Liberalization and Industrial Performance: Evidence from India and the UK

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Abstract

What is the relationship between liberalization and economic performance? In this paper we review evidence from two recent papers which exploit industry and firm panels for India and the UK to shed light on this important issue. A simple Schumpeterian growth model is used to guide our analysis where liberalization is modeled as a reform which reduces barriers to foreign entry. Incumbent firms can react to the entry threat by making innovative investments. The incentive to make such investments is high for advanced firms close to the technological frontier but low for backward firms. Advanced firms will therefore react to liberalization by increasing investment, productivity, profits and output. The opposite will be true of backward firms which stand little chance of competing in the post-liberalization environment. As a result the overall impact of liberalization will be unequal. Moreover, the institutional environment will affect incumbent firm behavior. The incentives to invest and innovate will be lower in regions with pro-worker labor institutions and these negative effects will be magnified by liberalization. By exploiting the Indian liberalization of 1991 we are able to confirm the existence of these effects in an Indian panel of 3-digit manufacturing state-industries. We then turn to a firm panel from the UK where we can observe actual foreign entry and show that both productivity growth and patenting is higher in firms closer to the technological frontier. These findings emphasize that the initial level of productivity and institutional context mattered for whether firms and industries benefited from liberalization.

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1 Introduction

There has been intense debates on the relationship between liberalization and economic performance. Advocates argue that, by increasing the size of markets and by fostering product market competition, liberalization enhances growth (see, for example, Dollar and Kray (2001, 2002), Frankel and Romer (1999), Sachs and Warner (1995) and World Bank (2001)). Critics instead point out that liberalization can be detrimental to growth, by inhibiting infant industries and learning-by-doing (Krugman (1981), Haussman and Rodrik (2002), Young (1991), Stiglitz (1995, 2002), Banerjee-Newman (2003), Acemoglu-Aghion-Zilibotti (2003)).

The evidence gathered so far on this issue is mainly at the country level and does not arrive at any clear consensus. The main contribution of this paper is to review some recent work which examines how these macroeconomic reforms affect microeconomic outcomes as picked up in industry and firm panel data sets from India and the UK.[1] In particular we are interested in the extent to which the effect of liberalization on performance measures such as productivity, investment and output, varies according to the technological capabilities of industries/firms and the institutional environments which they face.

Our main finding is that reducing barriers to entry to foreign products and firms, has a more positive effect on economic performance for firms and industries that are initially closer to the technological frontier. In contrast, performance in firms and industries that are initially far from frontier may actually be damaged by liberalization. As a result, liberalization magnifies the initial differences in productivity. The reason is that incumbent firms that are sufficiently close to the technological frontier can survive and deter entry by innovating. An increased entry threat, thus, results in higher innovation intensity aimed at escaping that threat. In contrast, firms and sectors that are far below the frontier are in a weaker position to fight external entry. For these firms, an increase in the entry threat reduces the expected payoff from innovating, since their expected life horizon has become shorter.

Another key finding is that the institutional environment in which firms function, has a central bearing on whether or not they benefit from liberalization. Here, our focus is on labor market institutions which affect the distribution of rents between firms and workers. More precisely, our theory predicts that the response of innovative investments to liberalization is dampened in regions with more pro-worker labor regulations. Thus, in relative terms, trade reforms hurt growth in regions with pro-labor regulations, while enhancing growth in regions with pro-employer regulations.

Our approach, which uses Schumpeterian growth theory to guide analysis of Indian and UK panel data, allows us to draw several important policy insights. The first is that the stage of technological development of a firm or industry matters. Policies which allow firms to upgrade their technological capabilities or which enable workers

[1] See Aghion-Burgess-Redding-Zilibotti (2003) and Aghion-Blundell-Griffith-Howitt-Prantl (2003).

to relocate from low to high productivity sectors, will help to increase the extent to which a country or region benefits from liberalization. A second is that the impact of liberalization on firm performance, depends upon institutions such as labor regulations which differ across regions and affect the incentives for firms to invest and innovate. This, in turn points to a complementarity between liberalizing product and labor markets. Domestic policy reforms can thus play a central role in determining the extent to which firms and industries benefit from macroeconomic reforms which lower barriers to entry.

The paper is organized as follows. Section 2 sketches a theoretical framework which links liberalization and entry to industrial performance across heterogeneous industries and summarizes its main implications. Section 3 shows the impact on industrial performance of the Indian liberalization experiment of 1991 using a 3-digit state-industry panel for the period 1980-1997. Section 4 presents related findings of the impact of increased foreign entry on productivity and patenting using a UK firm-level panel data set for the period 1987-1993. Section 5 briefly concludes.

2 Theoretical framework

2.1 A simple multi-sector Schumpeterian growth model

All agents live for one period. In each period t a final good (henceforth the numeraire) is produced in each state by a competitive sector using a continuum one of intermediate inputs, according to the technology:

$$y_t = \frac{1}{\alpha}[\int_0^1 (A_t(\nu))^{1-\alpha} x_t(\nu)^{\alpha} \ d\nu].$$

$x_t(\nu)$ is the quantity of intermediate input produced in sector ν at date t, $A_t(\nu)$ is a productivity parameter that measures the quality of the intermediate input ν in producing the final good, and $\alpha \in (0,1)$. The final good can be used either for consumption, or as an input in the process of production of intermediate goods, or for investments in innovation.

In each intermediate sector ν only one firm (a monopolist) is active in each period. Thus the variable ν refers both, to an intermediate sector (industry), and to the intermediate firm which is active in that sector. As any other agent in the economy, intermediate producers live for one period only and property rights over intermediate firms are transmitted within dynasties. Intermediate firms use labor and capital (final good) as inputs. As shown in Acemoglu et al (2003), the equilibrium profit for each intermediate firm will take the form:

$$\pi_t(\nu) = \delta A_t(\nu), \tag{1}$$

where δ reflects the bargaining power of the firm vis-a-vis its workers, with a higher δ corresponding to a more pro-employer labor market environment.

2.2 Technology and entry

Let $\overline{A}_t$ denote the new frontier productivity at date t and assume that this frontier grows at the exogenous rate g. At date t an intermediate firm can either be close to frontier, with productivity level $A_{t-1}(\nu) = \bar{A}_{t-1}$, or far below the frontier, with productivity level $A_{t-1}(\nu) = \bar{A}_{t-2}$.

Before they produce and generate profits, firms can innovate to increase their productivity. For innovation to be successful with probability z the intermediate firm at date t must invest

$$c_t(z) = \frac{1}{2} z^2 A_{t-1}(\nu).$$

Intermediate firms are subject to an entry threat from foreign producers. Let μ denote the probability that an entrant shows up. Liberalization corresponds to an increase in μ. Foreign entrants at date t are assumed to operate with the end-of-period frontier productivity, $\bar{A}_t$.

If the foreign firm manages to enter and competes with a local firm which has a lower productivity, it steals all the market. If it competes with a local firms which has the same productivity, however, Bertrand competition drives the profits of both the local and the foreign firm to zero. We assume the parameters to be such that the foreign firm will always find it profitable to try to enter if the local firm has a productivity level lower than the frontier. However, the foreign firm will never enter in period t if the local firm has achieved the frontier productivity level $\bar{A}_t$. Therefore, the probability of actual entry in any intermediate sector ν,is equal to zero the local firm ν was initially "advanced" and has successfully innovated, and it is equal to μ otherwise.

2.3 Equilibrium innovation investments

Using (1), together with the above innovation technology, we can analyze the innovation decisions respectively by intermediate firms that close and far below the frontier. Firms that are initially far below the frontier at date t choose their investment so as to maximize expected profits net of R&D costs, namely:

$$\max_z \{\delta \left[z(1-\mu)\bar{A}_{t-1} + (1-z)(1-\mu)\bar{A}_{t-2} \right] - \frac{1}{2} z^2 \bar{A}_{t-2}\},$$

so that by first-order condition:

$$z_2 = \delta(1-\mu) g. \tag{2}$$

Firms that are initially close choose their investment so as to:

$$\max_z \{\delta \left[z\bar{A}_t + (1-z)(1-\mu)\bar{A}_{t-1} \right] - \frac{1}{2} z^2 \bar{A}_{t-1}\}$$

so that:

$$z_1 = \delta (g + \mu). \tag{3}$$

We interpret an increase in the threat of product entry, μ, as a liberalization reform. Straightforward differentiation of equilibrium innovation intensities with respect to μ, yields:

$$\frac{\partial z_1}{\partial \mu} = \delta > 0; \frac{\partial z_2}{\partial \mu} = -\delta g < 0.$$

In other words, *increasing the threat of product entry (e.g., through trade liberalization) encourages innovation in advanced firms and discourages it in backward firms.* The intuition for these comparative statics is immediate. The higher the threat of entry, the more instrumental innovations will be in helping incumbent firms already close to the technological frontier to retain the local market. However, firms that are already far behind the frontier have no chance to win over a potential entrant. Thus, in that case, a higher threat of entry will only lower the expected net gain from innovation, thereby reducing ex ante incentives to invest in innovation.

Next, consider the effects of changes in labor market regulations on innovative investments.

$$\frac{\partial z_1}{\partial \delta} = g + \mu > 0; \frac{\partial z_2}{\partial \delta} = (1 - \mu) g > 0.$$

Hence, *pro-employer labor market regulations encourage innovation in all firms.*

Finally, if we look at the cross-partial derivatives with respect to reform (μ) and labor regulation (δ), we get:

$$\frac{\partial^2 z_1}{\partial \delta \partial \mu} = 1 > 0; \frac{\partial^2 z_2}{\partial \delta \partial \mu} = -g < 0.$$

Thus, in particular, *a more pro-employer labor regulation*, i.e a higher δ, *increases the positive impact of entry on innovation investments in type-1 industries.*

2.4 Main theoretical predictions

Let us conclude this section by summarizing our main findings:

1. *Liberalization (as measured by an increase in the threat of entry) encourages innovation in industries that are close to the frontier and discourages innovation in industries that are far from it. Productivity, output, and profits, should thus be higher in industries and firms that are initially more advanced.*

2. *Pro-worker labor market regulations discourage innovation and growth in all industries, and the negative effect increases with liberalization.*

3 The Indian liberalization experiment[2]

The 1991 Indian reforms represented one of the most dramatic liberalizations ever attempted in a developing country. Up to this point central government control over industrial development was maintained through public ownership, licensing and other controls. And planned industrialization took place in highly protected environment which was maintained by high tariff, non-tariff barriers and controls on foreign investment. The New Industrial Policy, introduced in 1991 in the wake of a balance of trade crisis, shattered this old order. As its central elements it include:. (i) *Trade liberalization* – across the 1990-97 period we find that there was a 51% reduction in tariffs with 97% of products experiencing tariff reductions. Quantitative controls on imports of intermediate products were also largely eliminated. (ii) *Foreign investment* – approval of foreign technology agreements and of foreign investment of up to 51% of equity was made automatic in a large number of industries. (iii) *Deregulation* – the requirement to obtain a license to start up a new production unit, expand production levels by more than 25% or to manufacture a new product were removed in the majority of industrial sectors. The number of industrial sectors reserved for the public sector also saw a dramatic reduction.

These different reforms would all have the net effect of lowering barriers to entry to foreign products and firms. The 1991 liberalization thus presents us with an ideal opportunity to study how industries in the different states of India responded to this increased threat of entry. Industrial sectors in different states of India were subject to the same liberalization reforms. However, as our model makes plain, the impact of these reforms on industrial performance may have been different across state-industries both because the their positions in the pre-reform productivity distributions and because institutional conditions vary across states. The empirical strategy pursued in ABRZ is straightforward. We track 3-digit state-industries across pre- and post-reform periods and examine whether being closer to the Indian technological frontier or having more pro-employer labor institutions pre-reform affects post-reform performance.

In studying the impact of liberalization on industrial performance ABRZ focus on one key sector of the Indian economy – the registered or organized manufacturing sector.[3] We do this for several reasons. Manufacturing is often seen as the key driver of structural change and economic growth in discourses on economic development (see e.g. Kaldor, 1967). And it was this heavily protected and regulated sector that was the target of liberalization reforms. The labor regulations that we study also pertain specifically to this sector (see Besley and Burgess, 2003). And the fact that

[2] This section is drawn from Aghion-Burgess-Redding-Zilibotti (2003) henceforth ABRZ.

[3] This covers manufacturing firms with more than 10 employees with power or 20 or more workers without power. Manufacturing firms with employment below these thresholds fall into the unregistered sector. Over the period 1980-1997 the registered sector comprises about 10% of GDP and the unregistered sector about 5% of GDP.

an Annual Survey of Industries was carried out on firms in this sector enables us to reliably track changes in industrial performance across the 1980-1997 period.

The aggregate figures indicate that liberalization had an overall positive effect on industrial performance – annual real per capita manufacturing which stood at around 4% in 1960-1991 period jumped to about 7% in the 1991-1997 period. As Figure 1 shows, these all-India growth rates, however, conceal a vast amount of variation in registered manufacturing performance across Indian states. And this variation becomes even more pronounced when we look at 3-digit industries within states which is the level at which we will be carrying out our econometric analysis.[4] Certain states like Andhra Pradesh, Gujarat, Haryana and Maharashtra show marked growth increases after 1991 whereas others like Assam, Bihar and Orissa show marked declines. It is this heterogeneity in growth responses to the *same* set of nationwide macroeconomic reforms that is striking. Our theory offers us a vehicle to help us think about why this might be happening. One possibility is that states which experienced declines contained a high fraction of backward industries which were incapable of competing in the post-liberalization environment. In these states investment and innovation would actually be discouraged by liberalization. The opposite would be true in states that contained a high fraction of advanced industries. Another possibility is that declining states had pro-worker labor institutions which would further blunt the incentives to invest and innovate after liberalization occurs. As a result, the impact of liberalization would be highly unequal across industries and states in the same country which is precisely what we observe.

3.1 Empirical analysis

To test the main predictions which emerge from the theoretical framework ABRZ run panel regressions of the form:

$$y_{ist} = \alpha_{is} + \beta_t + \gamma_i t + \delta(x_{is})(d_t) + \eta r_{st} + \theta(r_s)(d_t) + u_{ist} \tag{4}$$

where i indexes a 3-digit industries, s indexes the Indian state in which the industry is located and t indexes years. y_{ist} is a 3-digit state-industry manufacturing performance outcome expressed in logs. x_{is} is pre-reform distance to the Indian technological frontier defined as labor productivity in a 3-digit state-industry in 1990 divided by labor productivity in the most productive 3-digit state-industry in that year. This measure equals l for the frontier and is less than 1 for non-frontier state-industries. A higher x_{is} therefore corresponds to being closer to the technological frontier. The liberalization reform is captured with a dummy d_t which takes a value of 0 before 1991 and a value of 1 after. The coefficient on the interaction between pre-reform distance to frontier and the reform dummy (δ) tells us whether 3-digit state-industries

[4]There is an average of 79 3-digit industrial sectors functioning in each Indian state in a given year across the 1980-1997 time period.

closer to the frontier grew more quickly in the post-liberalization period relative to state-industries further from frontier.

To capture state level institutions ABRZ use the labor regulation measure r_{it} from Besley and Burgess (2003) which codes amendments to the central 1947 Industrial Disputes Act as pro-worker, pro-employer or neutral and cumulates these over time to give a state level picture of state level changes in the industrial relations climate (see Figure 2).[5] These labor regulations are specific to firms in the registered manufacturing sector which are included in the Annual Survey of Industries. We are thus linking regulatory change which affects a specific sector to outcome measures in the same sector. We look both at whether the direction of regulatory change across the 1980-1997 period affected industrial performance (the η coefficient) and also at whether pre-reform institutional conditions affected post-reform performance (the θ coefficient).

We include 3-digit state-industry and year fixed effects to control for unobserved characteristics of state-industries and common time effects across state-industries. We also include 3-digit industry time trends to control for the possibility that industries experience different rates of technological change. Our standard errors are adjusted for clustering by state to deal with problems with serial correlation (Bertrand, Duflo and Mullainathan, 2003).

3.2 Results

The key results from ABRZ are shown in Table 1. As our interest is in looking at a productivity measure that captures technological upgrading we focus in column (1) on total factor productivity (TFP). In the first row of results we see that 3-digit state-industries close to the most productive state-industry in India pre-reform experienced faster post-reform total factor productivity growth relative to state industries far from the frontier. A common liberalization reform is thus having a heterogenous impact on industries (located in different states) within the same 3-digit industrial sector. We then observe, in the second row, that, as predicted by the theory, the rate of technological progress is slower in states moving a pro-worker direction. This is evidence that institutional environment in which firms are embedded affected productivity growth across the 1980-1997 period. What is more striking is the evidence that liberalization magnifies the negative impact of pro-worker regulations on productivity growth. This shows how greater rent extraction by workers blunts the incentives of

[5]Labor relations fall on the Concurrent List of the Indian Constitution which implies that both central and state governments can introduce legislation in this area. Besley and Burgess (2003) code state level amendments to the (central government) Industrial Disputes Act of 1947 as either being neutral (0), pro-worker (1) or pro-employer (-1) and cumulate this measure over time to give a picture of the pattern of regulatory change across states and time. The measure captures the extent to which workers can appropriate industrial rents which may affect incentives of firms to make innovative investments as a response to entry threats.

firms to make innovative investments in order to fight entry. State specific regulatory policies therefore have a central bearing on whether or not the same 3-digit industries located in different parts of India benefit from liberalization.

In our theory new investment plays a key role in allowing industries to counter the threat of entry. In column (2) we examine this key channel by looking at fixed capital investment, a large component of which is investment in plant and machinery. Column (2) confirms that 3-digit state-industries closer to the frontier pre-reform exhibit an increase in investment post-reform. This is a central result as it indicates that firms make greater investments in plant, machinery and other forms of fixed capital post-reform when they are closer to the frontier pre-reform. The regression thus helps to establish a link between liberalization, which leads to a reduction in barriers to entry, and the technology adoption choices of firms. Through this mechanism liberalization has an unequalizing long-run effect by increasing productivity more in advanced state-industries relative to backward state-industries in the same industrial sector. Column (2) also confirms that industries located in states with more pro-worker industrial relations climates pre-reform experienced less investment activity post liberalization. This is direct evidence that the type of institutions extant in a state prior to reform affect the investment response of firms to liberalization. Domestic reforms which improve the institutional environment in which manufacturing firms function stands out as one means of improving the extent to which industries in a given region benefit from liberalization. In short, investment climate in a state matters for whether industries benefit from liberalization.

As a result of the innovative investments they make, we would expect profits to be greater post liberalization in firms in advanced industries relative to those in backward industries. Column (3) confirms that this is the case. It is the lure of these greater profits that leads firms to invest in new procedures and technologies in advanced industries whereas exactly the opposite is true for firms in backward industries which stand little chance of competing in the post-liberalization environment. Column (3) also shows that states which moved in a pro-worker direction in the 1980-1992 exhibited lower industry profits. This makes sense as returns on investments will be lower in industries located in these states. Moreover the blunting effect of having a pro-worker institutional environment is greater post-liberalization. Liberalization thus both creates the lure of greater profits but also magnifies the negative impact of having anti-business institutional environments.

A natural question to ask is how the size of different manufacturing sectors was affected by liberalization. This if often what people have in mind when considering the welfare implications of liberalization. In column (4) of Table 1 we confirm what we would expect from the theory – advanced industries experience greater output expansions following liberalization than do backward industries. We also see that moving in a pro-worker direction is associated with lower output in registered manufacturing industries. This result thus lines up with the state-level findings of Besley and Burgess (2003) who show that states which amended the Industrial Disputes

Act in a pro-worker direction experienced lowered output, employment, investment and productivity in registered or formal manufacturing across the 1958-1992 period. They also find that they find that regulating in a pro-worker direction was associated with increases in urban poverty. This points to potential negative welfare implications of having institutional environments which are not conducive to firms making innovative investments. And as column (4) indicates the negative impacts of having pro-labor institutions pre-reform were amplified post-liberalization. These results indicate that the technological capability of industries and the institutional environment in which they are positioned have fundamental consequences for whether they expand or contract following a liberalization shock.

4 Entry and growth in the UK[6]

4.1 Estimated equations and measures

Looking at the effect of entry on performance and productivity growth in the UK context, has both, advantages and disadvantages compared to the Indian liberalization experiment analyzed in the previous section. The main disadvantage is that no equivalent of the 1991 reform has taken place in the UK during the past two decades. The main advantage is the availability of richer micro data on productivity growth, patenting activity, and actual entry.

The former consideration makes it impossible to use a time dummy to capture liberalization as was done in the case of India. So, what is the alternative? Namely, to use a two-stage least squares procedure, regressing performance over the rate of actual foreign firm entry, while instrumenting actual entry using policy variables that directly affect entry threat. We thus focus our estimation exercise on an equation of the form:

$$Y_{ijt} = f\left(E_{jt}, F_{jt}, X_{ijt}\right) \tag{5}$$

where i indexes (incumbent) firms, j indexes industries (4-digit), and t indexes years, Y is a measure of incumbent firm innovative performance, E is the actual entry rate of foreign firms, F is the industries distance to the technological frontier and X is a vector of other firm and/or industry covariates that control for other economic processes that may affect the innovative performance of domestic incumbent firms.

But since we are primarily interested in the effect of entry threat, not actual entry per se, we instrument actual entry using a large set of policy instruments, in particular: (a) 53 investigations and decisions by the Monopoly and Merger Commission; (b) 11 privatization cases of large publicly owned companies; (c) 41 indicators for 3-digit industries expected to be highly affected by the EU single market programme. Thus

[6]This section is drawn from Aghion-Blundell-Griffith-Howitt-Prantl (2003), henceforth ABGHP.

ABGHP specifies the following reduced form equation for entry:

$$E_{jt} = Z'_{jt}\Pi + F_{jt}\psi + X_{ijt}\phi + v_{jt}, \tag{6}$$

with

$$E[v_{jt}|Z_{jt}, F_{jt}, X_{ijt}] = 0 \tag{7}$$

where Z_{it} denote the instruments.

We control for unobservable industry characteristics and common macro shocks by including dummies. However, these may not be sufficient to remove all spurious correlation between entry and the growth in TFP (or patent count). In particular, relative changes in the entry rate across industries may be indirectly caused by shocks to UK TFP growth (or patenting). Our approach to remove such temporal correlations is to use policy and foreign technology variables as excluded instruments that determine entry but have no direct effect on the growth in TFP (or patenting).

Innovative performance is measured in two ways: first, by growth in total factor productivity, using a very rich dataset containing disaggregate information on output and factor inputs at the plant level for the population of UK manufacturing enterprises. Second, by patent counts: these data are available for only a subset of firms (those listed on the UK Stock Market).

Entry is measured either by the actual number of employees in new foreign plants or by entry rates on 4-digit industries in the previous periods.

Distance to frontier is measured by the relative labor productivity index between UK and US industry on a 4-digit level, and to limit the high variation of a distance measure over time ABGHP use a three year moving average.

4.2 Data

The empirical models specified above are estimated using micro-level data on productivity growth and patenting activity of British firms between 1987 and 1993.

Several firm data are being used simultaneously. First, data from the Annual Respondents Database (ARD) for the manufacturing sector. The ARD contains the micro data underlying the Annual Census of Production and covers the time period from the early 1970s onwards. It is collected by the British Office for National Statistics under the 1947 Statistical Trade Act and response is mandatory. Detailed accounting information is available for all establishments selected for the ARD survey.

Second, data from the IFS-Leverhulme database which links patent data from the NBER/Case Western Patent database with firm level accounting data from DataStream. The patent database contains all patents granted by the United States PTO between 1968 and 1999. This patent data is linked to DataStream data on 415 firms listed on the London Stock Exchange (LSE) during the time period 1968-1996.

The main sample used by ABGHP for estimating productivity growth models is a panel of 17,741 observations on 2,944 domestic incumbent establishments in the

ARD between 1987 and 1993. The main firm panel for estimating innovation models consists of 1,101 observations on 179 firms in the IFS-Leverhume database. All firms in this sample are considered to be incumbent firms since firms listed on the LSE are all large and old. About 60 percent of the firms in the sample are patenting firms between 1987 and 1993.

4.3 Empirical results

The main empirical findings from ABGHP are summarized in Table 2. The first column shows a significant effect of foreign entry rate on productivity growth only after we instrument for entry as specified above. We also find a negative effect of closeness to the frontier (this variable is misleadingly referred to as the "distance to frontier" variable), and positive effects of competition and import penetration. More importantly, we see that the interaction between entry and distance to frontier is positive and significant at the 1% level. In other words, the regression vindicates our conjecture that the effect of entry on TFP growth is all the more positive when an industry is closer to the technological frontier.

The second column displays similar results, but with patent count as the dependant variable. Once again, the entry rate of foreign firms, import penetration, and competition, all have a positive and significant effect on patenting; moreover the interaction term between entry and distance to frontier is positive and highly significant (at the 1% level), so that the closer an industry initially is to the corresponding frontier, the more entry enhances patenting in that industry. ABGHP also show that for low values of the distance to frontier variable an increase in entry can have an overall negative effect on patenting, which in turn confirms the existence of a discouragement effect of entry for firms far below the frontier.

5 Conclusion

The world has tended to divide between those who are for or against liberalization. Reality it turns out is more nuanced. There can no a priori assumption that an industrial sector will benefit from or be harmed by liberalization. One has to look closer into initial technological conditions and the institutional environment. In particular we have first argued and provided evidence that liberalization should enhance performance to a larger extent in firms or industries that are initially closer to the technological frontier. Second we have shown that domestic institutional and policy choices such as that which pertain to labor institutions have a central bearing on whether firms and industries benefit from liberalization.

Our microeconomic analysis allows us to revisit the debate on liberalization. Here we believe that the devil is in the detail. For example we saw that even if liberalization has had a positive aggregate impact on productivity and output in a country

like India, it also had a negligible or negative impact on sectors far below the technological frontier. This, in turns suggests that complementary policies can be designed to encourage technological upgrading, either by existing firms or by reallocation of workers from low- to high-productivity firms. Similarly, our finding that pro-worker labor regulations may act as a brake on the potential positive impact of liberalization, points to key complementarities between macroeconomic reforms like tariff reductions and more microeconomic institutional reforms.

A key insight from our analysis is that there are both winners and losers from liberalization. This helps us to understand why liberalization itself is often opposed even if its overall impact is positive. Even if liberalization happens in the sense of reducing barriers to entry, groups or industries that would potentially lose from it may act as a barrier to complementary institutional reforms, thus further reducing the overall impact of liberalization on economic performance. Working out a set of liberalization reforms which are both, growth-enhancing and politically feasible, is an important subject for future research.

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Table 1: Liberalization and Industrial Performance in Indian Industries 1980-1997

	(1)	(2)	(3)	(4)
	Log TFP	Log investment	Log profits	Log output
Pre-Reform Distance*Reform	0.157***	0.539***	0.685***	0.440***
	(0.042)	(0.168)	(0.201)	(0.059)
Labor Regulation	-0.066***	-0.052	-0.236***	-0.090***
	(0.017)	(0.042)	(0.090)	(0.034)
Pre-Reform Labor Regulation*Reform	-0.035***	-0.023***	-0.043	-0.061***
	(0.011)	(0.008)	(0.032)	(0.015)
State-industry fixed effects	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Industry-time trends	YES	YES	YES	YES
State-reform dummies	NO	NO	NO	NO
Balanced panel	NO	NO	NO	NO
Observations	22883	21494	16204	22883
R-squared	0.69	0.87	0.75	0.94

Source: Aghion, Burgess, Redding and Zilibotti (2003). Notes: Robust standard errors in parentheses adjusted for clustering by state, * significant at 10%; ** significant at 5%; *** significant at 1%. Regressions are weighted using time-averaged state-industry employment shares. Sample is a three-dimensional panel of 3-digit industries from 16 Indian States during 1980-97. The data consists of a panel of 22,883 observations, where we condition on a minimum of 10 time-series observations for each state-industry and on at least two states being active within an industry in any time period. Log TFP is log total factor productivity. Log investment is log real gross fixed capital formation in registered manufacturing in a state-industry. Log profits is log real registered manufacturing profits in a state-industry. Log output is log real registered manufacturing output in a state-industry. Pre-reform distance is pre-reform state-industry labor productivity relative to the state with the highest level of pre-reform labor productivity within the industry. Reform is a dummy which equals 0 for 1990 and earlier and equals 1 from 1991 onwards. State amendments to the Industrial Disputes Act are coded 1=pro-worker, 0=neutral, -1=pro-employer and then cumulated over the pre-reform period to generate the labor regulation measure.

Table 2: Foreign Entry, Productivity Growth and Patenting in a UK Firm Panel

	(1)	(2)
Dependent Variable	TFP Growth	# of Patents
Independent variables		
Foreign firm entry rate$_{j, t-1}$	2.12**	37.17***
	(0.46)	(11.30)
Entry$_{j, t-1}$ * Distance$_{j, t-1 \text{ to } t-3}$	3.29***	40.45***
	(1.15)	(15.46)
Distance to the frontier$_{j, t-1 \text{ to } t-3}$	-0.05***	-1.33***
	(0.03)	(0.70)
Import penetration$_{j, t-1}$	0.05**	0.20
	(0.02)	(0.39)
Competition$_{j, t-1}$	0.16**	- 9.43**
	(0.07)	(4.75)
Pre sample patent stock$_{i, 1986}$		0.004***
D (patent stock$_{i, 1986}$>0)		2.50**
Instruments:		
t, CF term (entry)	- 2.16**	- 1.86*
F, policy inst. red. form	136.07 (86)***	6.65 (70)***
F, US inst. red. form	37.56 (9)***	3.02 (9)***
R^2, reduced form	0.5877	0.5447
Controls:		
Year dummies	YES	YES
3 digit industry dummies	NO	YES
Establishment fixed effects	YES	NO
# (observations)	15,060	1,059

Source: Aghion, Blundell, Griffiths, Howitt and Prantl (2003). Notes: Column (1) -- OLS regression results with robust standard errors in brackets. Sampling probability weights and clustering on the industry level taken into account. 15,060 observations on domestic incumbent establishments between 1987 and 1993. Column (2) -- Negative binomial regression results with robust standard errors in brackets. Clustering on the industry level is taken into account. 1,059 observations on incumbent firms listed at the UK stock market between 1987 and 1993. *** (**, *) indicates significance at the 1 (5, 10)-percent significance level.

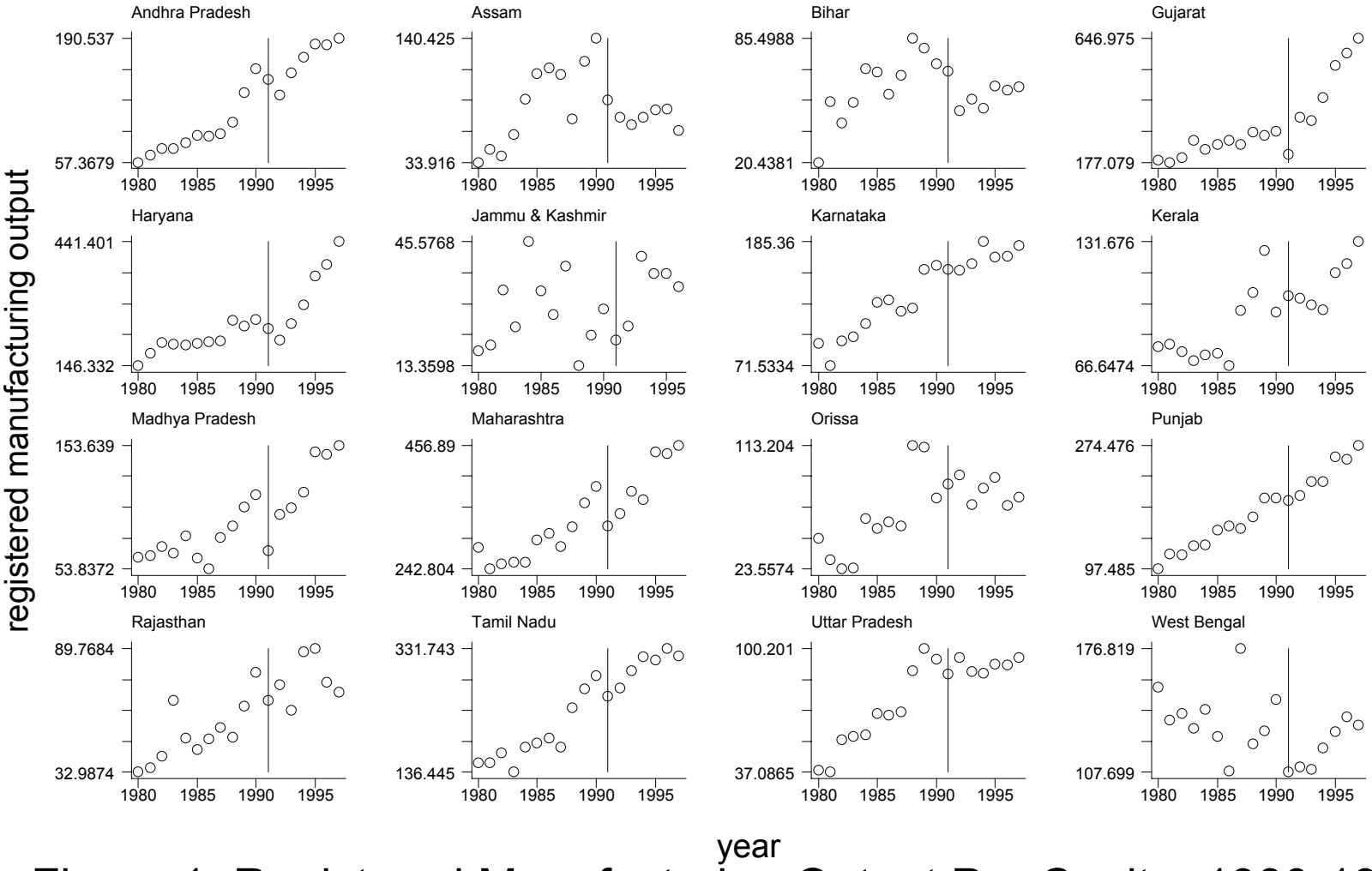

Figure 1: Registered Manufacturing Output Per Capita: 1980-1997

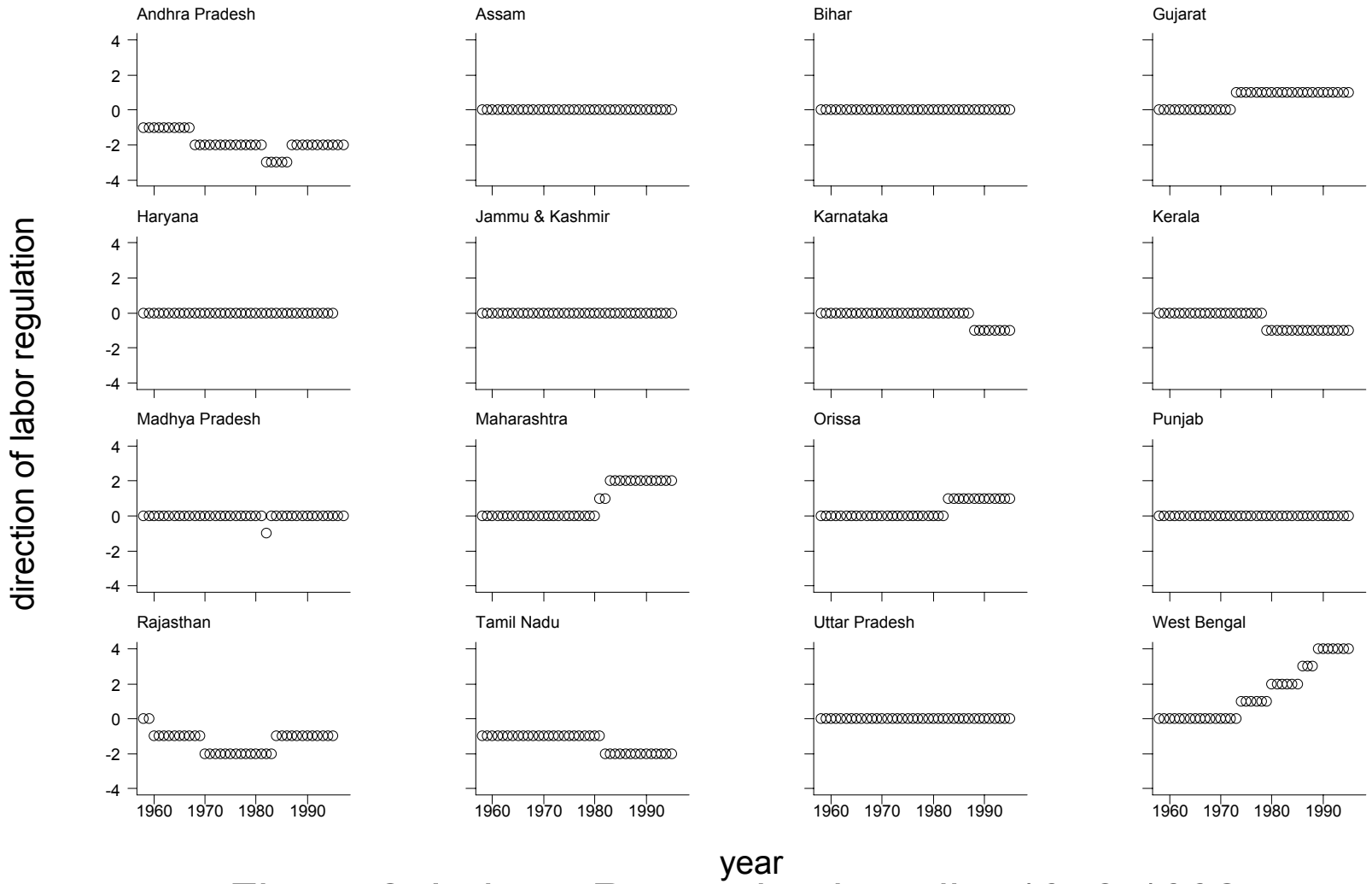

Figure 2: Labour Regulation in India: 1958-1992