Do political factors influence performance of Public Sector Enterprises? The Indian Disinvestment Experience

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Abstract: *India had adopted disinvestment, as part of broader reforms, in 1991 to improve performance of public sector enterprises (PSEs) owned by the Central government of India. The current study captures the effect of disinvestment policy on the performance of Central Public Sector Enterprises (CPSEs) with special emphasis on the local political and economic environments in which these enterprises operate. Using firm efficiency to capture performance of all CPSEs between 1991-92 and 2010-11, the study employs instrument variable regression and difference-in-difference estimation models. The results suggest that performance of CPSEs is driven by a harmonious union of internal (firm specific) and external factors. Experience, large firm size and low debts are among the internal factors that boost performance of CPSEs. Among external factors, disinvestment, as a policy intervention, has a positive impact on performance. Political and economic factors at the state level also have a significant impact on firm performance. Importantly, the effect of disinvestment is stronger if the enterprise is located in a state that is right winged and is ideologically similar to the state.*

JEL classification: P16, D22, L33, C33

Keywords: public sector enterprises, political economy, disinvestment, stochastic frontier analysis, instrument variable, Difference-in-difference estimation

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1 Introduction

It is commonly perceived that privately owned and managed firms operate more efficiently than comparable public sector ones. The crux of this argument is that, in general, in developing economies like India, state owned enterprises (SOEs) are used as critical instruments to achieve the social and developmental goals. However, more often than not this sector is generally free of competitive pressure. This privileged position when combined with an indistinct mandate of serving social interests leads to operational inefficiencies. Against this background, the moot issue is performance assessment of these enterprises and understanding factors affecting it. Economic performance of enterprises (public/private) is not driven just by firm level characteristics in isolation. Instead, performance depends on a harmonious union of internal factors and external conditions. The central argument of this study is based on this feature.

In the Indian context, more than 60 percent of state owned enterprises owned by the central government (central public sector enterprises, CPSEs) have a dynamic presence in a majority of states with a multi plant production process. Hence to capture performance of a particular CPSE, one needs to examine the internal factors as well as the external business environment in which each plant of the CPSE operates. Further, the performance of CPSEs in India had been notably below par in the late 1980s mainly due to lack of competition and serving multitude objectives (Ahuja and Majumdar, 1998; Majumdar, 1998; Ghosh, 2009). Burgeoning losses made these enterprises burdensome on the exchequer. As a result of this, disinvestment was adopted by India in 1991 as a part of the *New Economic Policy*. Even after two and a half decades since inception, the pace of implementation of disinvestment has been slow[1]. Against this background, the current study aims to evaluate the performance of CPSEs in India since the adoption of disinvestment policy. Specifically, the two points that the study investigates are

1. Efficacy of disinvestment as a policy option to improve CPSE performance
2. Influence of state specific political factors (ideology) on CPSE performance

Theoretically, disinvestment is the transfer of ownership of state owned enterprises from the government to the private sector. It has been documented in the international theoretical liter-

[1]Kapur and Ramamurti (2002) argue that political instability, poor financial market performance, judiciary institutions and CPSE structure are factors responsible for gradualism of disinvestment policy in India

ature (Matsumura (1998)) that the main rationale driving disinvestment is the assumption that private enterprises are better performing than the public ones. With disinvestment, the public sector enterprises experience better management, more focussed objective and hence better performance. The disinvestment policy in India witnessed the onset with the Chandrashekhar government making the first public announcement on March 4, 1991 stating to privatize up to 20% of its equity in selected CPSEs. Since its inception, the policy of disinvestment has evolved over a period of time. The period from 1991-1992 to 1995-1996, wherein partial disinvestment was attempted by fits and starts, marked the first phase of disinvestment. In the second phase from 1996-1997 to 1997-1998 the disinvestment commission was constituted with an effort of institutionalizing the disinvestment process on a firm footing. From 1998-1999 began the third phase which ended on 2007-2008 demonstrating a paradigm shift towards disinvestment. The final ongoing phase started in 2008-09.

Pursuant to over two decades of disinvestment efforts in India, there exist several empirical studies focusing on the impact of disinvestment on firm performance. The most common refrains about the disinvestment policy in India has been the absence of a focused objective and available alternate policy options (Gouri, 1997; Chari and Gupta, 2008). These studies suggest that because of political factors, reinvention of PSEs and introduction of competition was pursued more aggressively as compared to disinvestment. Further, Sarkar et al. (1998) and Ghosh (2009) explore the relationship between public ownership and firm performance. One of the main drivers of performance was stock market listing. Sarkar et al. (1998) deduce that whereas traded private banks were clearly superior to the public banks, non traded private banks were not significantly different in performance vis-a-vis the public banks. Ghosh (2008), Majumdar (2008) and Gupta (2005) find that disinvestment has had a positive impact on CPSE performance. Gupta (2005) suggests with shares of divested firms available on stock market there is an increase in the productivity without layoffs. Gupta (2010) finds that performance improvements for divested CPSEs are positively and significantly related to the fraction of equity sold.

Though abundant, existing literature on disinvestment in India suffer from the following limitations. First of all, majority of studies assess performance of public sector enterprises using standard accountancy measures which are best suited for private enterprises. These measures

fail to capture the true performance of public enterprises which are different from their private counterparts in objective, organization and structure. Secondly, performance of an enterprise is not solely driven by the inherent resources within the firms. Local resources, political conditions, institutional characteristics and prevalent policies shape performance of enterprises as much as the firm specific factors. Aforementioned studies have ignored this important factor. The present study aims to capture these two features and assess performance of public sector enterprises. Additionally, the study deviates from a classical dummy variable approach for disinvestment and ideology of governments. The present study attempts at using a multi dimensional approach by using a combination of variables to capture disinvestment as a policy option and ideology as a feature of the government.

The study employs panel data instrument variable and difference-in-difference (DiD) models to establish the empirical relationships. It draws on official data from the Public Enterprise Survey for the period 1991 to 2010 and uses firm efficiency to capture firm performance. Disinvestment decisions are captured using three definitions - First Time disinvestment (selection of firms for initial disinvestment), occurrence of disinvestment (first time and repeated overtime) and the extent of disinvestment(proportion of shares in a CPSE transferred from the government to the private sector).

The main findings of the study may be summarized as follows. Performance of public sector enterprises is driven by a combination of internal and external factors. Internal factors comprise of large size, more experience and low debt size. Further, first time selection, repeated selection and higher extent of disinvestment lead to improved performance of enterprises. Thus, the direct effect of disinvestment on firm efficiency is positive. In terms of external political factors, ideology of the state does not have a direct effect on firm performance. However, ideological difference between the centre and state have negative ramifications for firm performance. Further, the effect of disinvestment on firm performance is strongly conditioned on the ideology and ideology similarity (with the centre) of the state where the firm operates. The effect of disinvestment is stronger in right winged state because of better policies and environment to support disinvestment to affect firm performance. Similarly, as these enterprises are owned by the central government and disinvestment is a policy adopted by the centre, disinvestment has a stronger effect if the enterprise is in a state that has a similar ideology to the centre.

2 Influence of disinvestment and ideology on CPSE performance

Disinvestment and firm performance

Following Boycko et al. (1996), PSEs are not as efficient as their private counterparts because of two arguments based on the consideration that a company is a bundle of ownership and control rights. Firstly, the ownership based arguments states that governments might have a multidimensional objective function and hence might pursue goals other than profit maximization, such as employment increase, investment in certain regions or products, or high but unsustainable dividend payouts. The lack of clearly defined objective function affects the performance and outcome of public sector enterprises adversely. Hence, transferring the ownership to private investors can make the objective faced by the management more focused and that in turn implies that disinvestment as an intervention will improve firm performance.

The second argument in favour of disinvestment is based on the lack of transparency in managing public sector enterprises. Following Gebka (2008), after disinvestment the enterprises are listed on the stock market, which acts as a monitoring and controlling device, by delivering information about the enterprise, allowing conditioning managerial salaries on performance, and disciplining through takeover threats and the managerial labour market. Hence, disinvestment might improve corporate performance by introducing private mechanisms of monitoring and control: legal framework for private companies, actions of analysts and shareholders, market for corporate control and the managerial labor markets. Gupta (2005) concludes that partial privatization has had a positive impact on firm performance. The finding supports the notion that the monitoring and disciplining forces of the capital market are crucial for successful disinvestment.

Following the theoretical and empirical evidence, the study hypothesizes that even if enterprises are not being fully privatized, disinvestment leads to an improvement in the performance due to the aforementioned reasons.

Ideology of the state and firm performance

Despite being owned by the central government, CPSEs come under the direct helm of state governments due to two main reasons. First of all, daily operations are driven by external factors as much as by internal firm specific factors. Secondly, more than sixty percent of the enterprises have multi-plant structure with presence in more than one state. And, hence the overall performance of these enterprises is going to be driven by a combination of the business environment prevailing in each of the plant locations. These facts suggest that the governments of those states, their beliefs, actions and policies would directly affect the business environment. This effect would eventually trickle down to the industries and then the firms.

A unique feature of SOEs is that these firms are structurally different from their private counterparts. In India, CPSEs are owned by the Central government of India, which is elected by the citizens of India. Thus, the real owners of these enterprises are the citizens. Unlike private enterprises, CPSEs are run by managers (agent 1) which are appointed by selected ministries of the government (agent 2) on behalf of the citizens. This double agent problem may lead to a moral hazard problem in the performance and management of these enterprises thus resulting in efficiency losses. This feature of SOEs make them more susceptible (than private ones) to the external political and economic environment.

Theoretically, it is a long established fact that left winged governments promote redistributive policies more than their right winged counterparts which signals that governments inclined more towards the right side of the ideological spectrum will have relatively more policies that are beneficial to the industrial sector. Empirical investigation indicates similar results. Allers et al. (2001) find that left winged parties have a higher tax burden as opposed to the right winged ones. Comola (2009) finds that on an average right winged governments support export in certain industries more than the left winged governments.

According to the Board of Restructuring Public Sector Enterprises (BRPSE), that recommends CPSEs for closure or winding up to the Bureau for Industrial and Financial Reconstruction (BIFR), 47% of West Bengal (run by Trinamul Congress (TMC) which is a left winged party) CPSES were recommended for closure in 2014. This was much higher than Maharashtra (13%), Karnataka (24%) and Uttar Pradesh (27%) which were run by Shiv Sena (right-centre), In-

dian National Congress (centre) and Samajwadi Party (right-centre) parties respectively. This indicates that CPSEs located in left winged states have a considerable higher closure rate as opposed to right winged states.

Hence, the study hypothesizes that for an enterprise, performance is better if it operates in a state governed by right winged political party rather than a left winged one.

Firm performance and centre state ideological difference

The political structure in India requires a harmonious relationship between the Centre and the states. As mentioned by the inter-state council document, this relationship is contoured by the political parties in power at both wings of the government. The relationship was not of concern till 1960s when the Indian National Congress emerged as one major single party government at the Centre and many states. According to Venkataratnam and Verma (1997), the emergence of coalition government at the Centre, regional parties at the state level and as partners in coalition, and governments led by opposition parties in the states on one hand and declining time horizon of political parties put severe strain on implementing policies (Rao (2013)). Hence, the devices used earlier to maintain harmonious centre-state relations have become useless. According to a document by CPIM (2008) on centre state relations in India, there are several unresolved issues including vertical imbalance of power between the Centre and states, inadequate central transfers to state funds, unequal borrowings to different states, disparity in grants and aids given to states.

With the Central government of India having the power to decide on most of these issues, the decisions are driven by the ideology of the Centre. More specifically, the decisions are gravely influenced by the ideological differences between the Centre and the state. Most of these decisions have direct repercussions on the type of policies designed by the state government. This may range from high electricity tariffs to high tax rates due to insufficient funds from the Centre. There are several reality excerpts which present how political parties at the centre hold back funds for states run by ideologically dissimilar state governments.[2]. To summarize,

[2]BJP holds back funds for Orissa run by INC in 2002 - http://www.indianexpress.com/Storyold/131771/ and UPA holds back funds for Uttar Pradesh run by Samajwadi party in 2013- http://www.thehindu.com/news/national/upa-holding-back-funds-for-up-sp/article5311554.ece?homepage=true

while the Central government is responsible for the overall performance of the enterprises, labor management relations in plants, forward and backward linkages of the production process, electricity and power supply come under the jurisdiction of the respective state governments where the enterprises are located. Venkataratnam and Verma (1997) further emphasize that political differences among the parties in power caused problems for CPSEs. The study also discusses that policy decisions at the state level may stem from ideology positions not similar to that of the Centre. Given the diversity of the context and seriousness of the political ferment, ideological difference between the centre and state will have substantial ramifications for the performance of these enterprises.

Following these arguments, the study hypothesizes that enterprises located in states which are run by parties similar (ideologically) to parties running the Central government have better performance.

The effect of disinvestment and ideology on CPSE performance are not completely independent of each other. If an enterprise is located in a right winged state, the state policies will be more favorable to the industry. Similarly, if an enterprise is located in a state that is ideologically similar to the centre, the state will not face any unequal borrowing or funding issues with the Centre. By operating in a right winged state with an ideology similar to the centre, the CPSE will face a favorable external business environment. With strong political external situations, the effect of a policy like disinvestment will be stronger. The study takes explicit account of this conditional effect by taking interactions of disinvestment with ideology variables.

3 Performance assessment of Public sector enterprises

In a developing economy, the role of public sector enterprises is critical. The presence of this sector is dominated in areas which require heavy gestation periods, huge investments and heavy manufacturing industries. In the Indian context, these enterprises contribute significantly to total manufacturing output and hence performance of these enterprises incessantly affects the performance of developing economies. This suggests the relevance of using an appropriate measure to capture the performance of these enterprises. Standard accountancy ratios may capture the performance of a private firm seeking to maximize profits. However, in public

firms we deviate from the standard objective function of maximizing profits and analyze a hazy multidimensional objective function. This function is complicated by an absence of clearly quantifiable objectives, and multiplicity.

To do away with the complexity of formulating the exact objective function of a public firm the study uses a very basic requirement to measure firm performance, a measure that is crucial to any business, irrespective the objective function it follows- firm efficiency (Majumdar (2008)). According to Brada et al. (1997), technical efficiency is a very useful concept to utilize, especially, in a transition economy context, where firms may be maximizing profits or output subject to profit constraints, as well as other goals such as employment.

There are two techniques indentified in the relevant strand of literature- data envelopment analysis (DEA) and stochastic frontier analysis (SFA). Both the approaches have their own advantages and limitations. DEA is non parametric and hence makes no assumption about the distributional term. On the other hand, SFA allows random noise to be incorporated in the model. The present study is based on stochastic frontier models. It was originally proposed by Aigner et al. (1977). I use the latter to estimate efficiency scores.

The general form of the panel data version of the production frontier is presented as

$$y_{it} = f(x_{ijt}, t, \beta) + \epsilon_{it} \ \textit{where} \ \epsilon_{it} = V_{it} - U_{it} \qquad \textit{with} \ U_{it} \sim |N(m_{it}, \sigma_u^2)| \ \textit{and} \ V_{it} \sim N(0, \sigma_v^2)$$

In the above specification, y_{it} is the output of the ith firm in the tth year. x_{ijt} is the jth input used in the ith firm in tth year. V_{it} are the random error terms and U_{it} is the inefficiency term. The method of maximum likelihood is used to estimate the unknown parameters with the stochastic frontier and inefficiency effects estimated simultaneously. I get the technical efficiency from this using the following transformation

$$TE_{it} = E[exp(-U_{it})|\epsilon_{it}]$$

which is the expectation of the exponential technical inefficiencies, conditional on the error term. In the second part of the model, the efficiency term is then regressed on a set of explanatory variables which includes (disinvestment, state specific political and economic, industry and firm

specific variables)(Gumbau-Albert, 2000; Oczkowski and Sharma, 2005).

To reinstate the influence of disinvestment on firm efficiency, in particular, Majumdar (2008) states "... there is the reality of the political environment surrounding government-owned enterprises. While citizens may have little say in the functioning of government-owned firms, government decision-making is surrounded by a constellation of interests forming specialized coalitions interested in government-enterprise operations. These actors include politicians, unions, trade associations and consumer groups who can pressurize bureaucrats into directing government-owned bodies into acting in manners consistent with their own special interests. While the distributional consequences of such pulls and pressures may often be positive, their impact on efficiency is likely to be negative because such factors do tend to make the management process in government-owned enterprises complex and unfocussed." Disinvestment acts as a tool inverting the effect of these 'pulls and pressures' and hence, must have a positive effect on firm efficiency. Further, given the role of institutional and political environment which shapes the performance of firms, enterprises located in states that are right winged and have an ideology similar to the centre will be beneficial for performance of public sector enterprises.

4 Data and variables

I construct a unique dataset by compiling information on all manufacturing and non-financial services central public sector enterprises (CPSEs), ideological scores of parties and macroeconomic data for a twenty year period (1991-92 to 2010-11).

4.1 CPSE data

The data on manufacturing and non financial services (approximately 240) is collected from the Public Enterprise Survey (PES), an annual survey that reports the financial performance, disinvestment status, and Memorandum of Understanding (MoU) of all CPSEs[3]. I have not

[3] *Memorandum of Understanding:* MoU is a mutually negotiated document that is signed annually at the start of the financial year between the management of the PSU and the administrative ministry in the government. As per the MoU, the management decides the performance targets to be accomplished and the government agrees on the support to be given during the year. At the end of the financial year, performance assessment is done where the achievements are measured against the targets. This is based on both financial and non-financial parameters with specific weights allotted to each parameter using a five-point scale varying from *Poor* to *Excellent*

considered the CPSEs listed under the three strategic cognate groups (arms and ammunition and allied items of defense equipment, atomic energy and railway transport) since the Department of Disinvestment (DoD) had excluded these from disinvestment since inception. Given the multiplants and multistate presence of most CPSEs, plant level data would best suit the purpose. However, the most dis-aggregated level of CPSE data in India exists at the firm level. Hence, I proceed with firm level data.

4.1.1 Dependent Variable: Firm Efficiency

The variable of prime importance is firm efficiency which captures the performance of firms. The study uses efficiency scores as computed by the computer programme FRONTIER Version 4.1 written by Tim Coelli for different industries overtime. The production possibility frontier pertaining to each industry is computed by regressing output on estimated capital stock [4] , labor, construction of raw materials and expenditure on power and fuel . However, these efficiency levels are generated from production frontiers specific to each industry. But for the next step of the econometric investigation stacking the absolute scores seem to be inappropriate for inter-industry comparison. Hence, I normalize these scores to make it comparable across industries. For every firm, efficiency ($\hat{e_{ijt}}$ where i denotes firm index, j is the industry index and t is time) is standardised by using

$$\hat{e_{ijt}} = \frac{(e_{ijt} - e_{min.j})}{(e_{max.j} - e_{min.j})}$$

where $e_{min.j}$ and $e_{max.j}$ is the minimum and maximum efficiencies in that industry group respectively.

[4] Estimation methodology for capital stock has been discussed in Appendix II

Firm specific factors : The following firm specific variables are used

$$Age_{it} = Y_{it} - Y_{it-1}$$

$$Size_{it} = log[A_{it}]$$

$$Profit_{it} = \frac{PAT_{it}}{A_{it}}$$

$$Debtsize_{it} = \frac{D_{it}}{A_{it}}$$

where PAT_{it}, D_{it},S_{it} and A_{it} are profit after tax, total debt from the government and asset size of the ith firm in the tth year.

4.1.2 Disinvestment data

Data on disinvestment transactions is provided by the PES which specifies on a yearly basis the extent of disinvestment of firms which were selected. The study represents both first time disinvestment and repeated disinvestment using dummy variables and define extent of disinvestment for a firm as the proportion of shares transferred from the government to the private sector (takes values between 0 and 1). Disinvestment control dummy variable takes a value one if the disinvestment extent is greater than 50%[5]. While analyzing first time disinvestment, I drop a CPSE once it is selected for disinvestment.

Further, the policy of disinvestment has evolved significantly since 1991 with the disinvestment cap (maximum permissible disinvestment) for various cognate groups being revised continually. To account for the policy changes in the analysis, I construct a variable called *scope for disinvestment* which is defined as the difference between the disinvestment cap of the industry group to which the firm belongs and the extent to which the firm has been divested till the previous year. If scope for disinvestment takes the value zero for a particular CPSE in a particular year I drop it from the dataset for every succeeding year.

[5]Disinvestment in India is at a very slow pace. Only seven firms had a transfer of control to the private sector. With very little variation in "control" dummy, we are unable to use it in our econometric analysis.

4.1.3 Other policy controls

I observe data on whether a CPSE has signed an MoU with the government and the MoU score. By signing an MoU, a CPSE gains more autonomy in the day to day operations of the enterprise thereby limiting political interference.

4.2 Political Data

4.2.1 Ideology variables

In order to construct the ideology indices for the state and the central government, I rely on Chhibber and Nooruddin (2004) and Dash and Raja (2014), who have coded ideology scores of all national and major regional parties based on the parties' objectives, past prescribed policies and actions. For the few remaining regional parties, I collected the relevant information from the parties' websites and media reports. The ideological stand takes integer values from one to five, where right is coded 1, right-center 2, center 3, left-center 4 and left 5 [6]. I further collect data on the composition of all incumbent coalitions in the Lok Sabha (Lower House of parliament) from Sridharan (2010), since the party, or coalition of parties which holds a majority in the Lower House gets to form the government at the center. Based on this information the study employs three measures of ideology.

Ideology score of a coalition at the Centre: It is the seat-share weighted sum of ideology scores of all parties in a coalition for each Lok Sabha term. It may be formulated as $Index_t = \sum_{j=1}^{n} I_{jt} w_{jt}$ where I_{jt} and w_{jt} are the ideology scores and seat shares of the jth party in an N party coalition in the tth year. With $I_{jt} \in \{1, 2, .., 5\}$ and $w_{jt} \in [0, 1]$ I have $Index_t \in [0, 5]$. Hence, it is a continuous variable and is lower if the coalition is right leaning.

Ideology of the state: I identify the party that had won the most recent Vidhan Sabha (state-level) elections. Irrespective of whether the party made a single party government or was a part of a coalition government I use the party's ideology to be the government's ideology

[6] Ideology scores of all parties are presented in **Appendix B**.

during the term. Finally, I take a simple average of all the state ideologies where an enterprise has an operational branch [7].

Center-State Ideology difference: It is the absolute difference in ideology between the Centre and the state where the CPSE is located. Ideology difference is represented as $SI_{st} = |I_{st} - Index_t|$ where I_{st} is the ideological score of the sth state in year t. It is a continuous variable ranging 0 to 5 with zero denoting identical ideologies between the Centre and the state and five denoting ideologies being diametrically opposite to each other.

Ideology dispersion of a coalition: Ideology dispersion is captured by the seat share weighted variance of ideologies of all coalition partners. It is measured as $Spread_t = \frac{N''}{N''-1} \sum_{j=1}^{n} (I_{jt} - Index_t)^2$ where N'' is the number of non-zero weights. It is a continuous positive variable which increases when the parties in a coalition become more ideologically diverse.

4.2.2 Other political factors

Single party dummy: To capture whether the state government in term is part of a coalition or is a single party government I use a dummy variable. Due to the limitation of the data on composition of coalitions, I follow Sridharan (2010) which reports data on the presence of coalition governments in state elections. So, single party government is a categorical variable that takes the value 1 when the party with majority seats forms a single party government and the value 0 when it is part of a coalition government. This variable acts as a useful control in accounting for the coalition driven political era in Indian states.

More than 60 percent of these enterprises have plants in more than one state. I take the simple average of *all state specific political variables* for each of the states in which a particular enterprise has an operational plant. This implies that for every firm there is a unique political variable score depending on the number of states where the firm has an operational branch.

[7] State ideology is not the weighted measure of all parties forming a state level coalition due to unavailability of coalition data.

4.3 State specific economic factors

Performance of an enterprise is driven by institutional factors. These institutional factors comprise of various policies and laws adopted and implemented by the state government and other informal constraints prevalent in the local environment in which these enterprises operate[8]. These are as follows:

Road connectivity: It is defined as the ratio of total length of roads in the state to the total area covered by the state. It is expected to have a positive effect on firm performance.

Electricity generation: It is captured as the total electricity generated in a particular state normalized with respect to the total population of the state. Better and regular electricity supply to the enterprises enhances the performance of enterprises.

Credit availability: It is the ratio of the total industrial credit in a state to the state domestic product. Higher credit availability in a particular state suggests better and more favourable business conditions and is expected to be beneficial to firm performance.

Labor market rigidity: It is the ratio of total man days lost in a state due to strikes and lockouts to the total workforce in a state. A state with high labor market rigidity affects efficiency of enterprises negatively. It affects efficiency directly as operations are hindered and indirectly as it has a negative externality on the workforce as a whole.

Taxation policy: It is the ratio of total excise duty collected to the gross state domestic product of the state. Lower tax rates are always lucrative and beneficial for firm performance. Since, data on tax rates are unavailable, the study uses total excise duty collected as a proxy for the same.

This data is collected from Reserve Bank of India website, CMIE reports and other state-level documents.

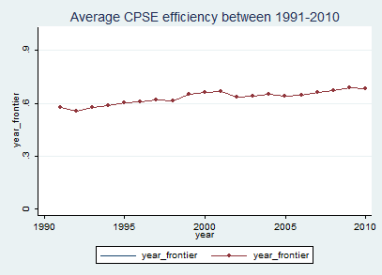
[8]For all firms with plants in more than a single state, I take the average of the state specific factors where a plant operates.

Other controls: An alternate policy tool for infusing competition in an industry is delicensing. I capture delicinsing at the two digit NIC industry level. It is the proportion of 4 digit NIC industries that were selected for delicensing for every 2 digit NIC industry code. The data has been collected from various government documents. Besides these controls I include dummies to control for industries, overtime unobserved effect, and geographical location of each public sector enterprise.

5 Descriptive statistics

The average annual efficiency scores of all CPSEs is plotted in Figure 1. As the graph denotes, the efficiency score has marked a meager rise from 0.57 in 1991 to 0.68 in 2010 with the an overall average of 0.62. Further in terms of average efficiency across cognate business groups, 'Coal and lignite' and 'Petroleum' are among groups comprising of firms with high efficiency scores (above 0.9). On the other hand 'Agro-based industries' and 'Fertilizers' are among the industries with low efficiency scores (less than 0.36).

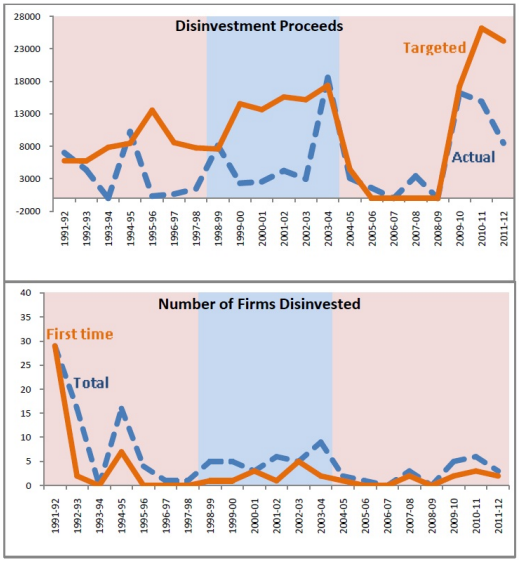
Figure 1 Average yearly efficiency scores



The slight rise in firm performance overlaps with the onset of disinvestment in India. I present the yearly real disinvestment proceeds collected against the target proceeds in Figure 2 (a). In the second panel, Figure 2(b), I present the number of firms selected for disinvestment (first time and repeated). It is observed that in most years the actual proceeds fall short of the yearly targets. For example, disinvestment was stalled in 1993-94 due to unfavorable stock market conditions. The rise in proceeds between 1999-00 to 2003-04 reflects the strategic sale (selling at least 51% of shares) of selected CPSEs by the right-wing BJP government. However with the establishment of Board of reconstruction of public sector enterprises (BRPSE), disinvestment

became stagnant for the next three years. As a response to the adverse global conditions, the government announced a one-time exception for the utilization of disinvestment proceeds for a period of three years beginning 2008, and made the proceeds fully available for investment in specific social sector schemes. Panel B of the figure indicates that a mere 25% (approximately) of firms were selected for disinvestment.

Figure 2 Disinvestment of CPSEs against the political timeline



To show that disinvestment may be an influencing factor in explaining firm performance, the mean differences between firms that were disinvested atleast once between 1991-2010 and firms that were never selected for disinvestment have been presented in Table 1. As it suggests, all relevant variables in the dataset have a significant difference between the two groups. This re-establishes the need for further econometric analysis.

6 Econometric Methodology

To estimate the effect of disinvestment on firm efficiency, two probit models (for first time and occurrence) and a fixed/random effects model (for extent of disinvestment) can yield unbiased estimates, after controlling for all the other underlying factors. However, the estimates are unbiased only if disinvestment is either a random policy decision or it can be conditioned solely on observable and controlled factors. I start with a fixed effects regression to obtain the baseline

Table 1 Mean difference between disinvested and never-disinvested firms

	Disinvested firms	Never-disinvested firms	Difference
Main variable of interest			
Standard frontier	0.661	0.619	0.42***
Political factors			
Ideology of the state	2.34	2.57	-0.220***
Ideology difference	0.088	0.238	-0.150***
Industry specific variables			
Delicensing	0.881	0.929	0.048***
Firm Specific factors			
MoU signed	0.688	0.367	0.032***
Profitability	0.064	0.011	0.075***
Debt size	0.303	0.445	-0.142***
Age	33.87	28.4	5.474***
Size	23.47	21.25	2.220***

Note: The table presents mean difference between the disinvested and never-disinvested firms for selected variables. Disinvestment is defined as a firm that has been selected for disinvestment at-least once between 1991-2010.

regression results. The regression equation is given by

$$y_{ijkt} = \alpha + \beta_j + \chi_t + \delta_{it}x_{it} + \gamma_{kt}z_{kt} + \phi_{jt}w_{jt} + \theta_{ijkt}D_{ijkt} + \epsilon_{ijkt} \tag{1}$$

Where y_{ijkt} is the normalized efficiency score of the ith firm belonging to the jth industry situated in kth state and in the tth year. The term α captures the intercept for the specification and β_j and χ_t captures the industry and time fixed effects respectively. x_{it} captures the firm specific characteristics of the tth firm. z_{kt} encompasses state specific choice variables. This includes both the categories of political and economic factors for the kth state(s). w_{jt} is the industry specific factors for the jth industry. D_{ijkt} is the disinvestment variables for the ith firm belonging to the jth industry situated in kth state and in the tth year.

However, capturing disinvestment as an exogenous variable in firm performance is a strong assumption. (Gupta (2005)). It is highly likely that there are unobservable variables which may be instrumental in affecting both- disinvestment selection and extent as well as firm performance. For example, efficient management of a CPSE may improve performance of a particular CPSE leading to profits and efficiency. Again a highly profitable CPSE is valuable and would yield better proceeds from disinvestment, thus making it a good candidate for disinvestment. Since it is not possible to capture management of a CPSE (using solely secondary data), simple probit and panel data models will lead to omitted variable bias or the endogeneity problem (Greene (2003)). To tackle endogeneity, a two stage least square (2SLS) estimation technique is used with suitable instruments.

More formally, if equation (1) represents the second stage of the 2SLS model with D_{ijkt} as the endogenous variable, then the first stage or the decision stage is captured using the following equation:

$$D_{ijkt} = \tau + \phi_j + \chi_t + \zeta_{it} C_{it} + \kappa_{it} z_{it} + e_{ijkt} \tag{2}$$

where C_{it} is a vector of exogenous variables that affect disinvestment of firms. Z_{it} is a vector of instruments that are correlated with disinvestment but uncorrelated with the error term, ϵ_{it}. However if $cov(z_{it}, \epsilon_{it}) = \rho \neq 0$ then disinvestment is endogenous.

Besides the direct effect of disinvestment on firm performance, the study is also interested on disinvestment effect when conditioned on the ideology of the state where the enterprise is located and the ideological difference between the centre and the state. This implies that along with disinvestment as an endogenous regressor, the data has two other endogenous interaction terms. With a dichotomous endogenous variable and its interaction with exogenous variables the traditional 2SLS models break down (Wooldridge (2001)). Thus I use a modified version of the 2SLS model as discussed by Wooldridge (2001). Instead of instrumenting disinvestment variables and its interactions with the relevant instruments in the first stage of 2SLS I use the predicted value of disinvestment, interaction term of the predicted value with the two ideology variables as instruments in the first stage of 2SLS[9].

In equation (2) I model disinvestment decisions made by the Central government. As instrument variables I consider the political variables pertaining to the Central government of India, following Gupta (2005). The rationale behind using these variables is that the decision of disinvestment is taken by the Centre which implies that the political environment prevailing at that level affects the decision directly. However, the operations and performance of the enterprises will be influenced by the state government, the local geographical environment and the local economic conditions in which the enterprises operate. The Centre will have no effect on the efficiency of the enterprises.[10].

[9] I use probit regressions to estimate first time and occurrence of disinvestment given by equation (2) for getting the predicted value of disinvestment.

[10] While capturing extent of disinvestment I use a fixed effects model as the dependent variable is a continuous variable.

As a next step I use the predicted values of the disinvestment variables and the interaction of the predicted variables as instruments in 2SLS. So, the first stage of the modified 2SLS model is given by

$$D_{ijkt} = \delta + \phi \hat{D_{ijkt}} + v_{ijkt} \tag{3}$$

where $\hat{D_{ijkt}}$ is the predicted value of disinvestment obtained from equation (2). Along with equation (3), I have two other endogenous variables given by $D_{ijkt} * I_{it}, D_{ijkt} * m_{it}$ where I_{it} and m_{it} are the ideology and ideology difference between the centre and the state where enterprise i is located. Thus, the remaining two equations of the first stage are given by

$$(D_{ijkt} * I_{it}) = \delta + \phi(\hat{D_{ijkt}} * I_{it}) + v_{ijkt} \tag{4}$$

$$(D_{ijkt} * m_{it}) = \delta + \phi(\hat{D_{ijkt}} * m_{it}) + v_{ijkt} \tag{5}$$

In the second stage, the outcome equation is estimated by equation (1) with the help of the predicted values as instruments obtained from (3), (4) and (5).

6.1 Robustness Check

As a robustness exercise, I use a propensity matching estimation in a difference-in-difference model. The methodology and results have been discussed in **Appendix III**.

7 Results

7.1 Instrument variable estimation with predicted probabilities (and interactions) as instruments

I use a modified instrument variable technique to account for the endogeneity of disinvestment decisions, which requires atleast one identifying variable that affects the disinvestment in the first equation but does not affect performance in the second equation. Specifically, the identifying variable (Z in equation (2)) must be theoretically and statistically related to disinvestment

Table 2 Estimates of instruments on firm efficiency

	Model I	Model II
Instruments		
Ideology score of the centre	-0.003	0.003
	(0.003)	(0.009)
Ideology dispersion at the Centre	0.002	0.003
	(0.003)	(0.005)
N	3723	3723
R squared	0.001	0.284
Controls	No	Yes

Note: The table presents estimates of the instruments used (for disinvestment decision) on firm efficiency. Model I does not include control factors where as Model II includes. None of the variables are significant at the specified levels. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

decision but unrelated to firm efficiency scores. The proposed identifying instrument variables are political variables pertaining to the Central government of India (Gupta, 2005). Specifically, I use two instruments- (i) ideology of the coalition at the Centre and (ii) ideology dispersion of the coalition at the centre. The regression results of efficiency on the two instruments has been compiled in Table 2. Both instruments are not significant in explaining firm performance suggesting that the instruments used do not affect the outcome variable of the second stage of the regression models.

As a next step, I also run regressions to check the effect of the instruments on disinvestment outcomes. Table 3 presents the results of the three regressions. Across all three models ideology score is significantly and negatively associated with disinvestment decisions. This implies that right winged governments at the Centre (low ideology score) leads to higher disinvestment probabilities and larger disinvestment extent. Ideology dispersion is significant and negatively associated with first time and extent of disinvestment implying a coalition comprising of similar ideological parties leads to higher probability of first time disinvestment and greater extent of disinvestment extent. Ideology dispersion has a positive significance on disinvestment occurrence. This indicates that a coalition with ideologically dispersed parties prefers disinvesting the same firms rather than selecting a fully owned public firm for the first time. The models have controlled for a series of firm specific and external factors as controls.

Next, I use the predicted values of the disinvestment variables (from the three models discussed in Table 3) as instruments for the disinvestment variables. For instrumenting the interaction terms I use interactions of the predicted values with state ideology and centre- state ideology difference. The first stage of 2SLS regressions are discussed in Appendix I. I also perform

Table 3 Disinvestment regressions to get the predicted values before IV estimation

	Model I	Model II	Model III
Instruments			
Ideology score of the centre	-0.690***	-0.242**	-0.01***
	(0.244)	(0.108)	(0.001)
Ideology dispersion at the centre	-0.996*	0.206**	-0.003***
	(0.616)	(0.098)	(0.001)
Political factor			
Seat share of the main party	-0.125	1.913***	-0.024***
	(1.319)	(0.371)	(0.006)
Firm factors			
Firm Age	0.003	0.001	0.001***
	(0.002)	(0.002)	(0)
Firm profitability	0.090*	0.072*	0.001
	(0.052)	(0.042)	(0.001)
Firm size	0.158***	0.258***	0.001***
	(0.035)	(0.024)	(0)
Industry factors			
Industry profitability	-4.322**	1.329	0.022
	(1.813)	(0.904)	(0.014)
Industry delicensing	-0.023	0.223	0.002
	(0.262)	(0.199)	(0.004)
Other controls			
Time dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Constant	-2.544	-8.584***	0.036***
	(2.005)	(0.816)	(0.011)
R squared	0.201	0.203	0.048
N	3723	3723	3723

Note: The table presents estimates of disinvestment variables on regressors. Model I and Model II are probit models with first time and occurrence of disinvestment as the dependent variables. Model III is a pooled OLS regression with extent of disinvestment as the dependent variable. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

the tests for under-identification and weak-identification of the endogenous regressors and to find if the instruments are valid or not. This is done by using xtivreg2 command in STATA. Tables 4, 5 and 6 present the results from these tests for the three disinvestment variables. The Sanderson-Windmeijer test is performed under the null hypothesis that the endogenous regressor is unidentified. I find a P-value of zero for all three cases. This confirms that I can reject the null at 1 percent level indicating that the regressor is identified. The LM test for under-identification is also performed and I find that the regressor is not under- identified (P-value=0) for all the three cases. I then perform the Cragg-Donald weak identification test of the instruments and find that the instruments are strong. Weak identification may arise when there is a weak correlation between the endogenous regressors and the chosen instruments. In that case, estimators may not be robust to the instrument-variable regressions. The Cragg-Donald Wald F statistic for all the models are found to give a value, which is higher than the Stock-Yogo weak ID test critical values. The Anderson-Rubin Wald test and Stock Wright LM S statistic is also satisfied to ensure that the instruments are not weak. These tests indicate that the instruments chosen are identified, strong and valid for all the models. Finally, in all the three cases, the P-value of the endogeneity test, whose null hypothesis is that the specified endogenous regressor is exogenous, is also lower than 0.05, which suggests that all three disinvestment variables are endogenous to

Table 4 Validity of instruments used in the first stage for first time disinvestment

	Model I	Model 2 (a)	Model 2(b)	Model 2(c)
F test for excluded instruments in first stage				
Sanderson-Windmeijer	34.69	22.27	29.22	50.90
	(0.00)	(0.00)	(0.00)	(0.00)
Underidentification test				
Anderson canon. corr. LM statistic (Chi squared)	34.74	21.81	56.96	24.4
	(0.00)	(0.00)	(0.00)	(0.00)
Weak Identification test				
Cragg Donald F statistic for predicted probability	34.69	21.55	56.27	24.64
Stock-Yogo weak ID test				
Critical values				
10% maximal IV size	16.38	22.3	22.3	22.3
15% maximal IV size	8.96	12.83	12.83	12.83
20% maximal IV size	6.66	9.54	9.54	9.54
25% maximal IV size	5.53	7.8	7.8	7.8
Weak Instrument Robust Inference				
Anderson-Rubin Wald test	6.13	28.68	28.68	28.68
	(0.01)	(0.00)	(0.00)	(0.00)
Stock-Wright LM S statistic	6.12	28.64	28.64	28.64
	(0.01)	(0.00)	(0.00)	(0.00)
Endogeneity test				
Chi square test	5.87	28.56	28.56	28.56
	(-0.01)	(0.00)	(0.00)	(0.00)

Note: The table presents test statistics obtained for first time disinvestment from xtivreg2 command in STATA 12. The models use predicted value of first time disinvestment and its interaction with the two ideology variables obtained from Table as instruments. Model I is the first stage of the modified IV estimation which does not include interaction terms. Models 2(a),(b) and (c) are the first stages of the model with the interaction terms: 2(a) models first time disinvestment, 2(b) models interaction between ideology of the state and first time disinvestment and 2(c) models the interaction between ideology difference and first time disinvestment respectively. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

explaining performance of firms in India. This implies that 2SLS estimation results are valid.

Next, the results of the second stage of 2SLS regression, with firm efficiency as the dependent variable is discussed in Tables 7, 8 and 9. Models I and II in these tables are the results of a fixed effects regression on firm efficiency. Model I includes only disinvestment and Model II includes an interaction of disinvestment with the two ideology variables. Models III and IV are the results of the IV estimation with disinvestment and with disinvestment along with interactions respectively. I have also used a set of controls- firm level factors (size, age and debt size of the firm), industry level factors, policy variables and other time specific effects. However, given that disinvestment variables are endogenous variables in explaining firm performance I focus on Models III and IV of Tables 7, 8 and 9.

7.1.1 First time disinvestment

First time selection of a CPSE for disinvestment has a positive and significant impact on firm performance. Although ideology of the state does not directly influence firm efficiency, it has an indirect effect on firm performance through disinvestment. The interaction of first time disinvestment with ideology of the state is negative suggesting that the effect of disinvestment is conditioned on ideology. More specifically, the effect of disinvestment on firm performance is

Table 5 Validity of instruments used in the first stage for disinvestment occurrence

	Model I	Model 2 (a)	Model 2(b)	Model 2(c)
F test for excluded instruments in first stage				
Sanderson-Windmeijer	37.75	16.72	41.09	99.93
	(0.00)	(0.00)	(0.00)	(0.00)
Underidentification test				
Anderson canon. corr. LM statistic (Chi squared)	37.78	54.85	299.08	295.48
	(0.00)	(0.00)	(0.00)	(0.00)
Weak Identification test				
Cragg Donald F statistic for predicted probability	37.75	54.19	295.48	181.91
Stock-Yogo weak ID test				
Critical values				
10% maximal IV size	16.38	22.3	22.3	22.3
15% maximal IV size	8.96	12.83	12.83	12.83
20% maximal IV size	6.66	9.54	9.54	9.54
25% maximal IV size	5.53	7.8	7.8	7.8
Weak Instrument Robust Inference				
Anderson-Rubin Wald test	13.23	33.78	33.78	33.78
	(0.00)	(0.00)	(0.00)	(0.00)
Stock-Wright LM S statistic	13.18	33.46	33.46	33.46
	(0.00)	(0.00)	(0.00)	(0.00)
Endogeneity test				
Chi square test	12.91	33.96	33.96	33.96
	(0.00)	(0.00)	(0.00)	(0.00)

Note: The table presents test statistics obtained for disinvestment occurrence from xtivreg2 command in STATA 12. The models use predicted value of disinvestment occurrence and its interaction with the two ideology variables obtained from Table as instruments. Model I is the first stage of the modified IV estimation which does not include interaction terms. Models 2(a),(b) and (c) are the first stages of the model with the interaction terms: 2(a) models disinvestment occurrence, 2(b) models interaction between ideology of the state and disinvestment occurrence and 2(c) models the interaction between ideology difference and disinvestment occurrence respectively. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 6 Validity of instruments used in the first stage for disinvestment extent

	Model I	Model 2 (a)	Model 2(b)	Model 2(c)
F test for excluded instruments in first stage				
Sanderson-Windmeijer	662.51	223.92	207.99	74.12
	(0.00)	(0.00)	(0.00)	(0.00)
Underidentification test				
Anderson canon. corr. LM statistic (Chi squared)	562.16	261.92	246.45	185.86
	(0.00)	(0.00)	(0.00)	(0.00)
Weak Identification test				
Cragg Donald F statistic for predicted probability	37.75	54.19	295.48	181.91
Stock-Yogo weak ID test				
Critical values				
10% maximal IV size	16.38	22.3	22.3	22.3
15% maximal IV size	8.96	12.83	12.83	12.83
20% maximal IV size	6.66	9.54	9.54	9.54
25% maximal IV size	5.53	7.8	7.8	7.8
Weak Instrument Robust Inference				
Anderson-Rubin Wald test	2.39	4.82	4.82	4.82
	(0.12)	(0.18)	(0.18)	(0.18)
Stock-Wright LM S statistic	2.39	4.82	4.82	4.82
	(0.12)	(0.18)	(0.18)	(0.18)
Endogeneity test				
Chi square test	4.13	6.68	6.68	6.68
	(0.04)	(0.07)	(0.07)	(0.07)

Note: The table presents test statistics obtained for disinvestment extent from xtivreg2 command in STATA 12. The models use predicted value of disinvestment extent and its interaction with the two ideology variables obtained from Table as instruments. Model I is the first stage of the modified IV estimation which does not include interaction terms. Models 2(a),(b) and (c) are the first stages of the model with the interaction terms: 2(a) models disinvestment extent, 2(b) models interaction between ideology of the state and disinvestment extent and 2(c) models the interaction between ideology difference and disinvestment extent respectively. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 7 Firm performance after being selected for disinvestment for the first time

	Model I	Model II	Model III	Model IV
Political variables				
Ideology of the state	-0.001	0.001	0.001	0.005
	(0.002)	(0.002)	(0.002)	(0.003)
Ideology difference	-0.007**	-0.007**	-0.010**	-0.008*
	(0.003)	(0.003)	(0.004)	(0.005)
Single government dummy	0.009	0.01	0.006	0.002
	(0.008)	(0.008)	(0.010)	(0.011)
Disinvestment				
First time dummy	-0.012	-0.009	0.599**	1.919**
	(0.023)	(0.116)	(0.261)	(0.943)
First time* Ideology of the state		0.02		-0.957***
		(0.039)		(0.270)
First time* Ideology difference		0.035		-0.508**
		(0.032)		(0.212)
State specific economic factors				
Electricity generation per capita	0.021***	0.021***	0.025***	0.027***
	(0.005)	(0.005)	(0.006)	(0.006)
Excise duty per state domestic product	-0.038**	-0.038**	-0.054**	-0.061**
	(0.019)	(0.019)	(0.023)	(0.027)
Labor market rigidity	-0.001	-0.001	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Credit availability	0.021***	0.01	0.029*	0.041**
	(0.005)	(0.009)	(0.015)	(0.019)
CPSE policy				
MoU signed dummy	0.051***	0.051***	0.062***	0.056**
	(0.014)	(0.014)	(0.017)	(0.023)
MoU score	-0.015***	-0.015***	-0.016***	-0.016***
	(0.004)	(0.004)	(0.004)	(0.005)
Industry				
Delicensing extent in an industry	0.09***	0.091***	0.070**	-0.062***
	(0.029)	(0.029)	(0.033)	(0.011)
Industry profitability	0.125*	0.119	0.057	-0.001
	(0.074)	(0.074)	(0.086)	(0.096)
Firm specific factors				
Firm size	0.019***	0.019***	0.023***	0.022***
	(0.003)	(0.003)	(0.005)	(0.006)
Firm age	0.05***	0.049***	0.125***	0.129***
	(0.012)	(0.012)	(0.027)	(0.037)
Firm debt size	-0.063***	-0.063***	-0.064***	-0.062***
	(0.009)	(0.009)	(0.010)	(0.011)
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
R- squared	0.491	0.491		
N	3723	3723	3723	3723

Note: The table presents results obtained from the regression analysis for determinants of firm efficiency with the first time selection of firms for disinvestment. Model I and II are fixed effects regressions and Model III and IV are the second stage results of the modified-2SLS regressions. Model II and IV include interaction terms between first time disinvestment and state specific political factors. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 8 Firm performance with occurrence of disinvestment

	Model I	Model II	Model III	Model IV
Political variables				
Ideology of the state	-0.000	0.000	0.000	0.003
	(0.002)	(0.002)	(0.003)	(0.003)
Ideology difference	-0.007**	-0.007**	-0.007*	-0.006
	(0.003)	(0.003)	(0.004)	(0.004)
Single government dummy	0.009	0.010	0.013	0.012
	(0.008)	(0.008)	(0.010)	(0.011)
Disinvestment				
Occurrence dummy	-0.005	0.018	0.513***	0.019***
	(0.014)	(0.060)	(0.163)	(0.008)
Occurrence* Ideology of the state		-0.005		-0.218***
		(0.021)		(0.079)
Occurrence* Ideology difference		-0.001		-0.151**
		(0.018)		(0.066)
State specific economic factors				
Electricity generation per capita	0.021***	0.021***	0.025***	0.025***
	(0.005)	(0.005)	(0.006)	(0.006)
Excise duty per state domestic product	-0.038**	-0.038**	-0.050**	-0.051**
	(0.019)	(0.019)	(0.024)	(0.025)
Labor market rigidity	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Credit availability	0.021***	0.010	0.014	0.017
	(0.005)	(0.009)	(0.012)	(0.013)
CPSE policy				
MoU signed dummy	0.051***	0.051***	0.057***	0.060***
	(0.014)	(0.014)	(0.017)	(0.018)
MoU score	-0.015***	-0.015***	-0.013***	-0.014***
	(0.004)	(0.004)	(0.004)	(0.005)
Industry				
Delicensing extent in an industry	0.091***	0.089***	0.096***	-0.067***
	(0.029)	(0.029)	(0.034)	(0.011)
Industry profitability	0.126*	0.122*	0.070	0.048
	(0.074)	(0.074)	(0.088)	(0.091)
Firm specific factors				
Firm size	0.019***	0.019***	0.027***	0.027***
	(0.003)	(0.003)	(0.005)	(0.005)
Firm age	0.050***	0.049***	0.138***	0.141***
	(0.012)	(0.012)	(0.029)	(0.031)
Firm debt size	-0.063***	-0.063***	-0.068***	-0.067***
	(0.009)	(0.009)	(0.011)	(0.011)
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
R- squared	0.491	0.491		
N	3723	3723	3723	3723

Note: The table presents results obtained from the regression analysis for determinants of firm efficiency with occurrence of disinvestment. Model I and II are fixed effects regressions and Model III and IV are the second stage results of the modified-2SLS regressions. Model II and IV include interaction terms between disinvestment occurrence and state specific political factors. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 9 Firm performance with extent of disinvestment

	Model I	Model II	Model III	Model IV
Political variables				
Ideology of the state	-0.000	0.000	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
Ideology difference	-0.007**	-0.007**	-0.007*	-0.007*
	(0.003)	(0.003)	(0.004)	(0.004)
Single government dummy	0.009	0.010	0.007	0.008
	(0.008)	(0.008)	(0.009)	(0.009)
Disinvestment				
Extent	-0.047	-0.087	0.236	1.489*
	(0.061)	(0.218)	(0.153)	(0.798)
Extent* Ideology of the state		0.032		-0.502
		(0.082)		(0.317)
Extent* Ideology difference		0.092		-0.433
		(0.095)		(0.417)
State specific economic factors				
Electricity generation per capita	0.021***	0.021***	0.025***	0.025***
	(0.005)	(0.005)	(0.005)	(0.005)
Excise duty per state domestic product	-0.038**	-0.038**	-0.037*	-0.037*
	(0.019)	(0.019)	(0.021)	(0.021)
Labor market rigidity	-0.000	-0.000	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Credit availability	0.021***	0.009	0.006	0.007
	(0.005)	(0.009)	(0.010)	(0.010)
CPSE policy				
MoU signed dummy	0.051***	0.051***	-0.004	-0.004
	(0.014)	(0.014)	(0.002)	(0.002)
MoU score	-0.015***	-0.015***	0.091***	0.089***
	(0.004)	(0.004)	(0.030)	(0.030)
Industry				
Delicensing extent in an industry	0.090***	0.090***	-0.066***	0.025***
	(0.029)	(0.029)	(0.009)	(0.005)
Industry profitability	0.126*	0.126*	0.148**	0.154**
	(0.074)	(0.074)	(0.074)	(0.075)
Firm specific factors				
Firm size	0.019***	0.019***	0.096***	0.097***
	(0.003)	(0.003)	(0.022)	(0.022)
Firm age	0.050***	0.050***	0.005*	0.005*
	(0.012)	(0.012)	(0.003)	(0.003)
Firm debt size	-0.063***	-0.063***	0.026***	0.025***
	(0.009)	(0.009)	(0.004)	(0.005)
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
R- squared	0.491	0.491		
N	3723	3723	3723	3723

Note: The table presents results obtained from the regression analysis for determinants of firm efficiency with disinvestment extent. Model I and II are fixed effects regressions and Model III and IV are the second stage results of the modified-2SLS regressions. Model II and IV include interaction terms between disinvestment extent and state specific political factors. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

stronger when the firm is operating in the right wined state. Low ideological difference between the centre and the state has a negative and significant effect on firm performance. Further, the interaction between first time disinvestment and ideological difference suggests that the effect of disinvestment of CPSEs on firm performance is stronger if the ideology between the centre and the state government is not high. Thus right winged states and ideologically similar states make the effect of disinvestment policy adopted by the central government more effective in improving the performance of CPSEs.

Besides political scenario at the state level, industrial environment of the state has a very critical role in firm performance. States characterized by readily available industrial credit, regular and increased electrical supply, and low excise duty rates boost firm efficiency. It is also seen that low debt size of the enterprises, more experienced and large sized firms have a positive influence on firm efficiency. I have controlled for two main policy tools available to the government- memorandum of understanding (MoU) and delicensing. It is seen that firms signing MoU, having better MoU scores (low MoU scores indicate better performance) and operating in industries with high delicensing have a positive influence on firm efficiency. I have also included industry and time dummies to control for unknown time and industry specific effects.

7.1.2 Disinvestment occurrence:

Repeated disinvestment, like first time selection of firms for disinvestment, also has a positive and significant effect on firm performance. Further, a right winged state and an ideologically similar state (to the centre) makes the effect of repeated selection of firms for disinvestment on firm performance stronger. State specific and firm level factors have a similar influence as discussed in first time disinvestment.

7.1.3 Disinvestment extent:

Larger shares of CPSEs being disinvested leads to better firm performance. However, unlike selection and occurrence of disinvestment, the effect of extent is not influenced by ideology of the state or the centre-state ideology difference. Other external factors- industry and state

specific factors have similar effects on firm performance. Even with internal factors, firm age and firm size have a positive effect on firm performance. However, debt size does not have an expected effect.

8 Conclusion

India had adopted disinvestment in 1991 as part of major reforms. On one hand, disinvestment is perceived to carry benefits like infusing efficiency and competitiveness in industries and inducing better performance of public firms. On the other hand, it is linked to higher unemployment, which in turn may have detrimental effect on the chance of re-election. Against this backdrop, using a comprehensive dataset of all enterprises owned by the Central government of India for the period of 1991-92 to 2010-11, the paper aims to explore the factors affecting the performance of public sector enterprises.

Using stochastic frontier analysis, I calculate firm efficiency scores to capture firm performance. As a next step, I investigate and identify two sets of factors that may affect performance of firms- the internal capacity of a firm driven by firm specific characteristics and external factors (disinvestment policy, political and institutional factors) in the states where the enterprises operate. I capture the effect of each of these factors on the efficiency of central public sector enterprises. I use a multidimensional approach to capture the effect of ideology and disinvestment policy instead of a standard dummy variable approach.

Using two stage least squares technique and difference-in-difference estimation I find that it's a combination of both internal and external factors that influence efficiency of enterprises. It is found that disinvestment has a strong positive impact on firm performance- as measured by all three variables and estimated by different estimation techniques. Further, results suggest that ideology of the state plays an important role in explaining better performance of firms in an indirect way. The effect of disinvestment on performance is driven by a more right state and low ideological difference between the centre and the state where the public enterprise is located.

There are a few caveats in the study. Econometric models used for robustness checks have focused only on first time disinvestment as these models do not allow capturing occurrence

or extent of disinvestment. Most of the states in India are governed by more than one party. However, gathering data on parties forming coalitions at the state level for 1991-2010 is beyond the scope of this study. This is mainly due to unavailability of data. Hence, the study is based on the simple assumption that the ideology of the party in the state with majority seat share is the representative of the government ruling that state irrespective of the fact that it might be a part of a coalition. This may be taken care of in future works.

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Appendix I

The first stage of 2SLS regressions are presented in Tables 10, 11 and 12 for first time, occurrence and disinvestment extent respectively. Table 10 presents the first stage results obtained from two models- Model I includes only first time disinvestment as the endogenous variable and Model II includes three endogenous variables- first time disinvestment and the two interaction terms. Models 2(a), (b) and (c) discuss the first stages with predicted first time disinvestment, interaction of state ideology with predicted probability and interaction of centre-state ideology difference with predicted probability as dependent variables respectively. Most of the instruments are significant. Credit availability is one of the most important state specific economic factors that have a significant influence on the disinvestment variables. Finally, firm age and size have a significant effect on the predicted values of first time disinvestment. Predicted values of disinvestment occurrence and extent (Tables 11 and 12) have similar results.

Appendix II

Capital Stock is estimated using perpetual inventory method Balakrishnan et al. (2000). ASI data contains information on gross opening and closing capital and depreciation for each factory.

Table 10 First stage of IV estimation: First time disinvestment

	Model I	Model 2 (a)	Model 2(b)	Model 2(c)
Political variables				
Predicted first time disinvestment	0.777***	1.118***	1.983*	-2.562***
	(0.132)	(0.370)	(1.223)	(0.593)
Predicted firsttime * Ideology of the state		-0.180	-0.033	0.794***
		(0.129)	(0.427)	(0.207)
Predicted first time * Ideology difference		-0.420***	-1.342***	1.496***
		(0.103)	(0.343)	(0.166)
State specific economic factors				
Electricity generation per capita	0.002	0.002	0.006	-0.000
	(0.003)	(0.003)	(0.013)	(0.006)
Excise duty per state domestic product	-0.023	-0.023	-0.077	0.013
	(0.014)	(0.014)	(0.048)	(0.023)
Labor market rigidity	0.000	0.000	0.001*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Credit availability	0.037***	0.038***	0.123***	-0.023*
	(0.007)	(0.007)	(0.024)	(0.011)
CPSE policy				
MoU signed dummy	0.028***	0.026**	0.057*	0.018
	(0.010)	(0.010)	(0.034)	(0.016)
MoU score	-0.004	-0.004	-0.012	0.001
	(0.003)	(0.003)	(0.009)	(0.004)
Industry				
Delicensing extent in an industry	-0.013	-0.012	-0.093	0.026
	(0.021)	(0.021)	(0.071)	(0.034)
Industry profitability	-0.077	-0.007	-0.414**	0.276***
	(0.052)	(0.011)	(0.173)	(0.084)
Firm specific factors				
Firm size	-0.005*	-0.006*	-0.018	-0.001
	(0.003)	(0.003)	(0.011)	(0.005)
Firm age	0.042***	0.046***	0.129**	0.004
	(0.015)	(0.015)	(0.052)	(0.025)
Firm debt size	-0.000	0.000	0.006	-0.007
	(0.006)	(0.006)	(0.022)	(0.010)
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
N	3723	3723	3723	3723

Note: The table presents results obtained from the first stage of modified IV estimation for first time disinvestment. The models use predicted value of first time disinvestment and its interaction with the two ideology variables obtained from Table as instruments. Model I is the first stage of the modified IV estimation which does not include interaction terms. Models 2(a),(b) and (c) are the first stages of the model with the interaction terms: 2(a) models first time disinvestment, 2(b) models interaction between ideology of the state and first time disinvestment and 2(c) models the interaction between ideology difference and first time disinvestment respectively. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 11 First stage of IV estimation: Disinvestment occurrence

	Model I	Model 2 (a)	Model 2(b)	Model 2(c)
Political variables				
Predicted disinvestment occurrence	0.606***	0.279**	-2.095***	-0.156
	(0.098)	(0.136)	(0.768)	(0.374)
Predicted occurrence* Ideology of the state		0.108	1.376***	-0.031
		(0.080)	(0.262)	(0.127)
Predicted occurrence * Ideology difference		-0.044	-0.035	0.900***
		(0.059)	(0.194)	(0.094)
State specific economic factors				
Electricity generation per capita	0.004	0.004	0.005	0.003
	(0.006)	(0.006)	(0.021)	(0.010)
Excise duty per state domestic product	-0.021	-0.021	-0.071	0.015
	(0.024)	(0.024)	(0.079)	(0.038)
Labor market rigidity	0.000*	0.000*	0.003**	-0.001***
	(0.000)	(0.000)	(0.001)	(0.000)
Credit availability	0.015	0.015	0.054	-0.005
	(0.012)	(0.012)	(0.039)	(0.019)
CPSE policy				
MoU signed dummy	0.023	0.024	0.062	0.026
	(0.017)	(0.017)	(0.056)	(0.027)
MoU score	0.000	-0.000	-0.000	-0.004
	(0.004)	(0.004)	(0.016)	(0.007)
Industry				
Delicensing extent in an industry	0.027	0.035	0.013	0.066
	(0.034)	(0.034)	(0.113)	(0.055)
Industry profitability	-0.144*	-0.005	-0.525*	0.239*
	(0.085)	(0.019)	(0.278)	(0.135)
Firm specific factors				
Firm size	-0.003	-0.004	-0.013	0.000
	(0.005)	(0.005)	(0.018)	(0.009)
Firm age	0.074***	0.077***	0.222***	-0.019
	(0.025)	(0.025)	(0.084)	(0.040)
Firm debt size	-0.005	-0.005	0.013	-0.036**
	(0.011)	(0.011)	(0.035)	(0.017)
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
N	3723	3723	3723	3723

Note: The table presents results obtained from the first stage of modified IV estimation for disinvestment occurrence. The models use predicted value of disinvestment occurrence and its interaction with the two ideology variables obtained from Table as instruments. Model I is the first stage of the modified IV estimation which does not include interaction terms. Models 2(a),(b) and (c) are the first stages of the model with the interaction terms: 2(a) models disinvestment occurrence, 2(b) models interaction between ideology of the state and disinvestment occurrence and 2(c) models the interaction between ideology difference and disinvestment occurrence respectively. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 12 First stage of IV estimation: Disinvestment extent

	Model I	Model 2 (a)	Model 2(b)	Model 2(c)
Political variables				
Predicted disinvestment extent	5.367***	4.721***	7.310***	0.622
	(0.208)	(0.366)	(1.127)	(0.471)
Predicted extent* Ideology of the state		0.255**	2.956***	-0.843***
		(0.122)	(0.376)	(0.157)
Predicted extent * Ideology difference		0.078	1.135***	0.218*
		(0.095)	(0.294)	(0.123)
State specific economic factors				
Electricity generation per capita	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.004)	(0.001)
Excise duty per state domestic product	-0.004	-0.005	-0.025	0.009
	(0.005)	(0.005)	(0.016)	(0.006)
Labor market rigidity	0.000	0.000	0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Credit availability	0.002	0.002	0.009	-0.000
	(0.002)	(0.002)	(0.008)	(0.003)
CPSE policy				
MoU signed dummy	0.000	0.000	0.002	-0.000
	(0.000)	(0.000)	(0.002)	(0.000)
MoU score	-0.000	0.000	-0.001	0.003
	(0.007)	(0.007)	(0.023)	(0.009)
Industry				
Delicensing extent in an industry	0.001	0.001	0.011	-0.006**
	(0.002)	(0.002)	(0.007)	(0.003)
Industry profitability	-0.149***	0.000	-0.406***	0.053**
	(0.019)	(0.004)	(0.060)	(0.025)
Firm specific factors				
Firm size	0.004	0.004	0.015	-0.004
	(0.005)	(0.005)	(0.017)	(0.007)
Firm age	-0.001	-0.001	-0.003	0.000
	(0.000)	(0.000)	(0.002)	(0.001)
Firm debt size	-0.006***	-0.006***	-0.019***	0.001
	(0.001)	(0.001)	(0.003)	(0.001)
Time dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
N	3723	3723	3723	3723

Note: The table presents results obtained from the first stage of modified IV estimation for disinvestment extent. The models use predicted value of disinvestment extent and its interaction with the two ideology variables obtained from Table as instruments. Model I is the first stage of the modified IV estimation which does not include interaction terms. Models 2(a),(b) and (c) are the first stages of the model with the interaction terms: 2(a) models disinvestment extent, 2(b) models interaction between ideology of the state and disinvestment extent and 2(c) models the interaction between ideology difference and disinvestment extent respectively. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

An investment series is generated by taking differences between gross closing and opening stock for each year.

Estimation of base year capital stock is the next step in estimation. I choose 1991-92 as the base year due to availability of greater number of observations. Following Balakrishnan et al. (2000) it is assumed that for the existing capital stock in 1991-92, the earliest vintage dates at most 20 years old to 1971-72. If the factory is incorporated in a year after 1971-72 then the year of incorporation is taken to be the earliest vintage year for capital. Using revaluation factor, the historic value of the base year capital is then converted to replacement cost of capital at current prices by multiplying base year capital values with R^G , where

$$R^G = \frac{[(1+g)^{(1+\tau)} - 1][(1+\pi)^{\tau}][(1+g)(1+\pi) - 1]}{g\big[[(1+g)(1+\pi)]^{(1+\tau)} - 1\big]}$$

τ is the number of vintage years, π is the rate at which price of capital changes such that $1 + \pi = \frac{P_t}{P_{(t-1)}}$. This is obtained from CSOs data on gross fixed capital formation published in various issues of the National Accounts Statistics (NAS). Similarly, it is assumed that investment also changes at a constant rate $1 + g = \frac{I_t}{I_{(t-1)}}$. The growth of fixed capital formation at 1993-94 prices, taken from various issues of NAS, is applied in the case of all the firms. The replacement cost of capital at current prices is then deflated using price index for machinery and machine tools. This provides the replacement value of base year capital stock at constant prices. Next, with information on base year replacement value of capital stock at constant prices, the subsequent stocks of capital have been estimated using the following Perpetual Inventory Method formula, given by

$$P_0K_t = P_0(1-\delta)K_(t-1) + P_0I_t$$

where P_0K_t is the real capital in time period t, $P_0K_{(t-1)}$ is real capital in time period $t-1$ and P_0I_t is the real investment in time period t. δ is the rate of economic depreciation, however I use gross values instead of net as economic rates of depreciation were not available.

Appendix III

As a robustness exercise, I use a propensity score matching that pairs firms that were selected for disinvestment and those that were never selected, on the basis of pre-disinvestment characteristics. To address remaining pre-disinvestment differences, matching can be combined with a difference-in-difference (DiD) model in panel data. One limitation with adopting this approach in the present context is that since I do not have data for the period before 1991, I match the firms that were selected for first time disinvestment only from 1992 onwards. Thus, I ignore firms that were selected for disinvestment for 1991 and consider firms to be in the treatment group if selected for disinvestment only after 1991. In other words, 1991 serves as a pre disinvestment periods for the above mentioned firm and I match these firms with their control counterparts in this year. This methodology suffers from the limitation arising from the difference in the matching period (1991) and policy action (anytime after 1991). The matching method is implemented by estimating a probit model for the year 1991 where the dependent variable takes the value 1 if the selected firm is selected for first time disinvestment between 1992 and 2010. Selection is captured as a function of political, industry and firm specific factors for the year 1991. The model is given by

$$P_i = \alpha + \beta X_i + \epsilon_i \tag{6}$$

Based on the propensity scores for the disinvested and never-disinvested outcomes from this regression, I match each disinvested firm with never-disinvested firm using caliper matching (0.01). I get the disinvestment effect on efficiency using DiD approach on the matched sample. DiD estimation requires having a treatment dummy variable that takes the value 1 for all years if a firm is selected for disinvestment in any year of the analysis (1992-2010). It also requires a time dummy that takes the value 1 for all years since the policy is implemented. In the present context, since different firms were selected in different years for first time disinvestment I do not have the same time dummy for all firms. To account for this, I allow for the matched control firms to take the same time dummy values that the respective matched treatment firms take [11]. Finally, the main variable of interest is the interaction term between the treatment and the

[11] This is done by matching time dummies based on matching id generated in STATA 12 after matching.

Table 13 Mean tests for Covariates before and after matching for DiD estimation

	Before matching		After matching	
	T-stat	P-value	T-stat	P-value
Ideology of the state	2.54***	0.012	-1	0.321
Ideology difference	-0.65	0.514	1.13	0.261
Delicensing	4.23***	0	0.88	0.384
MoU score	2.04***	0.042	-1.6	0.164
Firm profitability	-1.74**	0.082	1.69	0.096
Firm size	3.42***	0.001	0.24	0.809

Note: The table presents the match balance statistics of the covariates of the set of firms that are the candidates for the treatment and control sample. The first two columns show tests of difference in the sample mean before matching, while the next two show these tests for the subset selected after matching.

time dummy variables that gives the precise effect of disinvestment policy on firm efficiency. Formally,

$$Y_{it} = \alpha + \beta D_i + \gamma T_{it} + \delta D_i * T_{it} + \tau X_{it} + \epsilon_{it} \tag{7}$$

The main variable of interest is $(D_i * T_{it})$. A drawback is that the focus on differences between disinvested firms and never disinvested firms ignores potentially relevant information on firms to be treated sometime in the future. Since 1991 was the first adoption year of disinvestment policy, I perform a matching exercise for firms in 1991 separately. The procedure involves capturing the average treatment effect between the disinvested and non-disinvested firms for 1991 after matching (David Brown et al. (2010)).

Results

In order to re-affirm the effect of disinvestment (constraining to first time selection of firms) , I need to match the treated firms (firms selected for first time disinvestment between 1992-2010) with controls (firms never selected for disinvestment). I restrict the difference in difference approach only for 1992-2010, ignoring firms selected in 1991. This matching is done on the basis of a combination of internal (form specific) and external (state specific political , economic and industry level factors) using caliper matching. Table 13 depicts that the mean tests of these covariates is statistically insignificant for the matched sample, indicating that the treatment and control groups are similar.

The distribution of the propensity scores of the matched treatment and control groups also overlap as shown in Figure 3 and Figure 4. The overlap between the density of the two sets before matching (in Figure 3) indicates the region of common support, which becomes a tight

Table 14 DiD estimation for firms selected for disinvestment in 1992-2010

	Model I	Model II	Model III
Main variable			
Did Estimator	0.155***	0.144***	0.144***
	(0.052)	(0.052)	(0.052)
Controls			
Political variables	Yes	Yes	Yes
State specific economic factors	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Firm specific factors	Yes	Yes	Yes
Constant	0.265***	0.435***	0.379***
	(0.095)	(0.112)	(0.100)
Time dummies	No	Yes	Yes
Industry dummies	No	No	Yes
R- squared	0.12	0.136	0.119
N	1109	1109	1109

Note: The table presents DiD regression results of the matched sample for firms selected for disinvestment between 1992-2010. DiD is significant at 1%. The details of the regression with all the control variables can be provided on request. Model I does not include time and industry fixed effects. Model II includes year fixed effects. Model III includes both year and industry fixed effects. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The details of the regression with all the controls can be provided on request. $***p < 0.01, **p < 0.05, *p < 0.1$.

overlap after matching (in Figure 4).

Figure 3 Before matching propensity score for DiD estimation

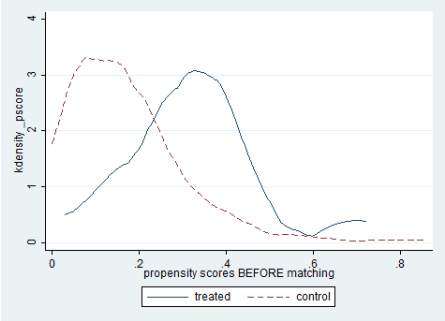
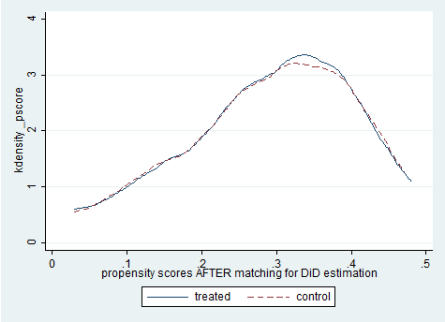


Figure 4 After matching propensity score for DiD estimation



The final matched set consists of 67 firms. I use this matched sample for my DiD regressions . The results of the DiD regression models are discussed in Table 14. Across different model specifications suggest that first time selection of firms for disinvestment has a positive and significant effect on firm performance.

Table 15 PSM for firms selected for disinvestment in 1991

	Model I	Model II	Model III	Model IV	Model V
Matching variables					
Ideology score of the state	0.176*	0.176*	0.176*	0.176*	0.176*
	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)
Ideology difference	-0.196	-0.196	-0.196	-0.196	-0.196
	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)
Firm controls	Yes	Yes	Yes	Yes	Yes
Industry controls	Yes	Yes	Yes	Yes	Yes
N	220	220	220	220	220
R squared	15.8	15.08	15.08	15.08	15.08
Support characteristics					
On-support treated	27	29	29	29	29
On-support contro;	191	191	191	191	191
p value of Post matching differences					
Ideology of the state	0.09	0.208	0.147	0.09	0.823
Ideology difference	0.612	0.632	0.717	0.278	0.448
LR Chi-squared					
Unmatched sample	25.96	25.86	25.86	25.86	25.86
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Matched sample	9.19	4.27	6.87	16.37	1.82
	(0.163)	(0.640)	(0.33)	(0.012)	(0.935)
Treatment effect on frontier					
ATT	0.2	0.15	0.133	0.07	-0.024
T-stat	2.14	1.95	1.35	1.12	-0.26

Note: The table presents propensity score matching regression results for firms selected for disinvestment in 1991. The details of the regression with all the control variables can be provided on request. Models I, II, III, IV and V use different matching techniques- caliper, nearest single neighbour, likelihood ratio, radius and mahalanobis matching respectively. The figures not in parenthesis are the coefficients and the ones in parenthesis are the robust standard errors. The difference between treatment and control for firm and industry controls are insignificant post matching. $***p < 0.01, **p < 0.05, *p < 0.1$.

This technique, though captures the effect of first time selection of firms for disinvestment, suffers from the limitation of not capturing the effect of occurrence or extent of disinvestment.

Finally, I do a similar matching exercise using different types of propensity score matching for 1991 to investigate if disinvestment had a positive effect on firm performance in the first year of its implementation in India. The results of the matching exercise and the effect on firm efficiency is discussed in Table 15.

I also present the distribution of propensity scores before matching (figure 5) and a series of figures after matching for caliper matching (Figure 6) and likelihood ratio matching (Figure 7) as they best fit the available data. These correspond to Models I and III in Table 15, indicating a positive effect of first time selection on firm efficiency.

Figure 5 Propensity score before matching

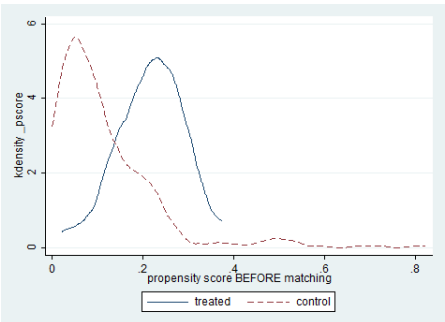


Figure 6 Propensity score after caliper matching

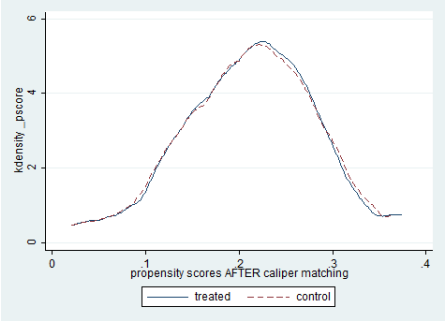


Figure 7 Propensity score after likelihood ratio matching