

Learning versus Stealing: How Important Are Market-Share Reallocations to India's Productivity Growth?

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Recent trade theory emphasizes the role of market-share reallocations across firms (“stealing”) in driving productivity growth, whereas previous literature focused on average productivity improvements (“learning”). We use comprehensive, firm-level data from India’s organized manufacturing sector to show that market-share reallocations were briefly relevant to explain aggregate productivity gains following the beginning of India’s trade reforms in 1991. However, aggregate productivity gains during the period from 1985 to 2004 were largely driven by improvements in average productivity. We show that India’s trade, FDI, and licensing reforms are not associated with productivity gains stemming from market share reallocations. Instead, we find that most of the productivity improvements in Indian manufacturing occurred through “learning” and that this learning was linked to the reforms. In the Indian case, the evidence rejects the notion that market share reallocations are the mechanism through which trade reform increases aggregate productivity. Although a plausible response would be that India’s labor laws do not easily permit market share reallocations, we show that restrictions on labor mobility cannot explain our results. JEL codes: F13, F14, F16, O24, O25.

Over the last two centuries, economists have frequently returned to the question of how nations gain from trade. Early studies focused primarily on aggregate productivity gains driven by interindustry specialization according to

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comparative advantage. In the 1980s, the importance of learning by doing and the role of trade in facilitating the exploitation of economies of scale were emphasized by Paul Krugman and others. Recently, productivity gains associated with the entry of more productive firms and the exit of less productive ones have generated significant interest. A related question is whether trade reforms lead to the redistribution of market share between incumbents with different productivity levels.

This most recent wave of trade theory stresses the importance of market-share reallocations in increasing aggregate productivity following trade liberalization (Bernard, Eaton, Jensen, and Kortum 2003; Melitz 2003). The “new new” trade theory emphasizes gains from trade in the presence of “heterogeneous firms.” In heterogeneous firm models, firms of different productivities, sizes, and profit levels coexist. A trade reform that exposes firms to greater competition or enables more firms to sell in export markets will lead less productive firms to exit or to lose market share. In a Melitz (2003) world, the primary sources of productivity gains associated with trade reform are the exit of less productive firms and the expansion of more productive firms.

Although early heterogeneous firm models, such as the model by Melitz (2003), assumed that firms had exogenous, fixed productivity levels, recent research allows for changing productivity within the firm.¹ This may occur when some product lines are discontinued and other product lines are developed. Consequently, trade reforms can lead to changes in within-firm productivity as firms shift their focus to high-productivity products. These theories recall earlier literature that emphasized that trade could improve average productivity within surviving firms.²

The policy implications that arise from these explanations for the gains from trade differ significantly. In a world where market share reallocation away from less productive firms matters more than learning or product shifting within the same firm, it is crucial to facilitate firm entry, exit, and downsizing. In a world where there is learning or shifting of product types within a firm, it is also crucial to work within the enterprise to facilitate the learning that accompanies trade reform. However, few empirical studies quantify the relative importance of average productivity gains and gains from market-share reallocations in the wake of major trade liberalization.

In this paper, we use a comprehensive, firm-level dataset to examine the role of market-share reallocations in driving aggregate productivity growth in India’s organized manufacturing sector from 1985 to 2004. The organized manufacturing sector in India consists of firms that are registered under sections 2m(i) and 2m(ii) of the Factories Act. All firms with 20 or more employees (10 if a power source is used) are required to register. In 1991, India

1. See Arkolakis and Muendler 2010; Bernard, Redding, and Schott 2010; Bernard, VanBeveren, and Vandenbussche 2010; Bernard, Redding, and Schott 2011; Eckel and Neary 2010; Feenstra and Ma 2007; Mayer, Melitz, and Ottaviano 2011; Nocke and Yeaple 2008.

2. See Corden 1974; Grossman and Helpman 1991; Helpman and Krugman 1985.

embarked on a series of reforms, including the liberalization of trade, licensing, and foreign direct investment (FDI) regulations. As part of the trade liberalization, nontariff barriers were removed from a number of product lines, and tariff levels were gradually reduced from extraordinarily high levels. The licensing regime, which required that firms seek permission from the “License Raj” to enter an industry and to change or expand production, was gradually dismantled. FDI restrictions that prohibited foreign firms from entering some sectors and restricted their participation in others were relaxed.

We begin by measuring aggregate productivity growth in the manufacturing sector and show that there were three distinct phases from 1985 to 2004. During this 20-year period, aggregate productivity (defined as output-weighted, mean firm productivity) grew by nearly 20 percent. From 1985 to 1990, the growth in aggregate productivity was driven by “learning,” an increase in unweighted, average firm productivity. This measure of learning captures the change in productivity for the average firm and includes not only changes in productivity among surviving firms but also changes in average productivity that can be attributed to firm entry and exit. In the period immediately following the beginning of the reforms (1991–1994), the “stealing” of market share (the reallocation of market share from less productive to more productive firms) became more important than learning for driving aggregate productivity growth. In the longer run (1998–2004), learning again became more important for aggregate productivity growth, with a minor contribution from stealing (reallocation).

Overall, we find that for the organized manufacturing sector as a whole, market-share reallocations were an important source of productivity growth in the years immediately following the beginning of the 1991 reforms, but not during other periods. In other words, in the Indian case, the contribution of the reallocation of market shares is concentrated at a given point in time. One implication is that trade reforms lead to short-term, one-off market share reallocations. Our results suggest that in the longer term, opening up trade in India had more important effects on average productivity.

Our main results rely on the widely used decomposition suggested by [Olley and Pakes \(1996\)](#). This method identifies changes in average productivity and reallocation but does not disentangle the contributions of survivors, entrants, and exiters. Although firm identifiers are not available for the organized sector data during most of the period that we study, we construct a panel dataset by matching individual firms from one year of the survey to the next. We match firms using beginning- and end-of-period information on capital and other types of stocks, supplemented with other identifying information. This panel allows us to test how our main results change when we employ an alternative decomposition method, suggested by [Melitz and Polanec \(2010\)](#). We find that our results are robust to these different approaches when decomposing the sources of productivity change during the period.

We then use the Olley-Pakes decomposition to examine the extent to which individual policy reforms are associated with industry-level productivity gains.

In particular, we exploit variations in tariff cuts, FDI liberalization, and industrial licensing reforms across industries to examine the contribution of each reform to changes in industry-level total factor productivity (TFP). We find that the average decline in final goods tariffs during the study period implies a 3 percent increase in aggregate productivity, whereas the average decline in input tariffs implies a 22 percent increase in aggregate and average productivity. Moreover, FDI liberalization accounts for a 4.7 percent increase in average productivity. Consequently, the reduction in input tariffs and opening up to foreign investment are the most important policy changes associated with improved firm performance in our sample. The industrial licensing reforms, which promoted internal competition, are associated with productivity gains among large firms and in states and industries that were relatively less exposed to external competition prior to the reforms. We use our constructed panel to show that the trade and FDI liberalizations are associated with increased productivity within firms, even when controlling for unobservable firm heterogeneity. Our results also suggest that, overall, the reforms are associated with average productivity improvements rather than market share reallocation across firms.

Finally, we explore whether our results can be explained by regulatory barriers that prevented market share reallocations, such as restrictive labor laws. Our results suggest that labor laws and a legal framework that prevented firm adjustment cannot explain our findings. We also explore the extent to which the reforms had differential effects in states and industries that were previously exposed to trade and among firms of different initial sizes. We find that delicensing and FDI reforms had larger effects on productivity among firms that were relatively less exposed to trade. These results suggest some substitutability between external and internal competition: where states or industries are not already exposed to trade through proximity to ports or international trade, industrial reforms that promote competition have larger effects.

Our study was motivated by the emphasis of contemporary trade theory on the importance of market-share reallocation in increasing aggregate productivity. Although a number of papers have tested implications of this literature, few of these studies directly examine the impact of trade liberalization on market-share reallocation.³ Existing evidence on the importance of reallocation in promoting productivity growth is mixed.⁴

Our study also contributes to the substantial body of work examining India's 1991 reforms. [Topalova and Khandelwal \(2011\)](#) establish that reductions in final goods and input tariffs increased productivity among approximately 4,000 large, publicly listed manufacturing firms. [Sivadasan \(2009\)](#) uses a pooled, cross-sectional dataset, but not a panel, for the early years of the

3. See, for example, [Arkolakis 2010](#); [Bernard et al. 2003](#); [Bernard, Jensen, and Schott 2006](#); [Berthou and Fontagne forthcoming](#); [Eaton, Kortum, and Kramarz 2011](#); [Helpman, Melitz, and Yeaple 2004](#); [Manova and Zhang 2012](#).

4. See, for example, [Tybout and Westbrook 1995](#); [Pavcnik 2002](#); [Trefler 2004](#); [Fernandes 2007](#); [Menezes-Filho and Muendler 2011](#).

reforms (1986–1994) and finds that the reduction in final goods tariffs and FDI liberalization increased productivity. He also documents that these reforms were associated with average productivity increases, but not reallocation, in the early 1990s. [Nataraj \(2011\)](#) compares the reactions of the organized and unorganized manufacturing sectors to trade liberalization and finds that although the reduction in final goods tariffs increased productivity significantly in the unorganized sector, the reduction in input tariffs was more important for productivity growth in the organized sector. [Aghion, Burgess, Redding, and Zilibotti \(2008\)](#) find that following the removal of licensing requirements, the number of factories and output in the organized sector increased, particularly in states with relatively less restrictive labor regulations.

Our study contributes to these two strands of the literature in several ways. First, we document that although market-share reallocations were important to overall productivity growth immediately following the implementation of the 1991 reforms, most of the productivity improvements in manufacturing during the period from 1985 to 2004 occurred because average productivity increased. Market-share reallocations, the focus of most of the heterogeneous trade literature, were not as important. One implication is that in the Indian case, theories that emphasize within-firm changes in response to trade policy changes are more relevant.

Second, we tie these different sources of productivity growth to the various reforms. Our constructed panel is the largest, most representative panel of Indian manufacturing firms that covers the period of the reforms, allowing us to isolate within-firm productivity improvements. In contrast to the earlier literature on gains from trade with heterogeneous firms, which assumed exogenous productivity draws at the firm level and emphasized the role of market-share reallocations, we cannot explain the increases in productivity with market-share reallocations using our policy measures. Instead, our constructed panel suggests that trade and FDI reforms raised average, within-firm productivity. One plausible mechanism is that trade reforms led to productivity improvements because firms focused on their most productive goods. However, evidence on this type of effect in the Indian case is mixed: [Goldberg, Khandelwal, Pavcnik, and Topalova \(2010a\)](#) find that lower input tariffs accounted for approximately one-third of the increase in new products created by Indian firms, but the same [authors \(2010b\)](#) test for evidence of product rationalization in the Indian case and reject this possibility.

The rest of this paper is organized as follows. Section I provides a brief background on the Indian reforms; section II describes the data and outlines the construction of the panel of firms; section III discusses the empirical framework and presents results; and section IV concludes.

I. THE 1991 REFORMS

Prior to 1991, India imposed high tariffs and nontariff barriers on most goods. FDI (foreign ownership) was capped at 40 percent for most industries, and

large manufacturing firms were required to obtain operating licenses. During the 1980s, India removed licensing requirements from approximately one-third of industries but retained its trade and FDI restrictions.

A combination of economic and political shocks created a balance of payments crisis in 1991, and the IMF agreed to assist the Indian government under certain conditions (Hasan, Mitra, and Ramaswamy 2007; Topalova and Khandelwal 2011). Major policy changes, including FDI and tariff liberalization, exchange rate liberalization, and the removal of the requirement for operating licenses in most industries, were announced in July 1991, and many of these policy changes were formalized in India's Eighth Five-Year Plan (1992–97).

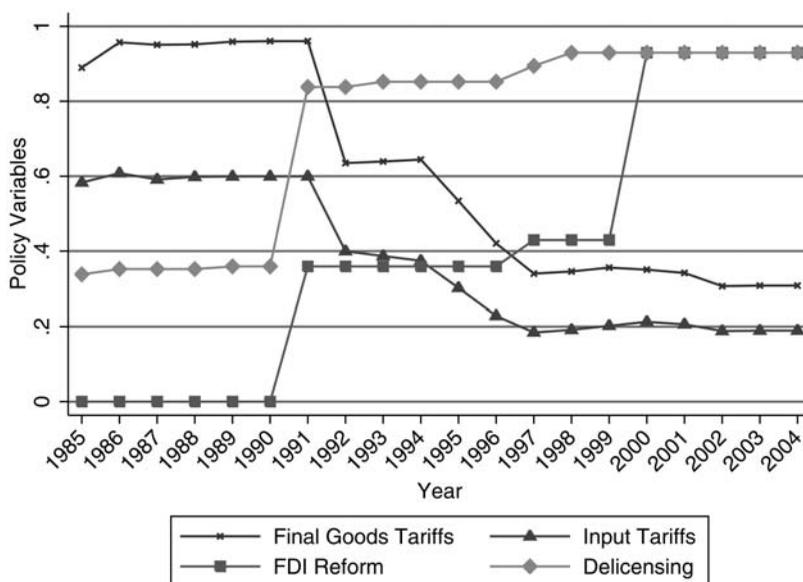
The average final goods tariff rate on manufactured products fell from 95 to 35 percent between 1991 and 1997, and tariffs were harmonized across industries (industries with the highest prereform tariffs received the largest tariff cuts). India continued to lower its tariffs after the Eighth Five-Year Plan ended in 1997, although the reductions were no longer as uniform. Input tariffs also fell significantly during this period. The supplementary appendix (available at <http://wber.oxfordjournals.org/>) illustrates the tariff changes in more detail (figure S1.1).

In addition, India dismantled its “License Raj” during this period. Under the licensing regime, every firm with more than 50 employees (100 employees where a power source is not used) and a certain amount of assets was required to obtain an operating license. The license specified the amount of output a firm could produce, the types of goods it could make, and a number of other conditions. Approximately one-third of industries were delicensed (the requirement for a license was dropped) in 1985, and most remaining industries were delicensed as part of the 1991 reforms (Aghion et al. 2008). Several additional industries were delicensed during the following decade.

Beginning in 1991, majority FDI shares were also allowed in a number of industries with “automatic” approval (Sivadasan 2009). Approximately one-third of industries were opened to FDI in 1991. A few additional industries were liberalized by 1997, and in 2000, the government indicated that all industries would be eligible for automatic FDI approval, except those requiring an industrial license or meeting several other conditions (figure 1).

The occurrence of most of these policy changes as part of an externally required reform package reduced the likelihood that industries were selected into the reforms on the basis of political factors. Furthermore, to the extent that industries with certain characteristics may have been more likely to be liberalized, we use a fixed-effects estimation strategy that should address any time-invariant characteristics that may have affected selection. However, if the reforms are correlated with prereform trends in industry characteristics, our results may be biased. To evaluate the potential extent of this bias, we examine the correlations between changes during the reforms (1990–2004) and prereform trends for a number of industry characteristics (1985–1989). In the supplementary appendix (table S1.1), we show that there are no statistically significant correlations between prereform trends in industry characteristics and future reforms.

FIGURE 1. Trade, FDI, and Licensing Reforms



Mean values of policy variables from 1985 to 2004. Final goods and input tariff variables are fractions, with one representing an ad valorem tariff of 100 percent. FDI Reform is a dummy variable equal to one if any products within the industry are liberalized and zero otherwise. Delicensing is a dummy variable equal to one if any products within the industry are delicensed and zero otherwise. *Source:* Authors' calculations based on various publications of the Government of India, including the Customs Tariff Working Schedules, the Trade Analysis and Information System database, and [Aghion et al. \(2008\)](#).

Moreover, the supplementary appendix (table S1.9) shows that our results are robust to limiting our analysis to the period ending in 1997. Because the initial reforms were developed in the wake of the 1991 crisis, they are even less likely to be subject to potential selection issues than are reforms in later years.

II. DATA

Our primary dataset consists of firm-level surveys from the Annual Survey of Industries (ASI).⁵ We obtained data for all available years between 1985 and 2004. Data were not available for 1995. Furthermore, the way in which input data were collected and made available for 1996 and 1997 made it impossible to construct certain key variables for those two years that were consistent with the other years. Therefore, we restrict our analysis to firm-level data for the

5. The ASI covers accounting years that ended on any day during the fiscal year. The 1985–86 survey (which we refer to as the 1985 survey) indicates the factory's accounting year that ended on any day between April 1, 1985, and March 31, 1986.

remaining 17 years between 1985 and 2004 (1985 through 1994 and 1998 through 2004).

The sampling universe for the ASI is all firms that are registered under sections 2m(i) and 2m(ii) of the Factories Act as well as firms registered under the Bidi & Cigar Workers Act and a number of utility and service providers. These firms constitute the “organized” sector; they account for approximately 80 percent of output but only 20 percent of employment in Indian manufacturing. We only include manufacturing firms in our analysis.⁶ Large firms are considered part of the “census” sector and are surveyed every year. Smaller firms are considered part of the “sample” sector and are sampled every few years.⁷ In the population-level analysis (but not the panel analysis), we apply the multiplier weights provided by the ASI. Each unit surveyed is generally a factory (plant); however, if an owner has two factories in the same state, sector (census versus sample) and industry, a joint return can be furnished. In the population of firms, fewer than 2 percent of the observations report having more than one factory. We will use the term “firm” to mean one observation in our dataset.

The key variables we construct from the ASI data are output, material input, labor, and capital.⁸ We drop closed firms, and we only include firms with positive values of the key variables. To address a few extreme outliers, we also trim the top 0.5 percent of the output and material input values. We deflate output using industry-specific wholesale price indices (WPI) from the Government of India’s Handbook of Industrial Statistics. Similarly, we construct material input deflators using the WPI along with India’s 1993–94 Input-Output Transactions Table. Labor is measured as the total number of individuals employed by the firm, and capital is measured by deflating the book value of capital by the WPI for machinery. Summary statistics for the population are presented in table 1.⁹

6. Our sample is therefore representative of all manufacturing firms that have registered with each state’s Chief Inspector of Factories. All firms that have 20 or more employees (10 or more employees if a power source is used) are required to register. In practice, a significant fraction of ASI firms report fewer than 10 employees. These firms may be registered for various reasons, including the possibility that they formerly had more than 10 employees but shrank, that they plan to grow in the future, and that registering may be a signal to creditors or other business partners.

7. The division between the two sectors depends on firm size. It changed several times from 1985 to 2004.

8. Output includes the ex-factory value of products, the increase in the stock of semifinished goods, and the value of own construction. Material input includes materials and fuel.

9. Sampling weights are applied to the summary statistics in the first column of table 1; hence, the results are representative of the overall organized sector. The second column shows results for the firms that were sampled without applying sampling weights. Because larger firms are surveyed more frequently than smaller firms, the mean and median values of output, capital, material inputs, and labor are much larger in the sampled population than in the estimated population. The term “firm-years” indicates the total number of firm-level observations over all of the years in our dataset, whereas “census-firm-years” indicates the total number of observations of “census” sector firms over all years.

TABLE 1. Summary Statistics for the Firm-Level Data

	Estimated population	Sampled Firms	Panel
Firm-years, no. obs.	1,410,725	580,941	414,074
Firms per year, mean	82,983	34,173	24,357
Census firm-years, no. obs.	277,178	277,178	247,777
Census firms per year, mean	16,304	16,304	14,575
Unique firm series			147,695
Output, mean (million Rs.)	18.7	32.0	41.8
Output, median (million Rs.)	2.6	3.6	5.3
Capital, mean (million Rs.)	6.9	12.8	17.0
Capital, median (million Rs.)	0.4	0.5	0.8
Materials, mean (million Rs.)	12.5	21.1	27.3
Materials, median (million Rs.)	1.9	2.6	3.9
Labor, mean (no. employees)	74.1	133.4	171.9
Labor, median (no. employees)	21	31	43
In panel, as fraction of total in sampled population:			
Output			0.93
Capital			0.95
Labor			0.92
Firm-years > 100 employees			0.94
Firm-years > 200 employees			0.96
Firm-years			0.71
Census firm-years			0.89

Source: Authors' calculations based on ASI data.

Summary statistics for the estimated population (using sampling weights), for the sampled population (not using sampling weights), and for firms that appear for two or more years in the panel. Only open firms with positive values of key variables are included. The term “firm-years” indicates the total number of observations, whereas “census firm-years” indicates the number of observations in the census sector. Mean and median values are averages across all years used in the analysis (1985–1994 and 1998–2004). Output, material inputs, and capital have been deflated to 1985 values and are expressed in millions of rupees. Fractions of output, capital, and so forth that appear in the panel are reported relative to the sampled (rather than the estimated) population.

Creating a Panel

The ASI data provide unique firm identifiers beginning in 1998. It has not previously been possible to track firms prior to 1998 and to follow them during the most significant reform period. We overcame this challenge by matching individual firms from one year of the survey to the next between 1985 and 1998. To construct our panel, we searched for firms that had matching open and close values between one year and the next (e.g., we searched for a match between the close value in 1985 and the open value in 1986) for one of several variables. To link firms for 1995, a year for which firm-level data have not been released, and for other years in which individual firms may not have been sampled, we matched firms on the basis of a number of static characteristics as well as growth projections. We then combined this constructed panel with the

actual panel provided by the ASI from 1998 to 2004. Details on panel construction are provided in the supplementary appendix.

Because we observe each firm's age, we are confident that we can correctly identify survivors and entrants in our panel. However, given the substantial fraction of firms that are not surveyed every year, we are more reserved about our ability to identify exiting firms. The rates of exit that we observe in our panel are significantly higher than the rates that we extrapolate on the basis of the observed distributions of firm age. Therefore, when estimating productivity, we avoid methods that rely on accurately identifying firm exit and instead employ an index number method that is robust to potentially spurious exit.

Summary statistics for the panel (to which we do not apply sampling multipliers) are presented in the final column of table 1. Observations of firms in the "census" sector (indicated by the number of census-firm years) account for 60 percent of total firm-year observations in the panel, 48 percent of firm-year observations in the full sample of firms, and only 20 percent of firm-year observations in the estimated population. The panel should not be considered representative of the population; rather, it is a selection of relatively large firms. Nonetheless, 71 percent of firm-year observations appearing in the sample, representing 93 percent of total deflated output over the entire period and 92 percent of the labor force, are captured for at least two years in the panel (table 1, bottom rows).

A key contribution of our panel is that we are confident in the firms that we are able to match over time. This contribution allows us to examine the impacts of the reforms on within-firm learning. These impacts have not previously been examined for such a large subsample of the organized manufacturing sector.

Policy Variables

We matched applied tariff data from the Government of India's Customs Tariff Working Schedules and the Trade Analysis and Information System database with India's three-digit National Industrial Classification (NIC-87) codes using the concordance developed by [Debroy and Santhanam \(1993\)](#). We then calculated average final goods tariff rates within each of approximately 140 NIC codes. We also calculated input tariffs using India's Input-Output Transactions Table, following the method suggested by [Amiti and Konings \(2007\)](#).¹⁰

To capture the effects of the delicensing and FDI reforms, we used data from [Aghion et al. \(2008\)](#), supplemented by information from Press Notes from the Ministry of Commerce and Industry. Both the delicensing and FDI reform variables are equal to one if any products in a three-digit industry have been liberalized and are equal to zero otherwise. Figure 1 shows changes in these policy variables over time.

10. For example, if the footwear industry derives 80 percent of its inputs from the leather industry and 20 percent from the textile industry, the input tariff for the footwear industry is 0.8 times the final goods tariff for the leather industry plus 0.2 times the final goods tariff for the textile industry. In our baseline measure of input tariffs, we use both traded and nontraded inputs, assigning tariff rates of zero to nontraded inputs.

III. EMPIRICAL FRAMEWORK AND RESULTS

We measure TFP for firm i in industry j at time t using a chain-linked, index number method. This measure is well suited for our data because approaches such as semiparametric methods (Olley and Pakes 1996, for example), which rely on panel data, cannot be used for the population of firms. Although we explore the robustness of our results to using a panel with linked firms over time below, in much of the analysis, we need an approach that allows us to exploit the population of firms. Another problem with the Olley-Pakes methodology and other semiparametric approaches is that they require an accurate identification of exit. Therefore, we employ the method suggested by Aw, Chen, and Roberts (2001):

$$TFP_{ijt} = (q_{ijt} - \bar{q}_{it}) + \sum_{r=2}^t (\bar{q}_{jr} - \bar{q}_{jr-1}) - \left[\sum_{z=1}^Z \frac{1}{2} (\xi_{ijt}^z + \bar{\xi}_{jt}^z) (z_{ijt} - \bar{z}_{jt}) + \sum_{r=2}^t \sum_{z=1}^Z \frac{1}{2} (\bar{\xi}_{jr}^z + \bar{\xi}_{jr-1}^z) (\bar{z}_{jr} - \bar{z}_{jr-1}) \right] \quad (1)$$

where q_{ijt} is the log of output, ξ_{ijt}^z is the revenue share of input z , and z_{ijt} is the log of input z . A firm's TFP is the deviation of its output from average output in that year and the difference in the average output in that year from the base year, minus the deviation of the firm's inputs from average inputs in that year, along with the difference in average inputs in that year from the base year. Inputs include labor, capital, and material inputs, which are measured and deflated as discussed in section II. Bars over variables indicate average values within a particular industry and year. Revenue shares for labor and material inputs are calculated as the share of each input in total revenue. Capital's revenue share is assumed to be one minus the sum of the other two shares.

Decomposing All-India TFP Growth

We begin by examining productivity changes for the population of firms from 1985 to 2004. To do so, we first calculate aggregate TFP in year t , Φ_t^{AGG} , as the sum of each firm's productivity, ϕ_{it} , weighted by its market share, ψ_{it} . Olley and Pakes (1996) show that this measure of aggregate TFP can be decomposed into two components:

$$\Phi_t^{AGG} = \sum_i \psi_{it} \phi_{it} = \bar{\phi}_t + \sum_i [\psi_{it} - \bar{\psi}_t] [\phi_{it} - \bar{\phi}_t] = \Phi_t^U + R_t \quad (2)$$

where $\bar{\phi}_t$ and $\bar{\psi}_t$ are unweighted average productivity and market share, respectively. The first component, Φ_t^U , is unweighted average productivity. The

second component, R_t , measures the covariance between firm productivity and market share. Changes in this measure represent a reallocation of market share between firms with different productivity levels.

We first construct these measures at the all-India level. To make the results representative of the population of firms and consistent over time, we premultiply each observation by the sampling weight provided by the ASI. Furthermore, to make the results more comparable with our later regression results, we only consider firms in state-industry groups (collections of firms in a particular state and three-digit industry) that exist over the entire period.

Following [Pavcnik \(2002\)](#), we normalize productivity values to zero in 1985. Hence, changes in productivity levels can be interpreted as growth since 1985. Between 1985 and 2004, aggregate productivity grew by 18 percent (figure 2). This increase in productivity implies an annual increase of slightly less than 1 percent per year, within the range found in previous studies.¹¹

When we consider the time period as a whole, nearly all of this increase can be attributed to growth in average productivity, rather than reallocation. However, figure 2 suggests that there are three distinct phases between 1985 and 2004. First, from 1985 to 1990, average productivity rose by over 8 percent, while the reallocation component fell by more than 6 percent, indicating that more productive firms lost market share relative to less productive firms. Beginning in 1991, this trend was reversed: average productivity fell, whereas reallocation productivity rose sharply. By 1998, however, average productivity improvements were once again the more important driver of aggregate productivity growth. Reallocation productivity remained at approximately the level it reached between 1992 and 1993, but it did not increase further.

Our results suggest that market-share reallocations played an important role in aggregate productivity growth, but only during the few years immediately following the implementation of the 1991 reforms. Over the longer time horizon, average productivity improvements remained more important for explaining the increase in aggregate TFP.

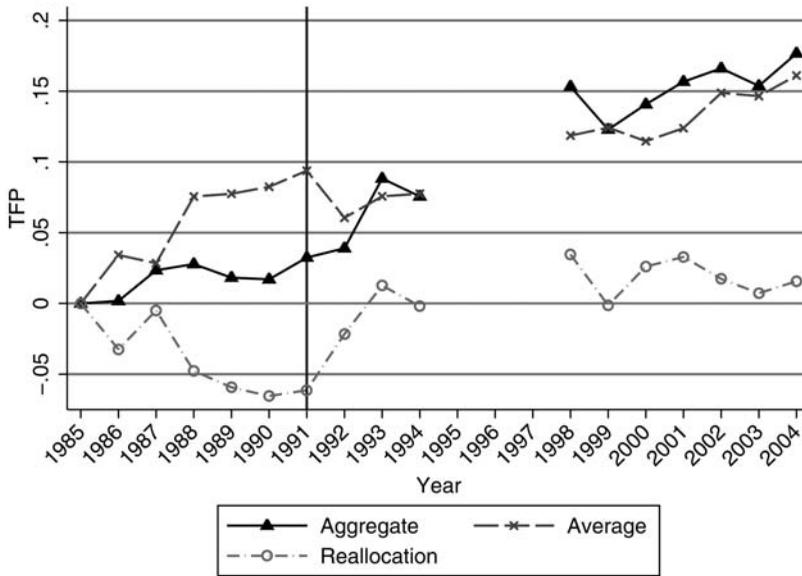
Industry-Level TFP Changes and Policy Reforms

To what extent can the increase in productivity be attributed to trade and other policy reforms that occurred during the 1990s? To answer this question, we exploit variation in policies across industries to examine whether changes in the individual components of productivity are systematically related to specific reforms.

To use policy variation across industries, we recreate our aggregate, average, and reallocation TFP measures at the state-industry level (recall that a state-industry group is the collection of firms in a particular state and three-digit

11. There has been an extensive debate about TFP growth in the organized Indian manufacturing sector, particularly during the 1980s. Goldar (December 7, 2002) provides a summary of a number of TFP growth estimates and discusses many of the measurement issues involved. Our TFP estimates are based on a gross output (rather than value added) production function. Value-added TFP growth rates tend to be much higher than gross output growth rates.

FIGURE 2. All-India Total Factor Productivity



TFP decompositions for the population of firms, conducted at the all-India level, using the Olley and Pakes method. “Aggregate” indicates market-share-weighted mean productivity, “Average” indicates unweighted mean productivity, and “Reallocation” indicates the covariance between market share and productivity. *Source:* Authors’ calculations based on ASI data.

industry). We use the state-industry level because this level of disaggregation allows us to consider variations in policies and other characteristics across both industries and states and because the ASI survey is designed to be representative at this level. We weight each group by the total number of firms that appear in that group across all years. This method ensures that the results are comparable to the all-India results because larger state-industry groups are given more weight.¹² We exploit the fact that the trade, licensing, and FDI reforms occurred differentially across industries to isolate the impacts of each policy on each productivity measure. Consider the relationship between our outcomes of interest and the

12. This weighting scheme ensures that average productivity is nearly the same at the state-industry and all-India levels. The reallocation component at the state-industry level follows the same general pattern as that observed in figure 2, but it is lower across most years. The reason is that at this level, we can only measure reallocation *within* state-industry groups. For example, suppose that the steel industry in Maharashtra is more productive than the chemical industry in Gujarat, and all firms in the former state-industry group increase output by 10 percent, whereas all firms in the latter state-industry group reduce output by 10 percent. The all-India reallocation measure will increase, but the state-industry reallocation measure will not. It would be ideal to capture market-share reallocations between and within state-industry groups, but our identification strategy relies on the variation in reforms across industries and over time and thus does not allow us to use an all-India measure of productivity. The supplementary appendix shows that our results are robust to performing the baseline regression analysis without including weights (table S1.12).

reforms:

$$\widehat{Y}_{jst} = \beta_1 \tau_{j,t-1} + \beta_2 \tau_{j,t-1}^I + \beta_3 Delic_{j,t-1} + \beta_4 FDI_{j,t-1} + \alpha_{js} + \alpha_t + \varepsilon_{jst} \quad (3)$$

where \widehat{Y}_{jst} is the estimated aggregate TFP ($\widehat{\Phi}_{jst}^{AGG}$), average TFP ($\widehat{\Phi}_{jst}^U$), or reallocation (\widehat{R}_{jst}) for industry j and state s at time t ; $\tau_{j,t-1}$ and $\tau_{j,t-1}^I$ are final goods tariffs and input tariffs; $Delic_{j,t-1}$ is a dummy variable equal to one if any products in an industry are delicensed and zero otherwise; $FDI_{j,t-1}$ is a dummy variable equal to one if any products in an industry are FDI liberalized and zero otherwise; and α_{js} and α_t are state-industry and year dummy variables, respectively. Because our firm data are annual and policy changes occurred throughout the year, we lag all policy variables by one year. We employ a fixed-effects estimator to estimate equation 3¹³ and cluster all standard errors at the state-industry level.¹⁴ We use a balanced panel of state-industries to avoid confounding within-group effects with the entry and exit of certain industries in particular states, and we weight all observations using the total number of firms in each state-industry group over all years.

Table 2 presents baseline results for 1986 to 2004.¹⁵ Column (1) suggests that a 10-percentage-point reduction in final goods tariffs yields a 0.51 percent increase in aggregate productivity, whereas a 10-percentage-point reduction in input tariffs yields a 5.7 percent increase in aggregate productivity. Columns (2) and (3) present results for the average and reallocation components of productivity, respectively. Column (2) indicates that 10-percentage-point declines in final goods and input tariffs raise average productivity by 0.44 and 5.5 percent, respectively, although the coefficient on final goods tariffs is not statistically significant at the 10 percent level. FDI liberalization increases average productivity by 5 percent. The results are similar in magnitude for the impact of the reforms on both aggregate and average productivity. This similarity largely results because the reforms primarily affected average productivity, which we refer to in this paper as “learning.”

In contrast, column (3) shows that input tariffs, final goods tariffs, and delicensing changes do not significantly affect productivity gains through reallocation of market share. The only statistically significant result, for FDI reform, indicates that liberalization lowers rather than raises reallocation productivity. One potential reason for this puzzling result is that prior to the FDI reform, foreign investors only invested in the most productive Indian firms. By introducing an “automatic” approval for majority FDI ownership, the reform decreased the fixed cost of foreign investment and may therefore have encouraged

13. This is similar to including a full set of state-industry interactions.

14. The supplementary appendix (table S1.14) shows that our results are robust to clustering standard errors at the industry-year level.

15. We exclude 1985 because we do not have lagged policy variables for this year.

TABLE 2. Productivity Decompositions and Policy Changes: Baseline Results

	Aggregate (1)	Average (2)	Reallocation (3)
Final Goods Tariff	-.051 (.026)**	-.044 (.030)	-.007 (.015)
Input Tariff	-.567 (.104)***	-.546 (.116)***	-.021 (.061)
FDI Reform	.021 (.013)	.050 (.014)***	-.030 (.010)***
Delicensed	-.006 (.017)	.005 (.017)	-.011 (.011)
Obs.	17106	17106	17106
R ²	.082	.077	.014

Source: Authors' analysis based on data sources discussed in the text.

Each observation is a state-industry. Dependent variable names are given at the top of each column. "Aggregate" indicates market-share-weighted mean productivity, "Average" indicates unweighted mean productivity, and "Reallocation" indicates the covariance between market share and productivity. All specifications are fixed-effects analyses at the state-industry level and include year dummies. Each observation is weighted by the total number of firms in the state-industry across all years, and standard errors are clustered at the state-industry level.

investment in less productive firms, allowing them to increase their market shares.

In table 3, we estimate the extent to which policy reforms can explain overall productivity growth by multiplying the coefficients from table 2 by the average policy changes. The results suggest that trade liberalization, particularly the decline in input tariffs, is largely responsible for aggregate and average productivity growth. A 60-percentage-point decline in final goods tariffs implies an aggregate productivity increase of 3 percent and an average productivity increase of 2.6 percent (although the related regression coefficient is not statistically significant), and a 40-percentage-point decline in input tariffs implies aggregate and average productivity increases of approximately 22 percent. FDI liberalization also plays a role, implying a 4.7 percent increase in average productivity.¹⁶ The variation in policies across industries cannot explain the gains in reallocation productivity that were observed in the initial years following the reforms. However, the policies explain the gains in average productivity, which was the more important driver of aggregate productivity growth during this period.

Firm-Level Regressions

Our results using the population of enterprises aggregated to the state-industry level suggest that average productivity ("learning") played a more important role in explaining aggregate productivity increases in India during the sample

16. In fact, the average policy changes can explain somewhat more than the total increase in productivity during this time period. In the regression framework, the coefficients on several year dummies are negative, implying that in the absence of policy reforms, productivity would have fallen.

TABLE 3. Productivity Increases Implied by Policy Changes

	Final Goods Tariffs	Input Tariffs	FDI Liberalization	Delicensing
Aggregate (%)	3.0	22.1	2.1	-0.4
Average (%)	2.6	21.3	4.7	0.3
Reallocation (%)	0.4	0.8	-2.8	-0.6

Source: Authors' analysis based on data sources discussed in the text.

Implied increases in aggregate, average, and reallocation productivity. Results are based on regression coefficients and average policy changes. Bold font indicates that the underlying regression results are statistically significant at the 10 percent level.

period than did reallocation of market share (“stealing”). In this section, we use firm-level data to confirm that learning was a key component of productivity change. If learning is important, we would expect our policy variables to explain productivity within the larger firm-level population and for the smaller constructed panel.

We now use the constructed panel to examine the average productivity results in more detail. We estimate the following equation at the firm level:

$$\hat{\phi}_{ijst} = \beta_1 \tau_{j,t-1} + \beta_2 \tau_{j,t-1}^I + \beta_3 Delic_{j,t-1} + \beta_4 FDI_{j,t-1} + \alpha_i + \alpha_t + \varepsilon_{ijst}. \quad (4)$$

As discussed in section II, our constructed panel makes it difficult to accurately identify firm exit. However, we are confident in the firms that we are able to match. Hence, the fixed-effects estimator shown in equation 4 should allow us to identify within-firm changes in productivity.

Table 4 presents the results. In column (1), we include all firms that were used in the state-industry level analysis (the estimated population). This specification includes industry and year dummy variables. As we expect, the coefficients on the policy variables are similar to the average productivity results at the state-industry level.

Column (2) presents results for firms that appear in the panel for at least two years, without sampling multipliers. This specification includes industry and year dummy variables but not firm fixed effects, and it shows that the results for firms in the panel are similar to the overall results. The coefficients on input tariffs and FDI reforms remain the largest and most significant, indicating that reductions in input tariffs and the FDI reform made the largest contributions to increased productivity during the sample period.

Column (3) controls for a number of firm characteristics and shows that public firms and young firms (less than three years old) are relatively unproductive, whereas firms furnishing joint returns for multiple factories (“multiplant” firms) are relatively more productive.¹⁷ The poor productivity performance of

17. The multiplant dummy should be cautiously interpreted because true multiplant firms may not be able or may not choose to submit joint returns (see section II).

TABLE 4. Firm-Level Productivity

	Population (1)	Panel Firms (2)	Panel Firms (3)	Firm FE (4)	OP (5)	Large Firms FE (6)
Final Goods Tariff	-.046 (.027)*	-.038 (.019)**	-.037 (.019)*	-.042 (.008)***	-.050 (.007)***	-.054 (.011)***
Input Tariff	-.486 (.108)***	-.532 (.088)***	-.519 (.087)***	-.141 (.034)***	-.085 (.029)***	-.156 (.053)***
FDI Reform	.045 (.015)***	.055 (.012)***	.053 (.011)***	.031 (.004)***	.027 (.004)***	.014 (.005)***
Delicensed	-.005 (.016)	-.002 (.013)	-.002 (.013)	-.002 (.005)	.005 (.005)	.027 (.007)***
Public			-.167 (.014)***			
Multiplant			.039 (.011)***			
Young			-.092 (.005)***			
Small			-.073 (.010)***			
Midsize			-.016 (.009)*			
Obs.	1322803	388430	388430	388430	384003	63062
R ²	.065	.057	.064	.002	.004	.046
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	No	No	No
Firm FE	No	No	No	Yes	Yes	Yes

Source: Authors' analysis based on data sources discussed in the text.

Each observation is a firm. The dependent variable is TFP, calculated following [Aw et al. \(2001\)](#) in all columns except (5), in which TFP is calculated following [Olley and Pakes \(1996\)](#). Column (1) includes all firms that were part of the state-industry level analysis; columns (2)–(5) only include firms that appear in the panel for at least two years. Column (6) only includes the largest firms in each year. Columns (1)–(3) include industry and time dummies, and standard errors are clustered at the state-industry level. Columns (4)–(6) include year dummies and firm fixed effects, and standard errors are clustered at the firm level. “FE” indicates fixed effects.

public sector enterprises is consistent with the evidence for other countries, including China (Du, Harrison, and Jefferson 2011) and Indonesia (Bartel and Harrison 2005). We also created dummy variables for firms in three size categories: less than 20 employees (small), 20 to 99 employees (medium), and more than 100 employees (large, the omitted category). The results indicate a positive correlation between size and productivity.

In column (4), we present results with firm fixed effects, thus isolating within-firm changes in productivity. The coefficient on final goods tariffs remains similar. Although the coefficients on input tariffs and FDI reform are attenuated, they remain statistically significant at the 1 percent level. These results confirm that trade and FDI liberalizations are associated with substantial increases in productivity within individual firms. However, the results also indicate that the changing composition of firms and unobserved, firm-level characteristics may play important roles in the observed average productivity gains for the population of firms.

As discussed above, our baseline productivity measure does not depend on accurately identifying exit; the difficulty in identifying exit is a limitation of our panel. Nevertheless, in column (5), we assume that our assignment of exit is accurate, and we use the Olley and Pakes method to estimate productivity. The coefficients are similar to those in column (4), although the coefficient on final goods tariffs is slightly larger in magnitude, whereas the coefficients on input tariffs and FDI are slightly smaller.

To our knowledge, our constructed panel is the largest and most representative of the organized sector to date, consisting of approximately 25,000 firms per year. Our study complements the work of Topalova and Khandelwal (2011), who examine the impacts of India's trade liberalization on approximately 4,000 large firms. Although we cannot replicate their analysis, in column (6), we restrict our analysis to the largest 4,000 firms that appear in the panel in any given year. The results for the largest firms and for the whole panel are similar. The coefficient on delicensing, which was insignificant across all firms, becomes positive and statistically significant for the largest firms. These results suggest that delicensing was particularly important for spurring productivity increases among the largest firms. Additionally, our study extends Sivadasan (2009) in several important ways. First, we create a panel of firms that allows us to confirm that the impacts of the trade and FDI liberalization are important even after controlling for firm fixed effects and to directly show that "learning" is an important mechanism for understanding productivity increases over this 20-year period. Second, we examine long-run impacts on productivity by extending our analysis through 2004. Third, we distinguish between the effects of final goods and input tariffs and demonstrate that input tariffs play a larger role in boosting productivity.

State, Industry, and Firm Characteristics

We now explore whether the effects of the reforms vary across states or industries with different prereform characteristics and among firms of different sizes using the population of firms.

First, we consider whether the impact of liberalization on firm productivity is influenced by exposure to trade. We use three measures to proxy for trade exposure. First, we construct a dummy variable that is equal to one if a state-industry group is located in a state with a port and that is equal to zero otherwise. Second, we calculate each industry's share of imports in output in 1990 using data from the COMTRADE database, and we create a dummy variable for import exposure that is equal to one if the industry has an import share above the median and that is equal to zero otherwise. Third, we construct a similar measure for export share.

The delicensing and FDI reforms have larger effects on productivity among firms that are relatively less exposed to trade (table 5). In states without ports and in nonimporting industries, delicensing is associated with a 4 to 5 percent increase in average productivity. FDI reform is associated with a 7.7 percent increase in average productivity among nonexporting industries. The effect of the FDI reform on average productivity is attenuated in exporting industries, whereas the effect of the delicensing reforms is actually reversed in importing industries and in states with ports. These results suggest some degree of substitutability between external competition and internal competition: where states or industries are not already exposed to trade through proximity to ports, import competition, or exposure to foreign markets, industrial reforms that encourage competition have larger effects.

Next, we consider the role of labor regulations using two state-level measures: (1) the measure developed by [Besley and Burgess \(2004\)](#), which is based on state amendments to the Industrial Disputes Act, and (2) data from the Ministry of Labor on how often firm requests to close down or lay off workers are granted. We interact each measure with our reform variables and show (tables S1.2 and S1.3 in the supplementary appendix) that the effects of the policy reforms are largely similar across states, regardless of labor regulations. However, FDI reform is associated with a 7.4 percent increase in average productivity in states where it is difficult to lay off workers but only a 2.6 percent increase in average productivity in states where it is easy to lay off workers. This difference suggests that in states where it is difficult for firms to achieve an optimal input mix by laying off workers, they may be able to increase their productivity through other means, such as attracting FDI. In other words, FDI reform matters more when existing rigidities make it difficult for firms to optimize their production.

Finally, we consider whether productivity changes may differ across firms of different sizes. Using the population data but harnessing information from the panel, we classify firms into three categories, small (<20 employees), medium

FDI Reform		-.013 (.016)			-.004 (.019)			-.009 (.015)	
Importing Industry X Delicensed		-.160 (.044)***			-.125 (.039)***			-.035 (.025)	
Exporting Industry X Final Goods Tariff			-.001 (.0004)**			-.001 (.0005)**			.0002 (.0003)
Exporting Industry X Input Tariff			.001 (.0008)			.001 (.001)			.00007 (.0007)
Exporting Industry X FDI Reform			-.038 (.017)**			-.048 (.018)***			.009 (.014)
Exporting Industry X Delicensed			.011 (.031)			-.013 (.030)			.024 (.020)
Obs.	17106	17106	17106	17106	17106	17106	17106	17106	17106
R ²	.083	.091	.085	.078	.083	.081	.015	.016	.014

Source: Authors' analysis based on data sources discussed in the text.

Each observation is a state-industry. Dependent variable names are given at the top of each column. "Aggregate" indicates market-share-weighted mean productivity, "Average" indicates unweighted mean productivity, and "Reallocation" indicates the covariance between market share and productivity. All specifications are fixed-effects analyses at the state-industry level and include year dummies. Each observation is weighted by the total number of firms in the state-industry across all years, and standard errors are clustered at the state-industry level. "Port in state" is a dummy variable equal to one if the state-industry group is located in a state with a port and zero otherwise. "Importing" ("Exporting") is a dummy variable equal to one if the industry's prereform share of imports (exports) in total output was greater than the median and zero otherwise.

(20–99 employees), and large (>100 employees), on the basis of the size of the firm when we first observed it. In the supplementary appendix (table S1.4), we show that across all types of firms, policy changes continue to drive average productivity, but not reallocation of market share across firms. However, the effects of the reforms vary by firm size. For example, FDI liberalization is most important for large firms; the reform is associated with a 7.5 percent (9.1 percent) increase in aggregate (average) productivity for firms with 100 or more employees, approximately twice the magnitude of the average effect. Although the delicensing reforms are not associated with overall productivity increases, they are associated with a 4.6 percent increase in aggregate productivity among large firms and a 3.9 percent increase in average productivity among mid-sized firms. This heterogeneity is consistent with the fact that only firms with 50 or more employees and a certain amount of assets were required to obtain operating licenses prior to reform.

Robustness Tests

We test the robustness of our baseline results in a number of ways. The results are presented in the supplementary appendix (tables S1.5 through S1.14). First, we examine whether our results are robust to constructing TFP in different ways: (1) winsorizing our baseline measure, (2) using a variation of our baseline measure that employs cost shares instead of revenue shares, and (3) using ordinary least squares. Next, we examine several other modifications of the baseline specification: using an alternative measure of capital; restricting the analysis to the initial years of the reforms, during which policy changes were less likely to be influenced by political considerations; using an alternative measure of input tariffs; removing outlier values in tariff changes; weighting all state-industry groups equally; including state-by-year dummy variables; and clustering standard errors at the industry-year level. The appendix shows that although there is some variation in the magnitude and significance of results, they are robust to each of these tests.

Finally, to test the robustness of our productivity decomposition, we use an alternative method suggested by [Melitz and Polanec \(2010\)](#). We divide the panel of firms in any two consecutive periods, $t - 1$ and t , into firms present in both periods (*survivors*), firms that exit after period $t - 1$ (*exiters*), and firms that enter in period t (*entrants*). In period $t - 1$, only exiters and survivors are present; $S_{X,t-1}$ denotes the market share associated with exiters. In period t , only entrants and survivors are present; $S_{E,t}$ denotes the market share associated with entrants. Melitz and Polanec show that the change in aggregate productivity from period $t - 1$ to t can be decomposed as follows:

$$\begin{aligned} \Phi_t^{AGG} - \Phi_{t-1}^{AGG} &= \left[\Phi_{S,t}^U - \Phi_{S,t-1}^U \right] + \left[R_{S,t} - R_{S,t-1} \right] + S_{E,t} \left[\Phi_{E,t}^{AGG} - \Phi_{S,t}^{AGG} \right] \\ &+ S_{X,t-1} \left[\Phi_{S,t-1}^{AGG} - \Phi_{X,t-1}^{AGG} \right]. \end{aligned} \quad (5)$$

The first and second terms on the right-hand side represent changes in within-firm productivity and the covariance between productivity and market share of firms that survive from $t - 1$ to t . The third term represents the contribution of firms that enter in period t , weighted by the market share of entrants, $S_{E,t}$. Similarly, the last term represents the contribution of firms that exit in period $t - 1$, weighted by the market share of exiters, $S_{X,t-1}$. Using this approach, we calculate the change in TFP between period $t - 1$ and period t and then add the change in TFP to the existing level of TFP in period $t - 1$. TFP is normalized to zero in 1985. In this analysis, we do not use the sampling multipliers.

To use this method, we must assign every firm in our panel to the category of survivor, entrant, or exiter in every year. Given the nature of our panel data, this method requires two relatively strong assumptions. First, to address the fact that we do not directly calculate TFP for 1995–1997, we impute missing values for TFP and output for each series that bridges these years using linear interpolation. We perform a similar linear interpolation of TFP and output for individual firms for which we have bridged over another year.¹⁸

Second, we must make some assumptions regarding firm exit. When we observe a potential exiter, it is unclear whether the firm actually exited, whether it still existed but was not surveyed in the following year, or whether it was surveyed but we failed to match it.¹⁹ We address this challenge by estimating the “true” rate of exit for each cohort of firms (e.g., firms established between 1974 and 1976) on the basis of the number of surviving firms that we observe. In each year, we consider the potential pool of exiting firms (i.e., firms we do not observe in any subsequent year), and we assign exit status to the number of firms that we estimate to have exited from each cohort.²⁰ The remaining firms are assigned to the group of survivors.

The baseline results are robust to this alternative decomposition method (table 6).²¹ A 10-percentage-point decline in input tariffs is associated with a 4.1 percent increase in aggregate productivity and a 4.8 percent increase in average productivity. FDI liberalization also increases aggregate productivity by

18. For example, if a firm was surveyed in 1992 and 1994 and we are able to link that firm across those years, we use a linear interpolation to estimate TFP and output for that firm in 1993.

19. In the actual panel from 1998 to 2004, the third case is not a concern, although we are still unable to distinguish between the first two cases in many instances.

20. To determine an appropriate method for assigning exit, we examined the distribution of TFP for potential exiters compared to that of survivors for two years (1999 and 2000) in which the observed exit rates are relatively close to estimated exit rates, indicating that the pool of potential exiters is likely to be representative of “true” exiters. We also examined TFP distributions in two years (1995 and 2004) when the observed exit rate is significantly higher than the estimated true exit rate, indicating that many true survivors are classified as exiters. In both cases, the distributions of potential exiters are slightly left-shifted, indicating that exiters are, on average, less productive than survivors. However, the two distributions of potential exiters are similarly left-shifted relative to the distributions of survivors, suggesting that the pool of potential exiters is fairly representative of the actual exiters. Therefore, we assign exit by selecting a random sample of firms from the pool of potential exiters.

21. In this case, the number of state-industry observations is larger because of the imputation of TFP in the panel.

TABLE 6. Robustness Test: Alternative Decomposition

	Aggregate (1)	AvgSurv (2)	ReallocSurv (3)	Entrants (4)	Exiters (5)
Final Goods Tariff	-.022 (.022)	-.023 (.026)	-.007 (.019)	.002 (.006)	.006 (.008)
Input Tariff	-.408 (.096)***	-.476 (.106)***	.093 (.082)	-.008 (.022)	-.016 (.033)
FDI Reform	.039 (.013)***	.044 (.014)***	-.011 (.012)	-.0006 (.002)	.006 (.004)
Delicensed	-.010 (.015)	.008 (.017)	-.014 (.015)	-.001 (.004)	-.003 (.005)
Obs.	19328	19328	19328	19328	19328
R ²	.059	.068	.035	.07	.003

Source: Authors' analysis based on data sources discussed in the text.

The decomposition is performed using the method suggested by Melitz and Polanec (2010), with false exit addressed as discussed in the text. Each observation is a state-industry. Dependent variable names are given at the top of each column. "Aggregate" indicates market-share-weighted mean productivity, "AvgSurv" and "ReallocSurv" indicate unweighted mean productivity and the covariance between market share and productivity for surviving firms, respectively, and "Entrants" and "Exiters" indicate the contributions of entering and exiting firms. All specifications are fixed-effects analyses at the state-industry level and include year dummies. Each observation is weighted by the total number of firms in the state-industry across all years, and standard errors are clustered at the state-industry level.

3.9 percent and average productivity by 4.4 percent. The policy reforms are not associated with reallocation among survivors, entrants, or exiters.

IV. CONCLUSION

In the Indian case, we show that market share reallocations were important drivers of productivity growth only at the beginning of the trade reforms in 1991. Over the longer 20-year period from 1985 to 2004, average productivity improvements played a larger role in determining aggregate productivity growth.

In contrast to the earlier trade literature on heterogeneous firms, such as Melitz (2003), we do not find a link between India's tariff liberalization and market-share reallocations. Instead, we find that both the trade and FDI reforms increase average firm productivity. Our constructed panel allows us to verify that even after controlling for unobservable, firm-specific characteristics, the trade and FDI reforms are associated with increased within-firm productivity. Although the delicensing reforms do not affect productivity in the organized manufacturing sector as a whole, they are linked to productivity gains among large firms and among firms not previously exposed to trade. One potential reason that we do not find a link between trade reform and reallocations could be that India's rigid labor laws prevent reallocation among firms. However, we

find that the reforms have similar effects in states with different degrees of labor market rigidities.

Our findings, which suggest that “learning” is more important than “stealing” over the 1985 through 2004 period, are consistent with the most recent literature on heterogeneous firms (see, for example, [Bernard, Redding, and Schott 2011](#)), which suggests that firms exposed to increased competition from trade may focus on higher productivity product lines. This finding implies that much of the productivity increase associated with trade reform is likely to manifest as within-firm increases rather than productivity gains associated with shifting market shares toward more efficient enterprises. Unfortunately, given the nature of our data during the years in which the major reforms occurred, we are unable to confirm that product shifting occurred, and the existing evidence from a sample of large firms is mixed ([Goldberg, Khandelwal, Pavcnik, and Topalova 2010a, 2010b](#)). Exploring the specific channels through which individual firms increase their productivity in India remains an important avenue for future research.

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