Import Penetration and the Demand for Managers: Evidence from India*

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Abstract

A few recent studies in trade literature indicate that globalization plays a significant role in understanding how a firm is organized. We make the first attempt to empirically study one very crucial aspect of this phenomenon: the impact of import penetration on the share of managerial compensation in total compensation. In other words, we aim to understand how product market competition affects the firm-level relative demand for managers. Using detailed firm-level data across manufacturing sectors in India spanning over two decades, and exploiting the exogenous nature of India's trade reform, we investigate the potential link between the two. We find that higher level of imports – especially those of intermediate inputs significantly increase the relative demand for managers. A 10 per cent drop in input tariffs induces 1–4.4 per cent increase in the managerial compensation ratio of a firm. This works through the incentive-based pay. An increase in demand for managers expands an Indian manufacturing firm vertically, i.e., there is an increase in the depth of the hierarchy. This pattern is observed for firms: (i) which are both exporters and non-exporters; (ii) across the firm-size distribution; (iii) belonging to the non-durables sector; and (iv) which are domestic and privately owned.

JEL classifications: F1, F14, F61

Keywords: Import Penetration, Trade liberalization, Intermediate Inputs, Demand for Managers, Organization, Management Layers, Firm Scope, Pay Structure

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1 Introduction

Economists have long been interested in understanding the different economic implications of globalization or trade liberalization or product market competition.[1] One of the crucial aspects about the effect of trade reform which received very little attention relates to firm-level organizational structure/hierarchies or management. Though, a number of recent studies highlight the importance of firm organization and management or managerial practices on firm performance and productivity (Bloom and Van Reenen, 2007, 2010; Bloom et al., 2013, 2014); the implications of organizational structure as a result of a trade reform is missing in the majority of the trade models. More so, in case of the two fundamental trade theory models, Eaton and Kortum (2002) and Melitz (2003). However, more recently, a number of authors suggest that trade reform does indeed play a significant role in organizational change (Caliendo and Rossi-Hansberg, 2012; Chen, 2013; Marin and Verdier, 2014). But, there is very little empirical literature documented to support these claims. One exception is: Guadalupe and Wulf (2010). It uses data for the U.S. corporates to empirically investigate the effect of trade liberalization on the span and depth of corporate hierarchies. They conclude that foreign competition flattens a firm (decreases the number of positions between the CEO and division managers). In a few similar kind of studies, Cunat and Guadalupe (2009) using U.S. firm-level data, Marin (2009) using data for German and Austrian firms and Ma (2013) theoretically argues that access to the global market is associated with a higher executive-to-worker pay ratio within a firm. Most of the studies addressing this trade-organization nexus based on data from developed economies point out the potential prominence of this nexus in developing economies, most notably India.[2]

In this paper, we investigate whether and how changes in trade policies affect firm-level organizational dynamics. In particular, we aim to see how the share of managerial compensation, or the relative demand for managers, responds to trade liberalization or import penetration. The paper contributes to the small, but growing trade-organizational economics

[1] Most of the studies related to the effect of trade reform focused primarily on productivity (Pavcnik, 2002; Melitz, 2003; Van Biesebroeck, 2005; Amiti and Konings, 2007; De Loecker, 2007; Khandelwal and Topalova, 2011; Ahsan, 2013), labour market outcomes (Amiti and Davis, 2011; Egger and Kreickemeier, 2009; Helpman and Itskhoki, 2010; Helpman et al., 2010), productscope (Broda and Weinstein, 2005; Khandelwal et al., 2011), product quality (Verhoogen, 2008; Kugler and Verhoogen, 2012), prices and markups (Melitz and Ottaviano, 2008; Khandelwal et al., 2012), multiproduct firms (Bernard, et al., 2010; Bernard et al., 2011) etc.

[2] Through a field experiment involving Indian textile firms, Bloom et al. (2013) find that better management practices can increase productivity by 17% in the first year, and lead to firm expansions within three years.

nexus literature in the following ways: firstly, we extend the literature for the case of a developing country (which is virtually non-existent), in this case India; and secondly, we go beyond the usual correlations between trade reform and organizational change in the sense that we utilize a quasi-natural experiment in order to establish the causal identification. Using a novel dataset on Indian firms–which reports data on managerial compensation–across manufacturing sectors, spanning over two decades, we empirically study a new and important insight on trade and organizational literature: the effect of import penetration on the share of managerial compensation or the relative demand for managers. Taking a step further, we also investigate how does product market competition affects organizational design of a firm. Our main finding is that higher import penetration ratio positively affects the managerial compensation ratio. And, this forces an Indian manufacturing firm to expand vertically – increase in the number of management layers. To the best of our knowledge, this is the first paper to study the relative demand for managers, relative to non-managers, to show that exposure to trade leads to a change in the managerial compensation ratio and organizational structure, even in the case of a developing economy.

Why is organization or management important? What are the different ways that trade could affect the organizational structure of a firm? All the studies focusing on the role of management points to the single and very important point: better organizational or management practices help a firm to have higher rates of growth, productivity and innovation (Bloom and Van Reenen, 2007, 2010; Bloom et al., 2013). About the differential effect of the trade reform on the organizational structure of a firm, two issues dominate the current research in the organizational economics literature: a. horizontal expansion or the span of control; b. vertical expansion or the depth of control. In the former set of issues, Chen (2013) provides a two-sector model with heterogeneous demand in a monopolistically competitive sector to show that firms, which face increasing import competition, flatten their hierarchies and use more incentive-based pay. Empirically, Guadalupe and Wulf (2010) using a unique panel dataset on firm hierarchies of large US firms (1986–1999) and exploiting Canada-US Free Trade Agreement of 1989 as a quasi-natural experiment finds support for this theoretical prediction: product market competition leads a firm to flatten its hierarchy. In other words, firms reduce the number of positions between the CEO and division managers. On the other hand, Caliendo and Rossi-Hansberg (2012) builds a theoretical model where a firm is a knowledge-based hierarchy. They face heterogeneous demands and use labour and knowledge to produce. The study concludes that as a result of trade liberalization, exporting firms' significantly increases the number of layers of management, i.e., a firm grows vertically. In a

similar study, Marin and Verdier (2014) builds on a Melitz and Ottaviano (2008) framework, where firms' have internal hierarchies to show that international trade increases the conflict of interest between CEO/owners and middle managers and this leads to decentralization of corporate hierarchies. They use data for German and Austrian firms to find consistent empirical outcomes. In a slightly different context, a series of theoretical papers by Conconi et al. (2012) and Alfaro et al. (2010) show how trade policy can shape the ownership structure of firms.

In contrast to the number of theroretical papers, empirical investigations to study the effect of international trade on firm organizational design are very limited. Except the paper by Guadalupe and Wulf (2010), all the other studies establish conditional correlations and not causal relation between exposure to international trade and the organizational structure of a firm. The novelity of our dataset allows us to address this gap and make a significant contribution to the existing empirical studies on organizational economics. We use a rich panel dataset of the Indian registered manufacturing sector across all the manufacturing industries over twenty one years (1990-2011). The data includes detailed information on managerial compensation, divided into wages and compensation for different management layers (hierarchial depth), and other important information on firm characteristics. Our dataset also provides information on compensation for non-managers. We utilize this information to investigate the effect of trade liberalization on the share of managerial compensation in total compensation. In other words, we look into the effect of trade policy on the relative compensation ratio of the managers. In doing so, we fully exploit the panel dimension of the data (i.e., variation with firms) and control for several other important firm and industry-level attributes, which may also drive the share of managerial compensation. We do so to control for both unobserved and observed attributes that may be correlated with the organizational structure of a firm.

We are interested in understanding whether there is indeed any systematic association between import penetration and relative demand for managers of a firm and more importantly whether the former causally affects the latter and why. To motivate our analysis further, we start with plotting the average number of managers (weighted by the number of manufacturing firms in a given year) for the years 1990 to 2006[3]. **Figure 1** clearly points out that there has been significant growth in the number of managers per firm over this period of time. In 1990, an average Indian manufacturing firm had 0.1 managers, which increased

[3]We restrict our analysis to the year 2006 in this case in order to avoid the effects of the 2008-09 financial crisis.

to around 1.5 in 2006, an increase by a factor of 15. Next, we plot trends of the managerial compensation ratio (manager-to-total compensation ratio) and import penetration ratio of a firm (defined as the total imports of a firm) for the period 1990-2011. **Figure 2** presents yearly average–over all the manufacturing firms–of the total imports of a firm and the share of managerial compensation in total labor compensation. We use the share of managerial compensation as the indicator for the relative demand for managers. Both measures increase steadily over the period exhibiting a correlation of 0.69, which is significant at 5 per cent level. Taking a step forward and using the panel structure of the dataset, we show consistent and robust positive association between the total imports of a firm, more so in case of intermediate inputs, and the relative demand for managers. While this evidence is suggestive, but certainly not conclusive. We follow Guadalupe and Wulf (2010) and Goldberg et al. (2010) to exploit exogenous changes in the process of globalization in order to find a causal effect of trade liberalization on organizational structure. Our identification strategy exploits a quasi-natural experiment based on the trade reform process in India, started in the year 1991. Our experiment is the trade liberalization process in India, which started as a result of a sudden macroeconomic shock. This reform process led to significantly dropping of tariffs across all the manufacturing sectors of India (Goldberg et al., 2010; Khandelwal and Topalova, 2011). The important point here is that this reform process provides us with an arguably exogenous change in industry-level tariffs and with ample cross-industry variation.

We use this quasi-natural experiment and the differential changes in tariffs across industries in order to implement a causal relationship between trade liberalization and the relative demand for managers. We find that fall in tariffs are significantly associated with the increase in the relative managerial compensation. In particular, a 10 per cent fall in tariffs increase the relative demand for managers or the managerial compensation ratio by 1-4.4 per cent. This leads to a change in the organizational structure of a firm. Management layers of a firm increase by 6-13 per cent.

The results illustrate how firms redesign their organizational structure through a set of complementary choices in response to changes in their environment. We discuss several other possible interpretations of this change. In other words, we evaluate a number of other alternative explanations for the observed increase in demand for managers or managerial compensation ratio and assess the robustness of our benchmark result to additional specifications. In particular, we evaluate the role of management technology (Chen, 2013), R&D investments, skill premium, productivity and a host of other potential factors. We continue to find that the results are robust to alternative specifications and that increase in import

penetration ratio (in other words, fall in tariffs) leads to a higher share of managerial compensation and expands a firm vertically. Ma (2013) uses CEO-to-worker pay ratio for the U.S. firms to look at the widening income gap between the rich and the rest of the population. This is the only other study, which comes close to what we use as the dependent variable.

Our empirical result draws strong support from the theoretical prediction by Caliendo and Rossi-Hansberg (2012). They argue that firms' add more layers to the management in order to solve the problems relating to production decisions. Garicano (2000) and Garicano and Rossi-Hansberg (2004, 2006 and 2012) also model firms as knowledge-based hierarchies where managers deal with exceptions. Problems need to be solved in order for output to be realized. And, in order to solve problems, workers need knowledge. Since acquiring knowledge in costly, hierarchies are created where managers solve the less common problems and workers deal with the routine ones (Caliendo and Rossi-Hansberg, 2012). Firms economize on the use of knowledge by using the knowledge of the managers. For e.g., a larger firm has more than one management layers, where the higher the manager is in the hierarchy, the lesser common problem she/he faces. Since adding a layer of management is costly, as managers do not generate production possibilities, but only solve problems, therefore a firm adds a layer of management only if that firm is producing high enough output. Drawing inference from this argument, we argue that as a result of trade liberalization or fall in tariffs, firms imported more intermediate inputs to produce higher quantities/qualities of final output. This compelled the firms to employ more managers in order to help with their knowledge in using the high-quality imported inputs in the production process. Bloom et al. (2010) uses firm-level survey data of 4000 firms across 12 countries in Europe, North America and Asia to show that greater product market competition increases decentralization as tougher competition makes managers' information more valuable. We take a step ahead and decompose total compensation into wages and incentive-based pay. We find that product market competition significantly increases the bonuses of top management (representing approximately half of their total income), thereby allocating greater authority to the managers (Cunat and Guadalupe, 2009; Guadalupe and Wulf, 2010; Holmstrom and Milgrom, 1994). In effect, the firms who import perform better with the extra rents going to the executives and thereby increasing the compensation share of the managers. This indicates that incentive-based pay structures also play a significant role in increasing the share of managerial compensation in total compensation.

The paper significantly contributes to the small but important empirical literature on the

effects of product market competition on firm-level organizational design. All the studies on product market competition or trade liberalization and organization design uses developed countries as their case studies. Unlike them, we focus on a developing economy, which is India and show them trade liberalization can also bring vertical expansion to a firm. More generally, we observe that firms tend to vertically expand over time, regardless of trade. This observation is quite the opposite from what we observe in the cases of the US (Rajan and Wulf, 2006; Guadalupe and Wulf, 2010), German and Austrian firms (Marin and Verdier, 2014) and France (Caliendo et al., 2013), where manufacturing firms flatten over time irrespective of the trade shock. This further emphasizes the contribution of studying a developing economy in this context.

The paper is structured as follows. Section 2 outlines the details of the firm-level data we use. The empirical strategy is described in Section 3. Section 4 describes the effect of import penetration ratio on the organizational hierarchy. We look into the potential mechanism to explain the observed phenomenon in Section 5, while Section 6 concludes.

2 Firm-level Data

The foundation of our empirical analysis is based on Indian firm-level data for different manufacturing industries. This dataset gives detailed data on different layers of managerial compensation in addition to other important firm-level and industry-level characteristics. We discuss our dataset in detail below.

The primary data source for our analysis is the PROWESS database, which is maintained by the Centre for Monitoring the Indian Economy (CMIE), a govt. sponsored agency. This database contains information primarily from the income statements and balance sheets of the listed companies and publicly traded firms. It comprises of more than 70 per cent of the economic activity in the organized industrial sector of India and accounts for 75 per cent of corporate taxes and 95 per cent of excise duty collected by the Govt. of India (Goldberg et al., 2010). CMIE gives detailed information at the product level. It uses an internal product classification that is based on the Harmonized System (hereafter, HS) and National Industrial Classification (hereafter, NIC) schedules. There are a total of 1,886 products linked to 108 four-digit NIC industries across the 22 manufacturing sectors (two-digit NIC codes) spanning the industrial composition of the Indian economy. The U.S. manufacturing data contains approximately 1,500 products, as defined by the Standard Industrial Classification (SIC) codes, therefore, the definition of product in this case is slightly more detailed.

The PROWESS database contains information of about 27,400 publicly listed companies, of which almost 11,500 are in the manufacturing sector. We use information for around 8000 firms for our analysis. We use data for the years 1990 to 2011. Firms in the dataset are placed according to the four-digit 2008 NIC level, but are reclassified at the 2004 NIC level in order to facilitate the matching with the industry-level (four-digit) tariffs. The database covers large companies, companies listed on the major stock exchanges and also many small enterprises. Data for big companies is worked out from balance sheets, while CMIE periodically surveys smaller companies for their data. The sample of firms in PROWESS also presents a reasonably good aggregate picture in terms of activity in international trade (around 30-35 per cent). However, the database does not cover the unorganized sector. The variables are measured in Indian Rupees (INR) Million. We use an unbalanced panel for estimation. PROWESS has several features that make it particularly appealing and interesting for the purpose of our study and has several advantages compared to other available sources, such as the Indian Annual Survey of Industries (ASI) dataset. For e.g., it tracks a firm over a period of time, which helps us to see or measure the change in a firm's organizational design or structure. In particular, the dataset is in effect a panel of firms, which enables us to study their behavior over time. This dataset reports direct measures on total sales, exports, imports (divided into import of raw materials, import of capital goods, import of stores and spares and import of finished goods), research and development (R&D) expenditures, royalty payments for technical knowhow (technology transfer), capital employed, labour, gross value added, assets, ownership, etc. Around 20 per cent of the firms in the dataset belong to the Chemical and Pharmaceutical industries, followed by Food Products and Beverages (13.74 per cent), Textiles (10.99 per cent) and Basic Metals (10.46 per cent). We use the total imports (also divided into different categories) of a firm as the indicator for import penetration and our main variable of interest.

The database also provides detailed information on managerial compensation. This allows us to examine the dynamics of the organizational design of a firm over a period of time. The dataset disaggregates the compensation data by managers and non-managers, which enables us to look for the changes in the relative demand for managers. It further divides the managers group into - directors and executives[4]. Executive directors are the ones, who

[4]The executives are further divided into executive directors and non-executive directors. Executive directors have executive powers in a firm, such as the CEO, CMD, Managing Director, Chairman, etc. whereas Non-Executive directors are independent directors such as Chairman Emeritus, Nominee Chairman, Nominee Director. They are without any executive power and are kept as only to monitor the activities of a firm. The data on the compensation of the non-executive directors are very small percentage of the total

have executive powers in a firm, such as the CEO, CMD, Managing Director, Chairman, etc. Directors are defined as managers without executive powers, such as divisional directors or managers, as opposed to executives. In effect, directors are considered to be middle management, whereas executives are the top management. On the other hand, non-managers are those employees of a firm, who does not manage other workers. This unique feature of the dataset allows us to identify changes in the organizational design within firms' over a twenty-one year period that is characterized by significant trade liberalization process. More importantly, the dataset also provides variation in hierarchies across firms and industries, which enables us to exploit the within-firm within-industry heterogeneity and also to understand how different industries or firms react to trade shocks. **Figure 3** plots the average share of managerial compensation in total labor compensation across two-digit industries for the period of 1990-2011. The figures clearly points out the heterogeneity involved across different industries within the manufacturing sector – from a low of approximately 1.5 per cent to 9 per cent. This is also evident when we measure changes over time. While in some industries the average annual rate of change is around 10 per cent, in some it is even higher than 200 per cent. It provides us with large amount of differences across industries, which we exploit in our rigorous empirical exercises later. This would eventually translate to the firm level, where such variation is even more prominent. One key related characteristic is that close to 25 per cent of Indian manufacturing firms' report of having no managerial layer (in the form of reporting zero, or otherwise sufficiently low, managerial compensation). This is consistent with the family-oriented Indian firm culture (Bloom et al., 2013).

An observation in the dataset is the total managerial compensation divided by total labor compensation of a firm in a year. The total managerial compensation includes both middle and top management. The data for compensation of each of the management layers include all the components of compensation – wages and incentives (contribution to provident fund, performance related pay i.e., bonus/commission, perquisites, retirement benefits etc.). We use this information to estimate the effect of import penetration on the changes in the relative demand for managers and organizational design. As for the latter, we focus on two different characteristics that are discussed in the theoretical literature on organizational economics: depth of hierarchy, i.e., change in the management layers and span of control. Our measure of the depth of hierarchy is defined as the number of management layers in a firm, which represents the vertical dimension or steepness (Garicano, 2000). It is defined according

compensation data on executives, about 3-4 per cent. The results remain the same, even when we drop this classification from our managerial compensation.

to the managerial powers of the employees of a firm and at three different levels - top management (CEO, CMD, Managing Director, Chairman) who has the power to undertake executive decisions, middle management (Department Heads/Managers, Deputy Manager) and workers (with no managerial powers).

The other measure, span, is a firm-level measure that captures the horizontal dimension or breadth of the hierarchy (Garicano, 2000). We measure span by the firm scope or the number of products produced. This helps us to understand how a firm changes its scope of operations over time. Firms may diversify its operations as a result of the trade liberalization and as a result change their organizational design. Goldberg et al. (2010) using the same firm-level data from India points out that import penetration or trade liberalization led to an average of 31 per cent of the new products introduced. However, one obvious question arises when using this variable: does information on the number of products reflect the span of the organizational design or structure of a firm? We duly acknowledge that this is not the perfect measure in order to measure or investigate the change in the horizontal dimension of a firm. The ideal would have the information on the number of the divisions of a firm. However, given the limitations of the dataset, this is the best we can come up with. Guadalupe and Wulf (2010) also highlights that firms' flatten as a result of the reductions in firm scope. Introducing new product(s) adds new responsibilities and problems (in the process of producing them) and this would certainly force a firm to decentralize their operations in order not to overburden the existing set of managers and employ new managers with the knowledge of solving these new problems in order to carry out the production process successfully. This may also add layers to the management. See **Table 1** for summary statistics of the final sample.

3 Trade and the Relative Demand for Managers

In this section, we introduce the analytical framework and the empirical strategy to investigate the relationship between trade and the relative demand for managers. Our main focus is on the total imports of a firm, as in Cunat and Guadalupe (2009) and Guadalupe and Wulf (2010). We use imports mainly because of two reasons: first, it helps us to establish a causal link between the import penetration ratio and managerial compensation ratio, thereby going beyond the results based on conditional correlations; secondly, the case of import penetration allows us to better understand the underlying mechanism about the changes in organizational design as a result of trade liberalization.

We start by constructing an analytical framework, from which we derive a testable empirical specification. Then, we test this framework firstly by providing some reduced form evidence based on conditional correlations, and finally establishing the causal link.

3.1 Analytical Framework

We follow the framework of Berman et al. (1994) on the demand for skilled-labor for US manufactures and apply to our case. Production requires three inputs: managers (m), non-managers (n), and imports (M). Following Garicano (2000) and Caliendo and Rossi-Hansberg (2012), we argue that firms are knowledge-based hierarchies and managers provide knowledge to the production process of a firm. In particular, managers are problem solvers and deal with less common problems. On the other hand, non-managers or workers deal with routine problems. Workers or non-managers use their time to generate a production possibility based on the available intermediate inputs. In order to produce output based on the given set of inputs, a firm needs to solve a problem, which requires knowledge. Trade liberalization (in the form of import penetration) significantly increases the set of choice of inputs by a firm thereby increasing its production possibilities. This requires either more managers (problem solvers) or non-managers (workers) or both. This depends on the type of inputs used by a firm. In particular, each production possibility is linked to an input drawn from some cumulative distribution. The output or the production possibility may require more knowledge, which would increase the relative demand for managers. Since, acquiring knowledge is costly and in general, it is not efficient for a firm to make workers or non-managers learn about how to solve problems, hierarchies are created by hiring more managers. Firms economize on the use of knowledge by leveraging on the knowledge of the managers (Caliendo and Rossi-Hansberg, 2012).

We use this production technology into an economy, where there is monopolistic competition and agents have CES preferences. The price of imports is determined in the international market and taken as given by the local firms. M is, therefore, assumed to be a quasi-fixed factor. Conversely, m and n are variable inputs. Hence, variable costs are given by $c = w_m \cdot m + w_n \cdot n$; w_m and w_n being the wage rates of managers and non-managers, respectively. If m and n are the $argmin$ of costs, then c is the cost function. The logarithm of c can be approximated by a translog cost function:

$$\begin{aligned}\ln(c) &= \alpha_m \ln(w_m) + \alpha_n \ln(w_n) + \alpha_M \ln(M) + \alpha_y \ln(y) + \\ &+\frac{1}{2}[\beta_{mm} \ln(w_m)^2 + \beta_{mn} \ln(w_m) \ln(w_n) + \beta_{nm} \ln(w_n) \ln(w_m) + \beta_{nn} \ln(w_n)^2 + \\ &+\beta_{MM} \ln(M)^2 + \beta_{yy} \ln(y)^2] + \gamma_{mM} \ln(w_m) \ln(M) + \gamma_{my} \ln(w_m) \ln(y) + \gamma_{nM} \ln(w_n) \ln(M) \\ &+\gamma_{ny} \ln(w_n) \ln(y) + \gamma_{My} \ln(M) \ln(y)\end{aligned}$$

where y is output. Symmetry implies $\beta_{mn} = \beta_{nm}$. And, by Shephard's lemma, $\partial c/\partial w_m = m$, so that the cost share of managers is:

$$S \equiv \frac{w_m m}{c} = \frac{\partial \ln(c)}{\partial \ln(w_m)} = \frac{\partial c}{\partial w_m} \frac{w_m}{c}$$

Using this in the translog we get:

$$S = \alpha_m + \beta_{mm} \ln(w_m) + \beta_{mn} \ln(w_n) + \gamma_{mM} \ln(M) + \gamma_{my} \ln(y)$$

By linear homogeneity of cost with respect to prices, cost shares are homogenous of degree zero. Therefore $\beta_{mm}+\beta_{mn} = 0$. In addition, also by the linear homogeneity of the production function we have $\gamma_{mM} + \gamma_{mM} = 0$ (increasing all inputs by same factor increases output by same factor, but this should not affect the cost share). Using these two properties gives us:

$$S = \alpha + \beta \ln\left(\frac{w_m}{w_n}\right) + \gamma \ln\left(\frac{M}{y}\right) \tag{1}$$

The compensation share of managers ($w_m m$) in total labor compensation (c), S, is affected by the managers to non-managers wage ratio, and the output share of imports. Due to the limitations of the dataset we use about not having the wage rates for managers and non-managers, we follow Berman et al. (1994) and assume that the quality-adjusted price ratio of managers to non-managers does not vary across industries. This would then add to the constant term (α) thereby shifting up the intercept. Nonetheless, as in Michaels et al. (2014), we add industry-year fixed effects, which will absorb the relative wage term in case when the above assumption is relaxed. We, therefore are left with the following outcome:

$$S = \alpha + \gamma \ln\left(\frac{M}{y}\right) \tag{2}$$

We use Equation (2) as the empirically testable specification that links output share of imports, and the share of managers' compensation in total labor compensation. We regard

the latter as the relative demand for managers in our empirical specification. We take this framework and estimate using data on managerial compensation and other important firm-level attributes. We describe our empirical strategy below in detail.

3.2 Empirical Strategy

We use the above framework to examine our main hypothesis – whether import penetration significantly affects the relative demand for managers? In other words, how does trade liberalization changes the compensation ratio for the managers? We exploit the reduced form or empirical version of Equation (2) using OLS fixed effects type of estimation, for firm i, at time t:

$$(\frac{Mcomp}{Tcomp})_{it} = \alpha + \ \beta * \ln(\frac{M}{GVA})_{it} + \gamma \mathbf{X}_{ijt} + firmcontrols + \delta_i + \eta_t + \epsilon_{it} \tag{3}$$

where, $Mcomp$ is the total compensation for the managers' and $Tcomp$ is the total labor compensation. We use the share of managerial compensation in total labor compensation as the dependent variable for our analysis. Our main variable of interest is $\frac{M}{GVA}$, where M is total imports of a firm and GVA is the gross value added and β is the coefficient of interest. β measures the effect of the import penetration or the trade liberalization exercise by India on the relative demand for managers for the manufacturing firms.

$\mathbf{X}$ is a vector of industry and firm-level controls, such as skill-intensity, management technology, gross value-added, productivity, capital employed by a firm etc. $firmcontrols$ includes the age of a firm (older firms may have a more established structure and culture, hence controlling for potential differences in the flexibility of undertaking organizational reforms), technology adoption, size of a firm and ownership dummy. By technology adoption, we mean the sum of research and development (R&D) expenses and technology transfer (payment made towards technical knowhow) of a firm. We use natural logarithm of total assets as the indicator of size of a firm. Ownership dummy is a binary variable, which indicates whether it is a domestic or a foreign firm[5]. δ_i are firm fixed effects, which absorb any permanent cross-sectional division/firm/industry differences, whereas, η_t are time dummies. ϵ_{it} is the error term. Chamarbagwala and Sharma (2011) notes that delicensing process of

[5]We do not specifically control for mergers and acquisitions in our empirical strategy. But, if there has been a merger or acquisition by a firm, the data will show separate entry for the different firms involved in the merger or acquisition. It will not be an aggregated figure.

the Indian industries (a part of the overall reform process) also helped the firms to upgrade their skill quotient. We address this concern by controlling for industry-specific time trends that absorb the industry secular trends. In effect, we investigate the different determinants of the relative demand for managers', measured through the share of managers' compensation in total labor compensation.

All the variables are measured in millions of Rupees and deflated to 2005 prices using the industry-specific Wholesale Price Index (WPI).[6] **Appendix A** describes the variables used in our empirical estimations. **Table 1** provides the descriptive statistics of the variables used. Panel A gives the different types of organizational characteristics of a firm, whereas Panel B rolls out the explanatory variables or the determinants of the change in the organizational design of a firm. **Table 2** computes the conditional correlation between the share of managerial compensation and imports, with imports being further divided into four different categories - import of raw materials, import of capital goods, import of stores and spares and import of finished goods. Column (1) of the correlation matrix shows that the total imports of a firm and share of managerial compensation of firm is significantly correlated at the 5 per cent level. Columns (2) - (5) divide total imports into several categories outlined above. The numbers point out that the correlation is most strong in case of import of capital goods (0.03) followed by import of raw materials (0.01) with no significance for import of stores and spares and finished goods. Nonetheless, these numbers are merely suggestive and not conclusive, unless we do not control for any other policy effects and firm and industry-level attributes.

However, the imports of a firm can also clearly be influenced by the managers hired by a firm. For e.g., highly knowledgeable managers may influence a firm's decision to buy more specialized intermediate inputs in order to create complex production problems, only to be solved by them, which in turn could increase their compensation thereby increasing their share of compensation in total compensation. Therefore, in order to control for the reverse causality problem, we utilize the quasi-natural experiment of India's trade liberalization process started in the year 1991-92 due to some exogenous macroeconomic shock in 1990-91, where tariffs were substantially reduced across all the manufacturing industries. We discuss this in detail below.

[6] We use data on industrywise WPI from Alcott et al. (2014).

3.2.1 Endogeneity of Imports: Utilizing the Trade Reform in India

As a consequence of the macroeconomic shock (Balance of Payment Crisis) during the end of 1990, India started a process of unilateral trade reform: deregulation of the manufacturing industries and reducing tariffs. This turn of events present a clear evidence of a quasi-natural experiment, which has important advantages for our empirical strategy. Since the start of the reform process was highly improbable and unexpected, it can be interpreted as an exogenous shock. Furthermore, there were no other significant shocks during that period so that the macroeconomic shock is unlikely to be confounded with other factors.

One of the main objectives of this study is to establish a causal link between import penetration and the relative demand for managers. In order to evaluate such association, we exploit the trade reform process as the quasi-natural experiment. Prior to 1990, India was one of the most trade-restrictive economies in Asia, having both high tariff and non-tariff barriers. In 1991, India turned to the IMF, following a balance-of-payments crisis. The latter conditioned such assistance on the implementation of a major adjustment program, which included liberalization steps that would abandon the restrictive trade policies. As a result, average tariffs fell from more than 87 per cent in 1990 to 43 per cent in 1996 (Khandelwal and Topalova, 2011) and non-tariff barriers dropped from 87 per cent in the late 1980s to 45 per cent in the mid- 1990s (Goldberg et al., 2010). And, if we consider the entire period, 1990-2011, the average drop in tariffs across the manufacturing industries is by around one-tenth. And, there is also significant heterogeneity involved in the reduction in tariffs across different industries, which we would likely to exploit extensively in our empirical exercises.

The trade reform process presents several advantages, which makes it appealing for the purpose of this study. First, the macroeconomic crisis that led to the adjustment program was triggered by external events, such as the sudden increases in oil prices, drop in remittances from Indian workers abroad, and major political occurrences (the murder of Rajiv Gandhi, for instance) that damaged foreign investment. These led to the sudden start of the reform process, which was not anticipated by the Indian firms. Second, the liberalization process did not target industries within the manufacturing sector in any way that was related to pre-reform conditions. Khandelwal and Topalova (2011) show that changes in industry-level tariffs as a result of the reform are not correlated with pre-reform industry characteristics. Further, they also show that the tariff change during the years 1991-1997 are not correlated with the firm or industry-level performance indicators. We follow Khandelwal and Topalova (2011) and restrict the causal analysis to the said period. However, we also utilize the entire period (1990-2011) to see whether the result holds as, firstly, our dependent variable is not a

firm or an industry-level performance measure, and secondly, our dependent variable is not significantly correlated with any performance measure, such as productivity, etc.

We use tariff data from Ahsan and Mitra (2014). Industry-level tariff data are categorized according to 1987 NIC code, but reclassified to 2004 NIC to match with our firm-level dataset. The data from Ahsan and Mitra (2014) runs from 1989 to 2003. We update our database (for the period 2004 to 2011) using HS six-digit level tariff data from WITS. The tariff data in WITS are given for the years 2004, 2005, 2007, 2008 and 2009. We use the same level of tariffs for the year(s) before which there is data available. For e.g., we assume the same rate of tariffs for the years 2010 and 2011 as 2009. Likewise for the year 2006, which is same as 2005. We match the HS six-digit level tariff data with our firm-level data by using the Debroy and Santhnam (1993) concordance table on matching trade codes with industrial codes.

4 Results

4.1 Basic Results

Table 2 produces our benchmark result. It examines the determinants of the relative demand for managers, measured through the share of managerial compensation in total labor compensation. In particular, it establishes the conditional correlation between the import penetration ratio and the relative share of managerial compensation in total labour compensation of a firm. Columns (1) - (3) exploit the full dataset. In particular, it uses an annual panel of 7845 manufacturing firms spanning across all the industries (105 industries at the NIC four-digit level) over the period of 1990-2011. Column (1) regresses the share of managerial compensation on total imports of a firm without controlling for its size, age, ownership and technological capacity. The total imports of a firm is a sum of import of raw materials, capital goods, stores and spares and finished goods. Our point estimate shows that import penetration ratio or trade liberalization significantly increases the share of managerial compensation in total labour compensation of a firm. The higher the imports of a firm are, the higher the demand for managers. Column (2) includes size, age, ownership and technological capacity of a firm. The size of a firm is the natural logarithm of total assets of a firm. Ownership is indicated by a binary variable, which takes a value 1 if it is a domestic firm and 0 otherwise. The technological capacity is measured as the sum of R&D investments and the payment towards technical knowhow. As the estimate demonstrates, it does little

to change the outcome. Import penetration continues to positively and significantly affect the compensation of the managers of a firm. Column (3) additionally uses the interaction of the industry and time fixed effects. These interactions will specifically control for (a) other macroeconomic reforms that India encountered in the 1990s, such as the delicensing process of the Indian industries, the FDI-liberalizing phenomenon; (b) different types of characteristics across industries, such as, wage-rate ratio or the ratio of working hours of the managers and the non-managers, different kinds of labor laws (Besley and Burgess, 2004), etc. Our benchmark result stays the same. In a nutshell, a 10 per cent increase in the import penetration ratio (M/GVA) of a an average Indian manufacturing firm leads to a growth in the share of managerial compensation ($\frac{Mcomp}{Tcomp}$) by around 1 per cent.

In columns (4) - (5), following Goldberg et al. (2010), we shorten our sample period to 1990-1997. They argue that this is the period when the trade reform process was completely exogenous. The sample of firms drop signficantly. However, the estimate stays positive and significant at the highest level. Overall, the results from columns (1) - (5) indicate that our main result is outstandingly robust to different estimation techniques and time periods.

In columns (6) - (9), we follow the argument by Goldberg et al. (2010, 2013) that the growth in total imports as a result of the trade reform in India is driven by import of production units and not final consumtion goods. In column (6), we divide total imports of a firm into different categories: raw materials, capital goods, stores and spares, and finished goods. The first two represents intermediate inputs, while the other two being non-inputs. We estimate Equation (3) by putting all these four groups together. We observe a clear pattern. The aggregate effect of the import penetration ratio on the managerial compensation ratio, which we find previously is apparently driven by the imports of raw materials and capital goods. Although the capital goods cannot be disaggregated further, our patterns are consistent with Bloom et al. (2014), who finds that ICT capital increases a manager's span of control (and hence indirectly their demand). Conversely, import of stores and spares and finished goods do not bear any significant effect on the managerial compensation. We also use these different classifications of import categories separately and the result remains the same (not reported). In column (7), we aggregate the import of raw materials and capital goods into the category of import of intermediate inputs. The effect is highly positive and significant. Column (8) sums up the import of stores and spares and finished goods. As the point estimate demonstrates, we do not find any effect of the non-production inputs on the demand for managers. The point estimate is statistically indistinguishable from zero. Lastly, column (8) put both these aggregated imports together.

The effect of the import of production or intermediate inputs continue to hold significantly. Higher import of production inputs, which are supposed to be of high quality, tend to create not-so-common problems when using in the production process. This forces a firm to employ more managers, who have specialized knowledge to solve these exceptional problems and help a firm to realize the targeted output. These results point out a strong correlation between the import penetration ratio and the managerial compensation ratio. The next section establishes the causal effect of the import penetration ratio on the relative demand for managers by utilizing the trade reform process in India as a result of the macroeconomic shock. We discuss this in detail below.

4.2 Causal Effect

Until this point, what we have established is the conditional correlation between import penetration ratio and demand for managers or change in the organizational design of a firm. However, there is a serious econometric concern that may raise doubt over the validity of our established result. The most notable of them being the potential endogeneity of the import peneration ratio to the relative demand for managers. In particular, the problem of reverse causality. Newly appointed experienced/skilled managers may open different production opportunities for the firms', which could lead them to import more inputs in order to carry out the required production. This could contaminate our findings. Therefore, a key question here is to establish a causal relation between the relative share of managerial compensation and import penetration. We address this concern in this section by utilizing the exogenous nature of India's trade reform during the 1990s. In particular, facing a sudden macroeconomic shock, India started to substantially liberalize its tariffs. We exploit this phenomenon and use input tariffs as the instrument for our main variable of interest, import penetration. **Table 4** establishes the causal effect.

Our exercise builds on a plausible and key assumption: drop in tariffs during the trade reform affect the managerial compensation only through their effect on imports. To do so, we follow Khandelwal and Topalova (2011), who finds that during the period of 1991-1997 the drop in tariffs were completely exogenous. In other words, they were not correlated with the key industry-level characteristics, such as productivity and output. They mentioned that there might be some association between the drop in tariffs and the industrial characteristics in the years after. Following their argument, we first restrict our analysis for the causal effect to the period of 1990-1997 (as in for instance, Goldberg et al., 2010). We estimate the causal

relation using the following reduced-form equation:

$$(\frac{Mcomp}{Tcomp})_{ijt} = \alpha + \ \beta * \ln(InputTariff_{jt-1}) + \gamma \mathbf{X}_{ijt} + firmcontrols + \delta_j + \eta_t + \epsilon_{ijt} \quad (4)$$

$InputTariff_{jt-1}$ is the input tariff of industry j at time $t-1$. Input tariffs are obtained from Ahsan (2014) at NIC 4-digit level. Columns (1) - (5) of **Table 4** establishes the causal effect of import penetration on the relative demand for managers using 1990-1997 as the time period. Column (1) regresses the share of managerial compensation on the one-year lagged values of input tariffs. Lower tariffs entail higher share of managerial compensation. The point estimate shows that the effect remains outstandingly similar to the OLS results. Treffler (2004) argues that one source of tariff endogeneity is that declining industries may have high tariff levels. He addresses this concern by using industry-specific trend. Column (2) follows Trefler (2004) and additionally controls for the interaction of industry fixed effects and time trend. The effect increases substantially. We use lagged dependent variable as one of the explanatory variables in column (3). Our primary result continues to hold significantly. Column (4) estimates the above reduced-form equation in first difference. Drop in tariffs is significantly associated with increase in the managerial compensation ratio. We estimate the dynamic version of the model using the standard Arellano-Bond procedure (Arellano and Bond, 1991) in column (5). The procedure uses lagged value of the dependent variable as one of the explanatory variable and all controls are instrumented using their respective lagged values. The results point out that a 10 per cent increase in import penetration ratio increases managerial compensation by 1-3 per cent.

Columns (6) - (10) repeat columns (1) - (5) with the time period as 1990-2011. The results are exactly the same as the outcomes for 1990-1997. Fall in tariff rates help to significantly increase in the managerial compensation ratio.

So, what is the economic rationale for such an outcome? In particular, why do fall in tariffs or imports have a positive effect on the demand for managers? India's trade regime was among one of the most restrictive in Asia. The import of final goods were restricted with high tariffs on import of inputs. The trade liberalization program as a result of the significant drop in the input tariffs opened up a wide range of choice for the firms', especially when choosing their input basket. A report from Dept. of Commerce, Govt. of India suggests that the import to GDP ratio in case of India increased from 7.6 in 1990 to 11.6 in 2000. Goldberg

et al. (2010) also show us that a significant fraction of the growth in imports is concentrated in products classified as production inputs[7]. Mukherji (2009) also points out that the growth in imports in case of India happens as a result of the growth in extensive margin. In other words, the growth in imports in mainly driven by the growth in intermediate inputs. In addition, an important feature of this phenomenon is that a large number of these imported production inputs are of high-quality and have been sourced from the OECD countries that were not previously imported prior to the reform. In addition, among all the intermediate inputs imported, around 70 per cent of the goods have been sourced only from the OECD countries (Goldberg et al., 2013). Moreover, in the context of an emerging economy or developing country, there is a general belief that imported inputs are of better quality than domestic inputs. Kugler and Verhoogen (2012) show that imported units tend to have higher unit values than domestically produced products. And, this feature is most true for import of inputs from OECD countries, as products produced in the OECD countries tend to be R&D intensive and of higher quality (Eaton and Kortum, 1995). This would certainly lead a firm to face different set of production possibilities and more so, creating a new set of not-so-common problems. Since, knowledge is expensive and it is also certainly not efficient to make learn the existing workers about the new problems, new managers (with specialized knowledge) are hired. These new managers helped the firms' to solve these exceptional problems and realize the production possibilities.

4.3 Additional Specifications and Controls

In **Panel A** of **Table 5**, we use some additional specifications about the causal effect of the trade liberalization on the managerial compensation ratio. Columns (1) and (2) of **Table 5** repeats columns (1) and (2) of **Table 4** by aggregating the share of managerial compensation or the independent variable to the industry-level. We continue to find robust result of the causal effect of trade liberalization on the relative demand for managers. The estimates increase significantly as it is aggregated at the industry-level. Lastly, we use an external instrument following Bloom et al. (2012). In particular, we exploit Chinese

[7] Goldberg et al. (2013) highlights that while the growth of final products increased substantially, by 90 per cent, increase in import of production inputs are more phenomenal: import of basic products, capital goods and intermediate products increased by 260, 125 and 297 per cent, respectively. These numbers prove that India's import growth following the trade liberalization exercise is driven primarily by import of components required for production as opposed to final goods. In a later section, we will also divide imports into several categories (inputs and final goods) to show that the effect on the demand for managers is concentrated on the effect by the production inputs.

exports to the World minus India as our external instrument. The idea here is to utilize the product market competition effect. India and China are fierce competitors in the world market in many product categories, such as leather, apparel, textiles etc., especially in the non-durable goods category. And, this may force the Indian manufacturing firms to import more high-quality intermediate inputs and export goods, which are of higher quality in order to maintain their market share or even to increase it. This in turn would indirectly affect the managerial compensation. The estimates from columns (3) and (4) prove our hypothesis to be true. Product market competition continues to positively and significantly affect the demand for managers.

Panel B of **Table 5** tests the robustness of our benchmark result by controlling for some additional characteristics, both at the industry and firm-level. Columns (5) - (6) use industry-level factors, whereas, columns (7) - (9) exploits firm-level controls. Column (5) introduces skill-intensity of an industry. Goldberg and Pavcnik (2007) find that trade liberalization increases demand for skill in developing economies. And if managers are hired because they are more skilled, then our benchmark result will simple be a consequence of an increase in the relative demand for skill. In order to test for this, we use the industry-level (at 2-digit) ratio of production to non-production workers as an indicator for skill-intensity.[8] The higher the ratio is, the higher is the skill-intensity of that particular industry. Given the limited availability of the data, we interact the skill-intensity measure with our main variable of interest, $InputTariff_{jt-1}$. Otherwise, using industry-level fixed effects would completely absorb the variation in the skill intensity measure across several industries. We do find some significant effect of the skill-intensity measure explaining the relative demand for managers, but the magnitude of the effect is one-half of the import penetration measure.

Another potential channel, which may affect the demand for managers, is the management technology of a firm. In a recent study, Chen (2013) studies the relation between trade liberalization and management technology. He asserts that better management technology requires a higher volume and quality of managers and this could lead to an increase in relative demand for managers. We follow Chen (2013) and use a proxy management technology indicator exploiting a cross country-industry management survey done by Bloom et al. (2010). They survey a large number of firms in various manufacturing industries across different countries (India, being one of them) in the year 2004 and construct a measure for management quality in different manufacturing sectors. This is a composite index, between 1 and 5, with 5 representing the best quality of management. We estimate the effect of

[8] This variable has been sourced from Ahsan (2013) and the ratio is available only for the year 1998.

management technology in the same way we measure skill-intensity, since this measure is also available for only one single year. Column (6) introduces the management technology and its interaction with the tariffs as one of the explanatory variables. We do not observe any effect of management technology explaining the managerial compensation ratio. Our coefficient of interest remains stable.

Setting up more plants would require more managers, as the local managers' knowledge may be valuable. This could push up the managerial compensation. We use the number of plants or factories according to two-digit industry and its interaction with input tariffs. We do not find any effect of the number of plants on the managerial compensation of a firm. Lastly, we examine whether an increase in the average wage across industry can explain the increase in the share of the managerial compensation ratio. We also do not find any such evidence (results not reported). Both these measures are only available for the year 1998.

Next, we also use some firm-level controls to examine whether controlling for firm-level characteristics could explain the increase of the compensation of the managers in total compensation. We start by following the literature on trade liberalization and firm-level productivity, which suggests that trade liberalization increases firm productivity substantially (Khandewal and Topalova, 2011). On the other hand, Hsieh and Klenow (2009) estimates that the ratio of total factor productivity (TFP) of the 90th to the 10th percentile of firms in India is 5, whereas Bloom et al. (2013) finds that better managed firms are significantly more productive. Putting these together, we hypothesize that quality of management of a firm may be correlated with the productivity level. We test this by using two different controls. Column (1) introduces the gross value-added (GVA) of a firm.[9] Higher GVA implies greater productivity. GVA of a firm is defined as the total sales minus the total raw material expenditure. We do not find any such evidence of higher productivity explaining the managerial compensation ratio. Next, in column (8), we use a more direct and precise measure of TFP. We estimate TFP using the Levinshon and Petrin (2003) methodology.[10] The methodology controls for the potential simultaneity in the production function by using a firm's raw material inputs as a proxy for the unobservable productivity shocks. Like column (7), we continue to find no effect of productivity on the relative share of managerial compensation.

Lastly, we explore the potential association between managers and capital intensity.

[9] This is equivalent to relaxing the assumption of constant returns to scale in production in our analytical framework.

[10] See Levinshon and Petrin (2003) for further details.

Griliches et al. (1969) points out that capital is complementary to skilled labor. This observation has been studied extensively in the literature (Krusell et al., 2000). If the stock of managers of a firm is correlated with the stock of skilled labor, and on the other hand imports increase a firm's capital stocks, then in effect what we might capture is simply the evidence of having a capital-skill complementarity technology. In particular, we test whether a change in relative demand for managers is a consequence of a change in a firm's capital stock, following a shock by import penetration. In order to check this, column (9) uses capital intensity of a manufacturing firm as an additional explanatory variable.[11] Capital Intensity of a firm is defined as the amount of capital employed divided by the GVA. We do find some evidence that capital intensity of a firm is significantly correlated with managerial compensation or the demand for managers. However, our coefficient of interest remains stable.

4.4 Other Firm Characteristics

We now take a step further and look into other firm and industry-level characteristics to investigate which type of firm or industry characteristic(s) is(are) driving the main result. The results are presented in **Table 6**. We use the data for the entire period, i.e., 1990-2011.

Columns (1) and (2) in **Table 6** divides the sample into exporters and non-exporters to understand whether there is a premium attached to an exporting firm. As the results show, the effect of import penetration on the demand for managers is observed for both the exporters and non-exporters. However, the effect is slightly stronger in case of the exporting firms, but the difference is not significant. The results point out to an interesting outcome. The change in the organizational design is not only restricted to the group of exporters, rather it spans across the entire set of manufacturing firms. This is unlike the other cases, where the change in organizational design as a result of the import competition concentrates only on the exporters. In case of India, it seems that the entire sector of manufacturing firms has undergone a change in their organizational structure.

Next, we categorize firms according to their end use - consumer non-durable, intermediate, basic, capital and consumer durable goods. We follow Nouroz (2001) and match our firm-level dataset with the Input-Output classification. Columns (3) - (7) produce the required result. The five different point estimates show us that the effect of the trade lib-

[11] This is equivalent to adding capital (k) as an additional quasi-fixed factor to the framework established previously. Such an addition yields an extra term, $ln(k/y)$, in the RHS of the Equations (1) and (2).

eralization on the demand for managers concentrates only on the consumer non-durable sector, with no effect on the intermediate, capital, basic and consumer durable goods sector category.

Column (8) investigates the role of the size of a firm. More specifically, is the increase is the relative demand for managers' concentrates in one section of firms or it differs across the size distribution? We divide the firms according to their size. We use total assets of a firm as the size indicator. We use the following method: if the total asset of a firm is less than the 25th percentile of total assets of that industry, that firm belongs to the 1st quartile. Likewise, if a firm's total asset falls within 25th to 50th, 50th to 75th and greater than 75th percentile, it falls into the category of 2nd, 3rd and 4th quartile respectively. Since firms could move across quartiles over time, we use the average rank of the firms for the period of analysis. In order to find out the required effect of import penetration, we interact the input tariffs with the respective quartiles. The result shows us that the change in organizational structure (more demand for managers) is significant across the firm size distribution, thereby pointing out that there is no size effect.

Lastly, we look into the ownership categories of an Indian manufacturing firm. We divide firms into three different groups - domestic and private owned, domestic and public (Central Govt. or State Govt.) and foreign owned. The coefficients of interest in columns (9) - (11) tell us that the main result is entirely driven by the change in the managerial compensation ratio in the domestic and privately owned firms. While it is not entirely unexpected that privately-owned firms have undergone a change in their organizational structure, it is nevertheless surprising to see that only the domestic firms are the main drivers of change in the overall organizational reform observed and not the multinationals.

4.5 Pay Structure

In this section we seek to investigate the effect of the import penetration on the structure of compensation by dividing compensation into wages and incentives or bonuses. For this, we look into the compensation structure of the managers and non-managers. We use this classification to understand which component of the compensation has been affected by the import penetration. We estimate the following equation in order to do the same:

$$Y_{ijt}^{d} = \alpha + \ \beta * \ln(InputTariff_{jt-1}) + \gamma \mathbf{X}_{ijt} + firmcontrols + \delta_j + \eta_t + \epsilon_{ijt} \qquad (5)$$

where Y_{ijt}^{d} is either wages or incentives/bonuses, $d \in \{\text{Managers and Non-managers}\}$. The rest is the same as the Equation (3). We estimate the above equation for each of the two different layers separately. We use the full sample period, 1990-2011.

Columns (1) - (2) of **Table 7** segregates the compensation for managers into wages and columns (3) and (4) look into incentives or bonuses. Wages is the pre-determined part of the total compensation received by the employees. Bonuses, on the other hand, are incentive-based and in most of the cases, they are linked to performance. The estimates show us that the increase in the wages is almost similar across different levels of management, i.e., the managers and the non-managers have the same kind of increase as a result of the product market competition. This result is in line with the Stolper-Samuelson prediction. Opening up to trade would lead to gains in the most relatively in the abundant factor. Ahsan and Mitra (2014) examining the share of wages in the total revenue of a firm as a result of the trade reform process suggests that trade liberalization led to an increase in labor's share in revenue for small, labor-intensive firms but a reduction in this share in the case of larger, less labor-intensive firms.

Analyzing performance-based pay in columns (3) - (4) however, changes the picture. We observe a large difference in the increase in managerial bonuses compared to the non-managerial layer. The increase in the incentives for the managers is highly significant, whereas, we do not observe any significant increase for the non-managers. This result indicates that the increase in the relative demand for managers is largely driven by an increase in executive bonuses or incentives. By looking further into the data, we find that the incentive-based pay for the non-managers is less than 1 per cent in average, whereas it is around 57 per cent for the case of the top management level or the executives. This finding is quite similar to the results reported by Cunat and Guadalupe (2009). They also find that import penetration increases the sensitivity of pay-to-performance of US executives significantly. Overall, the results support the argument of Bloom et al. (2010). Competition forces a firm to pay their managers more by increasing their incentives substantially in order to utilize their specialized knowledge.

To this point what we are able to establish is the significant and robust conditional and causal effect of import penetration on the relative demand for managers. This result carries significant implications for the organizational design of a firm. It could change the organizational structure of a firm. We discuss this in detail in the next section.

5 How does Trade affect the Organizational Design of a firm?

The literature on the impact of trade and organizational structure points out that trade can affect organizational design in two ways: (i) it can help a firm to grow horizontally, i.e., it increases a firm's span of control. Guadalupe and Wulf (2010) focusing on 300 corporate firms in the U.S. concludes that product market competition has led to the increase in the span of control of the CEO of a firm. This could act as a driving force behind the increased demand for managers; and (ii) expansion in the vertical layers or increase in the depth of the hierarchy of a firm. Using the theoretical model of corporate hierarchy from Garicano (2000), Caliendo and Rossi-Hansberg (2012) points out that trade liberalization leads to an increase in the number of vertical layers, which in turn could increase the relative demand for managers.

However, before starting to investigate how trade affects the organizational design of a firm, we would like to explore an important issue, which may drive the managerial compensation ratio upwards: reclassification of workers. It could well be possible that since delicensing is also a part of the broad reform agenda, and during this process firms' just reclassified some of their workers as managers. And this could increase the share of their compensation in total compensation and in turn change the organizational design. To show that this is not the case, we take the following step. If reclassification is the only reason behind the increase in the managerial compensation, then there is no reason *apriori* to believe that it should only be constrained to the firms which import. It should be a general or overall phenomenon across the entire set of manufacturing firms. In order to show that reclassification is not the phenomenon, which can explain the increasing share of the compensation of the managers, we plot the ratio of the managerial compensation to the total compensation for both set of firms: the firms which import and those do not. **Figure 4** shows us that such is not the case. We do not observe same pattern of increase in the managerial compensation ratio for the firms which do not import as when compared to the importing firms. Further, it could also be possible that the aggregate effect is driven by the large firms. That is to say that the outcome would have been different when we look at firms of different size. We plot he share of managerial compensation in total compensation across four different size quartiles for import-using firms and non-import-using firms in **Figure 5**. We continue to find that reclassification of workers do not explain the increase in the share of the managerial compensation. Now, we investigate the effect of the trade reform on the horizontal and vertical

expansion of a firm in the next section.

5.1 Horizontal and Vertical Expansion

We use the following equation to estimate the required effect:

$$x_{it} = \alpha + \ \beta * \ln(InputTariff_{jt-1}) + \gamma \mathbf{X}_{ijt} + firmcontrols + \delta_j + \eta_t + \epsilon_{ijt} \qquad (6)$$

where, x is either the number of products produced by each firm or the number of layers, when investigating for the horizontal span of control and vertical expansion, respectively. All the other variables remain the same.

5.1.1 Horizontal Expansion

Firms may diversify into more businesses as the result of trade liberalization (Goldberg et al., 2010), or reduce the number of products (Bernard et al., 2006) and as a result change their organizational structure. To test for this explanation, we use the number of products produced by each firm in a single year. The best would have been to use the number of divisions of a firm in order to measure the span of control. However, due to the limitations of the dataset, we use the productscope of a firm as the reasonable proxy. Column (1) of **Table 8** tests for the effect of trade liberalization on the firm scope. We find that as a result of trade liberalization, manufacturing firms in India significantly increase their scope and diverse their business operations. This is in complete tune with what Goldberg et al. (2010, 2013) concludes while studying the effect of imported inputs on domestic product growth.[12] **Figure 6** plots the average number of products produced by all the firms across all the manufacturing industries in a given year. In 1990, the average number of products produced by a manufacturing sector is around 350, which increased to around 900-950 in 2011. This is quite the opposite of what we experience in case of the developed economies. This suggests a possible mechanism of organizational change in a firm. An increase in firm scope leads to more operations, which a firm could respond by recruiting more managers with specialized knowledge to solve the problems that may arise when producing a new output using a new set of inputs. This gives an indication about the direction of change in

[12] In addition, they do not find any significant evidence of product churning in case of India. In particular, their estimates suggest that a much greater likelihood that firms add a product to their production line, but rarely remove any products.

the organizational design in the manufacturing firms of India, i.e., why did firms' hire more managers. However, in order to conclude the exact reason, we also need to look into the depth of the organizational hierarchy, which we do in the following section.

5.1.2 Vertical Expansion

In this section, we look into the effect of import penetration on the vertical layers of a firm. As for the vertical part, we use the number of layers in the organization. As described earlier, we have information at three different levels: non-managers, directors, and executives. Directors and Executives represent middle management and top management of a firm. Since executives are managers with executive powers, it makes the top management of a firm. We thus consider it as being the highest layer within a firm. Our independent variable takes a number between 1 and 3. It takes a value 1, when the total managerial compensation is zero, i.e., either it has no managers or the managerial compensation is sufficiently small that it has been recorded as zero; 2 is assigned when the compensation for the executives is zero and the directors managers is non-zero and vice-versa, suggesting that there exists one more layer on the top of the non-managers. Finally, the dummy assumes the value 3, as in when both the directors' and executives' compensation is non-zero, indicating presence of all three layers in a firm.

Columns (2) - (4) produce the desired results. The estimates show that the trade reform has significantly increased the number of layers of a firm. In order words, import of intermediate inputs force a firm to increase the number of layers. **Figure 7** plots the vertical layers across all industries and firms in the manufacturing sector over the period of 1990-2011. It clearly points out that the average depth of a firm has increased from 1.1 in 1990 to around 2.6 in 2011. We also plot the average number of vertical layers of management (over the period of our analysis, 1990-2011) for all the manufacturing industries at two-digit level (not reported). It shows the ample amount of variation in the management layers across different manufacturing industries in India.

Bloom et al. (2010) uses firm-level survey data of 4000 firms across 12 countries in Europe, North America and Asia to show that greater product market competition increases decentralization, i.e., it flattens the hierarchy of a firm. However, when dividing firms according to the region, they point out that firms in developing countries, such as Brazil, China and India, tend to be the most centralized with almost no decision taken by the owners in the corporate headquarters, as tougher competition makes local managers' information more

valuable. Our finding using detailed firm-level data on organization design and trade from India is consistent with their outcome from the firm-level survey analysis. Column (3) uses value added as one of the explanatory variable to test whether the probability of adding a layer is increasing in value added (Caliendo and Rossi-Hansberg, 2012). We find robust evidence in support of this claim. The higher the value addition to a firm is, the higher is the probability to add a management layer. Our primary result stays the same. Lastly, in column (10) we investigate whether the exporters expand vertically. As the estimate shows, the impact of the import penetration ratio on the management layers in case of the exporting firms is also significant. Our results are consistent with the predictions of Caliendo and Rossi-Hansberg (2012) - trade liberalization signifcantly increases the number of layers in the exporting firms.

5.1.3 Untangling the Puzzle

So, following the results from the previous sections, we can see that an average Indian firm is expanding both ways as a result of the trade liberalization process. Now, the question is: which side is significantly driving the increase in the share of the managerial compensation. In order to examine that, we regress the managerial compensation ratio on the change in productscope and layers of a firm in columns (5) and (6). The results point out that the change in the vertical layers of a firm significantly raises the share of managerial compensation in total compensation. Therefore, we can conclude that trade reform process in India has forced an average manufacturing firm to expand vertically.

The next step is to understand why firms expand vertically as they import more production units or intermediate inputs. We rely on Caliendo and Rossi-Hansberg (2012) as our guide. Firms organize production to economize on their use of knowledge, a costly input. And, production requires labor and knowledge. Workers in the layer one (when managerial compensation is zero) work on the production floor to produce output or the products. In order to produce, they solve problems–which their knowledge allows them–they face in production. If they solve the problems, the output is realized. When they do not know anything about the problems, the workers ask the managers in the upper layer and so on. Now, as result of the trade reform a firm starts importing more production inputs as it diverse or increase its scope. The use of these new high quality production inputs (as they are imported mainly from the OECD countries) in the production process creates new set of problems which are beyond their knowledge boundaries. Therefore, in order to solve these

not-so-common problems, a firm adds another layer of managers to understand the new set of exceptional problems and solve them. The new set of problems can also be solved without adding layers. The trade-off is simple: 'fixed' cost from adding one more layer with more knowledgeable managers versus lower 'marginal' cost of making the existing layers more knowledgeable. So, it is worth paying the 'fixed' cost as in the case, the expansion is large enough. Since, our results suggest that firms' increase their operations significantly. Goldberg et al. (2013) highlights that a firm produces more three times (in term of the number of products) of what they produced before the reform. Thus, the firms that expanded, expanded by adding more layers.

6 Robustness Checks

Table 9 produces some robustness checks using different techniques and different samples. Columns (1) and (2) use the measure of product market competition or import penetration by Bloom et al. (2010). We use the share of total imports over domestic sales in column (1). We use this measure at the firm-level with one-period lag to remove any potential contemporaneous feedback, unlike Bloom et al. (2010), who computes at the two-digit industry level for five-year period. As the result demonstrates, it does little to alter our benchmark or primary result. Column (2) constructs Lerner index of competition at the four-digit industry-level. It is defined as (1 - profits/sales). The effect continues to be positive and significant. In column (3), we follow the empirical strategy of Guadalupe and Wulf (2010). Though the tariffs started to fall (as a result of the trade liberalization process) after 1991, the rate of decline is much faster after India became a member of WTO in 1994. The average tariff rate across industries for the period of 1990-1993 is 140 per cent, whereas for the period of 1994-2003, it was around 35-40 per cent. The significant phase-out schedule could be a potential source of endogeneity as firms could seek protection from the government through lobbying. To avoid the endogeneity of the tariff-reduction schedule, we treat all industries equally and exploit the level of tariffs before India became the member of WTO. Therefore, we define AvgT94 to measure the level of exposure of a firm (belonging to a certain industry) to the liberalization process. This is the four-year average input tariffs between 1990 and 1993 at four-digit NIC. Next, we interact AvgT94 with Post94 to get our variable of interest. Post94 is a year-dummy variable that equals one from 1994 onwards. This is a standard difference-in-differences specification that exploits the trade liberalization when the 'treatment' or AvgT94 is continuous. Our coefficient of interest would capture the

differential effect of the liberalization on firms according to their level of exposure prior to 1993. In other words, it is the effect of the change in tariffs due to the WTO membership, net of the general change post-1994 and net of possible permanent differences across industries. We expect the sign of the interaction term to be positive, since firms in industries with higher tariffs prior to the trade liberalization would increase the managerial compensation more over the period as their product markets faced greater competition due to a decline in tariffs. And, we find our hypothesis to be significantly true.

Next, we use a logarithmic version of Equation (3) in column (5). We regress natural logarithm of $\frac{Mcomp}{Tcomp}$ plus 1 as our dependent variable. Our elasticity estimate continues to be significant. Lastly, in column (5), we deal with the problem of zeroes. We understand that dealing with zeroes is a huge issue and the plus one method is somewhat arbitrary. One standard way to deal with the situation is to instead estimate using a Poisson Pseudo-Maximum Likelihood (PPML) following Silva and Tenreyro (2006). Like logging the dependent variable, PPML estimates the coefficients in terms of percentage changes. On the other hand, unlike log, PPML is able to handle zeroes. PPML gives consistent point estimates for a broad class of models: the dependent variable does not have to follow a Poisson distribution or be integer-valued (it can be continuous). We estimate the standard errors using Eicker-White robust covariance matrix estimator. As the point estimates show, import penetration ratio significantly raises the share of managerial compensation.

Lastly, in columns (6) and (7), we use a different indicator for the relative demand for managers. PROWESS provides information on the names of the managers for each individual firm for every year. We exploit this information and count the total number of managers (top and middle management) for each firm. Our database also provides information on total number of employees of a firm. But, the information on the number of employees is not good, as all the firms do not report the information and even if they do, they do not for every year. However, we take whatever is available as given and and calculate the manager-to-total employee ratio as the proxy for the relative demand for managers. Column (6) uses information on the executive managers (top management) of a firm, whereas, column (7) put together the information on managers from both the top and middle management. The estimates point out that drop in tariffs or the import penetration ratio significantly increases the relative demand for managers.

7 Conclusion

The reasons for productivity differences across firms' and countries' are crucial to understand, especially to respect to globalization. One of them relates to firm-level organization design. Recent studies on firm management highlights that management or organization is an integral part of the overall performance of a firm, especially of the exporters. All the papers focusing on the effect of trade liberalization on the hierarchy of a firm focus on developed economies are on the U.S., Germany and Austria, with no study on an emerging economy. We make the first attempt to understand the mechanics of the effect of import penetration on organizational design of manufacturing firms for an emerging economy, such as India.

We use a rich firm-level data set that rolls out information on compensation of managers and non-managers to investigate the link between import penetration and the organizational design in the Indian manufacturing sector over the last two decades. In other words, we study the effect of import penetration on the relative demand for managers. We use the Indian trade liberalization process (in terms of using input tariffs) as an exogenous shock in order to establish the causal effect. We find that fall in tariffs significantly increases the share of managerial compensation or the demand for managers. This forces a firm to change its organizational design in terms of expanding it vertically. In other words, the process of trade reform changes the organizational structure of a firm, in terms of higher depth of the hierarchy. This effect is strong and robust for all firms–both exporting and non-exporting– and domestic-private owned firms which belongs to the non-durable sector. Lastly, we also show that a significant part of the increase in managerial compensation is a result of the steep increase in the incentive-based pay structure for the managers, especially the top management. Our empirical results are quite consistent with the theoretical predictions.

This study addresses a new empirical question through the case study of an emerging economy exploiting a quasi-natural experiment. The results point to various potential important policy implications. Given the established association between better management technology and performance of a firm, our results add that trade liberalization can play an important role in shaping the organizational design of a firm, most notably through import of intermediate inputs. This paper, therefore, calls for further research on the dynamics of organizational structure or design of firms with respect to a developing country, for which we can get new insights unlike those of the developed economies.

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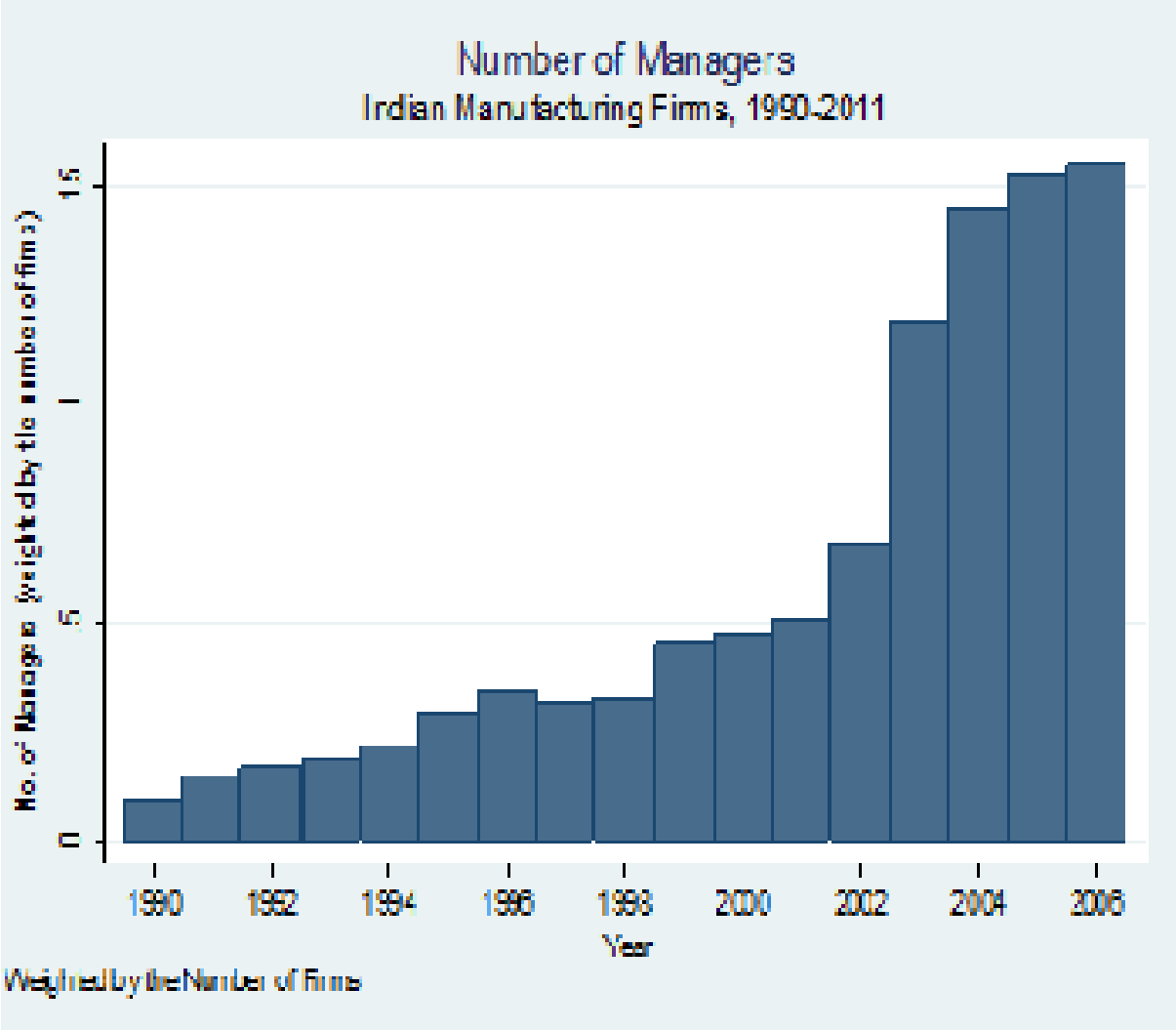

Figure 1 Number of Managers (weighted by the number of firms), 1990-2006

Notes: Figures represent yearly average (over all firms).

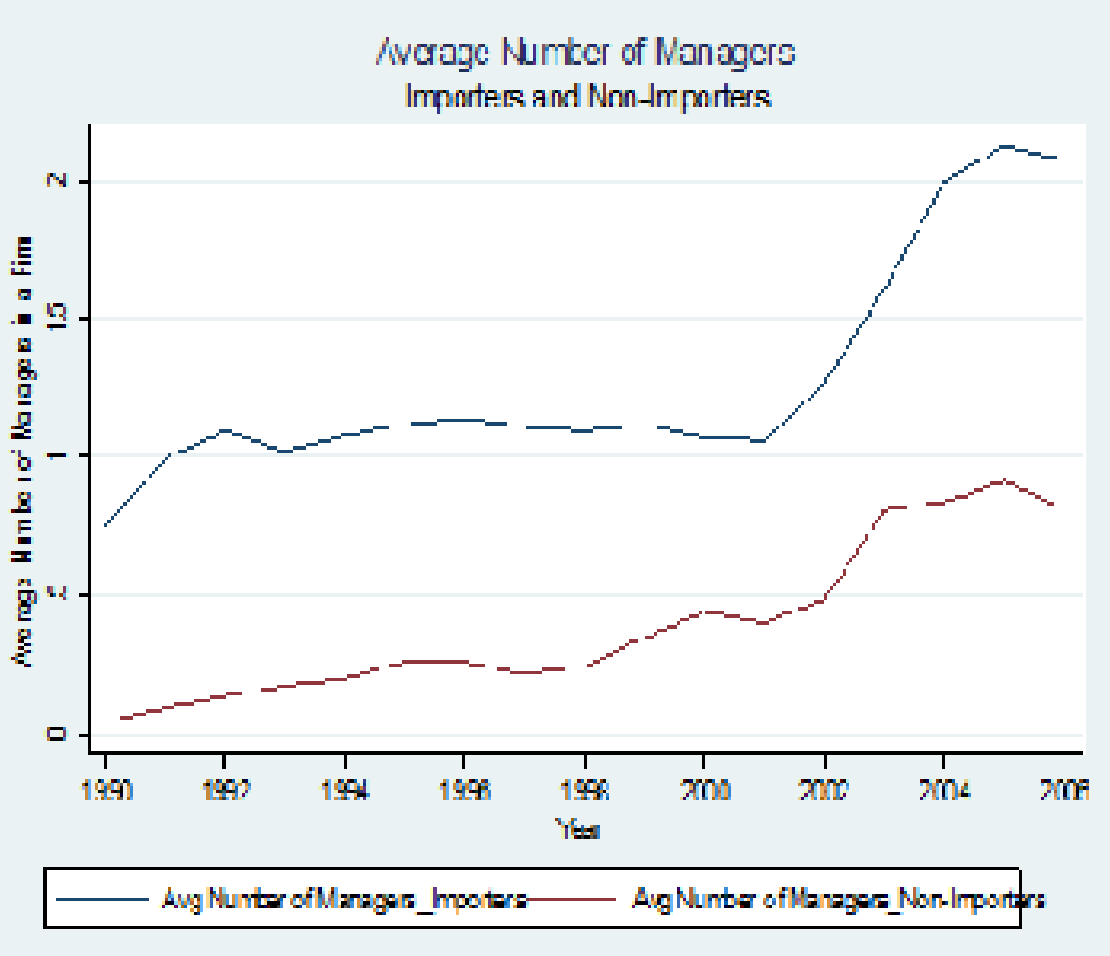

Figure 2 Average Number of Managers' for Importers and Non-Importers, Indian Manufacturing, 1990-2006

Notes: Figures represent yearly average (over all firms).

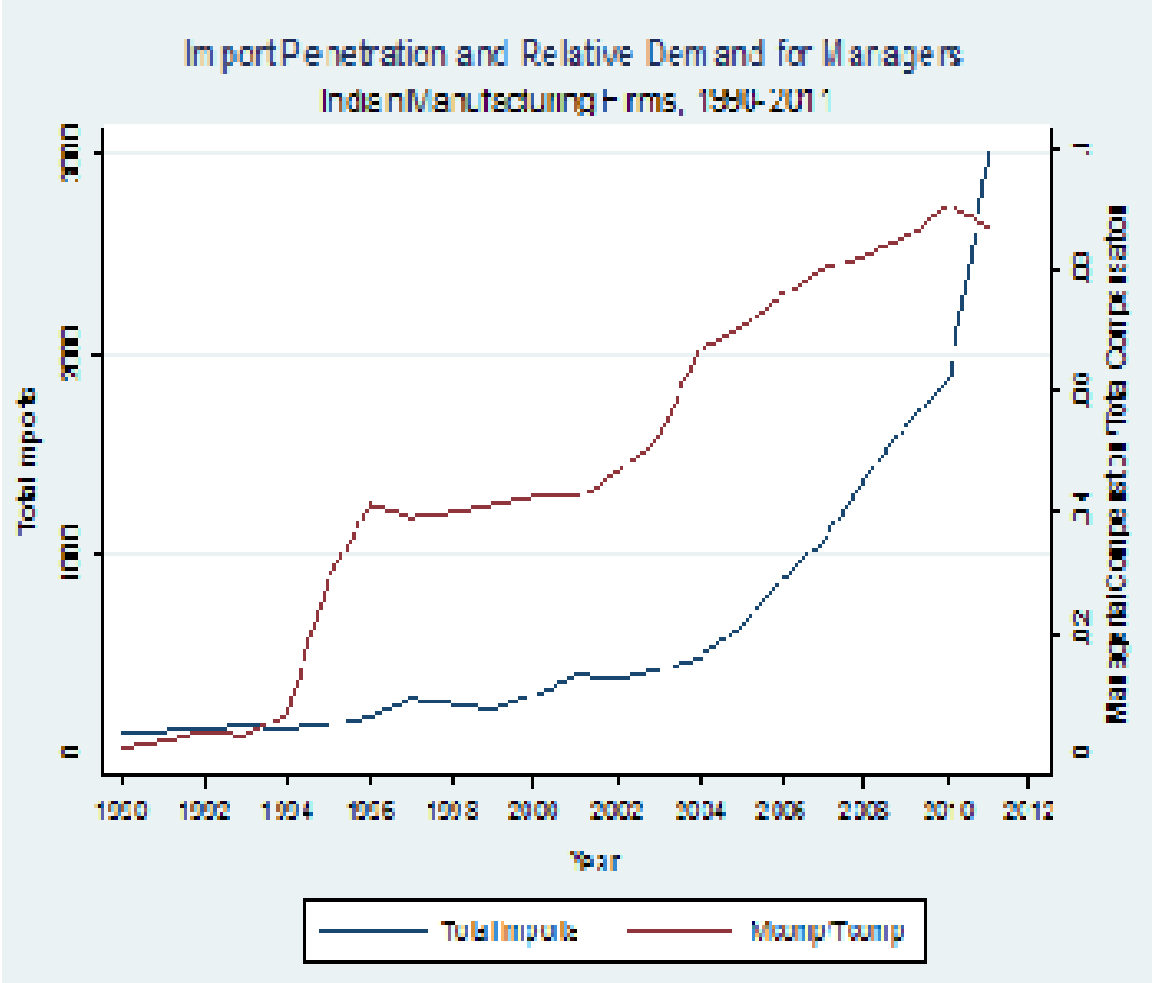

Figure 3 Import Penetration and the Relative Demand for Managers, Manufacturing Firms, 1990-2011

Notes: Figures represent yearly average (over all firms).

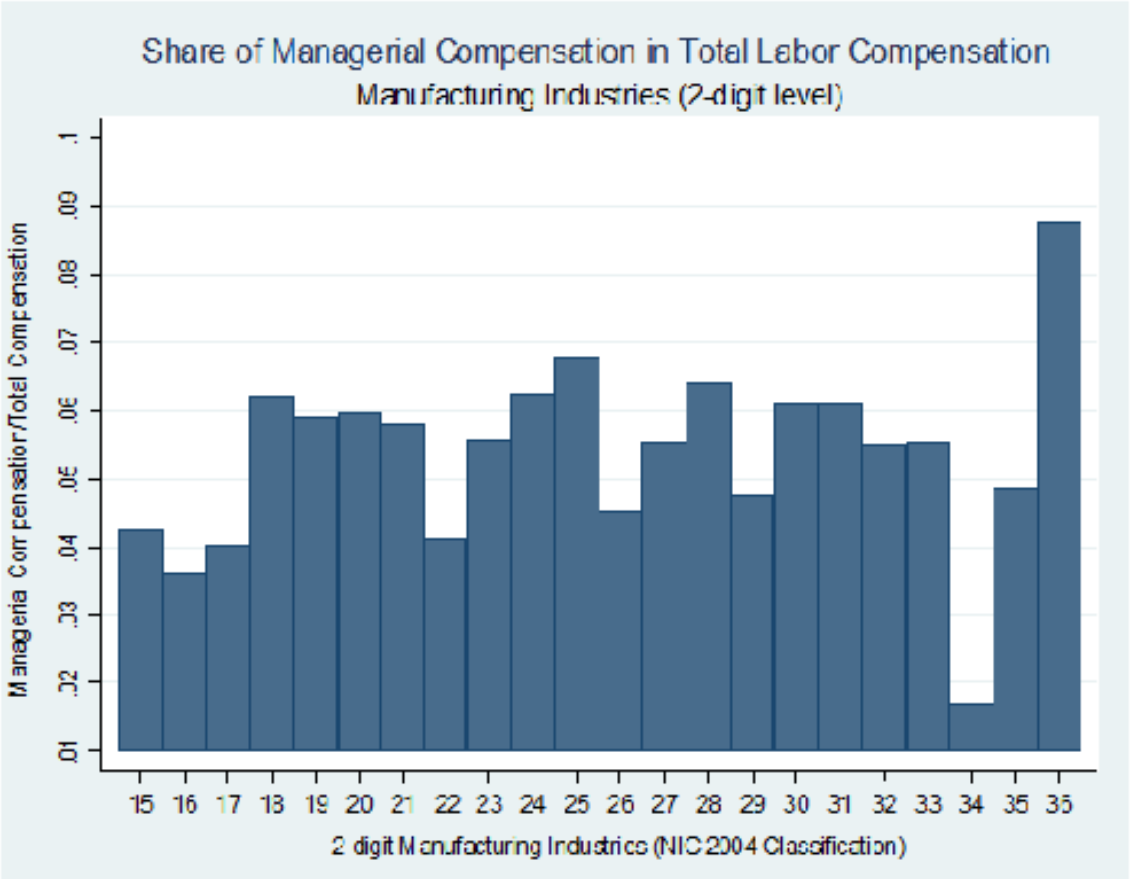

Figure 4 Share of Managerial Compensation in Total Labor Compensation, Manufacturing Industries, 2-digit level

Notes: Figures represent average over all firms and year for each industry.

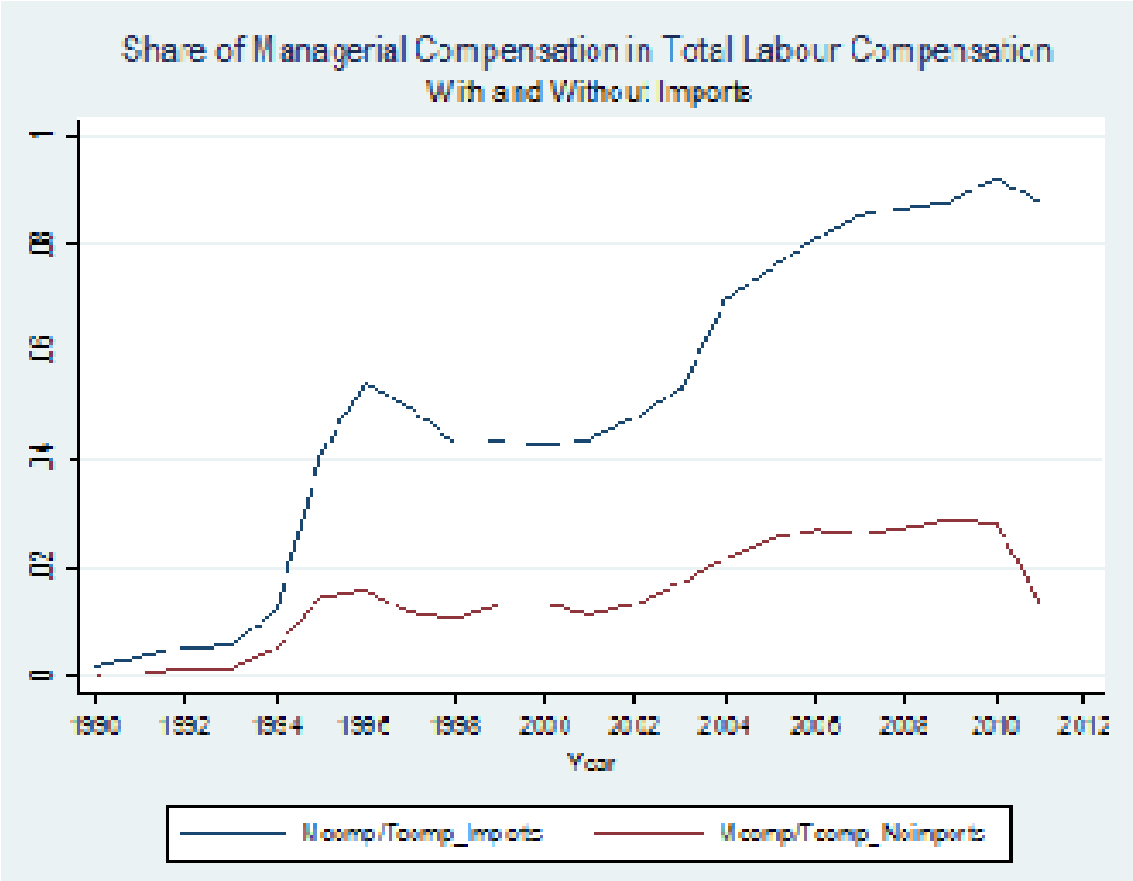

Figure 5 Ratio of Managerial Compensation in Total Labor Compensation for Import-Using and Non-Importing Firms

Notes: Figures reprsent the average ratio of managerial compensation in a given year

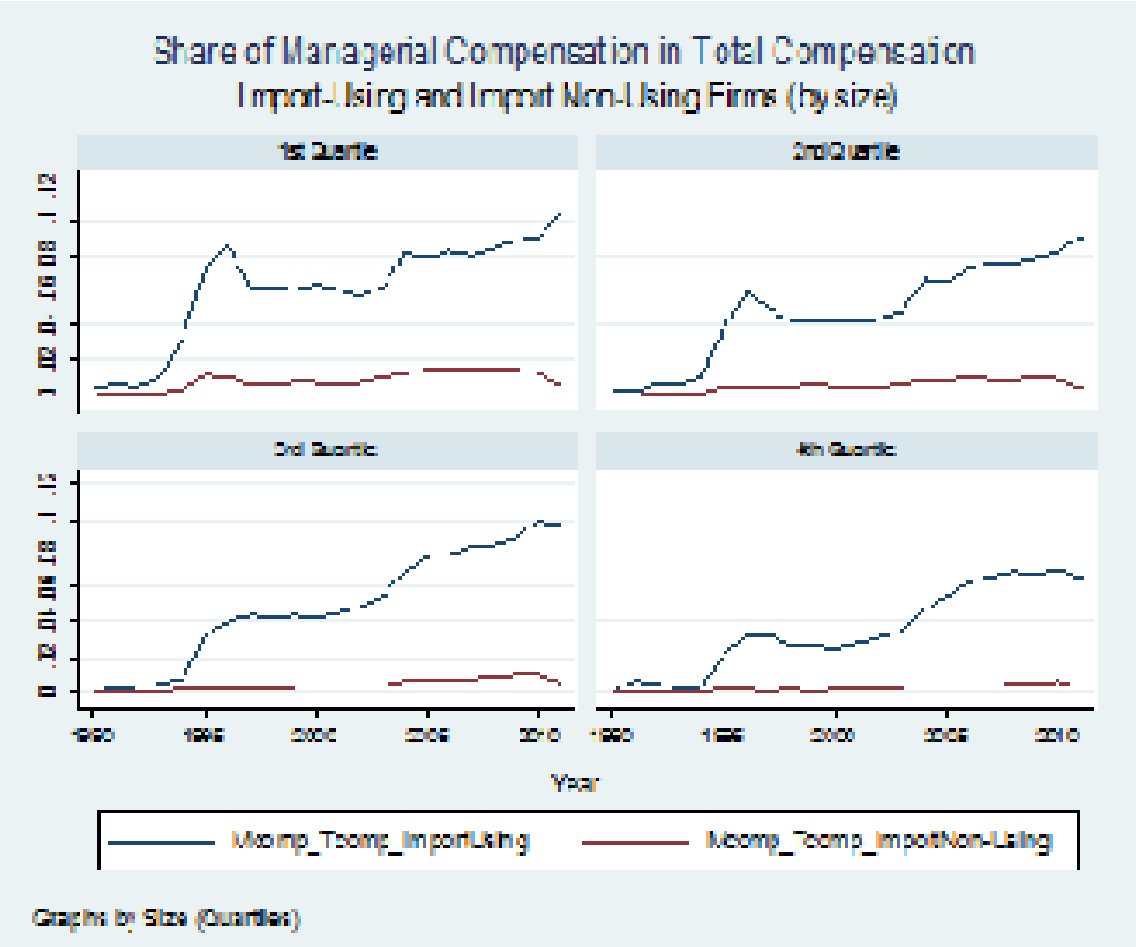

Figure 6 Ratio of Managerial Compensation in Total Labor Compensation for Import-Using and Non-Importing Firms Across Size Quartiles

Notes: Figures reprsent the average ratio of managerial compensation in a given year

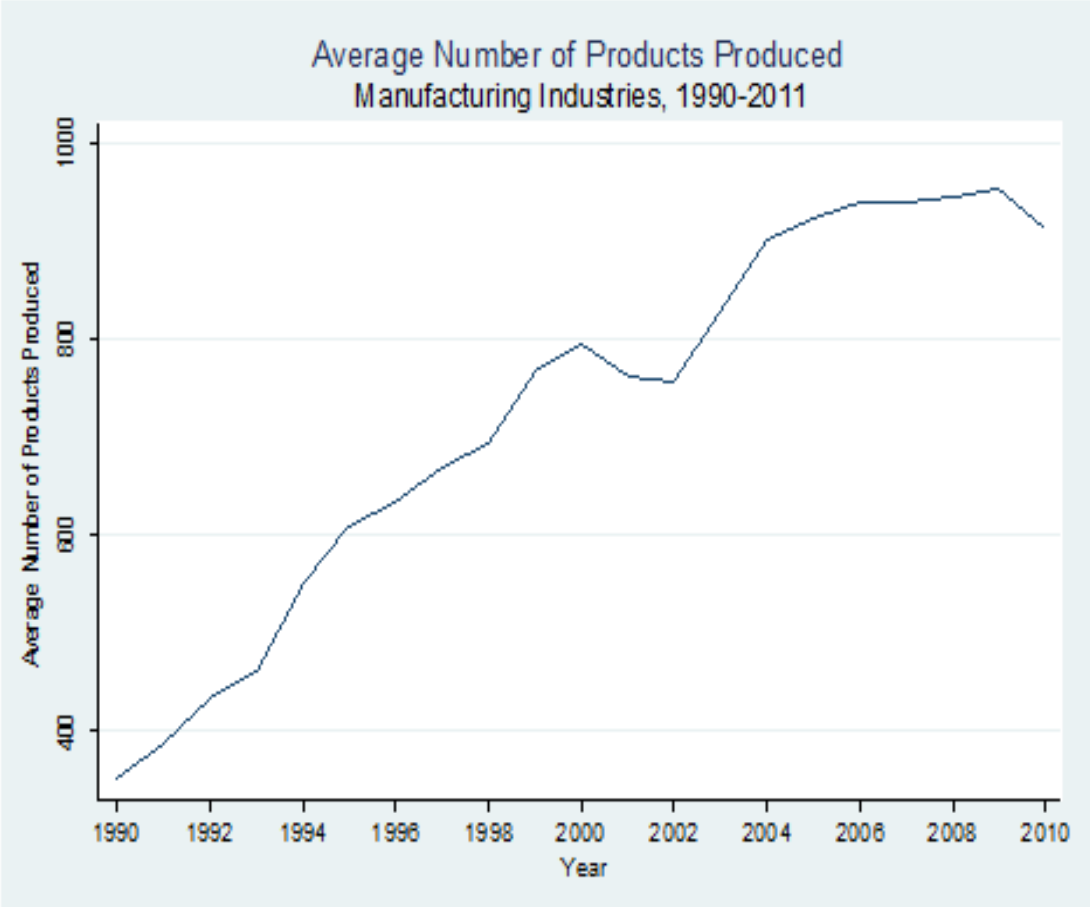

Figure 7 Average Number of Products Produced by each Manufacturing Industry (2-digit level)

Notes: Figures reprsent the average number of products produced per manufacturing industry (2-digit level) in a given year

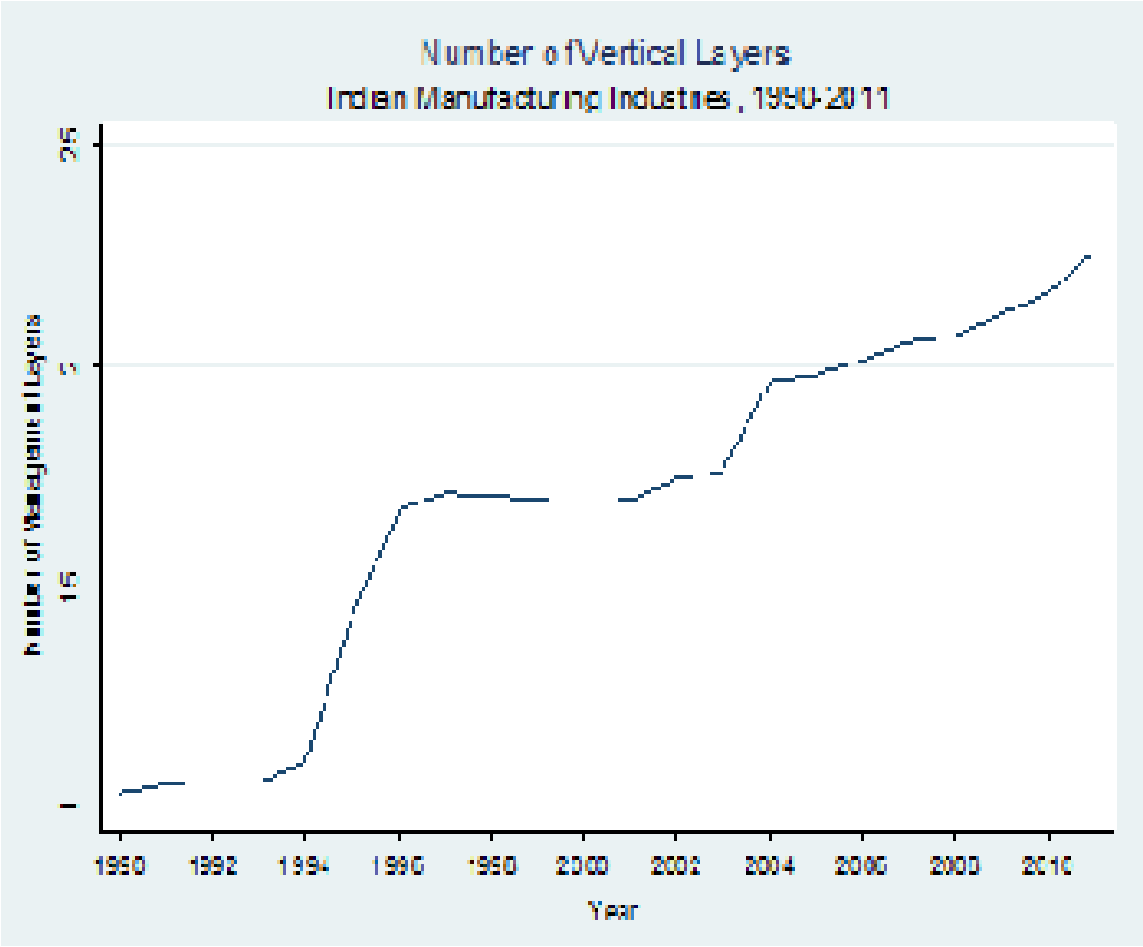

Figure 8 Average Number of Vertical Management Layers, 1990-2011

Notes: Figures represent the average number of vertical layers over time (1990-2011) across all firms

	Mean	Median	Std. Dev.	Min	Max
Panel A: Organizational Variables - Dependent Variables					
MComp/TComp	0.05	0.02	0.08	0	1
Layers	1.78	2	0.69	1	3
Product Scope	4.87	4	4.73	1	90
Managers' Compensation	11.38	0.40	1354.42	0	360003.6
Non-Managers Compensation	146.18	22.69	975.97	0.06	54738.33
Managers' Wages	7.99	0.40	1348.62	0	360003.6
Non-Managers' Wages	136.29	21.22	852.74	0.06	45090.11
Managers' Bonuses	0.51	0	21.18	0	8724.6
Non-Managers' Bonuses	13.99	0.13	149.39	0	11222.88
Panel B: Firm/Industry-level Determinants - Explanatory Variables					
Imp/GVA	0.88	0.05	38.43	0	7323.51
ImpRaw/GVA	0.45	0.01	17.86	0	4435.31
ImpCap/GVA	0.12	0	6.51	0	1192
ImpSto/GVA	0.02	0	0.30	0	40.45
ImpFin/GVA	0.29	0	32.98	0	7323.51
TechAdop/GVA	0.06	0	8.47	0	2163
Cap/GVA	8.79	1.80	114.40	0	16789
Productivity	1.13	0.84	1.92	0	230.28
GVA	1402.07	143.33	18010.09	0.06	1112399
Skill Intensity	0.28	0.28	0.03	0.18	0.42
Management Technology	2.50	2.48	0.41	0	3.17
Tariffs	61.99	41.29	47.77	17.34	202.02

Notes: The data is at the firm-level and covers the period of 1990-2011, annually. Numbers are the average values across all manufacturing sectors over the period 1990-2011. The values are in INR Millions. 'Mcomp/Tcomp' is the share of managerial compensation in total labour compensation. 'Product Scope' is the number of products produced by each firm in a single year. 'Layers' is the number of vertical layers corresponding to the organizational structure of a firm. It can either be 1, 2, or 3. Compensation' is the sum of 'Wages' and 'Bonuses', which are earned by Executives, Directors, or Non-managers. 'Imp', 'ImpRaw', 'ImpCap', 'ImpSto' and 'ImpFin' are total imports, import of raw materials, capital goods, stores and spares, and finished goods, respectively. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. 'Cap' is the amount of capital employed. 'Productivity' is a measure of firm productivity computed using the Levinshon and Petrin (2003) methodology. 'Skill intensity' is the industry level ratio of production workers to non-production workers. The data on 'Skill intensity' has been obtained from Ahsan (2013). Tariffs (input taruffs) is at the industry-level (4-digit NIC 2004). 'Management technology' is the industry-level management quality score obtained from Bloom and van Reenen (2010). "GVA' is gross value added.

Table 1: Descriptive Statistics

	Total Imports	Import of Capital Goods	Import of Raw Materials	Import of Stores & Spares	Import of Finished Goods	Share of Managerial Compensation
	(1)	(2)	(3)	(4)	(5)	(6)
Total Imports	1.00					
Import of Capital Goods	0.33*	1.00				
Import of Raw Materials	0.99*	0.37*	1.00			
Import of Stores and Spares	0.37*	0.35*	0.36*	1.00		
Import of Finished Goods	0.77*	0.20*	0.81*	0.19*	1.00	
Share of Managerial Compensation	0.01*	0.03*	0.01*	0.01	−0.02	1.00

Notes: * denotes significance at 5% level.

Table 2: Correlation Matrix - Imports and Managerial Compensation

	Managerial Compensation/Total Compensation								
	Baseline Results								
	1990-2011			1990-97		1990-2011			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Imp/GVA	0.010^a (0.001)	0.009^a (0.001)	0.009^a (0.001)	0.004^a (0.001)	0.004^a (0.001)				
ImpRaw/GVA						0.006^a (0.002)			
ImpCap/GVA						0.010^a (0.003)			
ImpStoSpa/GVA						0.002 (0.006)			
ImpFin/GVA						0.001 (0.003)			
ImpInput/GVA							0.008^a (0.001)		0.008^a (0.001)
ImpNInput/GVA								0.003 (0.003)	0.001 (0.003)
Firm Controls	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.16	0.16	0.17	0.16	0.17	0.18	0.18	0.17	0.18
N	73045	73045	73045	18967	18967	73045	73045	73045	73045
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Industry FE*Year FE	No	No	Yes	No	Yes	No	No	No	No

Notes: The dependent variable is the proportion of managerial compensation in the total compensation of a firm. Total Compensation = Compensation to Non-Managers + Compensation to Managers. Compensation to Managers is the sum of compensation of all the management levels. Compensation to Non-Managers is the compensation to all other employees. 'Imp/GVA' is the total imports-to-GVA ratio. Total Imports of a firm = Import of Raw Materials + Import of Capital Goods + Import of Stores and Spares + Import of Finished Goods. 'GVA' is Gross Value Added (GVA) of a firm. It is defined as Total Sales - Total Raw Material Expenditure. 'Mcomp/Tcomp' is the share of managerial compensation in the total compensation of a firm. 'ImpRaw', 'ImpCap', 'ImpStoSpa' and 'ImpFin' is the import of raw materials, capital goods, stores and spares and finished goods, respectively. 'ImpInput' is the import of intermediate inputs. which is = Import of Raw Materials + Import of Capital Goods. 'ImpNInput' is the sum of import of stores and spares and finished goods. Firm controls include age of a firm, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. ^{c},^{b},^{a} denotes 10%, 5% and 1% level of significance.

Table 3: Effect of Import Penetration on the Relative Demand for Managers - Conditional Correlation

	Managerial Compensation	Non-Managerial Compensation	No. of Managers		No. of Non-Managers	Managers/Total Employees	
			Top Management	Top + Middle Middle Management		Top Management	Top + Middle Middle Management
	Baseline Results (1990-2011)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Imp/GVA	0.192^{a} (0.021)	0.094^{a} (0.014)	0.035^{a} (0.013)	0.054^{c} (0.032)	0.266^{a} (0.050)	0.0002^{b} (0.000)	-0.0003 (0.000)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.60	0.78	0.72	0.52	0.35	0.16	0.001
N	45560	73045	20865	8551	3890	55561	13488
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1) and (2) use natural logarithm of managerial and non-managerial compensation as the dependent variable. Columns (3) and (4) use natural logarithm of number of managers belonging to top management and middle management, respectively. Column (5) uses natural logarithm of number of non- managers or other employees. Columns (6) and (7) is the proportion of total number of managers to total employees of a firm. Column (6) uses only the top management, whereas, column (5) exploits both top and middle management. 'Imp/GVA' is the total imports-to-GVA ratio. Total Imports of a firm = Import of Raw Materials + Import of Capital Goods + Import of Stores and Spares + Import of Finished Goods. 'GVA' is Gross Value Added (GVA) of a firm. It is defined as Total Sales - Total Raw Material Expenditure. Firm controls include age of a firm, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow. We use assets as the size indicator. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. ^{c},^{b},^{a} denotes 10%, 5% and 1% level of significance.

Table 4: Effect of Import Penetration on the Relative Demand for Managers - Conditional Correlation

	Managerial Compensation/Total Compensation									
	1990-1997					1990-2011				
				First Difference	Arellano Bond				First Difference	Arellano Bond
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
InpTariffs_{t-1}	-0.010^{b}	-0.029^{a}	-0.017^{a}	-0.012^{a}	-0.006^{b}	-0.019^{a}	-0.015^{a}	-0.005^{a}	-0.004^{a}	-0.023^{a}
	(0.004)	(0.004)	(0.001)	(0.002)	(0.002)	(0.006)	(0.003)	(0.000)	(0.001)	(0.001)
$(\text{Mcomp/Tcomp})_{t-1}$			0.601^{a}					0.813^{a}		
			(0.027)					(0.009)		
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.18	0.18	0.47	0.02	n/a	0.15	0.15	0.68	0.03	n/a
N	14370	14370	14370	14369	14370	61877	61877	61802	61801	61802
Industry FE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Year FE	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes
Industry FE*TimeTrend	No	Yes	No	No	No	No	Yes	No	No	No

Notes: The dependent variable is the proportion of managerial compensation in the total compensation of a firm. Total Compensation = Compensation to Non-Managers + Compensation to Managers. Compensation to Managers is the sum of compensation of all the management levels. Compensation to Non-Managers is the compensation to all other employees. 'InpTariffs' is Input Tariffs is at the 4-digit NIC 2004. Mcomp/Tcomp_{t-1} is the lagged dependent variable. Firm controls include age of a firm, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop/GVA' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow normalized by GVA. We use assets as the size indicator. All the dependent variables are in natural logarithm. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. ^{c},^{b},^{a} denotes 10%, 5% and 1% level of significance.

Table 5: Effect of Import Penetration on the Relative Demand for Managers - Causal Effect using Input Tariffs

	Managerial Compensation/Total Compensation								
	Panel A				Panel B				
	1990-1997		1990-2011		1990-1997				
	Industry-level		Chinese Exports		Industry Controls		Firm Controls		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$InpTariffs_{t-1}$	-7.440^{a} (0.410)	-7.460^{a} (0.407)			-0.044^{a} (0.013)	-0.014^{b} (0.006)	-0.006^{a} (0.002)	-0.005^{b} (0.002)	-0.005^{a} (0.002)
$ChineExp_{t-1}$			0.019^{a} (0.003)	0.020^{a} (0.007)					
$InpTariifs_{t-1}$*Skill Int					-0.027^{a} (0.009)				
$InpTariifs_{t-1}$*MT						0.003 (0.004)			
GVA							0.001 (0.001)		
Productivity								-0.004^{c} (0.003)	
Cap/GVA									0.001 (0.001)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.84	0.84	0.13	0.14	0.19	0.19	0.66	0.69	0.66
N	14370	14870	59116	59116	14370	14370	61802	43730	61802
Industry FE	Yes	No	Yes	No	Yes	Yes	No	No	No
Year FE	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Industry FE*TimeTrend	No	Yes	No	Yes	No	No	No	No	No
Firm FE	No	No	No	No	No	No	Yes	Yes	Yes

Notes: The dependent variable is the proportion of managerial compensation in the total compensation of a firm. Total Compensation = Compensation to Non-Managers + Compensation to Managers. Compensation to Managers is the sum of compensation of all the management levels. Compensation to Non-Managers is the compensation to all other employees. 'InpTariffs' is Input Tariffs is at the 4-digit NIC 2004. 'Skill intensity' (Skill Int) is defined as the industry level ratio of production workers to non-production workers. The data on 'Skill intensity' has been obtained from Ahsan (2013). 'Management Technology (MT)' is the industry-level management quality score obtained from Bloom and van Reenen (2010). '$ChineExp_{t-1}$' is one-period lag chinese exports to the world minus India. 'GVA' = Gross Value Added (GVA) = Total Sales - Total Raw Material Expenditure. 'Cap' is the amount of capital employed. 'Productivity', a firm-level measure computed using Levinshon and Petrin (2003) methodology. Firm controls include age of a firm, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop/GVA' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow normalized by GVA. We use assets as the size indicator. All the dependent variables are in natural logarithm. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. ^{c},^{b},^{a} denotes 10%, 5% and 1% level of significance.

	Managerial Compensation/Total Compensation										
	Exports		End Use					Size	Ownership		
	Exporters	Non-Exp	ConNDur	Inter	Basic	Capital	ConDur		Dom Private	Dom Public	Foreign Owned
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
$InpTariffs_{t-1}$	-0.010^a (0.002)	-0.009^a (0.003)	-0.004^a (0.002)	-0.003 (0.009)	-0.008 (0.008)	-0.002 (0.003)	-0.003 (0.005)		-0.009^a (0.002)	0.002 (0.003)	0.001 (0.005)
$(InpTa_{t-1})$*1stQr								-0.008^a (0.003)			
$(InpTa_{t-1})$*2ndQr								-0.009^a (0.003)			
$(InpTa_{t-1})$*3rdQr								-0.008^a (0.002)			
$(InpTa_{t-1})$*4thQr								-0.008^a (0.002)			
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.20	0.13	0.14	0.16	0.12	0.09	0.14	0.15	0.15	0.16	0.33
N	33876	22510	19966	15000	11012	11459	7594	61802	55659	1935	4208
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is the proportion of managerial compensation in the total compensation of a firm. Total Compensation = Compensation to Non-Managers + Compensation to Managers. Compensation to Managers is the sum of compensation of all the management levels. Compensation to Non-Managers is the compensation to all other employees. 'InpTariffs' is Input Tariffs is at the 4-digit NIC 2004. Firm controls include age of a firm, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop/GVA' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow normalized by GVA. We use assets as the size indicator. 'Non-Exp' is the group of non-exporting firms. 'ConNonDur', 'Inter', 'Basic', 'Capital', 'ConDur' are Consumer Non-Durable, Intermediate, Basic, Capital and Consumer Durable goods sector, respectively. Quartiles are defined according to the total assets of a firm. A firm belongs to 1st quartile if the assets of that firm is below 25th percentile of the total assets of that industry to which the firm belongs and so on. 'Dom Private', 'Dom Public' 'Foreign Owned' are domestic-private, domestic-public and foreign-owned firms, respectively. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. ^{c},^{b},^{a} denotes 10%, 5% and 1% level of significance.

Table 7: Effect of Import Penetration on the Relative Demand for Managers - Exporters, End Use, Size and Ownership

	Wages		Incentives	
	Managers	Non-Managers	Managers	Non-Managers
	(1)	(2)	(3)	(4)
InpTariffs_{t-1}	-0.014^{a}	-0.015^{a}	-0.786^{a}	-4.654
	(0.004)	(0.003)	(0.250)	(3.451)
Firm Controls	Yes	Yes	Yes	Yes
R-Square	0.08	0.10	0.03	0.04
N	58633	58472	73045	73045
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Notes: Columns (1) - (2) and (3) - (4) use wages and incentives/bonuses as the the dependent variable. 'InpTariffs' is Input Tariffs is at the 4-digit NIC 2004. Firm controls include age of a firm, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop/GVA' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow normalized by GVA. We use assets as the size indicator of a firm. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. ^{c},^{b},^{a} denotes 10%, 5% and 1% level of significance.

Table 8: Why Trade Increases Demand for Managers - Analysis of the Pay Structure

	Horizontal Expansion	Vertical Expansion				
	ProdScope	Layers			Mcomp/Tcomp	
			Adding VA	Exporters		
	(1)	(2)	(3)	(4)	(5)	(6)
InpTariffs_{t-1}	-0.216^{b} (0.136)	-0.126^{a} (0.024)	-0.059^{a} (0.016)	-0.114^{a} (0.034)	-0.036^{a} (0.011)	
ΔProdScope					-0.0001 (0.000)	-0.0001 (0.000)
GVA			0.042^{a} (0.005)			
ΔLayers					0.030^{a} (0.001)	0.029^{a} (0.001)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.26	0.71	0.36	0.44	0.75	0.75
N	61040	61877	61802	33915	60181	60181
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Column (1) use the number of products produced by a firm as the depedent variable, whereas, columns (2) - (4) exploits number of management layers in a firm as the same. Columns (5) - (6) use the proportion of managerial compensation in the total compensation of a firm as the dependent variable. 'InpTariffs' is Input Tariffs is at the 4-digit NIC 2004. 'ProdScope' is the number of products produced by a firm. 'GVA' is Gross Value Added (GVA) of a firm. 'Layers' is the number of management layers of a firm. Firm controls include age of a firm, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop/GVA' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow normalized by GVA. We use assets as the size indicator of a firm. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. *,**,*** denotes 10%, 5% and 1% level of significance.

Table 9: Why Trade Increases Demand for Managers - Horizontal or Vertical Expansion

	Managerial Compensation/Total Compensation					Managers/Total Employees	
	Different Indices and Methods						
	Different Indices			Log Version	PPML	Top Management	Top + Middle Middle Management
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\text{Imp/DomSales}_{t-1}$	0.005^{b} (0.002)						
$\text{Lerner Index}_{t-1}$		0.0001^{b} (0.000)					
AvgT94*Post94			0.002^{a} (0.000)				
InpTariffs_{t-1}				-0.007^{a} (0.002)	-0.557^{a} (0.006)	-0.0004^{a} (0.000)	-0.0010^{a} (0.000)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Square	0.63	0.06	0.13	0.16	n/a	0.004	0.003
N	72375	88220	74774	61802	73045	67098	14257
Industry FE	No	Yes	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	No	No	No	No	No

Notes: The dependent variable is the proportion of managerial compensation in the total compensation of a firm. Total Compensation = Compensation to Non-Managers + Compensation to Managers. Compensation to Managers is the sum of compensation of all the management levels. Compensation to Non-Managers is the compensation to all other employees. 'Imp/DomProd' is total imports by domestic sales. Total Imports of a firm = Import of Raw Materials + Import of Capital Goods + Import of Stores and Spares + Import of Finished Goods. 'Lerner Index' is (1 – profits/sales) is the 4-digit industry lerner index of competition calculated as the average across the entire firm-level dataset. 'AvgT94*Post94' is the interaction term of 'AvgT94' and 'Post94'. 'Post94' is a year dummy variable, which takes a value 1 if the year is greater than 1994. 'AvgT94' is the average of input tariffs at the four-digit industry-level for the years 1990-1993. Firm controls include age of a firm, ownership dummy (either domestic or foreign owned), 'TechAdop/GVA' and size of a firm. 'TechAdop/GVA' measures the level of technology adoption, defined as the sum of R&D expenditure and royalty payments for technical knowhow normalized by GVA. We use assets as the size indicator. All the dependent variables are in natural logarithm. Numbers in the parenthesis are robust clustered standard errors at the firm level. Intercepts are not reported. ^{c},^{b},^{a} denotes 10%, 5% and 1% level of significance.

Table 10: Effect of Import Penetration on the Relative Demand for Managers - Robustness Checks

Appendix

A Data

We use an annual-based panel of Indian manufacturing firms that covers up around 8000 firms, across 105 industries, over the period of 1990-2011. Data is used from the PROWESS database of the Centre for Monitoring Indian Economy (CMIE). All monetary-based variables measured in Millions of Indian Rupees (INR), deflated by 2005 industry-specific Wholesale Price Index (WPI). We use 2004 National Industrial Classification (NIC).

Variable definitions

Mcomp/Tcomp: Share of managerial compensation in total labor compensation. Compensation is defined as the sum of salaries/wages and bonuses/incentives. Total labor compensation = Managerial Compensation + Non-Managerial Compensation.

Layers: The number of vertical layers, 1, 2, or 3. '1' denotes having insignificant or no managerial layers; '2' denotes having either directors (middle management) or executives (top management) in the firm, but not both along with other workers or the non-managers; '3' denotes having both directors and executives in a firm.

Product scope: The number of products produced by a firm, which represents the scope of business of a firm.

Executives/Directors/Non-managers compensation: Total compensation of the executives or the directors or the non-managers. Total Compensation = Total Wages + Total Incentives/Bonuses. Executives are the top management with executive powers. Directors are the mid-ranked managers with no executive powers, such as Divisional Managers. Non-managers are other employees or workers, who do not manage others.

Executives/Directors/Non-managers wages: Total wages of the executives, directors, or non-managers.

Executives/Directors/Non-managers bonuses: Total bonuses/incentives of the executives, directors, or non-managers.

Imp/GVA: Share of Total Imports (Import of Raw Materials + Import of Capital Goods + Import of Stores & Spares + Import of Finished Goods) in Gross Value Added (GVA).

ImpRaw/GVA: Share of Import of Raw Material in Gross Value-Added.

ImpCap/GVA: Share of Import of Capital Goods in Gross Value-Added.

ImpSto/GVA: Share of Import of Stores and Spares in Gross Value-Added.

ImpFin/GVA: Share of Import of Final Goods in Gross Value-Added.

Exp/GVA: Share of Total Exports in Gross Value-Added.

TechAdop/GVA: Share of R&D expenditure and Royalty Payments for Technical Knowhow in Gross Value-Added.

Cap/GVA: Share of Capital Employed in Gross Value-Added.

GVA: Gross Value-Added = Total Sales - Total Raw Material Expenditure.

Age: Age of a firm in years.

Assets: Total assets of a firm.

Productivity: Firm TFP computed using the Levinsohn and Petrin (2003) methodology.

Tariffs: Input tariffs at the 4-digit level of the NIC 2004 classification. We obtained the information of tariff for the period of 1990-2003 from Ahsan (2013).

Skill intensity: Ratio of production workers to non-production workers at the 2-digit industry-level of 2004 NIC, obtained from Ahsan (2013). The data is only for the year 1998.

Management technology: 4-digit industry-level management quality score at the NIC 2004, obtained from Bloom et al. (2010). The score is between 1 and 5, with 5 denoting the highest quality. The data is only for the year 2004.