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Multi-product Firms and Product Turnover in the Developing World:

Evidence from India*

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Abstract

This paper provides evidence on the patterns of multi-product firm production in a large developing country – India – during a period that spans market reforms. In the cross-section, multi-product firms in India look remarkably similar to their U.S. counterparts. The time-series patterns however exhibit important differences. In contrast to evidence from the U.S., product churning – particularly product rationalization – is far less common in India. We find no link between product rationalization and output tariff declines following India's 1991 trade liberalization. The lack of "creative destruction" is consistent with the role of industrial regulation in preventing an efficient allocation of resources.

Keywords: Multi-product Firms, Product Churning, Developing Countries, India, Creative Destruction, Trade Liberalization

JEL: O12, O24, F0

1. **Introduction**

Firm-level studies have emphasized substantial gains in aggregate output that arise when policy reform, such as international trade liberalization, or changes in market fundamentals induce a reallocation from low- to high-performance firms within industries.[1] This literature typically treats each firm as producing a single product and abstracts from the reallocation of output within multi-product firms through changes in product mix in response to changes in the economic environment. A notable exception is recent work on multi-product firms by Bernard, Redding and Schott (henceforth, BRS (2006a, 2006b)), Nocke and Yeaple (2006), Eckel and Neary (2006), and Baldwin and Gu (2006).

The focus on multi-product firms' product mix decisions is relevant to the extent the changes in the product mix account for a significant portion of changes in firms' output over time. BRS (2006a, 2006b) indeed document that the contribution of firms' product margin towards output growth trumps the contribution of firm entry and exit, a widely studied channel in the literature on firm dynamics. This evidence suggest that product mix changes represent a potentially important channel through which resources are reallocated from less to more efficient uses *within* U.S. firms. While this work has uncovered thought-provoking new facts, it has focused mainly on the U.S.[2] This paper provides evidence on the characteristics and product mix decisions of multi-product firms in a large developing country, India.

The extension of firms' product mix literature to a developing country setting is relevant for several reasons. First, it is well known that countries at different stages of development exhibit notable differences in the size distribution of firms as well as differences in the efficiency of resource allocation across heterogeneous firms.[3] These differences stem in part from differences in the regulatory environments in which firms operate (Tybout (2000)). Firms in

developing countries often face constraints that are irrelevant to U.S. firms. In India, for example, private sector activity was heavily regulated through the "license raj", a system of complex industrial license requirements for establishing and expanding capacity in the manufacturing sector, while the Industrial Disputes Act (1947) provided significant protection for labor in the organized sector (Kochhar et al (2006)). Given these constraints, it is questionable whether Indian firms had the necessary flexibility to adjust their product mix in order to achieve a more efficient allocation of resources. Second, many developing countries implemented sweeping market reforms in recent years that altered the environment in which firms had operated in the past. In India, such reforms include the trade liberalization of the early 1990's and a stepped-up dismantling of the "license raj." These reforms provide an interesting setting for the purpose of investigating how firms adjust product mix in a changing economic environment.

We use a unique firm-level panel database which contains detailed information on products that each firm manufactures to study firms' product mix changes during a period of major market reforms in India. Our data is particularly well suited to examine whether Indian firms change their product scope in response to India's large-scale tariff liberalization. India's trade reform provides an attractive setting for the study in part because firms were unlikely to have anticipated the reform; tariff changes between 1991 and 1997 were less prone to the usual political economy pressures (Topalova (2007)).

The data indicate that Indian multi-product firms are quite similar to their counterparts in U.S. manufacturing studied by BRS along several dimensions. Multi-product firms are strong performers: within narrowly defined industries, India's multi-product firms are larger, more productive, and more likely to export than single-product firms. We also find a striking

resemblance of the within firm product distribution to the U.S. data. Finally, we document a positive correlation between the firms' extensive and intensive margins. These cross-sectional patterns are consistent with predictions of theoretical models of multi-product firms, especially BRS (2006b).

Perhaps more surprisingly, our analysis also suggests that despite the regulatory constraints described above, changes in firms' product mix had a non-negligible contribution to growth; *on net*, they account for approximately 25% of the increase in Indian manufacturing output during our sample period. This validates the focus on firms' product margin in recent empirical work. However, a closer examination of the *gross* changes in the product mix of Indian firms reveals important differences to U.S. firms in the time-series. While BRS (2006a) uncover a substantial amount of product churning within U.S. firms, Indian firms exhibit far less frequent changes in their product mix over a 5-year period. Moreover, firms in India infrequently drop a product or simultaneously add and drop a product. The contribution of the net product margin to total output growth is therefore driven almost exclusively by product additions, and not by discontinuation of product lines that have become obsolete. Hence, our results suggest that product churning, or "creative destruction" along the product dimension, is not happening in India in the 1990's, despite major trade and other structural reforms during this period. Furthermore, we are unable to connect the changes in firms' product mix to changes in trade policy. The empirical framework that exploits differential changes in tariffs across Indian industries finds no relationship between declines in output tariffs and a firms' extensive margin—the number of products it manufactures.

The lack of product dropping seems surprising given predictions from recent multi-product firm models in trade. For example, BRS (2006b), a multi-product extension of Melitz

(2003), predict that a decline in trade costs causes firms to rationalize their extension by shedding products outside their "core competency". More generally, theories emphasizing the role of “creative destruction” in the growth process predict that product dropping plays an important role in firms’ adjustment to a changing economic environment.

However, these models assume a frictionless environment that easily allows an efficient allocation of resources across and within firms. These assumptions are at odds with the conditions firms faced in India during our sample period. A plausible explanation for our findings is that remnants of industrial licensing and rigid labor market regulations continue to affect the daily operations of firms, potentially precluding them from eliminating unprofitable product lines. This interpretation is consistent with the explanations put forth for the lack of product dropping in case-studies on product scope of Indian conglomerates by Khanna and Palepu (1999).[4] Some of our results also suggest that declines in tariffs are associated with somewhat bigger changes in firms' product scope in industries no longer subject to licenses at the onset of the 1991 reform compared to regulated industries. Given the high sunk costs facing firms that wanted to expand their operations in the past, it is not surprising that firms that paid these high sunk costs are reluctant to withdraw established product lines even when these are unprofitable, as markets become more liberalized.

Alternatively, the low degree of product shedding might reflect the rapid growth of the Indian economy. In a fast-growing economy, the relative share of output of a given product could be declining considerably without an absolute decline of output and inputs and hence the lack of product dropping. Because of huge wealth disparities in India's population, it is also possible that there is always demand for older products, which would have become obsolete in

more developed countries like the U.S. Accordingly, we do not interpret our results as evidence against recent theories.

2. Data

We compile a firm-level panel data set that spans the period from 1989 to 2003 based on the Prowess database, collected by the Centre for Monitoring the Indian Economy (CMIE). The Prowess database contains information primarily from the income statements and balance sheets of about 9,500 publicly listed companies, almost 5,000 of which are in the manufacturing sector. This database is a firm-level panel and the only Indian database, to our knowledge, that records detailed annual information on firms' product-mix. Indian firms are required by the 1956 Companies Act to disclose product-level information on capacities, production and sales in their annual reports. The CMIE compiles these detailed quantitative data and therefore enables us to track a firm's adding and dropping of products over time. Furthermore, for each product manufactured by the firm, the dataset provides the value of sales, quantity and units. The Prowess is therefore particularly well suited for understanding how firms adjust their product lines over time and how their responses may be related to policy changes.[5]

The definition of a product is based on the CMIE's internal product classification. There are a total of 1,886 *products* linked to 108 four-digit NIC *industries* across the 22 manufacturing *sectors* (two-digit NIC codes). As a comparison, the U.S. data used by BRS (2006a), contain approximately 1,500 products, defined as five-digit Standard Industrial Classification (SIC) codes, across 455 four-digit SIC industries. Thus, our definition of a product is slightly more detailed than BRS (2006a).

We complement the data on firm product mix with various measures on trade policy at the industry level. Detailed description of data sources, product classification, variable

construction, and data quality is included in an unpublished appendix available on the authors' web sites.

3. A Portrait of Multi-Product Firms

While we are particularly interested in the implications of theories of multi-product firms for the way firms adjust to structural changes in an open economy, recent models (BRS (2006b), Nocke and Yeaple (2006)) also yield several predictions about the characteristics of multi-product firms in a cross section. In this section, we document the economic significance and characteristics of multi-product firms in India and examine the extent to which the cross-sectional patterns observed in the Indian data are consistent with these predictions.

We begin by examining the relative importance of single- and multi-product firms in India. Given the scant empirical evidence on multi-product firms, particularly for developing countries, the facts uncovered by BRS (2006a) for U.S. firms serve as a useful benchmark for the Indian firms. We emphasize however, that comparisons between the two studies should be interpreted with caution given that the U.S. and India are two countries incredibly distinct along several dimensions of their respective economic environments. Table 1 reports the share of each type of firm in the total number of firms, as well as their share in total manufacturing output in the Prowess sample. The table illustrates that multi-product firms account for 47% of manufacturing firms and 80% of manufacturing output.[6] By comparison, 39 percent of U.S. firms manufacture more than one product and these firms account for 87 percent of total output.

The third column of Table 1 shows that multiple-product firms manufacture on average 3 products, compared to 3.5 products for U.S. multi-product firms. 33 and 24 percent of firms manufacture products that span more than one industry and sector, respectively. These multiple-industry and multiple-sector firms account for 62 percent and 54 percent of output, respectively.

Again for comparison's sake, 28 and 10 percent of U.S. firms span multiple industries and sectors, and account for 81 and 66 percent of output, respectively. Thus, Indian firms tend to span more sectors, but multiple-sector firms account for a smaller share of output than multiple-sector U.S. firms. These facts are consistent with observations by Kochhar et al. (2006) that India's economic policies have lead to more diversification and firms of smaller capacity. Another explanation, proposed by Khanna and Palepu (1999), is that diversification may be a response to the lack of well-functioning capital, labor and product markets. The absence of market intermediaries may force firms to become more diversified to overcome these imperfections.

The recent multi-product models provide a number of cross-sectional predictions which we can examine using the Indian data. One important prediction of these models is that multi-product firms are stronger performers than single-product firms. This occurs because the presence of headquarter fixed costs implies that the more "able" firms will self-select into becoming multi-product firms. Accordingly, all models predict that multi-product firms will at the equilibrium have higher total sales and will be more likely to export. We find strong evidence that is consistent with these predictions reported in Table 2. In particular, we observe that Indian multi-product firms produce, on average, 125 percent ($e^{.81}$-1) higher output and are 13 percent more likely to export than single-product firms. These relative comparisons are quite similar to the average percent differences between U.S. single- and multiple-product firms in BRS (2006a). We also observe that multi-product firms are 1 percent more productive than single product firms, although the estimate is not statistically significant.[7] Overall, the evidence suggests that multi-product firms are stronger performers along several dimensions and this evidence is strongly consistent with BRS (2006b).[8]

The BRS (2006b) model also predicts that firms possess "core competencies", so that output should be highly skewed towards products for which firms have particular expertise. We also find evidence that Indian firms possess a core competent product with output inside the firm unevenly distributed across products in Table 3. The largest product accounts for 86% to 65% to 46 % of total sales in firms that produce at most 2, 5, and 10 products, respectively, and these figures are similar to U.S. (BRS (2006a)).

Finally, one implication of the BRS (2006b) model is that, depending on the distribution of productivity and product-expertise draws, it is possible to generate a positive correlation between the firm intensive and extensive margins. Our analysis suggests that approximately 8.5 to 11.5 percent of the variation in output across firms can be attributed to the variation in the extensive margin. Moreover, we find a positive correlation (0.43) between multi-product firms' extensive and intensive margins. We again note the similarity to the U.S. data along this dimension, as well.

In general, differences in the design of firm level surveys and product classifications make it hard to compare results related to firm and product characteristics across countries. With this caveat in mind, we cannot help but note that in the cross-section, Indian firms appear remarkably similar to U.S. firms in terms of the prevalence and characteristics of multiple-product firms, the distribution of products within the firm, and the correlations between the intensive and extensive product margins. These similarities are surprising given the vast differences between the two countries, especially those related to their regulatory environments. Furthermore, the cross-sectional patterns of multi-product Indian firms, like the ones documented for U.S. firms, are consistent with the main predictions of recent multi-product firm models.

4. Changes in Product Mix over Time

In this section we examine the importance of changes in firms' product margin over time, which for the typical Indian firm, steadily increased from about 1.4 products in 1989 to almost 2.3 products by 2003.

We first examine in greater detail the nature of product mix changes that led to the observed expansion of the extensive margin. We classify firm activity into one of four mutually exclusive groups: no activity, add products only, drop products only, and both add and drop products. A product is added in period *t* if it is produced in period *t* but not in period *t-1*. A product is dropped in period *t,* if it was produced in period *t-1* but it is not produced in period *t*. We compute these figures only for surviving firms, so that the analysis focuses on product mix changes at incumbents. We report the summary of overall, five-year, three-year and annual firm activity in Table 4. The top panel reports the share of firms participating in each activity and the bottom panel weighs participation in each activity by firm output.

In contrast to the cross-sectional descriptive results, this table shows large differences in the activities of Indian and U.S. firms. First, Indian firms are characterized by less product churning. Over a five-year period, only 28 percent of firms report changes in their product mix, with most of these being larger firms. The firms that switch products over a five-year interval account for 43 percent of the total output.[9] Second, Indian firms that change their product mix are far more likely to add products over time than to shed product lines: 22 percent of the firms report adding at least one product, 4 percent of firms drop a product, and 2 percent of firms simultaneously add and drop a product. This is in contrast to the U.S. where 54 percent of firms report a change in their product mix. However, a common feature of the Indian and U.S. data is that changes in product mix are more common among multi-product than single product firms.

The lack of product dropping in the data raises the concern that it may reflect reporting problems. There are several reasons suggesting that the lack of product shedding is not due to data problems. If there were inertia in reporting product lines, this would likely affect both the reporting of product adding and product dropping; however, we do find evidence of product adding. More importantly, firms were required to report not only the product name, but also the quantity produced and value of sales. If firms continued to list products that they no longer produced, we would observe a large share of observations with zero production. Yet, only 13 percent of the original product name-firm-year observations report zero production (we count these products as dropped). Furthermore, the product sales account for 92 and 99 percent of total output and manufacturing output reported by the firm on their annual statements (GKPT (2008)). Finally, apart from the product dropping patterns, the Indian data appear similar to the U.S. data along many dimensions discussed earlier. In the analysis that follows below we also show that the shrinking of products sales is limited as well, suggesting that the lack of reallocation from "shrinking" to "growing" products is real.

Changes in product mix provide a non-negligible contribution to changes in output of continuing firms, despite the relatively lower product switching in India relative to the U.S. We decompose the aggregate change in output of continuing firms into changes in output due to changes in product mix (i.e., the extensive margin) and changes in output due to existing products (i.e., the intensive margin) in Table 5.[10] Let Y_{ijt} denote the output of product *i* produced by firm *j* at time *t*, *C* the set of products that a firm produces in both periods *t* and *t-1* (i.e., the intensive margin), and *E* the set of products that the firms produce only in *t* or *t-1* (i.e., the

extensive margin). Then changes in a firm's total output between periods *t* and *t-1* can be decomposed as follows: $\Delta Y_{jt} = \sum_{i \in E} \Delta Y_{ijt} + \sum_{i \in C} \Delta Y_{ijt}$.

We can further decompose the (net) extensive margin into the gross margins due to product additions (A) and product droppings (D). The (net) intensive margin is the sum of the gross changes from growing (G) and shrinking products (S). The aggregate change in output among continuing firms in the Prowess database is therefore

$$\Delta Y_t = \sum_j \left[\sum_{i \in A} \Delta Y_{ijt} + \sum_{i \in D} \Delta Y_{ijt} + \sum_{i \in G} \Delta Y_{ijt} + \sum_{i \in S} \Delta Y_{ijt} \right].$$

The first two terms capture the growth due to changes in the firms' net extensive product margin and the final two terms capture changes in the net intensive margin.

Table 5 reports the decomposition. As in the U.S., the firm's intensive margin accounts for the majority (75 percent) of output growth over longer time horizons in India. Interestingly, despite the lower product churning observed in India, the extensive margin accounts for a considerable portion of output changes over longer time periods: 25% between 1989 and 2003. As in the U.S., the importance of the extensive margin fluctuates considerably over shorter horizons.

The relative contributions of the net extensive and intensive product margins over longer time horizons appear similar to those documented for the U.S. However, important differences emerge between the Indian and U.S. firms in comparing the gross margins. While product shedding is an important channel through which firms adjust their output in the U.S., its contribution to changes in output in India is negligible (with the exception of 1992). The changes in output stemming from the extensive margin are almost entirely driven by output growth due to product additions. Consequently, gross and net contributions of the extensive

margin to output growth are of similar orders of magnitude. This is in large contrast to the U.S., where both product additions and subtractions significantly contribute to output changes leaving the gross margin an order of magnitude larger than the net extensive margin. Similar patterns emerge when we decompose changes in the net intensive margin due to growing and shrinking products. The growth in the intensive margin in India is predominately driven by growth in "growing products", with little reallocation of output away from "shrinking products", so that the net and gross output changes are of similar orders of magnitude. Again, this in stark contrast to the U.S. data, where the gross intensive margin is an order of magnitude larger than the net intensive margin.

So, while the patterns we documented suggest many similarities between the U.S. and Indian multi-product firms in the cross section, their dynamic behavior, measured by the degree of product churning over time, appears quite distinct. These observed differences over time speak to how much more dynamic the U.S. economy is relative to India. Despite the significant reforms taking place in India during the 1990's, we find little evidence of "creative destruction". While our data do not allow us to pin down the reasons behind the lower degree of product churning in India, we believe that this pattern could be driven by two factors.

First, it is plausible that labor market regulation and the remnants of industrial regulation still affect the operation of Indian firms, constraining their flexibility to adjust to new economic conditions. While we do not have direct evidence on this hypothesis, earlier work has consistently found that pro-worker labor legislation, industrial licensing and especially their interaction leads to a less efficient allocation of resources, i.e., lower output and productivity in manufacturing industries (e.g., Besley and Burgess (2004), Aghion et al. (2008), Ahsan and Pages (2008)). While this evidence does not cover product turnover, it strongly suggests that the

sunk costs of firm entry and new product introduction were high. Therefore, it is not surprising that firms that did pay these high sunk costs are reluctant to withdraw products, even as markets become more liberalized.

The low degree of product shedding could also reflect that India is a fast-growing developing country, so that the relative share of output of a given product could be declining considerably without an absolute decline of output and inputs and hence no product dropping. This explanation is also consistent with the fact that when we examine the intensive margin, we find little evidence of "shrinking", but strong evidence of "growing" products. Given that India is also characterized by huge wealth disparities in its population, it is also possible that there is always demand for older products, which would have become obsolete in more developed countries like the U.S.[11]

As noted above, we are not able to distinguish between these hypotheses given the data available to us. However, a different approach towards explaining product turnover in India (or the lack thereof) is suggested by India's recent trade reforms. India underwent a significant trade liberalization in the early 1990's, which provides us with fairly precisely measured changes in trade barriers. In the next section we relate these changes in trade policy to changes in firms' product mix to examine if the patterns we observe in the Indian data can at least partly be explained by changes in the economic environment.

5. Product Mix and Trade Policy

Several studies emphasize the adjustments to trade reform that occur within industries, and recent papers focus on the role of firms' product margin in this process (BRS (2006b), Eckel and Neary (2006), Nocke and Yeaple (2006), Baldwin and Gu (2006)). These models generally predict that lower trade costs lead firms to reduce their extensive product margin by dropping

products. For example, in BRS (2006b), a symmetric bilateral decline in trade costs induces firms to reduce their product scope by shedding relatively unproductive products. This is because such a decline is associated with an increase in the domestic productivity cut-off (since the increase in exports leads to an increase in domestic labor demand, which in turn leads to higher wages). The least productive domestic firms exit and all firms reduce product scope. This leads to productivity growth within and across firms and in the aggregate. While these results are derived using a bilateral trade liberalization, similar predictions hold under unilateral liberalization. A multi-product firm extension of Melitz and Ottaviano (2008) also predicts that unilateral trade reform induces product rationalization because foreign entry intensifies product market competition (Baldwin and Gu (2006)).

To our knowledge, this link between declines in trade costs and firms' extensive margin has not been previously examined empirically in the context of developing countries, of which several have experienced substantial declines in their trade barriers in the last two decades. The large tariff declines resulting from India's 1991 trade liberalization provide a nice setting for such analysis for several reasons. First, India's reforms came as a surprise, so it is reasonable to assume that they were not anticipated by firms prior to the reform. Second, tariff cuts were large (average tariffs where reduced from over 90% in 1987 to about 30% in 1997) and brought a substantial decline in the dispersion of tariffs across industries. Industries with larger pre-reform tariffs experienced larger tariff declines, a pattern unlikely to be observed if traditional political economy concerns played an important role in India's trade liberalization of 1991. In fact, there is no evidence that industry tariff changes, which were mostly spelled out in the Eighth Five Year Plan (1992-1997) were correlated with pre-reform industry characteristics such as productivity, industry size, etc (Topalova, 2007). However, Topalova (2007) provides evidence

that tariff changes begin to appear susceptible to political economy pressures following the election of the BJP party in 1997. We thus restrict the analysis of the impact of the trade liberalization on the firms' extensive margin from 1989-1997.

We regress the (log) number of products manufactured by firm *j* in time *t*, n_{it}, on the tariff rate of the firm's main industry (*m*), lagged one year, $\tau_{m,t-1}$[12]

$$\log n_{jt} = \alpha_j + \alpha_t + \beta \tau_{m,t-1} + \varepsilon_{jt}. \quad (1)$$

The regression includes firm fixed effects and year fixed effects to control for time-invariant firm characteristics and unobserved aggregate shocks. Standard errors are clustered at the industry level.

Column 1 of Table 6 reports the results using output tariffs as the trade policy measure. The coefficient is negative but statistically insignificant. This suggests that declines in tariffs are uncorrelated with changes in the number of products at the firm-level. In column 2, we include sector (NIC2)-year fixed effects to control for sector-specific demand or supply shocks. The coefficient on tariffs remains statistically insignificant and the magnitude is quite similar to the baseline result that included year fixed effects. Given that some sectors were still subject to non-tariff barriers (NTBs) during this period, the lack of relationship between changes in product mix and output tariffs could be due to the fact that these sectors remained protected despite the decline in tariffs. By 2001, however, over 90% of the HS6 lines were not subject to NTBs. We therefore estimated regression (1) using data on only one pre- (1990) and one post-reform year (2001), by which the majority of NTBs were dismantled. The results of this regression are shown in column 3; the coefficient on the output tariff continues to be small in magnitude and insignificant. In column 4 we adopt a simple difference-in-differences approach by regressing firm-level number of products on an indicator if the industry had above average declines in

tariffs interacted with the post 1991 indicator, firm fixed effect, and year effects.[13] The interaction effect is statistically insignificant, consistent with the earlier columns.

If lower output tariffs induce firms to simultaneously add and drop products, the firm's extensive margin might remain unchanged. While none of the existing models generate product switching in response to trade reforms, Bernard, Schott, and Jensen (2006) find that U.S. firms that are exposed to a greater degree of foreign competition are more likely to switch an industry. Recall from Table 4 that simultaneous adding and dropping of product lines is quite rare for Indian firms. Nevertheless, in columns 5 and 6 of Table 6, we replace the dependent variable in equation (1) with an indicator (add_{it}) if firm i adds a product in year t, and a separate indicator ($drop_{it}$) if firm i drops a product in time t that it manufactured at $t-1$, respectively. The coefficients on the output tariffs remain small and statistically insignificant in both cases. Column 7 provides an alternative specification where firm-level tariffs are constructed by weighting industry tariffs according the initial industry shares of firm output. As before, the coefficient on tariffs remains statistically insignificant. In column 8, we assign a firm-specific tariff based on the least important (initial-period) product manufactured by the firm. This idea is motivated by the theoretical models which suggest that firms should rationalize the least important products in response to tariff liberalization. We find a small and statistically insignificant coefficient on this tariff measure. The take-away message of Table 6 is that the firms' product scope does not appear correlated with tariffs.

The lack of a relationship between declines in trade costs and firms' extensive margin is somewhat surprising in light of the predictions of theoretical models. As we noted earlier, the Indian trade liberalization of the early 1990's is best characterized as a unilateral trade reform, so that there is no tension between our results and the predictions of models that focus on

symmetric bilateral trade reductions (e.g., BRS (2006b)). However, the tension does exist, when one considers models that encompass the case of unilateral trade reform. At this point it is important to note that the previous literature on the effects of the Indian trade reforms does find firm adjustments to the 1991 trade barrier reductions. Lower output tariffs induce productivity gains (Krishna and Mitra (1998), Sivadasan (2006), Topalova (2007)). Yet, our results suggest that lower tariffs are not associated with product rationalization within surviving firms in India.[14]

A potential explanation for our findings is that remnants of the strict industrial regulation of the past may be inhibiting firms from shedding existing product lines, even when these become less profitable; the lack of shedding could in this sense be interpreted as indirect evidence that Indian firms faced high sunk costs when introducing a new product. As discussed above, industrial licenses were important parts of the economic climate in India during this period. India started dismantling its license system during the 1980s and stepped up this process in 1991. The removal of licenses would have lowered product-specific entry costs and may have enabled firms to increase their extensive margins. On the other hand, it may have allowed firms to become more flexible to shocks by shutting down or restarting a product line in the absence of license requirements. Column 9 of Table 6 reports the results of estimating equation (1) that includes an indicator that takes a value of one if the industry was license free as an additional control. The inclusion of delicensed variable does not affect the coefficient on output tariffs and the coefficient on delicensed is statistically insignificant.[15]

In order to examine the link between tariff reforms and delicensing in influencing firms' product scope more directly we distinguish between industries that were delicensed in the 1980s and those that continued to be regulated after 1988. One would expect tariff declines to have a larger effect on product scope in industries that were no longer regulated by licenses at the onset

of trade reform. We interact an indicator for whether an industry was delicensed by 1988 with the output tariff and include this interaction as an additional regressor in equation (1). Column 10 of Table 6 presents the results. The tariff coefficient is insignificant, but, the negative and significant coefficient on the interaction suggests that lower tariffs are associated with more product additions in industries that were delicensed by 1988. This result provides some tentative evidence that regulation might play some role in explaining the limited product churning in Indian firms.

Still, a striking feature of our data is that they indicate that firms expand their product scope during a period of substantial reforms; changes in the extensive margin are driven by product addition, not product destruction. Existing models focus on product scope *reduction* as a channel through which firms adjust to external shocks. Against this background, it may not come as a surprise that we cannot relate the product additions we observe to changes in trade policy, as suggested in these models.

6. Conclusion

We study multi-product firms in India. In the cross-section, India's multi-product firms look remarkably similar to U.S. counterparts, despite many differences in the regulatory environments in which these firms operate. We also find that changes in firms' product mix had a non-negligible contribution to growth; *on net*, they account for approximately 25% of the increase in Indian manufacturing output during our sample period. However, Indian and U.S. firms differ in *gross* changes in product mix. Product churning is substantially lower among Indian firms and almost entirely driven by product additions rather than the shedding of existing product lines.

The lack of product shedding is consistent with the high regulation of the past that placed constraints on Indian manufacturing firms' operating decisions. While India initiated market-oriented reforms in the early 1990s, firms faced high sunk costs of expanding operations prior to the reforms. It is therefore likely that once these costs were sunk, firms were reluctant to withdraw established product lines, particularly given the rapid growth rate of the Indian economy. Given that we do not find evidence of product dropping in raw data, perhaps unsurprisingly, we are then unable to connect the changes in firms' product mix through product additions to changes in trade policy. In future work, we plan to investigate additional channels through which changes in the economic environment, trade policy in particular, affect the product decisions of multi-product firms in developing countries.

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[1] See Bernard et al. (2003), Bernard et al (2007), Melitz (2003), Roberts and Tybout (1996) and Tybout (2003).

[2] Roberts and Lee (2008) and Navarro (2008) study multi-product firms in Taiwanese electronics and Chile.

[3] For example, see Tybout (2000), Hsieh and Klenow (2007), and Bartelsman et al (2006).

[4] Managers pointed to the costs of reducing scope of operations such as "lack of liquid markets for assets, regulatory restrictions on cost cutting through reduction of employees, lack of professionals with experience in takeovers, buyouts and restructuring, and prohibitive taxes on gains on asset sales." (Khanna and Palepu (1999), p. 226)

[5] This database is not well suited to study firm entry and exit because firms are under no legal obligation to report to the data collecting agency. However, since Prowess contains only the largest Indian firms, entry and exit is not necessarily an important margin for understanding these firms.

[6] The ASI rounds in 1997/98, 1999/2000 and 2001/02 record product-level information for manufacturing plants. These data are not suitable for analysis of firms' product mix changes because the ASI neither contains product information prior to the reforms nor is a panel. However, in these rounds, multi-product plants are 51 percent of total plants and account for 78 percent of manufacturing output. These figures are remarkably similar to the Prowess sample.

[7] Productivity measure is based on Levinsohn and Petrin methodology as in Topalova (2007). We should note that differences in productivity were statistically significant in the ASI data, which also includes smaller firms.

[8] In an earlier draft (GKPT (2008)) we find further support for the selection hypothesis. Initially single-product firms that eventually add products are stronger performers than (initially) single-product firms that do not add a product. We find a similar relationship for initial multi-product firms that add products relative to those that do not.

[9] The middle and right parts of the table repeat the analysis for single and multi-product firms separately. As in the U.S., multi-product firms in India are more likely to churn products than single product firms.

[10]We perform this decomposition for continuing firms, as Prowess is not well suited for studying firm entry and exit.

[11] We thank a referee and Dr. Janak Raj from the Reserve Bank of India for these two explanations for our findings.

[12] Tariffs are matched to the firm's 4-digit NIC industry code that reflects each firm's initial main line of business.

[13] This regression includes year and firm fixed effects, so post 1991 indicator and an indicator if the industry had above average declines in tariffs is not identified. Industry tariff decline is measured between 1997 and 1989.

[14] Firms could drop products by exiting the market but our data is not well suited to examine this channel. Moreover, given the size of these firms, firm exit is unlikely to be an important margin of adjustment.

[15]The coefficient on the delicensed dummy is similar in the unconditional regressions. Using the industry-level ASI data from 1980 to 1997, Aghion et al. (2008) find that de-licensing only affected output in states that pass more flexible labor market legislation. Our unreported results

find no heterogeneous impact of delicensing on the firm's extensive margin across labor markets. Many Prowess firms have plants in states with different labor markets, which may wash away any heterogeneity. In addition, there were no state amendments to labor market regulation after 1989 during the period of our sample (Aghion et el. (2008), Ahsan and Pages (2008)).

Table 1: Prevalence of Single- and Multiple-Product Firms

Type of Firm	Share of Firms	Share of Output	Mean Products, Industries or Sectors per Firm
Single-Product	0.53	0.20	1
Multiple-Product	0.47	0.80	3.06
Multiple-Industry	0.33	0.62	2.01
Multiple-Sector	0.24	0.54	1.68

Notes: Table classifies firms by single product, multiple product, multiple industry (four-digit NIC) and multiple-sector (two-digit NIC). The unconditional mean products per firm is 1.97. Source: Authors' calculations from Prowess database.

Table 2: Characteristics of Multiple-Product Firms

	Multiple Product	Multiple Industry	Multiple Sector
Output	0.81	0.73	0.73
Probability of Export	0.13	0.12	0.14
TFP	0.01^	0.00^	0.00^

Notes: Table summarizes the differences in 2000 between single-product and multiple-product firms. Each cell reports a separate regression of the dependent variable (reported in column 1) on a dummy that takes a value of one if the firm produces more than one product (column 2), industry (column 2) and sector (column 3), respectively. Regressions also include industry fixed effects and standard errors are clustered at the industry level. All coefficients are statistically significant at conventional levels with the exception of coefficients denoted with a ^. Probability of export is a linear probability regression. There are 2,889 observations in the output and export regressions, and 2,783 observations in the TFP regressions. Source: Authors' calculations from the Prowess database.

Table 3: Distribution of Products Within the Firm

Average Share of Product in Firm Sales (High to Low)	Number of Products Produced by the Firm									
	1	2	3	4	5	6	7	8	9	10+
1	100	86	75	70	65	63	62	64	53	46
2		14	20	21	21	21	19	16	22	20
3			4	7	9	9	9	9	12	13
4				2	4	4	6	5	7	7
5					2	2	3	3	3	4
6						1	1	2	2	3
7							0	1	1	2
8								0	1	2
9									0	1
10+										2

Notes: Columns indicate the number of products produced by the firm (truncated at 10 products). Rows indicate the share of the product in total firm sales, in decreasing order of size. Each cell is the (simple) average across the relevant firm-products in the sample (1989-2003). Source: Authors' calculations from the Prowess database.

Table 4: Firm Activity

	Percent of Firms											
	All Firms				Single-Product Firms				Multiple-Product Firms			
Period	No Activity	Add only	Drop only	Add and Drop	No Activity	Add only	Drop only	Add and Drop	No Activity	Add only	Drop only	Add and Drop
Overall	42	45	5	8	53	42	na	5	29	48	11	11
Five-Year Average	72	22	4	2	80	19	na	1	63	26	8	3
Three-Year Average	80	15	3	1	87	13	na	1	73	17	7	2
Annual Average	90	7	2	0	94	6	na	0	86	9	5	1

	Output-Weighted Percent of Firms											
	All Firms				Single-Product Firms				Multiple-Product Firms			
Period	No Activity	Add only	Drop only	Add and Drop	No Activity	Add only	Drop only	Add and Drop	No Activity	Add only	Drop only	Add and Drop
Overall	22	72	1	5	46	52	na	2	17	76	1	5
Five-Year Average	57	28	2	12	76	24	na	0	53	29	3	15
Three-Year Average	69	23	2	6	84	16	na	0	65	25	3	7
Annual Average	83	13	3	1	93	7	na	0	81	14	4	1

Notes: Table classifies continuing firms into four mutually exclusive groups: no activity, add only, drop only and both. A product addition is defined as a firm adding a product in period t that it did not produce in the previous period. A drop in defined as a firm dropping a product in period t that it produced in the previous time period. These definitions imply that a single-product firm cannot drop a product only. Source: Authors' calculations from the Prowess database.

Table 5: Decomposition of Sales Growth for Continuing Firms

		Extensive Margin			Intensive Margin		
Year	Gross Sales	Net	Product Entry	Product Exit	Net	Growing Products	Shrinking Products
1989							
1990	7.8	0.7	1.4	-0.8	7.1	10.5	-3.3
1991	10.6	1.0	1.3	-0.3	9.6	12.8	-3.2
1992	-0.7	0.3	1.6	-1.3	-1.0	7.8	-8.9
1993	0.9	0.8	1.4	-0.6	0.2	7.3	-7.1
1994	13.9	3.6	3.8	-0.1	10.3	14.8	-4.5
1995	13.9	3.1	3.4	-0.3	10.8	15.4	-4.6
1996	18.1	0.7	0.8	-0.1	17.4	21.1	-3.7
1997	8.3	1.5	1.7	-0.2	6.8	12.6	-5.8
1998	7.2	0.4	0.6	-0.3	6.8	12.7	-5.9
1999	10.9	0.6	0.9	-0.3	10.3	15.4	-5.1
2000	13.5	0.2	0.5	-0.3	13.3	18.0	-4.7
2001	11.4	1.0	1.1	-0.1	10.4	15.8	-5.3
2002	3.1	4.5	4.7	-0.2	-1.4	6.7	-8.1
2003	13.6	1.3	1.4	-0.2	12.3	16.7	-4.4
1989-1993	15.0	3.2	4.2	-1.0	11.7	20.2	-8.4
1994-1998	52.7	10.5	11.1	-0.6	42.3	49.4	-7.1
1999-2003	42.5	10.0	10.7	-0.6	32.5	41.3	-8.9
1989-2003	197.7	49.8	52.5	-2.7	147.9	156.6	-8.7

Notes: Table decomposes aggregate sales growth into contribution of the extensive and intensive product margin within Prowess from 1989-2003. The table reports the aggregate output growth of continuing firms. Column 2 reports gross sales growth. Columns 3-5 report the contribution to growth from the firms' extensive margin. Columns 6-8 report the contribution to growth from the firms' intensive margin. Values are deflated by sector-specific wholesale price indices. Source: Authors' calculations from the Prowess database.

Table 6: Firm Extensive Product Margin and Tariffs

	Scope	Scope	Scope	Scope	Add	Drop	Scope	Drop	Scope	Scope
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged Tariffs	-0.033	-0.028	0.032		-0.016	0.006			-0.034	0.024
	0.038	0.037	0.122		0.023	0.017			0.035	0.046
Post-1991 *Large Tariff Decline Indicator				-0.032						
				0.025						
Firm-Specific Lagged Tariff							-0.017			
							0.027			
Lagged Tariff of Smallest Product								-0.018		
								0.015		
Lagged Delicensed									-0.037	
									0.025	
Lagged Tariff x Delicensed by 1988										-0.081 *
										0.046
Year FEs	yes	no	yes	yes	yes	yes	yes	yes	yes	yes
NIC2*Year FEs	no	yes	no	no	no	no	no	no	no	no
Firm FEs	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
R-squared	0.90	0.90	0.94	0.89	0.27	0.25	0.90	0.26	0.90	0.9
Observations	14,864	14,864	4,115	14,596	11,615	11,615	14,819	11,569	13,435	13,435

Notes: The dependent variable for each regression is reported in the column heading. Scope is log number of products produced by a firm. Add and Drop are indicators for whether a firm adds (drops) a product. Column 3 uses pre- and post-liberalization years of data, 1990 and 2001; for 2001, the 1997 tariff is assigned. Columns 4 reports a specification where "post-1991" is an indicator that is 1 in 1991-97 and "Large Tariff Decline" indicator is one for NIC4 industries with above average (greater than 59 percentage points) decline in tariffs between 1989 and 1997. The post-1991 indicator and the "Large Tariff Decline" indicator are itself not identified because of the included year and fixed effects. Column 7 uses firm-specific tariffs based on the firms's initial product weights. Column 8 uses the tariff of the smallest (initial) product of the firm. Column 10 interacts lagged tariffs with an indicator for if the industry was delicensed by 1988 (the main effect of the delicensed in 88 variable is not identified because of the firm fixed effect). Standard errors clustered at the industry level except column 3 which clusters at the industry-year level. Significance: * 10 percent, ** 5 percent, *** 1 percent.