The "State" of Misallocation - Decentralisation, Bureaucratic Turnover, and Productivity: Evidence from India

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Abstract

The paper studies the impacts of state capacity on capital misallocation. Tweaking existing theoretical framework of misallocation, I introduce bureaucratic capacity as a multiplicative factor over the existing wedges that firms face. I utilise a policy experiment in India, which involved the abolition of a central body that administered approvals for foreign investment, and decentralisation of authority to individual ministries. Ex-ante High-MRPK firms observe 12% higher assets and 19% lower MRPK than their low-MRPK counterparts. I observe that there are aggregate TFP gains due to reallocation arising out of decentralisation of decision-making authority by 0.22%. However, higher bureaucratic churn offsets the productivity gains of decentralisation. In sectors where there are frequent bureaucratic changes, there are productivity losses arising of the amount of -0.28%. The actual productivity gain from decentralisation, with longer bureaucratic tenure, is 0.5%.

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1 Introduction

Misallocation of production inputs is a topic that is widely studied in recent economic literature. There have been numerous studies trying to assess the causes of misallocation (Restuccia and Rogerson, 2017; Bannerjee and Moll, 2010; Hopenhayn, 2014), the effects of misallocation on aggregate productivity, especially in the case of developing countries (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009; Restuccia and Rogerson, 2013; Duranton et al., 2015; Duranton et al., 2016; Bau and Matray, 2023), and how policies can be used to extract gains by reducing misallocation (Sraer and Thesmar, 2023; Bau and Matray, 2023).

Among the causes of misallocation, the common theme that comes across is the creation of "taxes" on firms, which act like wedges on input prices (Restuccia and Rogerson, 2008; Banerjee and Moll, 2010). These wedges (or taxes), affect the marginal productivity of inputs. Although these taxes would explain cross-sectional dispersions in productivity (across industries or countries), the persistence of misallocation can be explained by reasons why these "taxes" differ at a firm level. One reason could be varying regulations that differ according to firm characteristics which creates heterogeneity and impacts the allocation of resources (Restuccia and Rogerson, 2017; Gordon and Li, 2005). Other reasons could be differences in technological access and adoption (Hseih and Klenow, 2009; Ayerst, 2016; Cirera, Cruz, and Comin, 2022), financial frictions (Buera, Kaboski and Shin, 2011; Midrigan and Xu, 2014; Moll, 2014; Gopinath et al., 2017; Varela, 2017; Bau and Matray, 2023), and in general, market imperfections like enforcement of property rights (Besley and Ghatak, 2010; Bloom et al. 2013).

This paper is interested in investigating an interesting channel of misallocation that lies at the intersection of regulation, financial frictions and political economy. Previous studies have shown changes in industrial and financial regulations can have an impact on the misallocation of resources (Duranton et al., 2017; Alfaro and Chari, 2014; Chari and Gupta, 2008; Bau and Matray, 2023).

This paper studies the political economy causes of capital misallocation, through a unique natural experiment in India. Foreign investment flows in India through two routes – Automatic and Government. Some sectors, although open for foreign investment, require government approval to receive a foreign equity investment. In 2017, there was a policy change in the way government approval was provided to these foreign investors. This involved the disintegration of a centrally administered approval body (Foreign Investment Promotion Board, henceforth FIPB), which was previously under the Ministry of Finance, into individual ministries most closely related to the respective sector. By using a firm-level panel dataset, I try to isolate the changes in input wedges due to the change in this specific foreign investment approval policy.

I find that ex-ante High MRPK firms observe 12% higher assets and 19% lower MRPK than their low-MRPK counterparts. I observe that there are productivity gains to reallocation arising out of this decentralisation of decision-making authority by 0.22%. However, higher bureaucratic churn offsets productivity gains of decentralisation. In sectors where there are frequent bureaucrat transfers, there are productivity losses arising of the amount of -0.28%. The actual productivity gain from decentralisation (provided bureaucrats are allowed to stay on the job longer) is 0.5%.

The remaining paper is organised as follows - section 2 covers literature review of related papers; section 3 covers the policy context and the theoretical background; section 4 talks about the data sources, cleaning and construction of variables; section 5 specifies the regression equations and threats to identification; section 6 mentions the results; followed by a conclusion in section 7.

2 Literature Review

As Restuccia and Rogerson (2017) point out, there are "direct" and "indirect" approaches to studying input misallocation. The indirect approach exploits cross-sectional dispersion in marginal revenue products and tries to estimate the impacts of misallocation. This is done without identifying the sources of misallocation. This type of evidence is strongly available

in the literature, considering that data are more readily available at an industry level across countries (Hseih and Klenow, 2009; Busso, Madrigal, and Pagés, 2013; Kalemli-Ozcan and Sørensen., 2016; Bartlesman, Haltiwanger, and Scarpetta, 2013).

By direct approach, the studies try to pinpoint the sources of misallocation. The existing literature on the direct approach is relatively lesser because of the limited availability of data at a micro-level. Even if the data are available, the literature has been successful only in identifying large sources of misallocation in the agricultural sector (Restuccia and Rogerson, 2017), as compared to the manufacturing sector. The studies are even more sparse in the context of the services sector. Existing literature on this direct approach has identified some common sources of misallocation, namely – regulations[1], property rights[2], trade and competition[3], financial frictions[4], informational frictions and contract enforcement[5], or technology adoption[6].

This paper uses a direct approach and study the political economy aspects as a potential cause of capital misallocation in India. Just like in Bau and Matray (2023), this policy also impacts only certain sectors, and thus requires a weaker identification assumption for the differences-in-differences estimation. Unlike in Bau and Matray (2023), this unique experiment enables studying the direct impacts of government decisions on dispersions in productivity of firms in sectors in which the government controls foreign investment. Unlike previous literature that exists on deregulation (of banking, capital controls, industry licensing etc.) and capital misallocation (Alfaro and Chari, 2014; Sraer and Thesmar, 2023; Varela, 2017), this paper does not study a change in foreign investment policy, but the way in which government approval is provided to the foreign investors. This helps in identifying

[1]Examples include - adjustment costs (Hopenhayen and Rogerson, 1993; David and Venkateswaran, 2017), size-dependent policies (Guner, Ventura, and Xu, 2008; Garcia-Santana and Pijoan-Mas, 2014; Gourio and Roys, 2014; Garicano, Lelarge, and Van Reenen, 2016), the informality of sectors (Rauch 1991; La Porta and Shleifer 2014; Busso, Fazzio, and Levy, 2012), government regulations and state ownership (Hsieh and Moretti, 2015; Fajgelbaum et al., 2015; Song, Storesletten, and Zilibotti, 2011; Brandt, Tombe, and Zhu, 2013)

[2]See Besley and Ghatak, 2010; Boehm and Oberfield, 2018; Banerjee, 1999; Deininger and Feder, 2001.

[3]See Pavcnik, 2002; Trefler, 2004; Khandelwal, Schott, and Wei, 2013; Edmond, Midrigan, and Xu, 2015.

[4]See Midrigan and Xu, 2014; Varela, 2017; Saffie, Varela and Yi, 2018; Buera, Kaboski, and Shin, 2015; Gopinath et al., 2015.

[5]See David, Hopenhayn, and Venkateswaran, 2016; Caselli and Gennaioli, 2013

[6]See Bustos, 2011; Bloom, Draca, and Van Reenen, 2016; Aw, Roberts, and Xu, 2011.

the effects of changes in bureaucracy, corruption and efficiency of government departments on the misallocation of capital, which is a unique contribution to the literature.

The above paragraphs give a rough summary of the existing literature on input misallocation. However, since the extent of the misallocation literature is quite expansive.

Although there is a chunk of existing literature on misallocation in India, this paper contributes to the capital misallocation literature in three manners. Firstly, I utilize a policy regulation that does not directly increase foreign market access or reduce capital control but rather improves the way in which decisions are being taken. In a manner, it identifies the change in decision-making practices on input misallocation in India, which is a novel contribution to the literature. Secondly, the paper tweaks a theoretical framework incorporating the political economy angle to misallocation. Since FIPB abolition impacts all the industries whose foreign capital investment was under government control, and compared with other service industries whose foreign capital investment was always under the automatic route, I can isolate the impact of this policy change on capital misallocation in treated industries. Hence, identifying these existing gaps in knowledge, this paper makes unique contributions to several strands of misallocation literature. Lastly, I study the interaction of decentralisation with bureaucratic turnovers and assess its impact on capital misallocation.

3 Policy Context and Theoretical Background

3.1 FDI in India – FIPB and Related Reforms

India significantly opened its economic borders to foreign investors during the 1990s, in the wake of the large-scale economic reforms of 1991. When capital started flowing into the country, it was determined that for certain sectors[7], foreign investment would have to be approved by the government. For this purpose, FIPB, an inter-ministerial body was created. The job of the FIPB was to process these FDI proposals and recommend them for

[7]these are - mining, defence, broadcasting, print media and digital media, civil aviation, satellites, telecommunication, private security agencies, banking, pharmaceuticals, and retail.

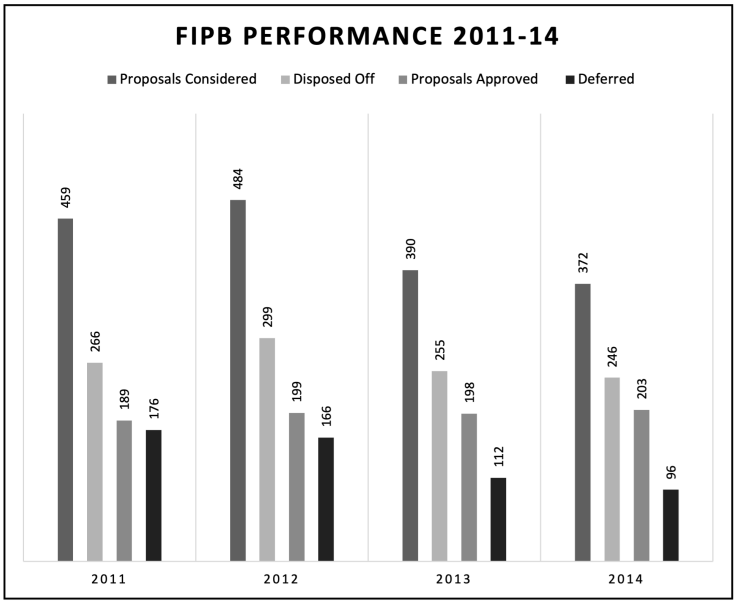
government approval. The board had bureaucrats mainly from the Finance Ministry and could co-opt bureaucrats from other ministries or experts.

In 2017, the FIPB was abolished and replaced by another single online portal called FIFP (Foreign Investment Promotion Portal). Under this, a foreign investor can submit proposals which will then get transferred to the concerned ministries, for approval. There is a standard operating procedure (SOP) issued for the working of FIFP which assures investors that decisions on their proposals would be communicated in 8-10 weeks. This move was to guarantee faster disposals of proposals. However, there are problems with this system. The SOP isn't a legal document and does not guarantee that there would not be any delays[8] Additionally, it doesn't give the right to appeal in case of rejections, unlike FIPB, and doesn't require any reasons to be communicated to the concerned party in the case of rejection of proposals. Additionally, cases under FIFP are not transparent, as were under FIPB.

Figure 1 shows the trends in the proposals considered, approved, and deferred between 2011 and 2014 by the FIPB. The proposals could be related to how much foreign investors want to invest in the country in that year, but the fact here to note here is that the disposal rate went up starkly from 58% in 2011 to 71% in 2014. Similarly, deferral rates have gone down from 38% in 2011 to 26% in 2014. These facts that are collected shortly before the policy change that abolished the FIPB (in 2017), reflect the fact that there indeed was an increase in the efficiency of FIPB in terms of deferral reduction and disposal improvement. Table 1 below represents some statistics on government route FDI in past years. The table shows that the number of proposals received through the government route has been decreasing, which could be affected due to macroeconomic factors, choice of investors, sectoral performance etc. On FIFP's 5-year completion, the government released another circular which said that FIFP has disposed of 853 cases in 5 years. Without any information on the total cases

[8] there are certain sectors that require security clearance from the Ministry of Home Affairs (MHA) now, before getting approval. The thing to observe is that the SOP doesn't put a strict timeline on the MHA approval process. It says the ideal time is six weeks, however, *"where MHA is not in a position to provide its comments within 6 weeks, it will intimate the Competent Authority of the expected time frame it would be able to give its comments."* Out of these 10 sectors that require government approval, 7 require clearance from MHA, which can delay its clearance without any legal consequences. Source - https://fifp.gov.in/Forms/SOP.pdf

Figure 1: FIPB Performance Indicators 2011-14



Notes: The figure shows the number of proposals considered, disposed off, accepted and deferred by the FIPB in years 2011 to 2014. Source - FIPB Review 2014

considered and deferral rates, which FIPB used to provide, nothing can be said concretely about the relative performance of FIFP with FIPB. However, it can be said that on the transparency front, FIPB outperforms FIFP. Yearly reviews of FIPB provided detailed data on all performance measures, proposal details, amount of inflow in each proposal, details of investors and investees, and above all, well-defined reasons for rejections.

Table 1: **Proposals Received under Government Route - 2016-19**

Year	Proposals Received
2016	199
2017	122
2018	117
Upto June 2019	55

Notes: The table shows proposals received under the government route. The data was revealed by a minister as a reply to a parliamentary question. Source - https://pib.gov.in/PressReleasePage.aspx?PRID=1827889

3.2 Theoretical Framework

The theoretical framework for this paper is divided into two parts. Firstly, I will be studying firm-level outcomes and assessing the policy effect at the firm-level. After this, I would be aggregating the effects at an industry level to understand the change in TFP resulting from this policy modification.

3.2.1 Firm-Level Outcomes

As is conventional in the literature, I also model misallocation as a wedge on input prices paid by the firm. Let the allocative price paid by a firm i for input x is $(1 + \gamma_i \tilde{\tau}_i^x) p^x$, where $x \in \{K, L, M\}$ and K, L and M denote fixed assets (tangible and intangible), labour and materials respectively, p^x is the observed price of the input, $\tilde{\tau}_i^x$ is the wedge/tax that the firm pays over the price, and γ_i is the firm-specific political friction, that either reduces or amplifies the wedge on the input price. This γ_i can be expressed as follows

$$\gamma_i = g(\bar{\gamma}) \tag{1}$$

where $\bar{\gamma}$ is the centre's (in this case FIPB) homogenous operating efficiency, and g is the function by which the political friction affects the overall wedge. $\bar{\gamma}$ is the centre's operating efficiency and I assume it stays same for all i's (ex-ante). In essence what this means is that all firms are exposed to the same central body in the same way.

Now a single-product firm has a profit function

$$\pi_i = p_i f_i(K_i, L_i, M_i) - \sum_{x \in \{K,L,M\}} (1 + g(\bar{\gamma}) \tilde{\tau}_i^x) p^x x_i \tag{2}$$

where f_i denotes the firm's production function which has diminishing marginal returns in each input.

Now the first order conditions for a cost-minimising firm (chooses x_i) will equal to zero at that x_i where the marginal benefit equals marginal cost.

$$p_i \frac{\partial f_i(K_i, L_i, M_i)}{\partial x_i} = \mu_i (1 + g(\bar{\gamma}) \tilde{\tau_i}^x) p^x \tag{3}$$

where μ_i is the markup wedge, and combined wedge (inclusive of political, output and input wedges), is $(1+\tau_i^x) = \mu_i(1 + g(\bar{\gamma})\tilde{\tau_i}^x)$. Thus, it can be observed that MRPK (Marginal Revenue Productivity of Capital) is proportional to the wedges on input price (for Cobb-Douglas Production Functions).

I propose that this wedge, changes for treated firms post the treatment years, and becomes different for different firms because of the horizontal distribution of authority. This creates heterogeneity in the rent-seeking behaviour in different industries (among different ministries controlling the approval process). Hence, the reformed combined wedge becomes

$$(1 + \tau_i^x) = \mu_i (1 + g(\gamma^I) \tilde{\tau_i}^x) \tag{4}$$

where γ^I is industry-specific (or in this case ministry-specific) bureaucratic cost. Thus, these changes in allocative efficiency can be seen on the firm-level outcomes such as sales, assets and MRPK. Same as in BM, if misallocation reduces, ex-ante high MRPK firms would see higher assets and lower MRPK ex-post compared to their low-MRPK counterparts.

Post the policy change, heterogeneity in bureaucratic capacity entering through γ^I, may be different for different industries. Ex-ante predictions of what happens to firms overall would be unreasonable. However, when I split the samples by measures of bureaucratic efficiency, that is to understand the heterogeneous impact of this policy in different sectors (based on bureaucratic efficiency). The effects on the MRPK and Assets of ex-ante high v/s low MRPK firms would be reflective of this mechanism.

3.2.2 Aggregation

According to BM, misallocation in a sector reduces if the Solow Residual of that sector increases. However, for aggregation purposes, their proposed Solow Residual decomposition requires that we have product-level outcomes for each firm, for production function

estimation (which is very difficult using service firms, which my sample also includes), and that the wedges stay the same overall (meaning that the allocative efficiency does not change due to the policy, but the allocation does, because of increase or decrease of the input itself). This is the reason why I use the sufficient statistics approach proposed by Sraer and Thesmar (2023) (henceforth ST), for calculating aggregate TFP changes due to changes in misallocation. Proposition 1 of their paper provides an interesting aggregation approach, which takes into account both, general equilibrium effects and changes in allocative efficiency.

Assuming firm-level outcomes satisfy two key assumptions (elasticity of revenue to factors is constant, and frictions are homogeneous across firms), then the counterfactual change in aggregate TFP from a policy (arising purely from this policy change), is given by the expression -

$$\Delta log(TFP) \approx -\frac{\alpha}{2}(1+\frac{\alpha\theta}{1-\theta})\sum_{s=1}^{S}\kappa_s\widehat{\Delta\Delta\sigma^2(s)}$$

$$-\frac{\alpha}{2}(1+\frac{\alpha\theta}{1-\theta})\sum_{s=1}^{S}[(\phi_s-\kappa_s)(\widehat{\Delta\Delta\mu(s)}+\widehat{\Delta\Delta\sigma_{lmrpk,lsales}}(s)+\frac{\alpha}{2}\frac{\alpha\theta}{1-\theta}\widehat{\Delta\Delta\sigma^2(s)})] \quad (5)$$

where $\widehat{\Delta\Delta\sigma^2(s)}$, $\widehat{\Delta\Delta\mu(s)}$, and $\widehat{\Delta\Delta\sigma_{lmrpk,lsales}}(s)$, are the diff-in-diff estimates of regressing the policy change on the industry-level variance, mean and covariance of MRPK and Sales; κ_s and ϕ_s are the industry's share of total capital and sales in economy; α is the capital share of production; and θ is $(\frac{\epsilon-1}{\epsilon})$ where ϵ is the price-elasticity of demand. The first part of the equation is referred in ST as the gains from within-industry reallocation of capital, and the second part is the gains from across-industry reallocation of capital.

4 Data

4.1 FDI Policy

Information about the specific industries that qualified under the government route was taken from the yearly FDI policy circulars and the press notes issued by the DPIIT[9] under Ministry of Commerce and Industry. The industries are then mapped to their specific 5-digit industry codes (called NIC Codes) using a document provided by the same website[10]. These mapped industry codes are helpful in determining which firms belonged to the treated industries (the ones affected by FIPB abolition). Roughly, the broad industries that qualified under government route were mainly Defence, Pharmaceuticals, Civil Aviation, Print, Mining, Broadcasting, Satellites, Telecommunications, Private Security Agencies, and Banking. Appendix table A1 provides information on the 5-digit codes of these industries and which are the ones covered in this study[11].

4.2 Firm-Level Outcomes

Firm-level data has been obtained using the ProwessDx database released by the CMIE. It is a panel dataset, covering over 50,000 Indian firms. The data is representative of medium and large-scale Indian firms, and comprises of annual balance sheet and income statement information from these companies. The Prowess data assigns each firm an NIC 5-digit product code, according to the main function of the firm. This is used in determining treatment status of each firm.

The duration of the study goes from 2013 to 2021, where the policy change takes place in 2017. Information retrieved includes data on yearly net sales, capital stock and compensation of employees. After dropping all such firms that have missing and/or zero values for sales,

[9] https://dpiit.gov.in/policies-rules-and-acts/press-notes-fdi-circular

[10] https://dpiit.gov.in/sites/default/files/Mapping_NIC2008_05January2015%20%202_0.pdf

[11] some sub-sectors of civil aviation - like ground handling or non-scheduled transport service were under government route until the 2016, and some other sub-units were included as a part of treatment in the middle of study duration. Since their treatment status is unclear, they are excluded from the analysis. Additionally, firms in Satellite Sector do not have data in ProwessDx.

capital stock and compensation, keeping only domestic firms that have data for ***atleast*** one year before and after the treatment (i.e. from 2016-2018), and keeping only those 5-digit industry groups that have atleast 5 firms (to calculate high and low MRPK firms), I have an unbalanced panel of 107,015 firm-year observations[12], covering 13,119 distinct companies, out of which 530 are treated firms. This data covers in total 377 5-digit industry groups, out of which 20 industry groups require government approval. All relevant financial variables are winsorised at 1%.

Classifying firms as ex-ante high and low MRPK is necessary for my empirical specification. For this, similar to BM, I also assume a Cobb-Douglas revenue production functions:

$$Revenue_{ijt} = TFPR_{ijt} K_{ijt}^{\alpha_j^k} L_{ijt}^{\alpha_j^l} M_{ijt}^{\alpha_j^m} \tag{6}$$

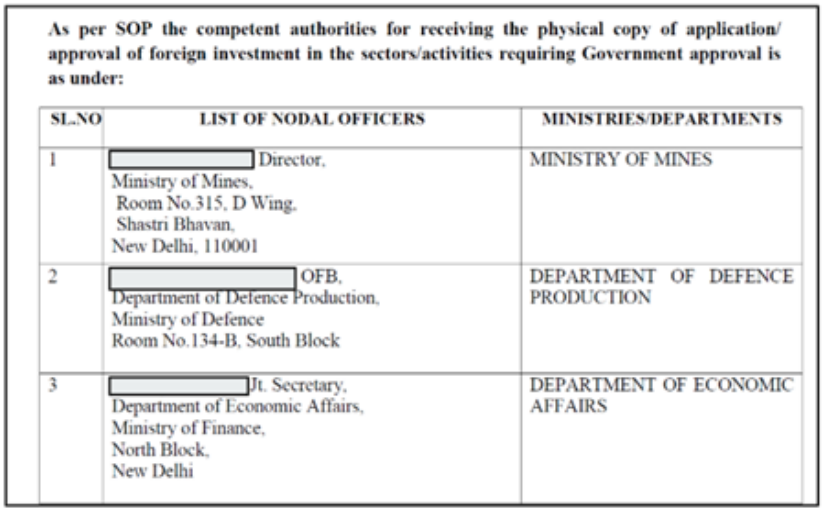
where i denotes a firm, j denotes an industry, t denotes a year, K, L, M are capital, labour and material inputs, and TFPR is the firm revenue productivity which is unobserved.

Under a Cobb Douglas revenue production function, since $MRPK = \frac{\partial Revenue_{ijt}}{\partial K_{ijt}} = \alpha_j^k \frac{Revenue_{ijt}}{K_{ijt}}$, which assuming that α_j^k is same for all firms in an industry j, provides a intra-industry measure of MRPK. As observed, MRPK within an industry is therefore, proportional to the sales-to-output ratio, which is taken as a proxy for MRPK. To classify a firm as high or low-MRPK, I construct a median measure of MRPK at a 5-digit industry levelin the pre-policy period (i.e. from 2013 to 2016), and classify a firm as high-MRPK if the average MRPK of the firm in the pre-policy period is above the 5-digit industry median. Appendix Figure B1 shows the distribution of MRPK, which roughly follows a normal distribution (an assumption needed for the aggregation approach).

4.3 Heterogeneity by Bureaucratic Changes

In order to study the mechanisms of changes in misallocation, I study the changes in authority in charge of these proposals at the sector-level. Namely, I classify the treated

[12]I exclude banking sector because of two reasons - output measurement would be very inaccurate, and so would the MRPK then, and secondly, increase in foreign equity flows would endogenously impact the financial market and affect banks through different channels.



As per SOP the competent authorities for receiving the physical copy of application/ approval of foreign investment in the sectors/activities requiring Government approval is as under:

SL.NO	LIST OF NODAL OFFICERS	MINISTRIES/DEPARTMENTS
1	[redacted] Director, Ministry of Mines, Room No.315, D Wing, Shastri Bhavan, New Delhi, 110001	MINISTRY OF MINES
2	[redacted] OFB, Department of Defence Production, Ministry of Defence Room No.134-B, South Block	DEPARTMENT OF DEFENCE PRODUCTION
3	[redacted] Jt. Secretary, Department of Economic Affairs, Ministry of Finance, North Block, New Delhi	DEPARTMENT OF ECONOMIC AFFAIRS

Figure 2: Nodal Officer List naming Bureaucrat-in-Charge

industries into two types $I \in \{E, N\}$ where E is *EverStay* industry type and N is *NeverStay* industry type. *EverStay* takes all those industries where the person-in-charge of the proposals is same for the industry for atleast more than a year. *NeverStay* takes all those industries where the bureaucrat-in-charge transfers out of the job or person-in-charge changes every year.

The reason for splitting the treated sectors into these two groups is by taking bureaucratic change as a proxy for allocative efficiency. In ex-ante, one would expect the sectors where bureaucrats stay longer at their jobs to be affected more positively, as they get a chance to adapt and learn the job, and be more efficient at it. However, this works under the assumption that ability of these bureaucrats is same across sectors, and the only factor impacting their efficiency is on-the-job experience.

The list of bureaucrats in-charge of the proposals can be obtained publicly through Nodal Lists posted on the FIFP website. Appendix table A1 depicts the treated sectors which are of *EverStay* or *NeverStay* type (for instance in Figure 2, I track similarly the name of the officer-in-charge over the years in the post-treatment period and construct the *EverStay* v/s *NeverStay* variable).

4.4 Aggregate Outcomes

The aggregation approach recommended by ST requires MRPK data at an industry-year level. Therefore, using the same MRPK calculation as above, I generate a 5-digit industry-year panel dataset which has the mean, variance and covariance variables. This results in 3384 industry-year observations, with 377 unique 5-digit industries, out of which 20 are treated.

For the aggregation exercise, data on parameters is taken to be the same as in ST, which is $\alpha = 0.33$ and $\theta \approx 0.83$. κ_s and ϕ_s are calculated by taking the average of the pre-treatment yearly share of industry s in total sales and capital stock of the economy.

5 Empirical Specification

In both parts of the analysis (firm-level outcomes and aggregation exercise), I use difference-in-differences models, albeit of different specifications and types.

5.1 Firm-Level Outcomes

As opposed to BM, who studied the policy change using a staggered difference-in-differences approach, the abolition of FIPB happened for all treated sectors at once. I use triple difference-in-differences as my main specification to study heterogeneous impacts on low and high MRPK firms. The baseline and the main equation of the firm-level outcomes that takes into account the differential impact of the policy for ex-ante high-wedge firms is in quation (7). This equation is fundamental for telling the within-industry impact of the policy

on misallocation[13] [14].

$$Y_{ijt} = \delta_t + \omega_i + \beta_1 Post_t \times Treated_j + \beta_2 Post_t \times Treated_j \times HighMRPK_{ij} + \Gamma X_{it} + \epsilon_{ijt} \quad (7)$$

where Y_{ijt} takes values of log(Sales), log(Gross fixed assets), and log(MRPK); δ_t and ω_i are time and firm fixed effects respectively, capturing firm-invariant and time-invariant characteristics; $Post_t$ takes value 1 post 2017, and 0 before that; $Treated_j$ takes value 1 if the firm i lies in an industry j which is treated (in this case, requires government approval for foreign investment); $HighMRPK_{ij}$ takes value 1 if the firm i is a high-MRPK firm in the pre-policy period in industry j, as defined in the section above; X_{it} are firm-age and size-year fixed effects, as taken by BM as well [15], and ϵ_{ijt} is the stochastic disturbance term.

Here β_2 is the coefficient of interest, as it tells us the difference between high and low MRPK firms in treated industries, hence helping us infer the change in allocation of resources post the treatment year. The total effect of the policy on High MRPK firms can be perceived by $\beta_1 + \beta_2$. Equation (8) is then estimated for *EverStay* and *NeverStay* sectors by splitting the sample, as described in Section 4.3[16].

5.1.1 Assumptions and Threats to Identification

Parallel Trends - One of the fundamental assumptions of diff-in-diff estimation is the existence of parallel trends. In equation (8), to identify β_2, the necessary assumption is that the *the average difference in the outcome between high and low MRPK firms in treated and control firms trends in the same manner, in the absence of the treatment*.

[13] this is same to the triple diff-in-diff methodology proposed by Olden and Moen (2022).

[14] All the single and double interactions term not mentioned are perfectly collinear with linear combinations of fixed effects, and are hence absorbed. The term $Post_t \times HighMRPK_{ij}$, although identified, would not be interpretable. That shows the difference in outcome in the post-treatment period in untreated firms. However, it may be tempting to interpret this coefficient along with the triple interaction coefficient as the across-sector impact, $HighMRPK_{ij}$, is a relative within-industry measure. I am restricting this coefficient to be 0, under the assumption that the difference between low and high-MRPK firms in untreated sectors would be unchanged in the post-treatment period, as they are not exposed to the shock.

[15] older firms are more established and may see different misallocation trends as younger ones. Similarly, this comparison can be related to large and small firms as well. The regression compares low and high MRPK firms with the same age and in same size-year cell.

[16] comparison group for each of those are the untreated industries

In order to assess parallel trends, I estimate the following dynamic event-study type diff-in-diff regression controlling for the covariates as above.

$$Y_{ijt} = \omega_i + \sum_{t \in T/2016} I(g = t)[\beta_{1t} Post_t \times Treated_j + \beta_{2t} Post_t \times Treated_j \times HighMRPK_{ij}] + \Gamma X_{it} + \epsilon_{ijt}. \quad (8)$$

where T/2016 takes discrete yearly values from 2013 to 2017 (excluding 2016, to avoid multicollinearity), and $I(g = t)$ is an indicator variable takes value 1 when time is equal to t[17].

Endogeneity of Treatment - Endogeneity of treatment would impact the diff-in-diff estimates and produce inconsistent estimates. This would bias our inferences. On the endogeneity of treatment here, there are two strong arguments - (1) The government approval process changing is a subtler treatment than liberalisation or increasing FDI limits on industries. The treatment status (here the abolition of FIPB) affects all the industries and subsequently, companies requiring government approval, at the same time, and since it is an exogenous policy shock, is unlikely to be affected by the industries themselves; (2) Most importantly, perhaps the reasons why these industries required government approval is key to understand to prevent endogeneity. Many of these sectors, like print, media, defense, satellites, telecommunications are very sensitive to national security issues.

[17] As suggested by Roth et al., (2022), conditional parallel trends when covariates are controlled for are stronger, although, including covariates by year effects may produce biased ATT estimates and hence semi-parametric methods may be used for this.

5.2 Aggregate Outcomes

Akin to the ST approach, to calculate the sufficient statistics required for observing the TFP change, I estimate the following DID regression with heterogeneous treatment exposure -

$$M_{jt} \quad = \quad \delta_t + \omega_i + \gamma_1 Post_t \times Treated_j + \gamma_2 Post_t \times Treated_j \times EverStay_j + \eta_{jt} \quad (9)$$

where M_{jt} is the 5-digit industry-year level cross-sectional moments (mean, variance and covariance of sales and MRPK); $EverStay_j$ takes value 1, if industry j is of *EverStay* type as described in section 4.3; and $\delta_t, \omega_i, \eta_{jt}$ variables are the year FE, industry FE and errors.

After estimation, the Δ in the sufficient statistics which is what I use for the TFP change calculation, can be given by $\gamma_1 Treated_j$ for *NeverStay* industries, and $(\gamma_1 + \gamma_2) Treated_j$ for *EverStay* industries. For all firms in industry of type $I \in \{E, N\}$, the

$$\widehat{\Delta\Delta M(s)} = \widehat{\Delta\Delta M^I} \quad (10)$$

$\forall M \in \{\mu, \sigma^2, \sigma_{lmrpk,lsales}\}$

Using these estimates I calculate the $\Delta log(TFP)$ as specified in Section 3.2.2. However, I also look at the decomposition of this measure into the *EverStay* and *NeverStay* industry types.

$$\Delta log(TFP) = \Delta log(TFP)^E + \Delta log(TFP)^N. \quad (11)$$

Each of these terms can be further decomposed to understand the gains from reallocation within sector and across sectors (as specified in ST approach). This can help understand the total gains from decentralisation, and any gains/losses from any changes to bureaucratic authority.

6 Results

6.1 Results by ex-ante MRPK

To understand changes in misallocation, it would be imperative to compare the treatment effects considering the pre-period productivity. Table 2 provides the result for specification 7. The β_1 coefficient on *Treated* $\times$ *Post* gives an estimate of the treatment effects on the ex-ante low-MRPK firms. The β_2 coefficient tells us the differential treatment effects on the ex-ante high-MRPK firms v/s the ex-ante low-MRPK firms. $\beta_1 + \beta_2$ gives us the total treatment-effect on ex-ante high-MRPK treated firms. Figure 3 shows the event-study graphs for this specification.

Table 2: **Heterogeneous Treatment Effects on Firm-level Outcomes by ex-ante MRPK**

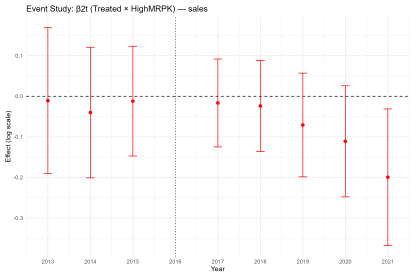
	Sales	Assets	MRPK
Treated $\times$ Post	0.076***	-0.018	0.094***
	(0.029)	(0.026)	(0.030)
Treated $\times$ Post $\times$ HighMRPK	-0.067	0.122***	-0.189***
	(0.039)	(0.036)	(0.041)
N	107,015	107,015	107,015
Year FE	Y	Y	Y
Firm FE	Y	Y	Y
Size $\times$ Year FE	Y	Y	Y
Firm-Age FE	Y	Y	Y
p-val for H_0: $\beta_1 + \beta_2 = 0$	0.7370	0.0001	0.0011

Standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

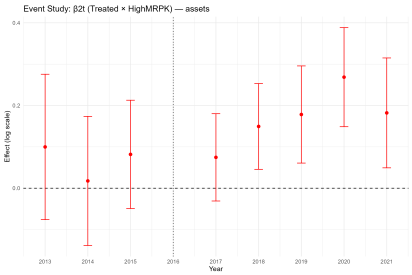
Low-MRPK treated firms on average, see higher sales by 8%, and higher MRPK by 9% in the post-treatment period (compared to untreated firms). High-MRPK treated firms on average, have 7% lower sales, 12% higher assets and 19% lower MRPK than the low-MRPK treated firms. In total treatment effects, this implies that for high-MRPK firms, post-treatment MRPK reduced by 9% and for low-MRPK firms, their post-treatment MRPK has also increased by 9%, indicative of reduced post-treatment dispersion of productivity in treated industries. This is suggestive of the fact that within the treated industries,

misallocation of capital seems to have reduced. However, the effects of improved allocation are do not trickle down to the sales of high-MRPK firms (who in total see no change in post-treatment sales as compared to the untreated firms).

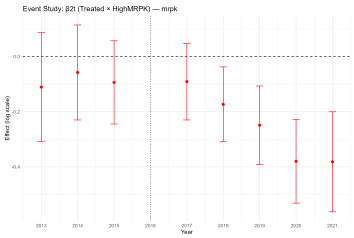
Figure 3: Event Study: β_{2t} Effects (Treated $\times$ HighMRPK)



(a) Sales



(b) Assets



(c) MRPK

6.2 Heterogeneity by Bureaucratic Changes

To proxy for bureaucrat efficiency, I study the same specification as in equation (7) for two separate comparison exercises . Looking at Table 3 and Table 4, we observe that in the *EverStay* industries low-MRPK firms observe a 24% higher sales, 4% higher assets and 20% higher MRPK. The high-MRPK firms on average, see 10% lower sales, 11% higher assets, and 21% lower MRPK than their low-MRPK counterparts. Aggregate effects on high-MRPK firms however, shows an increase in sales by 14%, assets by 15%, but no significant changes to post-treatment MRPK (comparing to the untreated firms).

In the *NeverStay* industries, low-MRPK firms on average, see a 7% lower sales and 7% lower assets in the post-treatment period. High-MRPK NeverStay firms 13% higher assets and 17% lower MRPK as compared to the low-MRPK counterparts, in the post-treatment

Table 3: **Heterogenous Treatment Effects by ex-ante High MRPK : *EverStay* Industries**

	Sales	Assets	MRPK
Treated × Post	0.240***	0.041	0.198***
	(0.032)	(0.025)	(0.034)
Treated × Post × HighMRPK	-0.100**	0.109***	-0.209***
	(0.041)	(0.038)	(0.044)
N	104,677	104,677	104,677
Year FE	Y	Y	Y
Firm FE	Y	Y	Y
Size × Year FE	Y	Y	Y
Firm-Age FE	Y	Y	Y
p-val for $H_0 : \beta_1 + \beta_2 = 0$	4.61×10^{-8}	1.41×10^{-7}	0.715

Standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

period. In aggregate, high MRPK firms have 10% lower sales, but 7% higher assets, and 17% lower MRPK than the untreated firms. The lower MRPK effects of the ex-ante high productivity firms could also be mechanical as these firms see a decrease in sales, while their assets are going up (and MRPK is proxied as the sales-to-assets ratio).

Table 4: **Heterogenous Treatment Effects by ex-ante High MRPK : *NeverStay* Industries**

	Sales	Assets	MRPK
Treated × Post	-0.068	-0.069*	0.001
	(0.046)	(0.042)	(0.047)
Treated × Post × HighMRPK	-0.035	0.132**	-0.167**
	(0.063)	(0.059)	(0.067)
N	105,083	105,083	105,083
Year FE	Y	Y	Y
Firm FE	Y	Y	Y
Size × Year FE	Y	Y	Y
Firm-Age FE	Y	Y	Y
p-val for H_0: $\beta_1 + \beta_2 = 0$	0.0157	0.1241	0.0005

Standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

6.3 Aggregate Impacts

In order to understand impacts on misallocation and aggregate productivity I use the aggregation approach as proposed in Sraer and Thesmar (2023). Estimating equation (9), I first calculate estimated impacts on the sufficient statistics of MRPK in the treated industries, by taking *EverStay* as a measure for heterogenous exposure. Observing estimates reported in Table 5, the mean MRPK in *EverStay* industries increases by 13%, with the variance of MRPK reducing by 42%, signalling substantial capital reallocation gains. As observed in the above tables, the increase in average MRPK is driven by firms with ex-ante low MRPK. Firms do get more capital constrained on-average in the *EverStay* industries, however the firms that were previously capital-constrained have a lower MRPK ex-post (consistent with Table 3). There are no significant impacts on covariance of firm-size (sales) and MRPK, ex-post. This implies that firms in the *EverStay* industries see a mild increase in average distortions, however, also see better reallocation of capital.

The same impacts for the *NeverStay* industries are opposite. With no significant impacts on average MRPK and covariance ex-post, the effect on variance of MRPK is significant. Variance of MRPK has increased by 38%. This is consistent with the results in Table ?? where we see the ex-ante low-MRPK *NeverStay* firms also decrease their post-period MRPK. So although MRPK of both high and low firms decreases in post-period, the overall within-industry variance increases, signalling that there are overall decreased distortions but not enough reallocation between low and high MRPK firms within the *NeverStay* industries.

Using Proposition 1 of Sraer and Thesmar (2023), I calculate the effects on aggregate productivity ($\Delta log(TFP)$) (under the assumption of log-normality of MRPK within industries). The estimate correspond to counterfactual change in the sufficient statistics if the "abolition of FIPB and decentralization of authority" was the unique source of change in the economy.

However, additionally I calculate two-more aggregate statistics: $\Delta log(TFP)^E$ and $\Delta log(TFP)^N$. These are effects on aggregate productivity, if all the firms who were affected by the abolition of FIPB were to only go to ministries of the *EverStay* type, or *NeverStay* type respectively. The $[\Delta log(TFP) - \Delta log(TFP)^E]$ gives us the productivity loss occurring as a result of bu-

Table 5: **Aggregate Impacts on Sufficient Statistics of MRPK**

	μ_{lmrpk}	σ^2_{lmrpk}	$\sigma_{lmrpk,lsales}$
Treated × Post	-0.081	0.375*	-0.238
	(0.095)	(0.227)	(0.252)
Treated × Post × *EverStay*	0.214**	-0.794*	-0.194
	(0.100)	(0.406)	(0.330)
N	3,393	3,384	3,384
Year FE	Y	Y	Y
Firm FE	Y	Y	Y
Size × Year FE	Y	Y	Y
Firm-Age FE	Y	Y	Y
p-val for H_0: $\gamma_1 + \gamma_2 = 0$	0.00065	0.2230	0.0520

Standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

reaucratic change. $\Delta log(TFP)^N$ gives us the total productivity loss where there is frequent bureaucratic change. $\Delta log(TFP)^E$ gives the ideal productivity gains from decentralization of authority coupled with efficient bureaucracy.

Table 6: **Decomposition of** $\Delta log(TFP)$

	Total	Within-Reallocation	Across Reallocation
$\Delta \log(TFP)$	0.22%	0.28%	-0.05%
$\Delta \log(TFP)^E$	0.51%	0.54%	-0.03%
$\Delta \log(TFP)^N$	-0.28%	-0.26%	-0.02%

The estimates are reported in Table 6. Total TFP-gain ($\Delta log(TFP)$) from this decentralization policy is 0.22%. Gains from within-industry reallocation of capital contribute to 0.28% change in aggregate TFP, and cross-industry production reallocation lowers the TFP gain by 0.05%. This is because of increased production in pre-reform distorted firms (as also suggested by ST). These gains can be decomposed into the *EverStay* and *NeverStay* industries. The $\Delta log(TFP)^E$ is 0.51% and $\Delta log(TFP)^N$ is -0.28%. This hints that there are gains from reallocation (especially from within industry reallocation) if the authority post-decentralisation does not suffer frequent changes.

7 Conclusion

The paper uses a unique policy experiment to understand the effects of decentralisation and changes in authority on firm productivity. Overall, the decentralisation policy has a positive impact in increasing the assets of the previously capital-constrained firms. This possibly happens due to faster disposal of foreign investment approvals, through decreased bureaucratic load. However, effects are different for sectors where there is a higher bureaucratic turnover. In industries where the decision making authority changes frequently, I observe losses aggregate productivity of about 0.3%. In the sectors where bureaucrats stay longer on their job, there are productivity gains of about 0.5% (stemming primarly from within-industry reallocation of capital). The paper shows that productivity gains to decentralisation and decrease of bureaucratic load can be offset by bureaucratic turnovers.

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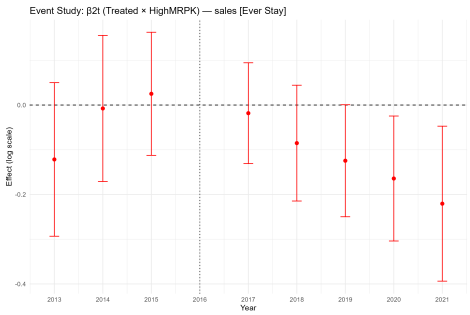
A Appendix - Additional Information

Table A1: Treatment Industry Codes and *EverStay* Classification

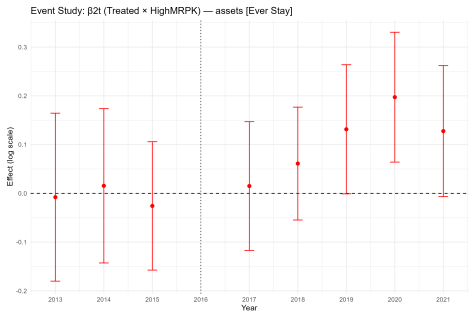
NIC Code	Description	Ministry-in-Charge	*EverStay*
07200	Mining	Mines	1
20292	Manufacture of explosives, ammunition and fire works	Defence	1
21001	Manufacture of medicinal substances used in the manufacture of pharmaceuticals	Pharmaceuticals	1
21002	Manufacture of allopathic pharmaceutical preparations	Pharmaceuticals	1
21003	Manufacture of 'ayurvedic' or 'unani' pharmaceutical preparation	Pharmaceuticals	1
47411	Retail sale of computers and computer peripherals	DPIIT	0
47510	Retail sale of textiles in specialized stores	DPIIT	0
47599	Retail sale of other household appliances	DPIIT	0
47711	Retail sale of readymade garments, hosiery goods, other articles of clothing and clothing accessories such as gloves, ties, braces etc.	DPIIT	0
47713	Retail sale of articles of fur and artificial fur	DPIIT	0
47721	Retail sale of footwear	DPIIT	0
47733	Retail sale of leather goods and travel accessories of leather and leather substitutes	DPIIT	0
47739	Other retail sale of new goods in specialized stores	DPIIT	0
47990	Other retail sale not in stores, stalls or markets	DPIIT	0
52231	Activities related to air transport of passengers, animals or freight	Civil Aviation	1
52242	Cargo handling incidental to water transport	Civil Aviation	1
58131	Publishing of newspapers	I&B	0
58132	Publishing of journals and periodicals	I&B	0
61103	Activities of the cable operators	I&B	0
61900	Activities of providing internet access by the operator of the wired infrastructure	I&B	0

B Appendix - Figures

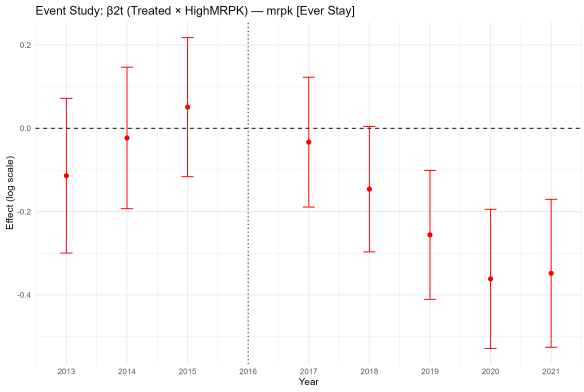
Figure 4: Event Study - *EverStay*: β_{2t} Effects (Treated × HighMRPK)



(a) Sales

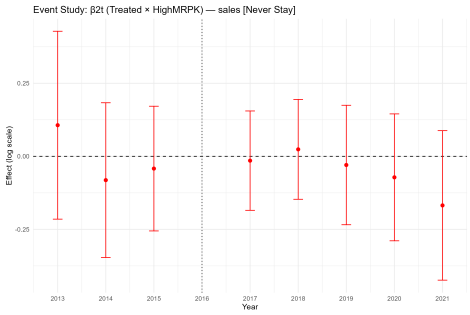


(b) Assets

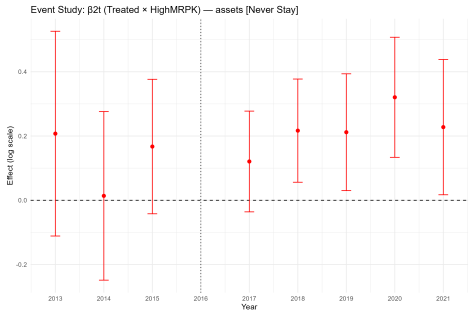


(c) MRPK

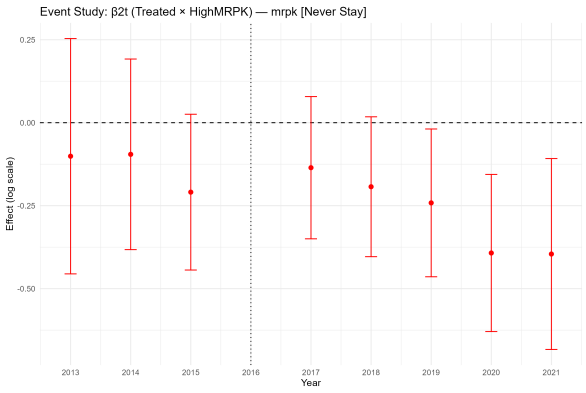
Figure 5: Event Study - *NeverStay*: β_{2t} Effects (Treated $\times$ HighMRPK)



(a) Sales

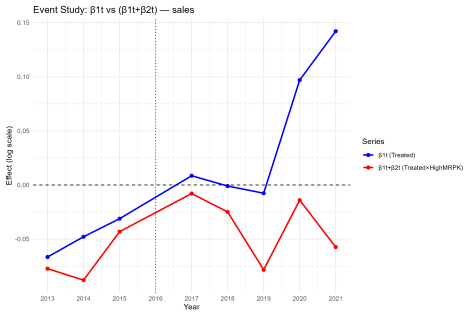


(b) Assets

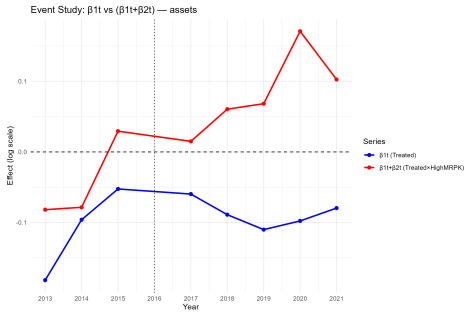


(c) MRPK

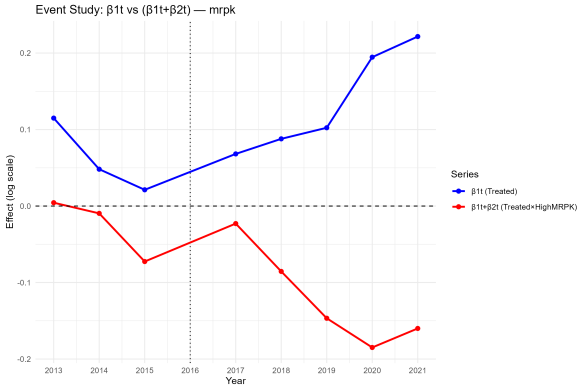
Figure 6: High MRPK v/s Low MRPK firms: All



(a) Sales

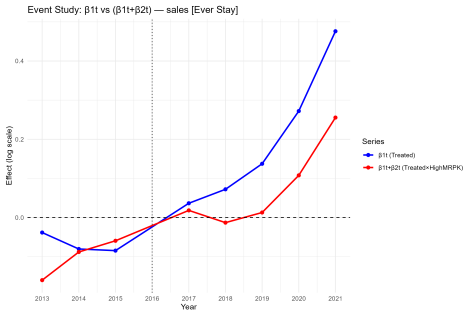


(b) Assets

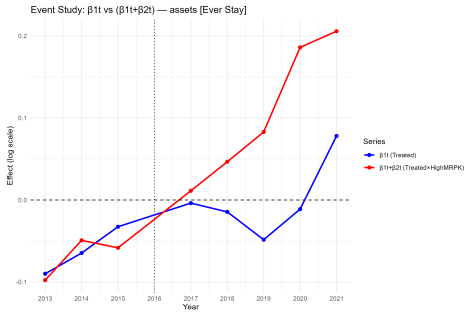


(c) MRPK

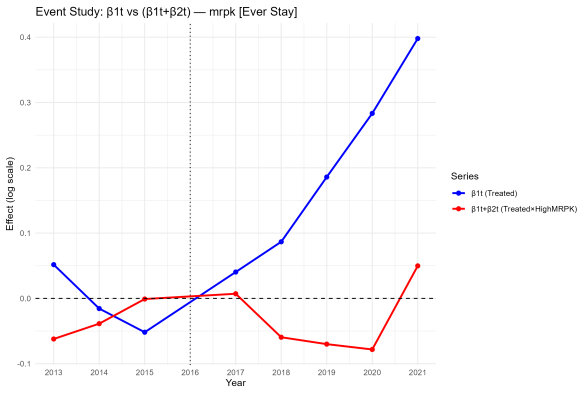
Figure 7: High MRPK v/s Low MRPK firms: *EverStay*



(a) Sales

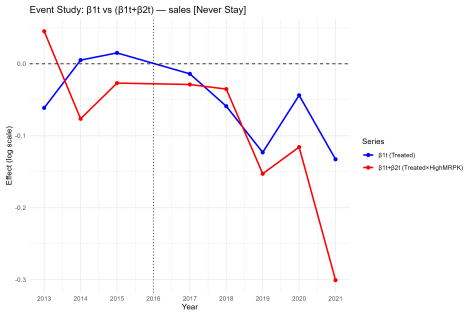


(b) Assets

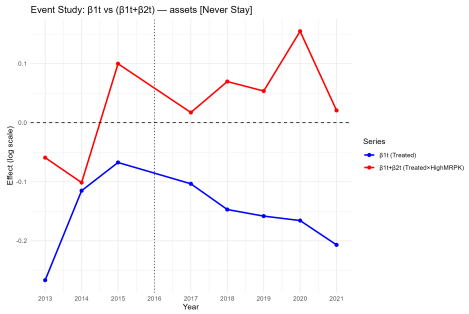


(c) MRPK

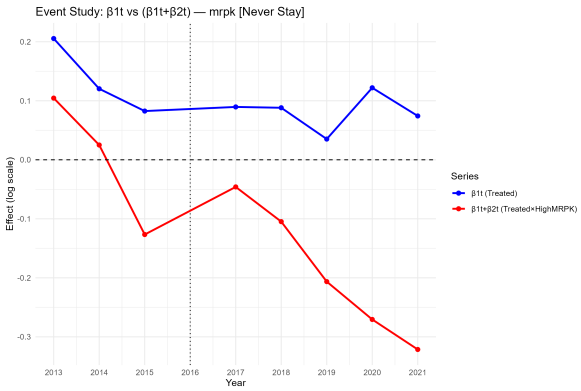
Figure 8: High MRPK v/s Low MRPK firms: *NeverStay*



(a) Sales



(b) Assets



(c) MRPK