel basic industries, non-ferrous basic metal industries, manufacture of metal products except machinery and transport equipment, manufacture of machinery except electrical machinery, and manufacture of electrical machinery, apparatus, appliances and supplies.

To capture the unobserved productivity that could be correlated with the heavy industry drive and to ensure a reasonable comparison between the targeted and non-targeted industries, I include the following pre-treatment period covariates for each industry in my panel regression specifications:[14]

- Wage Bill per Worker: It is the average of real wages paid per worker for 1951–53. I deflate the wage bill by using all commodities as deflators.[15]
- Material Input per Worker: It is the average of real material input costs (fuels + raw materials) per worker for 1951–53. I deflate material input (fuels + raw materials) by using the weighted average of fuels, power, light and lubricants, and industrial raw materials.
- Worker Productivity: It is the average of real gross value added per worker for 1951–53. I deflate gross value added using a common "All Commodities" deflator in the wholesale price statistics.
- Plant Size: It is the average of the ratio of number of workers to number of factories for 1951–53.

4.3 Descriptive Statistics

The summary statistics for targeted and non-targeted industries in the industry panel are shown in Tables B1 and B2 respectively. For the non-harmonized pooled dataset of industries, these statistics are shown in Tables B3 and B4. Targeted industries, which tend to be more upstream in the production chain, on average, have higher gross output, value added, material input, number of factories, workers, and employees than non-targeted industries in both the panel and the non-harmonized pooled data.

14. The data to deflate covariates come from:Chandhok (1978). Controls were only constructed for the industry panel of 36 industries.

15. I also tried food articles as an alternate deflator for wage bill. The qualitative results stay the same.

However, the average performance of the targeted industries hides a lot of inter-industry variation. Figure C1 presents the individual industry plots for all industries (with the 5 targeted industries highlighted in different colors) for two outcome variables : number of factories and workers. One can observe that iron and steel basic industries, and manufacture of metal products and machinery are outliers and there is a substantial difference in the level of logs between these industries compared to the other three targeted industries. Hence, it is not clear whether the targeted industries as a whole were doing considerably better than the non-targeted industries after the Second Five-Year Plan.

4.4 Empirical Specification

To investigate the causal impact of targeting of heavy industries on their development outcomes, I use a difference-in-differences (DD) research design. The DD specification is :

$$\mathrm{Y_{it}} = \alpha_{\mathrm{i}} + \tau_{\mathrm{t}} + \beta \cdot (\mathrm{Targeted_i} \times \mathrm{Post_t}) + \sum_{\mathrm{j} \neq 1953} \Omega_{\mathrm{j}} \cdot (\mathrm{X_i'} \times \mathrm{Year_t^j}) + \epsilon_{\mathrm{it}} \quad (1)$$

Equation 1 is a linear two-way fixed effects estimation where $\mathrm{Y_{it}}$ represents industrial development outcomes listed in Section 4.1, α_{i}'s are industry fixed effects, τ_{t}'s are year fixed effects and $\mathrm{Targeted_i}$ is a dummy variable which assigns a value of 1 to heavy industry sectors targeted by the Indian Second Five-Year Plan (see Section 4.2). The variable of interest in Equation 1 is $\mathrm{Targeted_i} \times \mathrm{Post_t}$ where the binary treatment term $\mathrm{Targeted_i}$ is interacted with another dummy variable Post (=0 before 1956 and =1 after). The coefficient β captures the differential impact of sectoral targeting on industrial development outcomes for targeted versus non-targeted industries before and after the treatment period. The variable t refers to all time periods between

1951–53 and 1957–65. $\mathrm{X_i'} \times \mathrm{Year_t^j}$ represents the vector of covariates (material costs per worker, wages paid to each worker, plant size, and labor productivity) that have been averaged for the period 1951–53 and are interacted with every year excluding the last pre-treatment period (i.e., 1953). Standard errors are clustered at the industry-level, allowing for within-industry correlation.

To gauge the dynamic impacts of the industrial policy a minor variation of Equation 1) is used. The dynamic DD specification is :

$$\mathrm{Y_{it}} = \alpha_\mathrm{i} + \tau_\mathrm{t} + \sum_{\mathrm{j}\neq 1953} \beta_\mathrm{j} \cdot (\mathrm{Targeted_i} \times \mathrm{Year_t^j}) + \sum_{\mathrm{j}\neq 1953} \Omega_\mathrm{j} \cdot (\mathrm{X_i'} \times \mathrm{Year_t^j}) + \epsilon_\mathrm{it} \tag{2}$$

The variable of interest in Equation 2 is $\mathrm{Targeted_i} \times \mathrm{Year_t^j}$ where the binary treatment term $\mathrm{Targeted_i}$ is interacted with year fixed effects. The variable t refers to all time periods between 1951–53 and 1957–65. The coefficient on this variable (β_j) conveys the differential impact of sectoral targeting on industrial development outcomes for targeted versus non-targeted industries for each year with respect to the last pre-treatment period (i.e., 1953). The other terms in Equation 2 are the same as in Equation 1.

To address potential endogeneity concerns, it is important to note that the selection of industries that were to be targeted was not made on the basis of under- or over-performance of some industries compared to others. The Second Five-Year Plan involved centralised decision making and being influenced in their thinking by Soviet planning in the 1920s, the planners strategically decided to steer the country towards production of capital goods. The targeting of heavy industries was a reflection of that vision.

As was discussed in Section 3, the underlying data for this study come from two different industrial classifications. The panel data harmonizes the two different industrial classifications to identify common industries throughout the period of analysis. Given that there was a change in industrial classification in 1959, there is a concern that the effect shown by Equations 1 and 2 when applied to the panel data could be contaminated by this issue. It will be useful to do the analysis in terms of growth rates of outcome variables because then the change from 1958 to 1959 (which might not be interpretable due to industrial classification change) can be dropped.

The first difference specification in Equation 3 is run on the panel. The variable of interest in Equation 3 is $\mathrm{Targeted_i} \times \mathrm{Post_t}$ and the coefficient β captures the differential impact of sectoral targeting on the growth rate of industrial development outcomes for targeted versus non-targeted industries in the panel before and after the treatment period. For sake of comparison, the first difference analysis is also applied to the non-harmonized pooled data of industries (Equation 4). Since this data is not harmonized across different industrial classifications, there is no change observed from 1958 to 1959. The variable of interest in Equation 4 is $\mathrm{Targeted_i} \times \mathrm{Post_t}$ and the coefficient β_2 captures the differential impact of sectoral targeting on the growth rate of industrial development outcomes for targeted versus non-targeted industries in the non-harmonized pooled data before and after the treatment period. Since Equation 4 is not run on a panel, it does not have industry fixed effects.

$$\Delta \mathrm{Y_{it}} = \alpha_\mathrm{i} + \tau_\mathrm{t} + \beta \cdot (\mathrm{Targeted_i} \times \mathrm{Post_t}) + \sum_{\mathrm{j} \neq 1953} \Omega_\mathrm{j} \cdot (\mathrm{X_i'} \times \mathrm{Year_t^j}) + \epsilon_\mathrm{it} \quad (3)$$

$$\Delta \mathrm{Y_{it}} = \tau_\mathrm{t} + \beta_1 \cdot \mathrm{Targeted_i} + \beta_2 \cdot (\mathrm{Targeted_i} \times \mathrm{Post_t}) + \epsilon_\mathrm{it} \quad (4)$$

5 Impact of the Heavy Industry Drive

5.1 Results

Tables 2 and 3 present results obtained from estimating Equation 1 for all the outcome variables using the harmonized panel of industries. These results include industry and year fixed effects but no controls. The point estimates are usually positive (except for number of factories) but small. The point estimates indicate that, between 1957 and 1965, targeted industries experienced an approximately 32% growth in output, and an approximately 37% growth in material input, as compared to non-targeted industries. However, the 95% confidence interval includes zero suggesting an insignificant impact of the policy. To offer some comparison, Lane (2022) in his study of South Korea's HCI drive finds large and statistically significant growth in output (about 123%) and variable costs (about 134%) for heavy chemical industry manufactures (the targeted group) as compared to the non-targeted group cumulated over the period of the heavy industry drive and a couple years following it (1973–86).

Figures 1-3 presents event study plots relative to 1953 obtained from estimating Equation 2 for all the outcome variables utilizing the harmonized panel of industries. These plots depict the differences in industrial development outcomes for targeted industries compared to non-targeted industries for each year for which data is available relative to the last pre-treatment period (i.e., 1953). These results include industry and year fixed effects but no controls. For each year after the policy was enacted in 1956, the policy has a statistically insignificant impact on industrial development outcomes. An important point to observe here is that all the event study plots in Figures 1-3 for which data are available for 1959 show a dip in the point estimate for 1959. 1959 happens to be the year when the industrial classification changed. The results for Equations 1 and 2 that include pre-treatment controls interacted with time utilizing the harmonized panel of industries are shown in the Appendix (Tables C1-C5 and Figures C2-C4). The results after adding controls are qualitatively similar. One can observe that the policy did not have a significant impact on industrial development outcomes and the event study plots in Figures C2-C4 also show a dip in the point estimate for 1959 for those outcome variables for which data is available for 1959.

With some apriori knowledge that the underlying data between two different industrial classifications might be different, I break the harmonization and re-do the analysis using the non-harmonized pooled data of industries from two different industrial classifications (SSMI that runs from 1951–58 and ASI that begins in 1959). The event study plots from this analysis are shown in Figures 4-6. These plots depict the differences in industrial development outcomes for targeted industries compared to non-targeted industries for each year for which data is available. These results include year fixed effects but no controls. There is a jump in the coefficient estimates in Figures 4-6 in the year when the industrial classification had changed (i.e, 1959). It is hard to believe that this is a positive effect of the industrial policy. Most likely, the dip in the point estimate for 1959 in the event study plots in Figures 1-3 and C2-C4 was a result of the harmonization that was done to put together a panel of industries.

Through the first difference regression design (Equations 3 and 4), I address the challenge of finding the impact of the industrial policy taking into account the change in industrial classification. This will help me to obtain point estimates for various outcome variables that are unaffected by variations in industrial classification over the analysis period. Columns (1) of Tables 4 and 5 present results from estimating Equation 4 while Columns (2)-(4) present results from estimating various specifications from the saturated model shown in Equation 3. For almost all outcome variables, the estimated coefficient on the treatment term is small and statistically insignificant and in several cases, the point estimate is negative. The largest positive numerical point estimate in Tables 4 and 5 is that on the difference in log of gross value added in Column (1) of Table 4. This suggests that using the non-harmonized pooled data of industries, we can say that there was about 3.8% per year increase in gross value added which would be equivalent to a 35% cumulative increase in gross value added over 1957-65. It should be noted however, that for gross value added, use of pooled cross-section (Column (1) of Table 4) also has the highest standard error. So, it is not clear that this is the best estimate of the impact of the industrial policy. Columns (2) and (3) of Table 5 suggest that there was a 9.5% per-year reduction in the growth rate of material input after the industrial policy was enacted. Hence, it is hard to make a claim that the industrial policy had any positive and significant impact in enhancing the industrial development of targeted industries.

5.2 Learning-By-Doing

Literature on successful industrial policy episodes like the East Asian case suggests that dynamic externalities (in particular, unleashing intra-industry learning-by-doing forces) are a key aspect justifying selective government intervention (Amsden 1992; Redding 1999; Pons-Benaiges 2017; Lane 2022). The development literature on learning was inspired by Arrow's seminal paper on learning (Arrow 1962). As he noted, "Learning is the product of experience. Learning can only take place through the attempt to solve a problem and therefore only takes place during activity" (Arrow 1962, pp. 155). To the extent that such learning adds to the stock of knowledge, it becomes an input into the production process. Several studies in this literature have considered the role of this stock of knowledge in enhancing productivity of the firm or industry (Bahk and Gort 1993; Pons-Benaiges 2017).

If active learning-by-doing forces were unleashed by the heavy industry drive in India during the Second Five-Year Plan, then one should expect a significant impact of the experience gained during the drive in boosting the productivity of the targeted industries. To test this hypothesis, I estimate the following regression model :

$$\mathrm{Y_{it}} = \alpha_\mathrm{i} + \tau_\mathrm{t} + \theta\,\mathrm{Experience_{it}} + \beta\,\cdot\,(\mathrm{Experience_{it}} \times \mathrm{Targeted_i}) + \gamma\,\mathrm{Size_{it}} + \Omega\,\mathrm{X'_{it}} + \epsilon_\mathrm{it} \tag{5}$$

Equation 5 is estimated only for the period after the Second Five Year Plan started (1957–1965). I run this specification on data covering two different time periods. Since I have the harmonized panel data for 1951–53 and 1957–65, I use that to run this specification for the period 1957-65 (leaving out 1959, the year in which industrial classification changes). I also run this specification for data from the ASI period only (1960–65). The outcome variable $\mathrm{Y_{it}}$ is a productivity measure (labor productivity). $\mathrm{Experience_{it}}$ is the per-period cumulative labor productivity (gross value added per worker).[16] $\mathrm{Targeted_i}$ is a dummy variable that identifies the targeted industries (see Section 4.2). $\mathrm{Size_{it}}$ (ratio of number of workers to number of factories) captures the static scale effects for each industry i. $\mathrm{X'_{it}}$ represents the vector of per-worker intermediates (material input per worker and capital per worker) which controls for technological progress that might be embodied in capital or material input over the period when the heavy industry drive was in operation. I also include time and industry fixed effects (τ_t's and α_i's respectively). Standard errors are clustered at the industry-level, allowing for within-industry correlation. The coefficient θ captures the impact of experience gained on the labor productivity of non-targeted industries while $\theta + \beta$ captures the impact of experience gained on the labor productivity of targeted industries. Hence, β captures the differential impact of experience on labor productivity for targeted versus non-targeted industries.

Tables 6 and 7 report the results for the learning-by-doing specification

16. The literature on learning uses various variables as proxies to capture experience : time elapsed since birth of a firm/industry, cumulative output, cumulative output per worker and logarithmic value of cumulative industry sales. By measuring cumulative output as cumulative output per worker, we avoid the possibility that cumulative output just measures plant scale.

(Equation 5). In Table 6, the coefficient of interest ($\text{Experience}_{\text{it}} \times \text{Targeted}_{\text{i}}$) has a positive and significant impact on labor productivity when I do not control for per-worker intermediates (Column 1 of Table 6) but it is insignificant when per-worker intermediates are controlled for (Column 2 of Table 6). In Table 7, the differential impact is positive and significant even after controlling for per-worker intermediates but the impact of experience on the labor productivity of targeted industries (reported in the bottom panel of Table 7) is still negative though insignificant. The change going from Table 6 to Table 7 is that targeted industries slightly gain from experience in the later years of the heavy industry drive (1960-65) but the non-targeted industries perform even worse. Hence, the differential impact between targeted and non-targeted industries grows and also turns out to be significant in Table 7. There is no evidence to suggest that the government intervention in India aimed at enhancing the production of capital goods unleashed dynamic externalities of the kind that were observed in the East Asian case.

The optimal East Asian-type industrial transformation followed stages in the learning process which were lacking in the sub-optimal Indian case. In both the East Asian and the Indian context, agriculture-based production was followed by the first industrial stage of easy import-substitution. At this stage, opening up of the economy begins and the import of consumer non-durables and some durables is substituted with domestic production of these goods. However, just after this stage, India in the 1950s, unlike some East Asian countries in the mid-1960s, leapfrogged the crucial stage of easy export substitution wherein primary product exports are replaced by simple manufactured exports like consumer non-durables and simple consumer durables. In the 1950s, India prematurely jumped to difficult import-substitution wherein the focus is on the production of intermediate and capital goods that tend to be more capital- and knowledge-intensive. India's shift to difficult import-substitution following easy import-substitution occurred when the country was not already ready to produce the more sophisticated commodities characteristic of that stage of industrialization (Cypher 2021). The sequencing of industrial transformation matters to be able to unleash learning-by-doing forces.

5.3 Identifying Assumptions

5.3.1 Parallel Trends Assumption

In the difference-in-differences research design, the identification of causal effects rests on the parallel trends assumption. The identifying assumption here is that differences in targeted and non-targeted industries would have evolved similarly in the absence of industrial policy. In other words, it is the sectoral targeting and not something else that has created the change in the respective industrial development outcome. Though there is no way to test this assumption directly, I present two pieces of evidence to provide some indirect evidence.

The first piece of evidence is visual inspection. Figures C5-C7 show the time series plots of the average of the outcome variables for targeted and non-targeted industries. We can see that the average of outcome variables moved similarly in both targeted and non-targeted groups in the pre-treatment period from 1951–53 (particularly for gross value added, number of factories, number of workers and number of employees).

A second piece of evidence to test the parallel trends assumption is to look at the individual and joint significance of the estimated coefficients in the dynamic DD (Equation 2) before the policy was enacted in 1956. The estimated coefficients for the years 1951 and 1952 are individually insignificant for most variables (the error bars cross 0 for the years 1951–52 for three variables in Figures 1-3 and for most variables in Figures C2-C4). Tables C3-C5 report the p-values from the test for the joint significance of the estimated coefficients before the pre-treatment period. In most cases, the p-values are insignificant. This suggests that the difference between the performance of the targeted and non-targeted industries was not statistically different from each other before the policy was implemented.

5.3.2 Stable Unit Treatment Value Assumption (SUTVA)

Inter-industry spillovers can violate the SUTVA because industries in the control group (non-targeted industries) can get impacted due to their linkages with industries in the treatment group (targeted industries). If there are spillovers to the non-targeted industries as a result of targeting, then the difference-in-differences point estimate should significantly go down as a result of these spillovers. Hence, lack of an effect of heavy industry targeting could be explained by growth of non-targeted industries induced by growth of targeted industries. To ensure that my results are robust to any violation of SUTVA and that the control group is not being contaminated by spillover effects, I offer two robustness checks.

First, I re-estimate the baseline DD (equation 1) by keeping only those industries in the control group that have low linkages with industries in the treatment group.[17] Low-linkage industries are those industries in the control group whose backward or forward linkages are less than the average backward or forward linkage between a treated industry and any other industry. Tables C6-C7 present this robustness check for low backward-linkage industries in the control group and Tables C8-C9 present this robustness check for low forward-linkage industries in the control group for all six outcome variables. For each outcome variable, a comparison of results in Tables 2-3 or Tables C1-C2 with those in Tables C6-C9 show that the results obtained by restricting control group to low-linkage industries are qualitatively similar to the direct impacts presented in Section 5.1. The similarity is greater when the

17. I only consider direct linkages because those are of first-order importance when the researcher is worried that there could be spillovers to industries in the control group.

control group is restricted to low backward-linkage industries. When the control group is restricted to low forward-linkage industries, the point estimates for several variables in various specifications go down.

For the second robustness check, I re-estimate the baseline DD (equation 1) controlling for forward and backward linkage spillovers from targeted to non-targeted industries to see if the results presented in Section 5.1 stay the same qualitatively.[18] The results of the estimation are shown in Tables C10-C11. The point estimates do go down for most outcome variables in Tables C10-C11 compared to results in Tables 2-3 and Tables C1-C2 but not significantly so.

6 Inter-Sectoral Linkages

With substantial investment in heavy industries, there is the expectation that such a big push will eventually benefit other industries as well. Achieving broad-based industrial development through a heavy industry drive relies on the strength of linkages between the targeted heavy industries and other industries. The economic development literature focuses on production (supply) side and demand side linkages between various sectors of the economy. One of the early models to propose production linkages was that of Lewis (1954) further extended by Ranis and Fei (1961). In the Lewis-Ranis-Fei framework, inter-sectoral growth and employment linkages are established by transfer of surplus labor and foodgrains from agriculture to manufacturing. Another kind of production linkage was proposed by Hirschman (1958). Hirschman, a proponent of the 'unbalanced' growth approach, argued that growth happens first in a leading industry and then spills over to other sectors

18. I add the interaction terms Backward Linkage × Post × non-targeted and Forward Linkage × Post × non-targeted in equations 1 and 2. Non-targeted is a dummy that takes the value of 1 for non-targeted sectors in the panel and the value 0 for targeted sectors. I use Post instead of year fixed effects to avoid increasing the number of parameters to be estimated.

through backward and forward linkages that can be measured from input-output tables. The proponents of the 'balanced' growth school (Rosenstein-Rodan 1943; Nurkse 1953), on the other hand, focused on inter-sectoral consumption linkages that operate through the demand-side wherein expansion of different sectors is complementary.

To understand the potential of spillovers from targeted to non-targeted industrial sectors in the Indian context of the 1950s, I study inter-sectoral linkages among these sectors in my panel data before the heavy industry drive began in 1956. I compute backward and forward linkages from a 36 sector Indian input-output table from 1953-54. Table 8 shows the average linkages between targeted and non-targeted sectors.[19] The non-targeted sector is said to be backward linked if it supplies inputs to a targeted sector and it is said to be forward linked if it receives inputs from a targeted sector. Targeted sector linkages are the linkages that exist between targeted sectors. Targeted sector linkages with other targeted sectors ignores the production linkage that a targeted sector has with itself.

Backward linkages represent the total input that is received by a sector from other sectors for its production requirements. Forward linkages represent the total input that is supplied by a sector to other sectors. In an input-output table, the rows i represent the input-supplying sectors and the columns j represent the input-receiving sectors. Backward Linkage$_\mathrm{i} = \sum_{\mathrm{i}=1}^{\mathrm{n}} \mathrm{a}_{\mathrm{ij}}$, where $\mathbf{A} = \{\mathrm{a}_{\mathrm{ij}}\}$ is the matrix of technical coefficients. Forward Linkage$_\mathrm{i} = \sum_{\mathrm{j}=1}^{\mathrm{n}} \mathrm{a}_{\mathrm{ij}}$, where $\mathbf{A} = \{\mathrm{a}_{\mathrm{ij}}\}$ is the matrix of technical coefficients (Dávila-Fernández and Punzo 2020).

19. Out of 36 sectors in the input-output table, 15 sectors constitute the organised manufacturing sector and they map to the 36 sectors in the industrial panel dataset that I have constructed (see Table A7 for a harmonization between the two). Of these 15 sectors, I refer to the following 5 sectors as "targeted": iron and steel, non-ferrous metal, engineering, chemicals, and cement and the following 10 as "non-targeted": other building materials, food, drink, tobacco etc., cotton textiles, other textiles, jute and other fibres, glass and ceramics, leather and rubber, paper, printing and stationery, electricity, and all other mining.

From Table 8, one can note that most of the active linkages exist among the targeted sectors themselves (row 3 of Table 8). When the linkage existing between the same targeted sector is excluded, the extent of linkages between a targeted sector and other targeted sectors reduces (row 4 of Table 8) but it is still greater than the linkages between targeted and non-targeted sectors (row 1 and 2 of Table 8).[20] This fact is also expressed in Figure 7 which is a network diagram depicting the inter-sectoral interactions between the 15 sectors that constitute the organised manufacturing sector in the 1953-54 input-output table. The nodes in Figure 7 denote the 15 sectors (targeted industries are denoted by green nodes while non-targeted ones are denoted by red nodes) and the size of the nodes is determined by their eigenvalue centrality.[21] The directed edges denoted in blue in Figure 7 connect two nodes and show the input flow from one sector to the other. They are weighted by strength of the connection (i.e, the higher is the input flow from one sector to the other, the darker is the color of the edge). One can observe that Figure 7 has sparse connections between sectors. The most prominent connections are loops - input flows from a sector to itself (representing the diagonal entries in an input-output table). Hence, more than inter-sectoral *interdependence*, the industrial sectors represented *independence* before the heavy industry drive was initiated.

India embarked on a heavy industry drive that sought to increase the production of capital goods. However, the structure of the economy was such

20. The reader might wonder why the average backward linkages (both direct and Leontief) are greater than the average forward linkages in Table 8. Since targeted industries are heavy industries that tend to be more upstream, the forward linkage of non-targeted industries should be greater than their backward linkage. This happens because "All Other Mining" is a non-targeted sector which is relatively upstream to the targeted industries. If I remove "All Other Mining" from the list, then the average forward linkages for non-targeted industries will be greater than the backward linkages.

21. Eigenvalue centrality is a network statistic that measures a node's importance while giving consideration to the importance of its neighbors. A high eigenvector centrality score means that a node is connected to many nodes who themselves have high scores. The weights used to compute eigenvector centrality are the edge weights.

that there were relatively weak linkages between heavy industries and other industries. Even if the industrial policy had been successful in boosting the development of heavy industries, there would be little spillover benefits to non-targeted industries.

7 Conclusion

In this paper, I have demonstrated that the heavy industry drive which was part of the Second Five-Year Plan in India was not successful in enhancing industrial development of the targeted industries. I found no evidence supporting direct effects of the policy on industrial development outcomes. I show that change in industrial classification is a problem that previous research in this area has not adequately dealt with. I devise a method to deal with that issue and my findings about lack of impact of the policy are robust to the use of that method. I find no indication of dynamic externalities, such as learning-by-doing forces, being triggered by this heavy industry drive. Weak intersectoral linkages between the targeted and non-targeted industries prior to the commencement of the heavy industry drive weaken the case for broad-based industrial development.

The process of learning involves several stages. Countries in East Asia like South Korea went through all the stages of that learning process. In the Indian case, some of those stages (like the easy export substitution phase where countries start exporting consumer non-durables and simple consumer durables before moving into the production of metals and machinery) were leapfrogged (Cypher 2021). Even the rationale for this heavy-industry-led unbalanced growth strategy is not clear given the Indian context in the 1950s. There were weak interlinkages between heavy industries and other downstream industries. Well-developed inter-sectoral linkages offer some justification for industrial policies of the kind South Korea implemented during the

HCI drive, but such interlinkages were missing in India before it started its heavy industry drive. Additional critiques within the literature that explores this period of Indian industrialization include the Indian state's inability to discipline the capitalist class (Chibber 2003), neglect of the wage-goods constraint (Vakil and Brahmananda 1956), and the inefficiencies introduced through state intervention (Bhagwati and Desai 1970). This is the first study that revisits India's only state-led heavy industry drive offering a wealth of empirical detail.

The analysis in this paper has some limitations. First, I face several data limitations in conducting this analysis. I have missing data for quite a few industries for three years between my period of analysis (1954–56), and hence I had to drop those years. Second, my study does not propose specific testable mechanisms to explain why the heavy industry drive may not have influenced industrial development outcomes. This opens the door for future research to delve deeper into this area.

With these limitations in mind, this study does raise some interesting concerns for further research. The recent revival of research on industrial policy suggests that state-led intervention in industrial development can be fruitful. However, such a result is not guaranteed and depends on the quality of the state intervention as well as the context and institutional structure of the country. No country can borrow the exact development trajectory of another country. The other aspect that my research throws light upon is the theme of adverse path dependence that can arise due to incorrect choice of policies. The Indian economy moved from agriculture to services being the biggest contributor to GDP, bypassing the industrialization phase. This lack of structural change might be due to the improper sequencing of development goals in the early years of development planning in the country.

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Tables and Figures

Table 1: Investment Allocations by Sector in the Second Five-Year Plan (%)

Sector	Allocation
Industry: Basic Investment goods	34.4
Industry: consumer goods	18.2
Agriculture	17.2
Household Enterprises	3.6
Services	26.6

Source: *The Process of Planning*, Hanson (1966), pp. 126

Table 2: Direct Impacts of Industrial Policy

Dependent Variables:	Gross Output	Gross Value Added	Number of Factories
Model:	(1)	(2)	(3)
Variables			
targeted × Post	0.2748	0.2235	-0.2428
	(0.2019)	(0.2267)	(0.2346)
Observations	432	432	432
R^2	0.96376	0.95121	0.91841
Industry Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Controls	No	No	No

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 3: Direct Impacts of Industrial Policy

Dependent Variables:	Number of Workers	Number of Employees	Material Input
Model:	(1)	(2)	(3)
Variables			
targeted × Post	0.1027	0.1166	0.3132
	(0.1693)	(0.1743)	(0.2315)
Observations	396	432	396
R^2	0.95855	0.95851	0.96068
Industry Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Controls	No	No	No

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 4: First Difference Regression

Coefficient of Interest:	targeted × Post			
Model:	(1)	(2)	(3)	(4)
Outcome Variables				
Change in Gross Output	-0.0792	-0.0699	-0.0699	-0.0083
	(0.0677)	(0.0422)	(0.0422)	(0.0647)
Observations	541	324	324	360
R^2	0.03406	0.05831	0.17810	0.24675
Change in Gross Value Added	0.0379	-0.0044	-0.0044	0.0282
	(0.1075)	(0.0630)	(0.0629)	(0.0859)
Observations	541	324	324	360
R^2	0.01585	0.01676	0.11112	0.17372
Change in Number of Factories	-0.0644	0.0022	0.0022	-0.0024
	(0.0674)	(0.0737)	(0.0736)	(0.0929)
Observations	434	324	324	360
R^2	0.07295	0.06159	0.15777	0.44137
Industry Fixed Effects	No	No	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Controls	No	No	No	Yes
Year 1959	No	No	No	Yes
Targeted Dummy	Yes	Yes	No	No
Data(Pooled Cross-Section (PCS)/Panel(P))	PCS	P	P	P

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 5: First Difference Regression

Coefficient of Interest:	targeted × Post			
Model:	(1)	(2)	(3)	(4)
Outcome Variables				
Change in Number of Workers	-0.0350	-0.0090	-0.0090	-0.0568
	(0.0643)	(0.0478)	(0.0477)	(0.0551)
Observations	391	288	288	288
R^2	0.10153	0.13999	0.30013	0.41704
Change in Number of Employees	-0.0063	0.0012	0.0012	-0.0565
	(0.0586)	(0.0491)	(0.0490)	(0.0655)
Observations	434	324	324	360
R^2	0.09059	0.11777	0.27967	0.33722
Change in Material Input	-0.0328	-0.0947*	-0.0947*	-0.0195
	(0.0629)	(0.0503)	(0.0502)	(0.0648)
Observations	391	288	288	288
R^2	0.04219	0.08199	0.22422	0.30824
Industry Fixed Effects	No	No	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Controls	No	No	No	Yes
Year 1959	No	No	No	Yes
Targeted Dummy	Yes	Yes	No	No
Data(Pooled Cross-Section (PCS)/Panel(P))	PCS	P	P	P

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 6: Learning-By-Doing (1957-65) leaving out 1959

Dependent Variable:	Labor Productivity	
Model:	(1)	(2)
Variables		
Experience	-0.0708***	-0.0875***
	(0.0098)	(0.0212)
Size	0.1152	-2.027
	(4.313)	(2.994)
Experience × targeted	0.0819***	0.0503
	(0.0300)	(0.0319)
Material Input per worker		0.1627*
		(0.0928)
Capital per worker		0.0528***
		(0.0187)
Experience + Experience x Targeted	0.0111	-0.0372
	(0.7091)	(0.1887)
Observations	288	288
R^2	0.94409	0.96074
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table 7: Learning-By-Doing (1960-65)

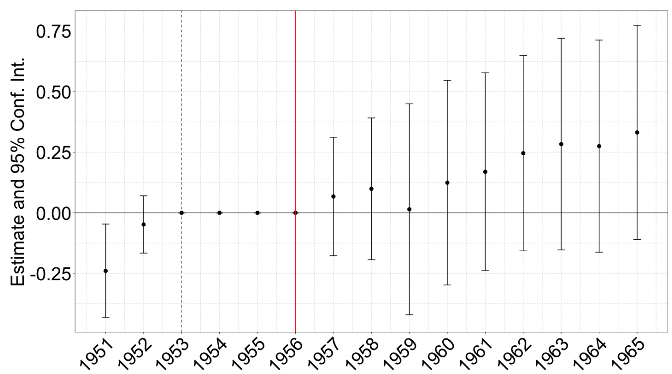
Dependent Variable:	Labor Productivity	
Model:	(1)	(2)
Variables		
Experience	-0.0944***	-0.1153***
	(0.0193)	(0.0237)
Size	-5.217**	-4.915
	(2.549)	(2.985)
Experience × targeted	0.0871***	0.0884***
	(0.0235)	(0.0293)
Material Input per worker		0.2021***
		(0.0589)
Capital per worker		0.0023
		(0.0190)
Experience + Experience x Targeted	-0.0073	-0.0269
	(0.7113)	(0.3578)
Observations	258	258
R^2	0.94265	0.94833
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

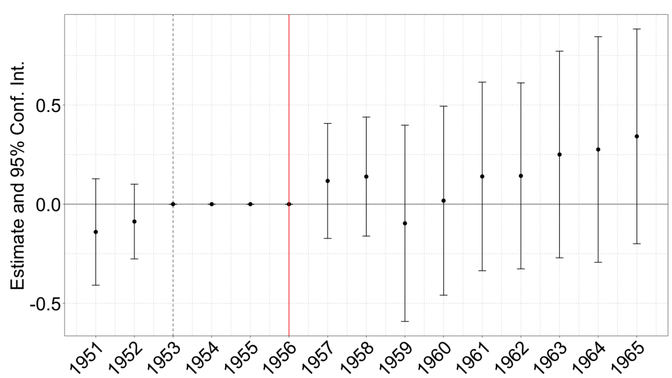
Table 8: Average Linkages

	Direct	Total (Leontief)
1. Non-Targeted Backward Linkage	0.06382	0.09371
2. Non-Targeted Forward Linkage	0.04158	0.07123
3. Targeted Sector Linkages	0.20672	1.29225
4. Targeted Sector Linkages With Other Targeted Sectors	0.07392	0.12361

Figure 1: Equation 2 estimated (without controls) for various outcome variables using the harmonized panel of industries

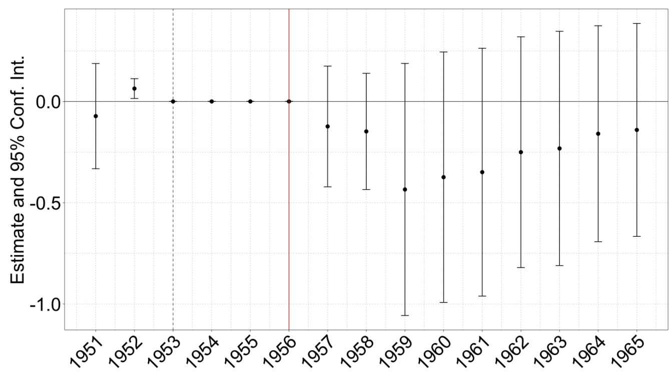


Gross Output

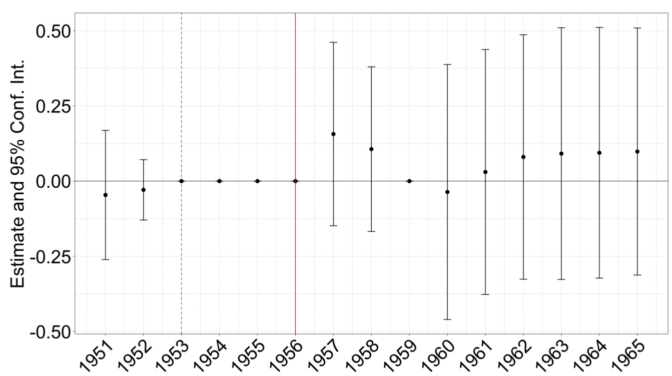


Gross Value Added

Figure 2: Equation 2 estimated (without controls) for various outcome variables using the harmonized panel of industries

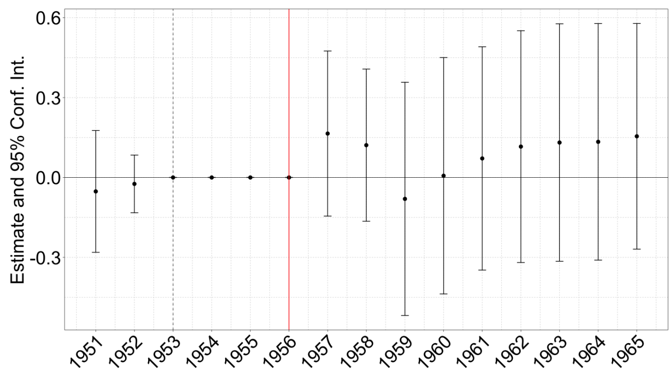


Number of Factories

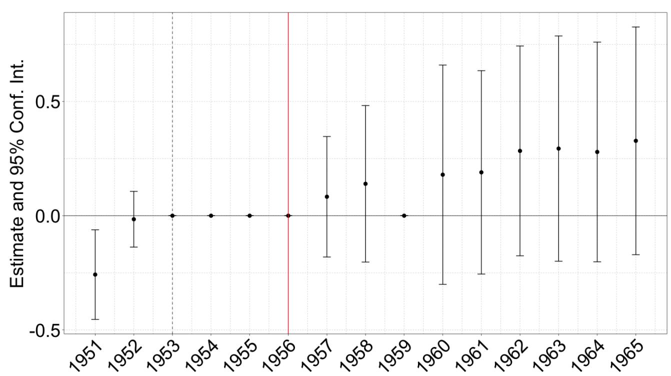


Number of Workers

Figure 3: Equation 2 estimated (without controls) for various outcome variables using the harmonized panel of industries

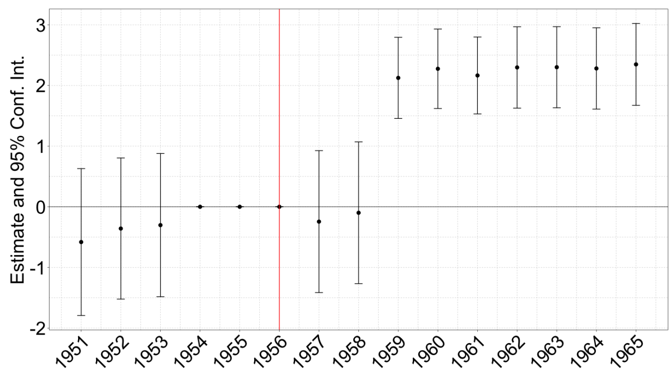


Number of Employees

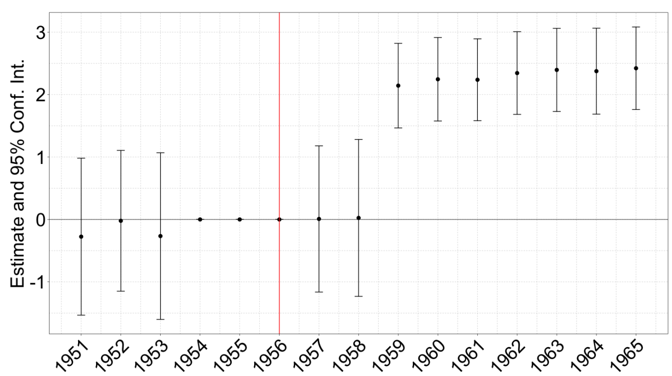


Material Input

Figure 4: Equation 2 estimated (without controls) for various outcome variables using the non-harmonized pooled dataset of industries

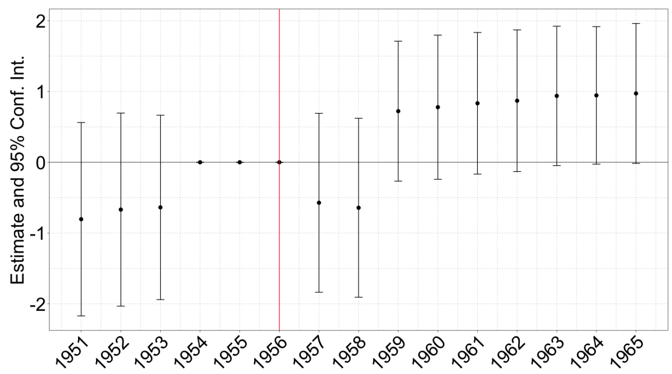


Gross Output

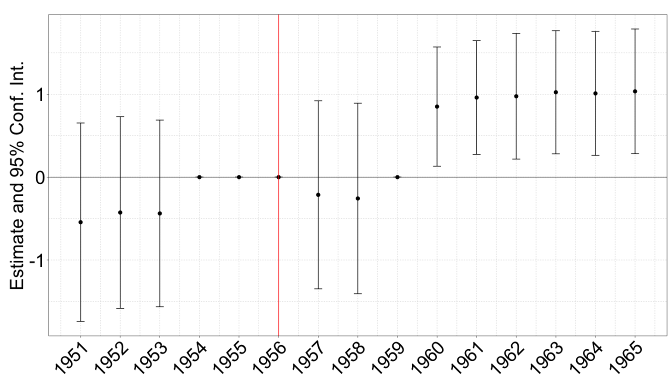


Gross Value Added

Figure 5: Equation 2 estimated (without controls) for various outcome variables using the non-harmonized pooled dataset of industries

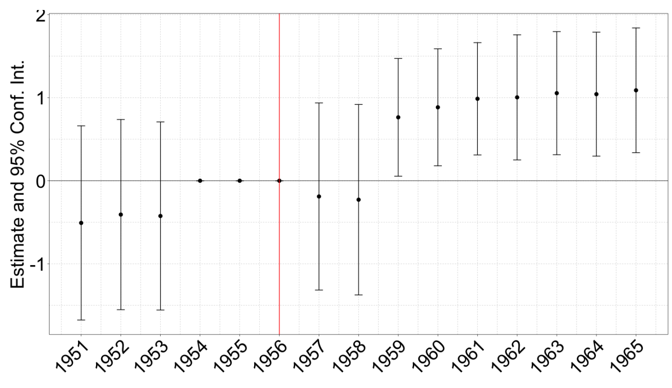


Number of Factories

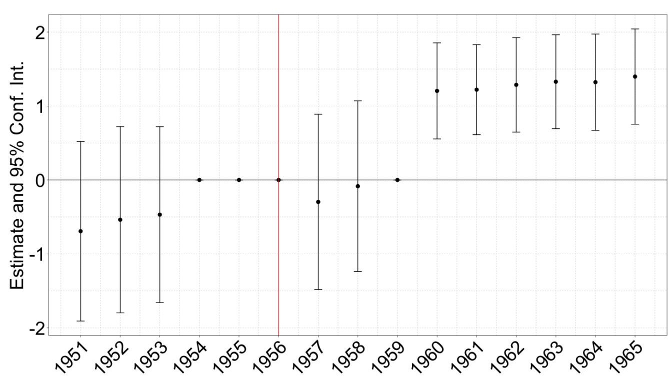


Number of Workers

Figure 6: Equation 2 estimated (without controls) for various outcome variables using the non-harmonized pooled dataset of industries

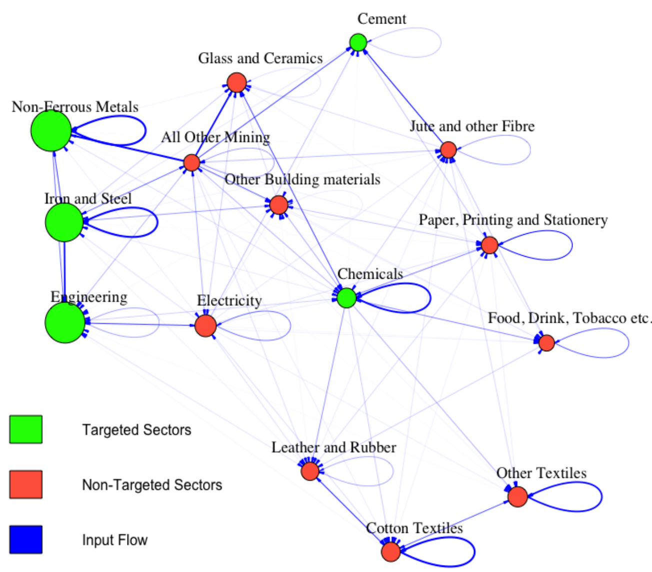


Number of Employees



Material Input

Figure 7: Network diagram representing production linkages among large-scale manufacturing sectors in India



Source: Indian Input-Output Table 1953-54

Appendices

Appendix A Dataset Description

Table A1: SSMI Industrial Classification 1951–58

Serial Number	CMI (Census for Manufacturing Industries) Code	Industrial Sector
1	1	wheat flour
2	2	rice milling
3	3	biscuit making
4	4	fruits and vegetables processing
5	5	sugar
6	6	distilleries and breweries
7	7	starch
8	8	vegetable oil (including hydrogenated oil)
9	9	paints and varnishes
10	10	soap
11	11	tanning
12	12	cement
13	13	glass and glassware
14	14	ceramics
15	15	plywood and tea-chests
16	16	paper and paper board
17	17	matches
18	18	cotton textiles
19	19	woollen textiles
20	20	jute textiles
21	21	chemicals (including drugs)
22	22	aluminium, copper and brass
23	23	iron and steel
24	24	bicycles
25	25	sewing machines
26	27	electric lamps
27	28	electric fans

SSMI Industrial Classification 1951–58

Serial Number	CMI (Census for Manufacturing Industries) Code	Industrial Sector
28	29	general and electrical engineering
29	30	footwear and leather manufacturing
30	31	rubber and rubber manufacturing
31	32	enamelware
32	33	hume pipes and other cement and cement concrete products
33	34	asbestos and asbestos cement products
34	35	bricks, tiles, lime and surkhi manufacturing
35	36	lac
36	37	turpentine and rosin
37	38	plasties (including gramophone records)
38	39	petroleum refining
39	40	saw milling
40	41	woodware (including furniture)
41	42	tea manufacturing
42	43	tobacco products
43	44	groundnut decorticating etc.
44	45	printing and bookbinding etc.
45	46	webbing narrow fabrics
46	47	hosiery and other knitted goods
47	48	thread and thread ball making
48	49	textiles dyeing, bleaching etc.
49	50	clothing and tailoring
50	51	cotton ginning and pressing
51	52	rope making
52	53	silk and artificial silk
53	54	jute pressing
54	55	electricity generation and transformation
55	56	automobiles and coach building
56	57	ship building and repairing
57	60	aircraft assembling and repairing services
58	62	textile machineries and accessories
59	63	unspecified industries

Table A2: ASI Sample Sector Industrial Classification: 1959–65

Serial Number	Labor Bureau Classification Code	Industrial Sector
1	010	ginning and pressing
2	201	slaughtering, preparation and preserving of meat
3	202	manufacture of dairy products
4	203	canning and preserving of fruits and vegetables
5	204	canning and preserving of fish and other sea foods
6	205	manufacture of grain mill products
7	206	manufacture of bakery products
8	207	sugar factories and refineries
9	208	manufacture of cocoa, chocolate and sugar confectionery
10	209	manufacture of miscellaneous food preparations
11	211	distilling, rectifying and blending of spirits (alcohol)
12	212	wine industries
13	213	breweries and manufacture of malt
14	214	soft drinks and carbonated water industries
15	220	tobacco manufacture
16	231	spinning, weaving and finishing of textiles
17	232	knitting mills
18	233	cordage, rope and twine industries
19	239	manufacture of other textiles
20	241	manufacture of footwear
21	242	repair of footwear
22	243	manufacture of wearing apparel (except footwear)
23	244	manufacture of made up textile goods, except wearing apparel
24	250	manufacture of wood and cork except furniture
25	260	manufacture of furniture and fixtures
26	271	manufacture of pulp, paper and paper board
27	280	printing, publishing and allied industries
28	291	tanneries and leather finishing plants
29	292	manufacture of leather products except footwear
30	300	manufacture of rubber products

ASI Sample Sector Industrial Classification: 1959–65

Serial Number	Labor Bureau Classification Code	Industrial Sector
31	311	basic industrial chemicals, including fertilizers
32	312	vegetable and animal oils and fats (except edible oils)
33	319	manufacture of miscellaneous chemical products
34	321	petroleum refineries
35	322	coke ovens
36	329	manufacture of miscellaneous products of petroleum and coal
37	331	manufacture of structural clay products
38	332	manufacture of glass and glass products
39	333	manufacture of pottery, china and earthen-ware
40	334	manufacture of cement (hydraulic)
41	339	manufacture of non-metallic mineral products not elsewhere classified
42	341	iron and steel basic industries
43	342	non-ferrous basic metal industries
44	350	manufacture of metal products except machinery and transport equipment
45	360	manufacture of machinery except electrical machinery
46	370	manufacture of electrical machinery, apparatus, appliances and supplies
47	381	ship building and repairing
48	382	manufacture of rail-road equipment
49	383	manufacture of motor vehicles
50	384	repair of motor vehicles
51	385	manufacture of motor cycles and bicycles
52	386	manufacture of aircraft
53	389	manufacture of transport equipment not elsewhere classified
54	391	manufacture of professional and scientific measuring instruments
55	392	manufacture of photographic and optical goods
56	393	manufacture of watches and clocks
57	394	repair of watches and clocks
58	395	manufacture of jewellery and related articles
59	396	manufacture of musical instruments
60	399	manufacture of industries not elsewhere classified
61	511	electric light, power, gas manufacture and distribution

Table A3: ASI Census Sector Industrial Classification: 1959–65

Serial Number	ASI Classification Code	Industrial Sector
1	201	slaughtering, preparation and preserving of meat
2	202	manufacture of dairy products
3	203	canning and preserving of fruits and vegetables
4	204	canning and preserving of fish and other sea foods
5	205	manufacture of grain mill products
6	206	manufacture of bakery products
7	207	sugar factories and refineries
8	208	manufacture of cocoa, chocolate and sugar confectionery
9	209	manufacture of miscellaneous food preparations
10	211	distilling, rectifying and blending of spirits (alcohol)
11	212	wine industries
12	213	breweries and manufacture of malt
13	214	soft drinks and carbonated water industries
14	220	tobacco manufacture
15	231	spinning, weaving and finishing of textiles
16	232	knitting mills
17	233	cordage, rope and twine industries
18	239	manufacture of textiles not elsewhere classified
19	241	manufacture of footwear
20	242	repair of footwear
21	243	manufacture of wearing apparel (except footwear)
22	244	manufacture of made up textile goods, except wearing apparel
23	251	saw mills, planning and other wood mills
24	252	wooden and cane containers and cane small ware
25	259	manufacture of cork and wood products not elsewhere classified
26	260	manufacture of furniture and fixtures
27	271	manufacture of pulp, paper and paper board
28	280	printing, publishing and allied industries
29	291	tanneries and leather finishing plants
30	293	manufacture of leather products except footwear and other wearing apparel
31	300	manufacture of rubber products

ASI Census Sector Industrial Classification: 1959–65

Serial Number	ASI Classification Code	Industrial Sector
32	311	basic industrial chemicals, including fertilizers
33	312	vegetable and animal oils and fats (except edible oils)
34	313	manufacture of paints, varnishes and lacquers
35	319	manufacture of miscellaneous chemical products
36	321	petroleum refineries
37	329	manufacture of miscellaneous products of petroleum and coal
38	331	manufacture of structural clay products
39	332	manufacture of glass and glass products
40	333	manufacture of pottery, china and earthen-ware
41	334	manufacture of cement (hydraulic)
42	339	manufacture of non-metallic mineral products not elsewhere classified
43	341	iron and steel basic industries
44	342	non-ferrous basic metal industries
45	350	manufacture of metal products except machinery and transport equipment
46	360	manufacture of machinery except electrical machinery
47	370	manufacture of electrical machinery, apparatus, appliances and supplies
48	381	ship building and repairing
49	382	manufacture of rail-road equipment
50	383	manufacture of motor vehicles
51	384	repair of motor vehicles
52	385	manufacture of motor cycles and bicycles
53	386	manufacture of aircraft
54	389	manufacture of transport equipment not elsewhere classified
55	391	manufacture of professional and scientific measuring instruments
56	392	manufacture of photographic and optical goods
57	393	manufacture of watches and clocks
58	394	manufacture of jewellery and related articles
59	395	manufacture of musical instruments
60	399	manufacture of industries not elsewhere classified
61	511	electric light and power

Table A4: Correspondence between ASI Census and Sample Sector Classification

ASI Classification Code	Industrial Sector	Labor Bureau Classification Code
201	slaughtering, preparation and preserving of meat	201
202	manufacture of dairy products	202
203	canning and preserving of fruits and vegetables	203
204	canning and preserving of fish and other sea foods	204
205	manufacture of grain mill products	205
206	manufacture of bakery products	206
207	sugar factories and refineries	207
208	manufacture of cocoa, chocolate and sugar confectionery	208
209	manufacture of miscellaneous food preparations	209
211	distilling, rectifying and blending of spirits (alcohol)	211
212	wine industries	212
213	breweries and manufacture of malt	213
214	soft drinks and carbonated water industries	214
220	tobacco manufacture	220
231	spinning, weaving and finishing of textiles	231
232	knitting mills	232
233	cordage, rope and twine industries	233
239	manufacture of textiles not elsewhere classified	010 + 239
241	manufacture of footwear	241
242	repair of footwear	242
243	manufacture of wearing apparel (except footwear)	243
244	manufacture of made up textile goods, except wearing apparel	244
251	saw mills, planning and other wood mills	NA
252	wooden and cane containers and cane small ware	NA
259	manufacture of cork and wood products not elsewhere classified	250
260	manufacture of furniture and fixtures	260
271	manufacture of pulp, paper and paper board	271
280	printing, publishing and allied industries	280
291	tanneries and leather finishing plants	291
293	manufacture of leather products except footwear and other wearing apparel	292
300	manufacture of rubber products	300

Correspondence between ASI Census and Sample Sector Classification

ASI Classification Code	Industrial Sector	Labor Bureau Classification Code
311	basic industrial chemicals, including fertilizers	311
312	vegetable and animal oils and fats (except edible oils)	312
313	manufacture of paints, varnishes and lacquers	NA
319	manufacture of miscellaneous chemical products	319
321	petroleum refineries	321
329	manufacture of miscellaneous products of petroleum and coal	322 + 329
331	manufacture of structural clay products	331
332	manufacture of glass and glass products	332
333	manufacture of pottery, china and earthen-ware	333
334	manufacture of cement (hydraulic)	334
339	manufacture of non-metallic mineral products not elsewhere classified	339
341	iron and steel basic industries	341
342	non-ferrous basic metal industries	342
350	manufacture of metal products except machinery and transport equipment	350
360	manufacture of machinery except electrical machinery	360
370	manufacture of electrical machinery, apparatus, appliances and supplies	370
381	ship building and repairing	381
382	manufacture of rail-road equipment	382
383	manufacture of motor vehicles	383
384	repair of motor vehicles	384
385	manufacture of motor cycles and bicycles	385
386	manufacture of aircraft	386
389	manufacture of transport equipment not elsewhere classified	389
391	manufacture of professional and scientific measuring instruments	391
392	manufacture of photographic and optical goods	392
393	manufacture of watches and clocks	393 + 394
394	manufacture of jewellery and related articles	395
395	manufacture of musical instruments	396
399	manufacture of industries not elsewhere classified	399
511	electric light and power	511

Table A5: Correspondence between ASI and SSMI Classification

ASI Classification Code	Industrial Sector	CMI Code
203	canning and preserving of fruits and vegetables	4
205	manufacture of grain mill products	1+2
206	manufacture of bakery products	3
207	sugar factories and refineries	5
209	manufacture of miscellaneous food preparations	7+8+42+44
211+212+213	alcohol industries	6
220	tobacco manufacture	43
231	spinning, weaving and finishing of textiles	18+19+20+46+48+49+53+54
232	knitting mills	47
233	cordage, rope and twine industries	52
239	manufacture of textiles not elsewhere classified	51
241+293	Footwear and Leather Manufacturing	30
243	manufacture of wearing apparel (except footwear)	50
251	saw mills, wood and cork products	40
252 + 260	manufacture of furniture and fixtures	15 + 41
271	manufacture of pulp, paper and paper board	16
280	printing, publishing and allied industries	45
291	tanneries and leather finishing plants	11
300	manufacture of rubber products	31
311	basic industrial chemicals, including fertilizers	37+21
313	manufacture of paints, varnishes and lacquers	9
319	manufacture of miscellaneous chemical products	10+17+21+36
321	petroleum refineries	39
331	manufacture of structural clay products	35
332	manufacture of glass and glass products	13
333	manufacture of pottery, china and earthen-ware	14
334	manufacture of cement (hydraulic)	12
339	manufacture of non-metallic mineral products not elsewhere classified	33+34+35
341	iron and steel basic industries	23
342	non-ferrous basic metal industries	22
350+360+370	manufacture of metal products and machinery	25+27+28+29+32+62

Correspondence between ASI and SSMI Classification

ASI Classification Code	Industrial Sector	CMI Code
381	ship building and repairing	57
383	manufacture of motor vehicles	56
385	manufacture of motor cycles and bicycles	24
386	manufacture of aircraft	60
511	electric power, gas manufacture and distribution	55

Table A6: Correspondence between ASI and Industrial Prices Classification

ASI Classification Code	Industrial Sector (Output)	Industrial Sector (Prices)
203	canning and preserving of fruits and vegetables	Fruits and Vegetables
205	manufacture of grain mill products	Cereals
206	manufacture of bakery products	Other Food Articles
207	sugar factories and refineries	Sugar and Allied Products
209	manufacture of miscellaneous food preparations	Weighted Average of Edible Oils, Tea and Groundnut
211+212+213	alcohol industries	Liquor
220	tobacco manufacture	Tobacco (Total)
231	spinning, weaving and finishing of textiles	Weighted Average of Textile Yarn and Textile Products
232	knitting mills	Textile Yarn
233	cordage, rope and twine industries	Fibres
239	manufacture of textiles not elsewhere classified	Cotton Raw
241+293	Footwear and Leather Manufacturing	Leather Products (Shoes)
243	manufacture of wearing apparel (except footwear)	Textile Products
251	saw mills, wood and cork products	Logs and Timber
252 + 260	manufacture of furniture and fixtures	Weighted Average of Logs and Timber and Plywood Tea Chests
271	manufacture of pulp, paper and paper board	Weighted Average of Bamboo and Paper Products
280	printing, publishing and allied industries	Paper Products
291	tanneries and leather finishing plants	Weighted Average of Tanning Materials and Leather
300	manufacture of rubber products	Rubber Products
311	basic industrial chemicals, including fertilizers	Chemicals
313	manufacture of paints, varnishes and lacquers	Paints, Varnishes
319	manufacture of miscellaneous chemical products	Weighted Average of Soap, Matches, Drugs and Medicines, and Lac

Correspondence between ASI and Industrial Prices Classification

ASI Classification Code	Industrial Sector (Output)	Industrial Sector (Prices)
321	petroleum refineries	Petrol
331	manufacture of structural clay products	Weighted Average of Bricks, Tiles and Lime
332	manufacture of glass and glass products	Glass Manufactures
333	manufacture of pottery, china and earthen-ware	Pottery Goods
334	manufacture of cement (hydraulic)	Cement
339	manufacture of non-metallic mineral products not elsewhere classified	Non-Metallic Products
341	iron and steel basic industries	Iron and Steel Manufactures
342	non-ferrous basic metal industries	Weighted Average of Aluminium Sheets, Brass Sheets and Copper Sheets
350+360+370	manufacture of metal products and machinery	Weighted Average of Metal Products and Machinery
381	ship building and repairing	Weighted Average of Machinery, Metals and Metal Products
383	manufacture of motor vehicles	Vehicles
385	manufacture of motor cycles and bicycles	Cycles
386	manufacture of aircraft	Weighted Average of Machinery, Metals and Metal Products
511	electric power, gas manufacture and distribution	Fuel, Power, Light, Lubricants

Table A7: Correspondence between ASI and Input-Output Table Classification

ASI Classification Code	Industrial Sector	Input-Output Sector
203	canning and preserving of fruits and vegetables	Food, drink, tobacco, etc.
205	manufacture of grain mill products	Food, drink, tobacco, etc.
206	manufacture of bakery products	Food, drink, tobacco, etc.
207	sugar factories and refineries	Food, drink, tobacco, etc.
209	manufacture of miscellaneous food preparations	Food, drink, tobacco, etc. + Chemicals
211+212+213	alcohol industries	Food, drink, tobacco, etc.
220	tobacco manufacture	Food, drink, tobacco, etc.
231	spinning, weaving and finishing of textiles	Cotton textiles + Other Textiles + Jute and Other Fibres
232	knitting mills	Other Textiles
233	cordage, rope and twine industries	Jute and Other Fibres
239	manufacture of textiles not elsewhere classified	Cotton textiles
241+293	Footwear and Leather Manufacturing	Leather and Rubber
243	manufacture of wearing apparel (except footwear)	Other Textiles
251	saw mills, wood and cork products	Other Building Materials and Wood Manufacture
252 + 260	manufacture of furniture and fixtures	Other Building Materials and Wood Manufacture
271	manufacture of pulp, paper and paper board	Paper, Printing and Stationery
280	printing, publishing and allied industries	Paper, Printing and Stationery
291	tanneries and leather finishing plants	Leather and Rubber
300	manufacture of rubber products	Leather and Rubber
311	basic industrial chemicals, including fertilizers	Chemicals
313	manufacture of paints, varnishes and lacquers	Chemicals
319	manufacture of miscellaneous chemical products	Chemicals

Correspondence between ASI and Input-Output Table Classification

ASI Classification Code	Industrial Sector	Input-Output Sector
321	petroleum refineries	All Other Mining
331	manufacture of structural clay products	Other Building Materials
332	manufacture of glass and glass products	Glass and ceramics
333	manufacture of pottery, china and earthen-ware	Glass and ceramics
334	manufacture of cement (hydraulic)	Cement
339	manufacture of non-metallic mineral products not elsewhere classified	Cement + Other Building materials and Wood Manufacture
341	iron and steel basic industries	Iron and Steel
342	non-ferrous basic metal industries	Non-Ferrous Metal
350+360+370	manufacture of metal products and machinery	Engineering
381	ship building and repairing	Engineering
383	manufacture of motor vehicles	Engineering
385	manufacture of motor cycles and bicycles	Engineering
386	manufacture of aircraft	Engineering
511	electric power, gas manufacture and distribution	Electricity

Appendix B Descriptive Statistics

Table B1: Summary Statistics for Targeted Industries (Panel)

Variable	N	Min	Max	Mean	SD
Worker Productivity	60	2,804	9,315	5,498	2,460
Plant Size	60	48	657	193	236
Wage Bill Per Worker	60	1,113	1,855	1,458	285
Material Input Per Worker	60	3,453	15,467	9,578	4,392
Gross Output	60	238,331,536	6,999,703,908	1,740,627,079	1,675,240,638
Gross Value Added	60	49,535,589	2,058,766,864	524,098,577	479,424,539
Number of Factories	60	19	8,395	1,387	2,098
Number of Workers	55	11,168	446,628	106,510	116,031
Number of Employees	60	13,500	564,877	127,871	137,809
Material Input	55	123,636,700	4,378,175,838	1,116,227,610	1,083,580,387

Notes: All monetary values are deflated and denominated in INR. The control variables (first four variables) are averaged for the period 1951–53.

Table B2: Summary Statistics for Non-Targeted Industries (Panel)

	N	Min	Max	Mean	SD
Worker Productivity	372	1,217	32,759	4,673	5,536
Plant Size	372	19	740	153	164
Wage Bill Per Worker	372	153	2,772	1,070	509
Material Input Per Worker	372	1,391	24,295	8,277	6,010
Gross Output	372	9,255,200	11,676,856,076	949,134,669	1,910,643,199
Gross Value Added	372	1,391,303	3,376,173,988	243,671,246	534,961,489
Number of Factories	372	1	5,594	854	1,267
Number of Workers	341	1,147	1,156,383	77,753	196,720
Number of Employees	372	1,334	1,258,918	88,097	211,953
Material Input	341	6,342,237	7,694,638,472	692,626,087	1,426,143,098

Notes: All monetary values are deflated and denominated in INR. The control variables (first four variables) are averaged for the period 1951–53.

Table B3: Summary Statistics for Targeted Industries (Pooled Cross-Section)

	N	Min	Max	Mean	SD
Gross Output	104	5,419,103	5,208,906,826	1,004,207,930	1,102,704,986
Gross Value Added	104	891,709	1,405,359,310	302,364,564	310,033,104
Number of Factories	104	3	3,630	822	1,010
Number of Workers	97	296	249,624	60,753	66,201
Material Input	97	3,446,733	3,184,549,937	629,127,643	695,068,712
Number of Employees	104	421	315,020	74,145	79,363

Notes: All monetary values are deflated and denominated in INR.

Table B4: Summary Statistics for Non-Targeted Industries (Pooled Cross-Section)

	N	Min	Max	Mean	SD
Gross Output	618	448,400	11,676,856,076	610,373,251	1,416,165,600
Gross Value Added	618	137,226	3,376,173,988	157,937,727	393,954,821
Number of Factories	490	1	5,116	652	951
Number of Workers	454	468	1,145,848	60,689	151,586
Material Input	454	2,077,375	7,363,210,302	528,824,033	1,037,611,767
Number of Employees	490	604	1,245,184	69,523	165,854

Notes: All monetary values are deflated and denominated in INR.

Appendix C Results

Table C1: Average Impacts of Industrial Policy

Dependent Variables:	Gross Output	Gross Value Added	Number of Factories
Model:	(1)	(2)	(3)
Variables			
targeted × Post	0.2880	0.1961	-0.2508
	(0.2391)	(0.2438)	(0.3339)
Observations	432	432	432
R^2	0.96947	0.95649	0.93690
Industry Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C2: Average Impacts of Industrial Policy

Dependent Variables:	Number of Workers	Number of Employees	Material Input
Model:	(1)	(2)	(3)
Variables			
targeted × Post	0.0572	0.0718	0.3295
	(0.2265)	(0.2351)	(0.2603)
Observations	396	432	396
R^2	0.96357	0.96376	0.97000
Industry Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C3: Dynamic Impacts of Industrial Policy

Dependent Variables:	Gross Output		Gross Value Added	
Model:	(1)	(2)	(3)	(4)
Variables				
targeted × year = 1951	-0.2395**	-0.0965	-0.1402	-0.0052
	(0.0985)	(0.1383)	(0.1369)	(0.1596)
targeted × year = 1952	-0.0481	-0.0523	-0.0876	-0.0882
	(0.0604)	(0.0619)	(0.0962)	(0.1081)
targeted × year = 1957	0.0674	0.1162	0.1173	0.1369
	(0.1247)	(0.1594)	(0.1480)	(0.1643)
targeted × year = 1958	0.0990	0.0479	0.1390	0.0076
	(0.1492)	(0.1808)	(0.1531)	(0.1532)
targeted × year = 1959	0.0145	0.0277	-0.0964	-0.1036
	(0.2220)	(0.2783)	(0.2525)	(0.2971)
targeted × year = 1960	0.1243	0.1497	0.0175	0.0409
	(0.2153)	(0.2719)	(0.2432)	(0.2908)
targeted × year = 1961	0.1694	0.2789	0.1397	0.2022
	(0.2083)	(0.2711)	(0.2427)	(0.2936)
targeted × year = 1962	0.2458	0.3094	0.1427	0.1846
	(0.2055)	(0.2538)	(0.2393)	(0.2849)
targeted × year = 1963	0.2834	0.3876	0.2504	0.3018
	(0.2227)	(0.2763)	(0.2658)	(0.3109)
targeted × year = 1964	0.2751	0.3920	0.2759	0.3304
	(0.2232)	(0.2824)	(0.2903)	(0.3244)
targeted × year = 1965	0.3317	0.4357	0.3420	0.3835
	(0.2256)	(0.2753)	(0.2763)	(0.3261)
Observations	432	432	432	432
R^2	0.96431	0.97023	0.95193	0.95739
Pre-Trends Joint Test (p-values)	0.03327	0.3715	0.2294	0.6525
Industry Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C4: Dynamic Impacts of Industrial Policy

Dependent Variables:	Number of Factories		Number of Workers	
Model:	(1)	(2)	(3)	(4)
Variables				
targeted × year = 1951	-0.0725	-0.0091	-0.0461	-0.1360
	(0.1325)	(0.1775)	(0.1096)	(0.1394)
targeted × year = 1952	0.0636**	0.0867**	-0.0290	-0.1463
	(0.0250)	(0.0376)	(0.0511)	(0.0892)
targeted × year = 1957	-0.1234	-0.1382	0.1565	0.0238
	(0.1521)	(0.2323)	(0.1556)	(0.2269)
targeted × year = 1958	-0.1481	-0.1430	0.1064	-0.0726
	(0.1464)	(0.2133)	(0.1396)	(0.2065)
targeted × year = 1959	-0.4347	-0.3986		
	(0.3176)	(0.4640)		
targeted × year = 1960	-0.3741	-0.3508	-0.0362	-0.1654
	(0.3155)	(0.4253)	(0.2163)	(0.2715)
targeted × year = 1961	-0.3492	-0.2773	0.0304	-0.0629
	(0.3123)	(0.4297)	(0.2078)	(0.2631)
targeted × year = 1962	-0.2505	-0.2327	0.0803	-0.0309
	(0.2907)	(0.3880)	(0.2074)	(0.2506)
targeted × year = 1963	-0.2321	-0.2191	0.0915	0.0109
	(0.2951)	(0.4181)	(0.2136)	(0.2671)
targeted × year = 1964	-0.1594	-0.1435	0.0942	0.0039
	(0.2721)	(0.3710)	(0.2127)	(0.2605)
targeted × year = 1965	-0.1407	-0.1211	0.0983	-0.0018
	(0.2683)	(0.3844)	(0.2096)	(0.2431)
Observations	432	432	396	396
R^2	0.91883	0.93718	0.95867	0.96376
Pre-Trends Joint Test (p-values)	0.95	0.7003	0.5914	0.1869
Industry Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C5: Dynamic Impacts of Industrial Policy

Dependent Variables:	Number of Employees		Material Input	
Model:	(1)	(2)	(3)	(4)
Variables				
targeted × year = 1951	-0.0523	-0.1166	-0.2578**	-0.1225
	(0.1167)	(0.1464)	(0.1001)	(0.1545)
targeted × year = 1952	-0.0241	-0.1211	-0.0155	-0.0074
	(0.0553)	(0.0814)	(0.0622)	(0.0642)
targeted × year = 1957	0.1650	0.0485	0.0830	0.1144
	(0.1582)	(0.2288)	(0.1346)	(0.1725)
targeted × year = 1958	0.1214	-0.0352	0.1396	0.1166
	(0.1458)	(0.2210)	(0.1748)	(0.2029)
targeted × year = 1959	-0.0804	-0.1805		
	(0.2234)	(0.2895)		
targeted × year = 1960	0.0065	-0.1025	0.1795	0.1790
	(0.2265)	(0.2902)	(0.2449)	(0.2926)
targeted × year = 1961	0.0715	-0.0018	0.1898	0.2917
	(0.2139)	(0.2769)	(0.2271)	(0.2811)
targeted × year = 1962	0.1160	0.0215	0.2837	0.3625
	(0.2221)	(0.2741)	(0.2343)	(0.2751)
targeted × year = 1963	0.1312	0.0649	0.2938	0.4003
	(0.2276)	(0.2908)	(0.2515)	(0.2907)
targeted × year = 1964	0.1339	0.0555	0.2791	0.3980
	(0.2266)	(0.2889)	(0.2453)	(0.2901)
targeted × year = 1965	0.1547	0.0630	0.3278	0.4272
	(0.2162)	(0.2574)	(0.2542)	(0.2744)
Observations	432	432	396	396
R^2	0.95876	0.96404	0.96108	0.97049
Pre-Trends Joint Test (p-values)	0.6232	0.2619	0.04605	0.4677
Industry Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level.
Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C6: SUTVA Robustness Check using low backward-linkage industries in the control group

Coefficient of Interest:	targeted × Post	
Model:	(1)	(2)
Outcome Variables		
Gross Output	0.2692	0.2586
	(0.2060)	(0.2673)
Observations	372	372
R^2	0.96078	0.96745
Gross Value Added	0.2113	0.1954
	(0.2339)	(0.2387)
Observations	372	372
R^2	0.94583	0.95644
Number of Factories	-0.1791	-0.2933
	(0.2289)	(0.3212)
Observations	372	372
R^2	0.92027	0.92792
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Controls	No	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C7: SUTVA Robustness Check using low backward-linkage industries in the control group

Coefficient of Interest:	targeted × Post	
Model:	(1)	(2)
Outcome Variables		
Number of Workers	0.1010	-0.0338
	(0.1786)	(0.2616)
Observations	341	341
R^2	0.94813	0.95690
Number of Employees	0.1258	-0.0027
	(0.1832)	(0.2689)
Observations	372	372
R^2	0.94942	0.95760
Material Input	0.3169	0.2656
	(0.2341)	(0.2945)
Observations	341	341
R^2	0.95929	0.96746
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Controls	No	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C8: SUTVA Robustness Check using low forward-linkage industries in the control group

Coefficient of Interest:	targeted × Post	
Model:	(1)	(2)
Outcome Variables		
Gross Output	0.2925	0.0554
	(0.2261)	(0.2406)
Observations	204	204
R^2	0.97972	0.98691
Gross Value Added	0.1993	-0.1765
	(0.2472)	(0.2248)
Observations	204	204
R^2	0.96859	0.97695
Number of Factories	-0.6720**	-1.005**
	(0.3141)	(0.4581)
Observations	204	204
R^2	0.94604	0.96498
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Controls	No	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C9: SUTVA Robustness Check using low forward-linkage industries in the control group

Coefficient of Interest:	targeted × Post	
Model:	(1)	(2)
Outcome Variables		
Number of Workers	0.0599	-0.1591
	(0.2072)	(0.3211)
Observations	187	187
R^2	0.97688	0.98074
Number of Employees	0.0626	-0.1931
	(0.2143)	(0.3240)
Observation	204	204
R^2	0.97635	0.98109
Material Input	0.3546	0.1501
	(0.2682)	(0.2821)
Observations	187	187
R^2	0.97406	0.98534
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Controls	No	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C10: SUTVA Robustness Check:Impacts of Industrial Policy Controlling for Direct Linkages

Coefficient of Interest:	targeted × Post	
Model:	(1)	(2)
Outcome Variables		
Gross Output	0.2869	0.2317
	(0.2133)	(0.2620)
Observations	432	432
R^2	0.96378	0.96995
Gross Value Added	0.1865	0.0864
	(0.2435)	(0.2677)
Observations	432	432
R^2	0.95130	0.95712
Number of Factories	-0.6079**	-0.6556*
	(0.2838)	(0.3320)
Observations	432	432
R^2	0.92646	0.94164
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Controls	No	Yes

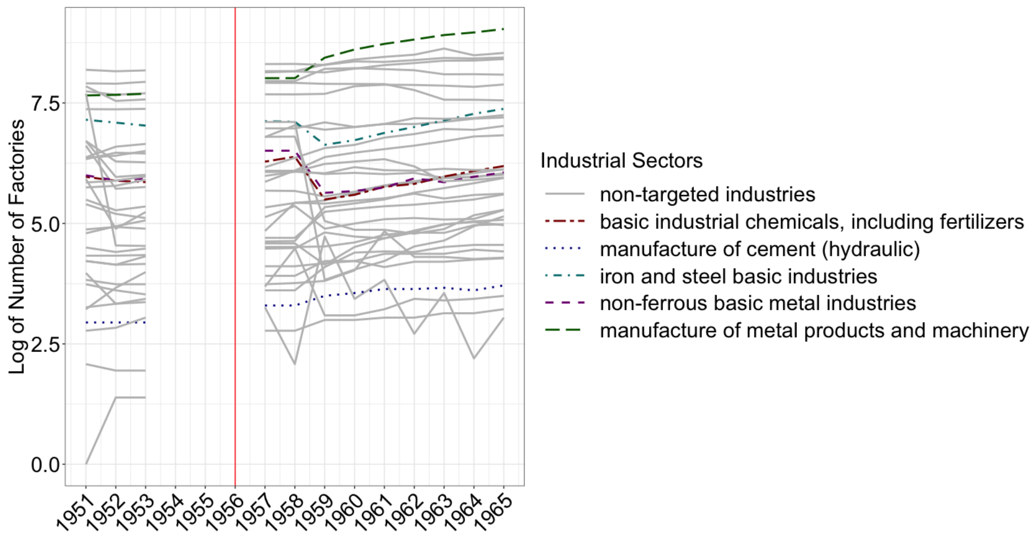
Notes: Standard errors reported in parentheses are clustered at the industry level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Table C11: SUTVA Robustness Check:Impacts of Industrial Policy Controlling for Direct Linkages

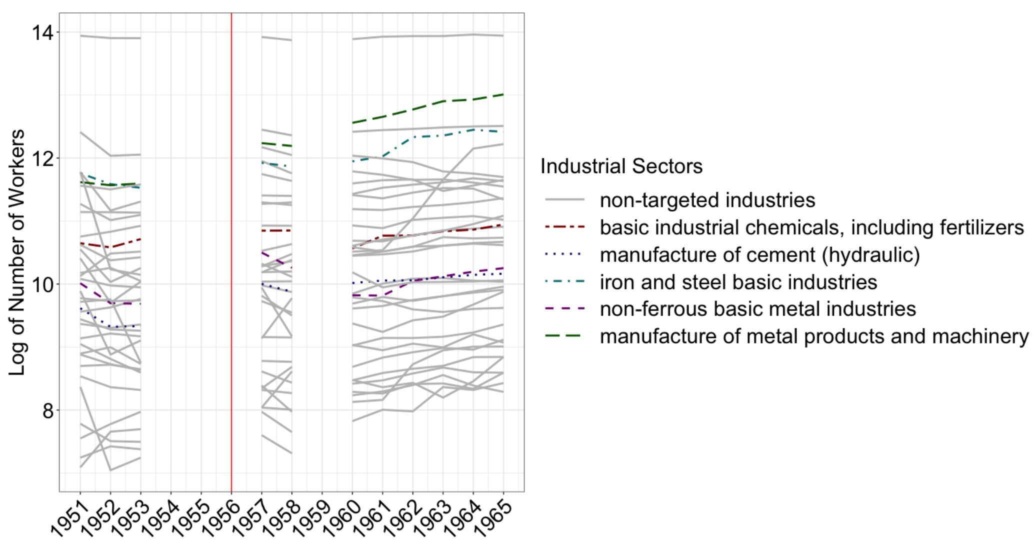
Coefficient of Interest:	targeted × Post	
Model:	(1)	(2)
Outcome Variables		
Number of Workers	0.0580	-0.0686
	(0.2074)	(0.2810)
Observations	396	396
R^2	0.95864	0.96413
Number of Employees	0.0719	-0.0493
	(0.2120)	(0.2879)
Observation	432	432
R^2	0.95868	0.96419
Material Input	0.3586	0.2839
	(0.2471)	(0.2820)
Observations	396	396
R^2	0.96075	0.97046
Industry Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes
Controls	No	Yes

Notes: Standard errors reported in parentheses are clustered at the industry level. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Figure C1: Plots for Targeted Industries for Selected Outcome Variables

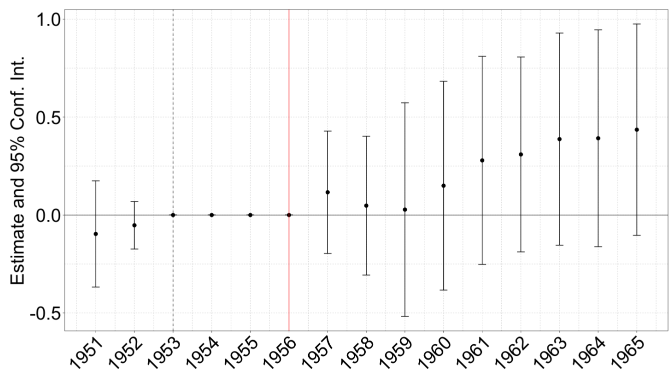


Number of Factories

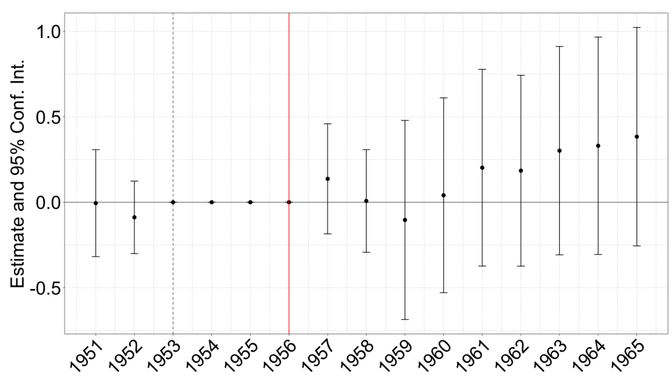


Number of Workers

Figure C2: Equation 2 estimated (with controls) for various outcome variables using the harmonized panel of industries

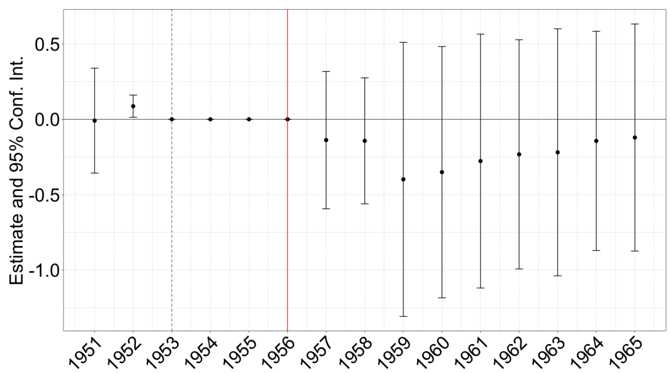


Gross Output

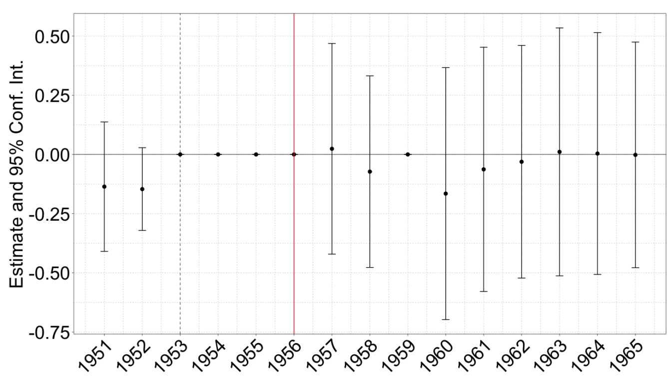


Gross Value Added

Figure C3: Equation 2 estimated (with controls) for various outcome variables using the harmonized panel of industries

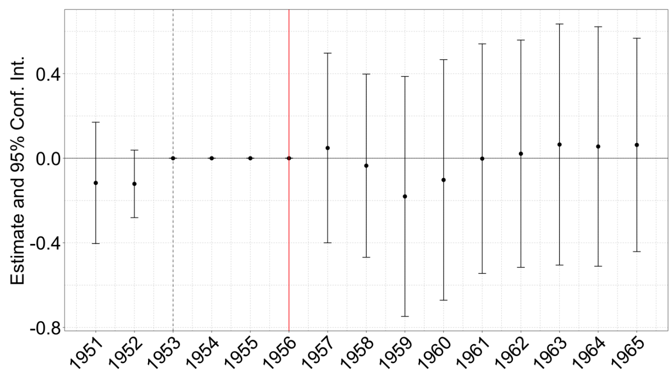


Number of Factories

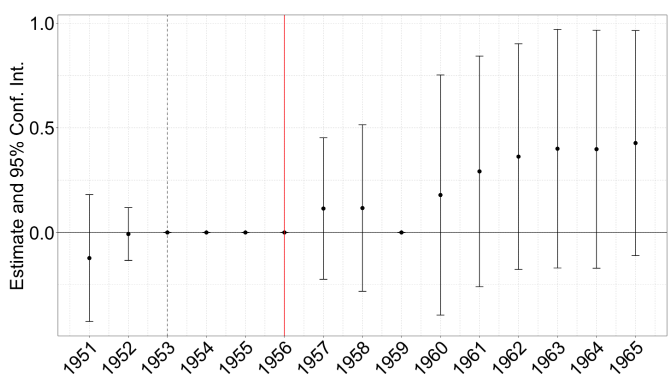


Number of Workers

Figure C4: Equation 2 estimated (with controls) for various outcome variables using the harmonized panel of industries

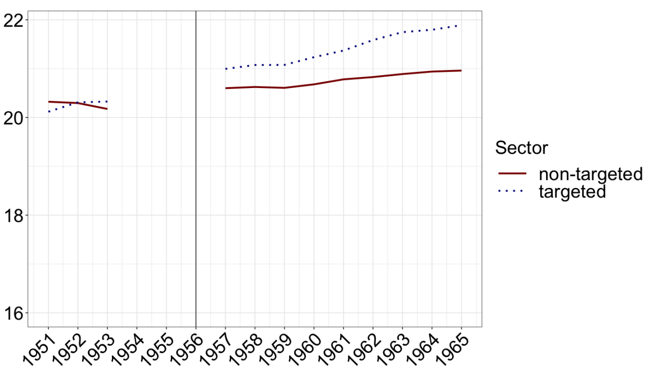


Number of Employees

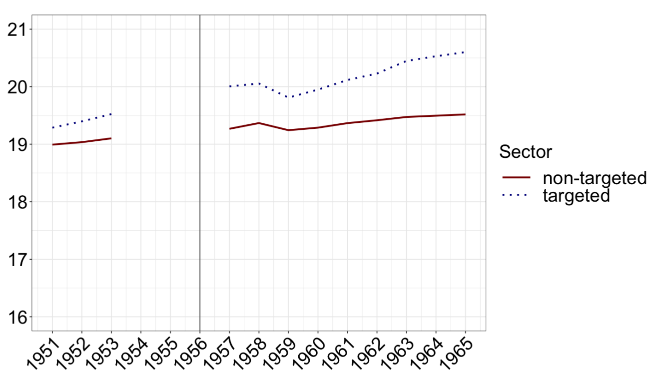


Material Input

Figure C5: Raw Outcome Variable (Average) Plots for Targeted and Non-Targeted Industries

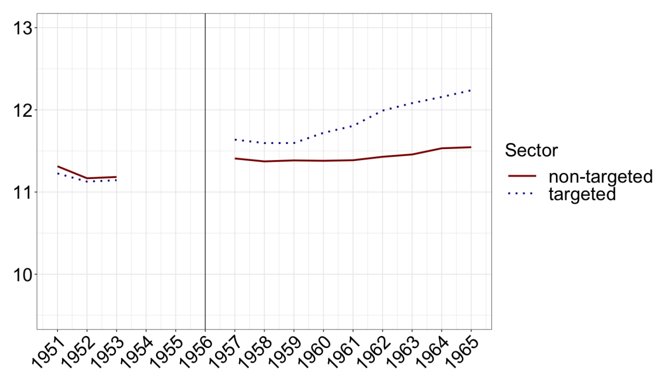


Gross Output

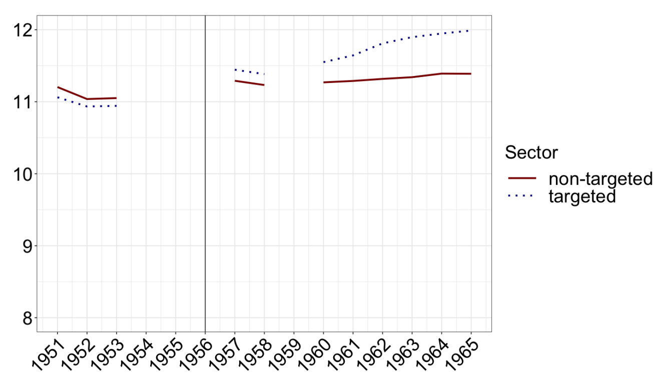


Gross Value Added

Figure C6: Raw Outcome Variable (Average) Plots for Targeted and Non-Targeted Industries

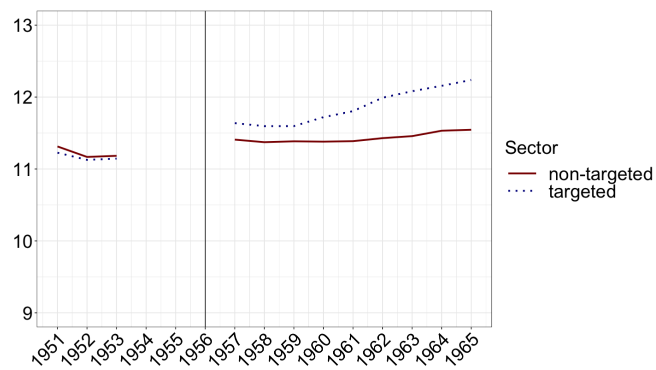


Number of Factories

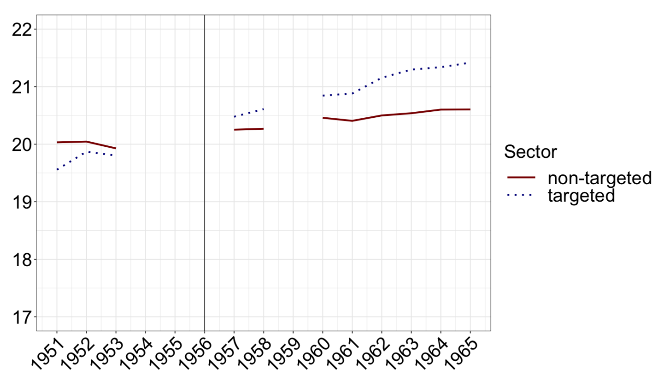


Number of Workers

Figure C7: Raw Outcome Variable (Average) Plots for Targeted and Non-Targeted Industries



Number of Employees



Material Input