

Aid, Trade and Foreign Direct Investment

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vorgelegt von
Birgit Elisabeth Meyer, M.Sc.
aus Büren

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Dekan/in: Prof. Dr. Achim Walter
Erstbegutachtung: Prof. Holger Görg, Ph.D.
Zweitbegutachtung: Prof. Dr. Annetrin Niebuhr
Drittbegutachtung: Prof. Eric Strobel, Ph.D.
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To my parents,
Alfons and Irmgard

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CHAPTER 0. ACKNOWLEDGEMENTS

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Birgit Meyer
Kiel, March 2016

Preface

This dissertation with the title “Aid, Trade and FDI” has been prepared in a cumulative manner. It includes the following self-contained papers:

Part I: Aid for Trade

- Chapter 2: Hühne P., Meyer B, & Nunnenkamp, P. 2014. Who Benefits from Aid for Trade? *Journal of Development Studies*, 50(9): 1275-1288.
- Chapter 3: Hühne P., Meyer B, & Nunnenkamp, P. 2015. Does Aid for Trade from the North promote South-South trade? *Applied Economics Letters*, 21(17):1230-1233.
- Chapter 4: Hühne P., Meyer B, & Nunnenkamp, P. 2015. Aid for Trade: Assessing the Effects on Recipient Exports of Manufactures and Primary Commodities to Donors and Non-donors. In: M. Arvin, and B. Lew (Eds.). *Handbook on the Economics of Foreign Aid*. Chapter 10: 141–161, Cheltenham: *Edward Elgar*.

Part II: Aid, Infrastructure and FDI

- Chapter 5: Donaubaauer, J., Meyer, B. & Nunnenkamp, P. 2016. A New Global Index of Infrastructure: Construction, Rankings and Applications. *The World Economy*, 39(2): 236-259.
- Chapter 6: Donaubaauer, J., Meyer, B. & Nunnenkamp, P. 2016. Aid, Infrastructure and FDI: Assessing the Transmission Channel with a New Index of Infrastructure. *World Development*, 78: 230-245.

Part III: FDI in India

- Chapter 7: Meyer, B. 2016. Product Mix and Foreign Ownership: Evidence from India’s Investment Liberalization

These papers empirically investigate various topics in the field of international and development economics. Five of these papers are co-authored with other researchers. These co-authors are

Julian Donaubauer researcher at the Helmut Schmidt University, Hamburg, Germany

Philipp Hühne researcher at the Helmut Schmidt University, Hamburg, Germany

Peter Nunnenkamp senior researcher at the Kiel Institute for the World Economy, Kiel, Germany

The work was split equally across co-authors for those papers written in cooperation. My contribution in all these papers was substantial. I contributed most to the empirical work.

For copyright reasons the previously published chapters cannot be included in the electronic version of this dissertation. Please see the respective journal articles which can be accessed via the links given on the respective pages.

Chapter 1

Introduction

Sustainable development, growth promotion and sharing prosperity are the main aims of the United Nations Sustainable Development Goals. To support this aim and to assist the economic development of new partnerships, higher levels of foreign aid are demanded by the United Nation. Promoting development is one of the main goals of foreign aid programs, even the motivation behind aid giving might not be fully altruistic, and potentially depends on historical ties, political and strategical goals, and economical considerations (Alesina and Dollar, 2000; Dollar and Levin, 2006; Berthélemy, 2006).

Aid for Trade (AfT), with the purpose of facilitating exports, imports and foreign direct investments (FDI), has become a major part of the foreign aid distribution. AfT aims to improve the performance of developing countries in harnessing the benefits from international trade. The integration into international markets and the inflow of FDI is associated with welfare gains and economic growth for developing countries (Banerjee and Duflo, 2005; 2005; Melitz and Ottaviano, 2008; Borensztein et al, 1998). Foreign aid, in particular in trade related needs, has the potential to alleviate the lack of net capital flows to less developed countries, to reduce severe supply-side constraints, to improving market environments and to facilitate participation of developing countries in international trade.

The economical considerations behind granting aid are also encouraged by the Organization for Economic Co-operation and Development (OECD). For example, the OECD claims that “Official Development assistance-backed efforts to enhance the investment climate are relevant in the context of attracting FDI” (OECD, 2006, p.18). An extensive literature shows the positive impact of FDI on firm performance. Empirical as well as theoretical literature shows the positive impact of FDI on productivity, trade, innovation and wages (see for example Harris and Robinson, 2003; Görg and Greenaway,

2004: Markusen, 2004). Various policies have been designed in developing countries to attract FDI. In India, for example, tax holidays and additional depreciation of 20 percent on new investments are promised to foreign investors (United Nations, 2000; Indian Ministry of Commerce and Industry, 2015).

Only a few authors so far have exploit the link between AfT, trade and FDI. A recent wave of literature focuses on the effectiveness of development assistance on trade (see among others Martínez-Zarzosa et al, 2009; Calí and te Velde, 2011; Nelson and Juhasz Silva, 2012; Johansson and Pettersson, 2012; Helble et al, 2012). My dissertation wants to fill this gap. I empirically show that AfT increases trade with donor countries but as well with other developing countries. Further, aid targeted at infrastructure needs helps to remove obstacles of foreign investors related to transportation, communication, financial and energy-related infrastructure. A higher inflow of FDI is associated with higher technology and knowledge spillovers and higher product-level dynamic which are important drivers of productivity growth and economic development.

The first part of my dissertation analyzes the link between AfT and trade. To investigate who really benefits from the AfT initiative, together with Philipp Hühne and Peter Nunnenkamp, I take a closer look on the donor and recipient countries trade pattern. In chapter 2, we simultaneously estimate and compare the effects of AfT on trade with donors. We find that AfT increases recipient exports to donors as well as recipient imports from donors. The first effect tends to dominate the latter, which contradicts the skeptical view that donors grant AfT primarily to promote their own export interests. Chapter 3 extends this work to South-South trade. AfT granted by OECD donors seems to strengthen the trade relations of recipient countries with other developing countries. Chapter 4 further differentiates the impact of AfT on trade in differentiated manufacturing goods and trade in primary commodities. Diversifying and upgrading the export structure is important for developing countries since primary commodity dependence is a major concern in various low income countries. Our result suggest that AfT has been effective in promoting recipient exports of manufactures. These findings hold not only for trade relations with donor countries but also in south-south trade with other developing countries.

The second part of my dissertation investigates the link between foreign aid and FDI in more detail. Official development assistance (ODA) and foreign direct investment (FDI) are widely perceived to be alternative means of supplementing domestic savings and promoting economic development in low- and middle-income countries. However, possible complementarities of aid and FDI have received limited attention so far. Together with Julian Donaubauer

and Peter Nunnenkamp, I examine whether aid specifically targeted at economic infrastructure helps developing countries attract higher FDI inflows through improving their endowment with infrastructure in transportation, communication, energy, and finance. To measure infrastructure appropriately, we construct comprehensive and comparable indices on the most relevant components of economic infrastructure. An unobserved components model is employed to cover the largest possible number of developing and developed countries over the period 1990-2010¹. Chapter 5 provides details on the construction, country rankings and possible applications of the infrastructure indices. Thus, by overcoming several data limitations, our new global index can help to address the link between development assistance, infrastructure and aid more systematically (chapter 6). By performing 3SLS estimations we explicitly account for dependencies between the allocation of sector-specific aid, the determinants of infrastructure, and the determinants of FDI. We find strong and robust evidence that aid in infrastructure is effective in improving the recipient countries' endowment with infrastructure. Infrastructure consistently proves to be an important determinant of developing countries' attractiveness to FDI. Consequently, only aid targeted at infrastructure needs promotes FDI indirectly through the infrastructure channel. In addition, aid in infrastructure has direct effects on FDI.

Having established a positive link between aid and FDI, the last part of my dissertation analyzes intra-firm reallocation effects of FDI in developing countries. Foreign direct investment (FDI) in developing countries is associated with productivity growth of host country firms due to knowledge and technology spillovers. The productivity-increasing channel via product range optimization and product scope expansion in the aftermath of a foreign acquisition, however, has largely been ignored so far. Chapter 7 looks explicitly at the effects of FDI on the product mix of multi-product firms (MPF) in India to investigate this channel in detail. Access to developed countries' technologies and know-how through FDI affect the performance by product scope expansion of foreign acquired companies. With the help of a firm-product-level dataset of Indian manufacturing firms, I reveal that foreign owned firms are associated with a higher product scope and a more flexible manufacturing process allowing to produce more similar products together. Using a doubly robust propensity score reweighted covariate adjusted regression to control for the selection bias associated with the entry of foreign investors, I show that foreign acquired firms expand their product range. FDI increases the probability to introduce new products, upgrade products and drop unrelated products from their product portfolio. The effect is most pronounced for majority and wholly-acquired foreign firms. By analyzing the product-level dynamics within firms, I reveal an important

¹We will extend our new global index in the future.

micro-level channel of productivity increases after foreign acquisition.

Overall, the findings of my dissertation can be informative to policy makers and researchers interested in the link between aid, trade, FDI and a countries product structure. My research shows that the Aid-for-Trade initiative is effective in enhancing trade with donors and other developing countries. Further, aid targeted at the bottlenecks of foreign investors, in particular targeted at infrastructure, helps to attract FDI inflows. FDI inflows, in turn, induce higher product-level dynamic which are an important driver of economic growth.

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Part I

Aid for Trade

Chapter 2

Who Benefits from Aid for Trade? Comparing the Effects on Recipient versus Donor Exports

Philipp Hühne^a, Birgit Meyer^b, Peter Nunnenkamp^c

^a Helmut-Schmidt University, Hamburg, Germany

^b University of Kiel, Kiel, Germany

^c Kiel Institute for the World Economy, Kiel, Germany

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Abstract: Recent studies offer an ambiguous picture on the effectiveness of foreign aid in strengthening the export capacity of recipient countries. Moreover, the literature on aid for trade (AfT) has often neglected the fact that exporters in the donor countries may be among the main beneficiaries. We simultaneously estimate and compare the effects of AfT on trade in both directions. We find that AfT increases recipient exports to donors as well as recipient imports from donors. The first effect tends to dominate the latter, which contradicts the sceptical view that donors grant AfT primarily to promote their own export interests.

Chapter 3

Does Aid for Trade from the North promote South–South trade?

Philipp Hühne^a, Birgit Meyer^b, Peter Nunnenkamp^c

^a Helmut-Schmidt University, Hamburg, Germany

^b University of Kiel, Kiel, Germany

^c Kiel Institute for the World Economy, Kiel, Germany

Applied Economics Letters, 2015, 21(17):1230-1233

<http://dx.doi.org/10.1080/13504851.2014.922665>

Abstract: Our empirical estimations indicate that Aid for Trade (AfT) granted by OECD donors strengthens the trade relations of recipient countries with other developing countries. By focusing on South–South trade, we mitigate endogeneity concerns that have plagued analyses of trade between recipients and donors of AfT.

Chapter 4

Aid for Trade: Assessing the Effects on Recipient Exports of Manufactures and Primary Commodities to Donors and Non-donors

Philipp Hühne^a, Birgit Meyer^b, Peter Nunnenkamp^c

^a Helmut-Schmidt University, Hamburg, Germany

^b University of Kiel, Kiel, Germany

^c Kiel Institute for the World Economy, Kiel, Germany

2015, In: *Handbook on the Economics of Foreign Aid*, Mak Arvin and Byron Lew (Eds.), Chapter 10: 141–161, Cheltenham: Edward Elgar

<http://dx.doi.org/10.4337/9781783474592.00018>

Abstract: Considering that primary commodity dependence continues to be a major problem of various lower income countries, we analyze whether Aid for Trade (AfT) has helped recipient countries upgrade and diversify their exports. Estimating an asymmetric and aggregated gravity model, we find that AfT has been effective in promoting recipient exports of manufactures – whereas the effects on primary commodities are typically insignificant. These findings hold not only for trade relations with donor countries but also in south-south trade with other developing countries.

Part II

Aid, Infrastructure and FDI

Chapter 5

A New Global Index of Infrastructure: Construction, Rankings and Applications

Julian Donaubaue^a, Birgit Meyer^b, Peter Nunnenkamp^c

^a Helmut-Schmidt University, Hamburg, Germany

^b University of Kiel, Kiel, Germany

^c Kiel Institute for the World Economy, Kiel, Germany

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Abstract: We construct comprehensive and comparable indices on the most relevant components of economic infrastructure. An unobserved components model is employed to cover the largest possible number of developing and developed countries over the period 1990-2010. We map major findings from the new indices of infrastructure and provide country rankings, which we also compare with subjective assessments of infrastructure in the World Economic Forum's Global Competitiveness Report. Finally, we exemplify possible applications related to trade and FDI. By overcoming several data limitations, our new global index can help assess the links between infrastructure and economic development more systematically.

Chapter 6

Aid, Infrastructure, and FDI: Assessing the Transmission Channel with a New Index of Infrastructure

Julian Donaubauer^a, Birgit Meyer^b, Peter Nunnenkamp^c

^a Helmut-Schmidt University, Hamburg, Germany

^b University of Kiel, Kiel, Germany

^c Kiel Institute for the World Economy, Kiel, Germany

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Abstract: Official development assistance (ODA) and foreign direct investment (FDI) are widely perceived to be alternative means of supplementing domestic savings and promoting economic development in low- and middle-income countries. However, possible complementarities of aid and FDI have received limited attention so far. It remains open to debate whether aid could render recipient countries more attractive to FDI by removing specific bottlenecks that prevent higher FDI inflows. In particular, we raise the hypothesis that aid specifically targeted at economic infrastructure helps developing countries attract higher FDI inflows through improving their endowment with infrastructure in transportation, communication, energy, and finance. By performing 3SLS estimations we explicitly account for dependencies be-

tween three structural equations on the allocation of sector-specific aid, the determinants of infrastructure, and the determinants of FDI. We find strong and robust evidence that aid in infrastructure is effective in improving the recipient countries' endowment with infrastructure. In sharp contrast, other aid is not effective in improving infrastructure. Infrastructure consistently proves to be an important determinant of developing countries' attractiveness to FDI. Consequently, only targeted aid promotes FDI indirectly through the infrastructure channel. In addition, aid in infrastructure has direct effects on FDI. It appears that foreign investors anticipate longer term effects of aid on the country's endowment with infrastructure and expect aid-financed infrastructure to serve them particularly well.

Part III

FDI in India

Chapter 7

Product Mix and Foreign Ownership: Evidence from India's Investment Liberalization

Birgit Meyer^{a,b}

^a University of Kiel, Kiel, Germany

^b Kiel Institute for the World Economy, Kiel, Germany

Abstract: Foreign direct investment (FDI) in developing countries is associated with productivity growth of host country firms due to knowledge and technology spillovers. Little is known, however, how the presence of multinational enterprises affects the product mix and the manufacturing of more advanced products by firms. This paper wants to fill this gap by examining the effects of foreign ownership and foreign ownership structures on within firm reallocation processes. With the help of a firm-product-level dataset of Indian manufacturing firms, I reveal that foreign owned firms are associated with a higher product scope and a more flexible manufacturing process allowing to produce more similar products together. Using a doubly robust propensity score reweighted covariate adjusted regression to control for the selection bias associated with the entry of foreign investors, I show that foreign acquired firms expand their product range. FDI increases the probability to introduce new products, upgrade products and drop unrelated products from their product portfolio. The effect is most pronounced for majority and wholly-acquired foreign firms.

1. Introduction

A numerous amount of empirical and theoretical work on the effects of foreign investment liberalization (Borensztein et al, 1998; Markusen, 2004; Alfaro et al, 2004) has significantly contributed to our understanding how the entry of foreign investors can promote growth and spur development. For developing countries, trade expansions, technological and knowledge spillovers are typically identified as key determinants of substantial economic gains after opening the economy to foreign direct investments (FDI). Policies in developing countries have been designed in various ways to become more attractive for foreign investors. In India, for example, tax holidays and additional depreciation of 20 percent on new investments are promised to foreign investors (United Nations, 2000; Indian Ministry of Commerce and Industry, 2015).

An extensive body of empirical literature shows the positive impact of FDI on productivity, trading activities, innovation and wages of host country firms (for example Harris and Robinson, 2003; Görg and Greenaway, 2004; Arnold and Javorcik, 2009).¹ This empirical work fits various theoretical models of multinational enterprises, either in the tradition of the knowledge capital model (Carr et al, 2001; Markusen, 2004) or the more recent models of heterogeneous firms (Helpman et al, 2004) which assume that multinationals have specific assets, technologies and knowledge which generate a productivity advantage.

A most recent and promising extension to the firm heterogeneity literature takes into account heterogeneity not only at the firm level, but also at the product level. The pioneering work of Bernard et al (2007) and Bernard et al (2010) shows that US firms producing multiple products account for 90 percent of total output in manufacturing, and among those firms adding and dropping products is common.² This prevalence of multi-product firms (MPF), which can be found also in many developing countries, raises a number of new and exciting questions related to international trade.

For example, Arkolakis and Muendler (2010), Eckel and Neary (2010), Iacovone and Javorcik (2010), Mayer et al (2014) and Bernard et al (2014) examine product-level dynamics within firms in the context of exporting behavior and trade liberalization. More productive firms export more products to more countries and have higher average product-country export flows. Goldberg et al (2010a) show that liberalizing tariffs in India is associated with an expansion of product scope. New product introductions are concentrated in sectors with disproportionately large input tariff declines that allow firms access to new, previously unavailable imported materials. Little is known, however, how the presence of multinational enterprises affects the product mix and the manufacturing of more advanced products by firms.

¹ This is mainly done by implementing methods from microeconomic program evaluation to estimate the direct treatment effect of being acquired by a foreign investor (the treatment) compared to non-treated domestic firms (the control group).

² Over 90 percent of US manufacturing firms add and/or drop a product over a given five-year interval.

CHAPTER 7. PRODUCT MIX AND FOREIGN OWNERSHIP

By examining the productivity enhancing channel of FDI in detail, this paper contributes to the small but fast growing literature on product dynamics and international trade. Placing the production of some varieties abroad, foreign investors may alter the product mix of their local acquisition. Adopting new production technologies and realizing synergy effects might allow cost reduction, product innovation and product upgrading, which might alter the product mix. An expansion in the product scope is associated with higher firm productivity (Bernard et al 2010; Goldberg et al 2010b).

Using a firm-product-level dataset of Indian manufacturing firms, I show that foreign owned firms are associated with a higher product scope and a more flexible manufacturing process allowing to produce more similar products together. To establish causality, I implement the so-called doubly robust estimator, a propensity score reweighting estimator combined with covariate adjustment, to account for the fact that foreign capital is generally invested in larger and more productive firms, which tend to produce a higher variety of products. This estimator has the advantage that it correctly identifies the average treatment effect of being acquired by a foreign investors even if either the propensity score or the conditional regression model are possibly misspecified (Wooldridge 2007; Girma et al , 2015). Further, distinguishing between different foreign entry modes allows to differentiate between the effects of minority and majority foreign acquisitions and the related technology spillovers on the product mix.

My results suggest that firms acquired by foreign investors drastically restructure their product mix. Foreign acquired firms seem to skew their production towards better performing products, exploit higher economies of scale by churning unrelated product and introducing more varieties within their existing product lines. Firms become leaner in their product lines while introducing new varieties to their core product lines. Adopting new technologies, process and product innovation allows to reduce costs and upgrade products, while it simultaneously allows acquired firms to expand their product scope. The effect is most pronounced for majority and wholly-acquired firms. Directly after foreign acquisition, majority acquired firms increase their net extensive product margin by 37.2 percent compared to similar firms in purely domestic hands.

Thus, by exploring the impact of changes in ownership on MPFs in a developing country, this paper contributes to the literature by providing evidence of a further micro-level channel through which FDI promotes productivity growth. Its novelty lies in testing how access to new technologies and know-how through FDI affect the performance by product scope expansion of acquired companies.³ Looking explicitly at intra-firm reallocation at the product level, this paper is – to the best of my knowledge – one of the first ones linking foreign ownership and foreign ownership structure to within firm reallocation processes. Related to my work

³ Previous literature suggests that foreign affiliates have a superior performance (Görg and Greenaway, 2004; Arnold and Javorcik, 2009) and tend to export higher-unit-value products (Harding and Javorcik, 2012; Iacovone and Javorcik, 2010). Quality increases in both homogeneous and differentiated goods might be facilitated in presence of FDI inflows into developing countries.

is the study by Harding and Javorcik (2012) who show that FDI has the potential for raising the quality of exports in developing countries in both absolute terms and in terms of closing the gap to the quality frontier. FDI speeds up growth by facilitating the manufacturing of more sophisticated products by local firms (Eck and Huber, 2016).

My findings can be informative to policy makers and researchers interested in the link between the structure of a firm, FDI, productivity and economic growth.⁴ Innovation and productivity improvements within firms account for a large fraction of productivity gains. Moreover, variety-loving consumers benefit not only from new products, but also from product and process innovation.⁵ Understanding the dynamics of introducing new varieties at the firm level and the innovation process constitutes a first step in understanding how a country can upgrade its product structure and what policies, if any, can stimulate this process.

The remainder of the paper is structured as follows. Section 2 briefly reviews the related literature on MPFs, international trade and FDI. Section 3 describes the firm level data set. Section 4 presents characteristics of MPFs in India. Section 5 empirically analyzes the effect of FDI on the product mix. The last section concludes.

2. Multi-product Firms and International Trade

A new strand of the MPF literature considers explanations of productivity changes arising from intra-firm resource reallocation in the presence of product heterogeneity. Recent empirical as well as theoretical evidence suggest an important role of international trade for within firm reallocation of resources between products. Intra-firm dynamics affect productivity beyond the firm level: product churning affects overall growth at the industry and economy level. As shown by Bernard et al (2010) product switching was the driving force behind the U.S. output growth between 1972 and 1997.

The theoretical literature has developed various models incorporating heterogeneity at the product level, and relates them to international trade (Bernard et al, 2007; Feenstra and Ma, 2008; Baldwin and Gu, 2009; Arkolakis and Muendler, 2010; Eckel and Neary, 2010; Nocke and Yeaple, 2014; Mayer et al, 2014). These models capture endogenous dynamics across firms (for example exporting activities undertaken by some firms versus the exclusive focus on the domestic market by others) as well as within firms (for example some products being exported but not others). The aggregate responses to policy changes emerge as a combination of these multiple dynamics within and across firms.

MPFs produce a range of imperfectly substitutable products. Varieties within a firm's product line are typically linked on the cost side through a flexible manufacturing technology (Milgrom and Roberts, 1990; Eckel, 2009;

⁴ See an emerging literature started by Hausman et al (2007).

⁵ In his revolutionizing work, Krugman (1976) models how countries could gain from trade through import of new varieties. Broda and Weinstein (2006) show that the increase in product varieties has contributed to large welfare gains in the United States over the period between 1972 and 2001.

CHAPTER 7. PRODUCT MIX AND FOREIGN OWNERSHIP

Eckel and Neary, 2010). Firms choose their optimal number of products by balancing the net profits from producing a new variety against the cost of cannibalizing their sales of other varieties. Demand and cost linkages between the varieties produced induce a trade-off between product and process innovation, which is particularly important for multinational MPFs. Models of MPFs for example by Bernard et al (2010, 2011), Eckel and Neary (2010), Nocke and Yeaple (2014), and Damijan et al (2014) demonstrate how either trade participation or trade liberalization affect firms' product scope. Increased import competition and strong competition in export markets push companies to rationalize their product scope towards their core competencies and better performing products, which in turn improves firms' performance. Mayer et al (2014) stress the importance of the repercussions of the trading environment on the product mix of firms.

Despite this recognition for the relevance of the intra-firm channel related to international trade, there has been less attention so far on how changes in ownership affect product scope and product innovation. An exception are Bernard et al (2010) who show that in the U.S. most of the firms engaging in merger and acquisition activities also alter their product mix, half of those firms even switch sectors. However, Bernard et al (2010) do not investigate further the extent of ownership changes on within firm changes and innovation activities. In particular, they do not distinguish different types of merger and acquisitions, and do not take into account that foreign acquisitions might be different to domestic merger and acquisition activities. Distinguishing between different effects of domestic and multinational merger and acquisition activities is of particular importance for developing countries: cheaper raw materials, lower labor cost, lower transaction costs and reduced trade costs are major motives of international mergers and acquisitions.

These cost advantages of developing countries might induce multinational MPFs to place the production of some of their varieties abroad. Multinational enterprises tend to fragment their production across countries to exploit factor price differences. Foreign investors seeking lower production costs vertically integrate in particular firms producing intermediate goods into their global value chain. Thus, by placing the production of some products to developing countries, FDI might induce changes in the product mix of an acquired company. The engagement of foreign investors in developing countries potentially affects the product mix and productivity of firms due to quality and quantity adjustments, technological spillovers and skill upgrading.

Foreign owners might extend the product scope by adding varieties to the existing product range of acquired companies. As stressed by Baldwin and Ottaviano (2001), analogues to the Brander-Krugman insight, foreign owners might accept a reduced rate of return on new varieties produced by their acquired partner abroad since trade barriers protect parts of the products from the cannibalization effect.⁶ Knowledge and technology spillovers to the acquired firms might facilitate product innovation and process upgrading. Superior technology

⁶ Producing products abroad enhances trade, in form of exports to new locations and in form of reverse imports, opposed to the usual trade displacement of exports with local sales of foreign affiliates.

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of a foreign investor enhances the competitive position of the acquired firm in a developing country. Foreign investors are likely to engage with local partners whose level of technology is lower than their own. In a country like India, where the majority of investors are from more advanced countries like Singapore, the United States, Japan or Germany, there might be a huge technology gap.⁷ Hence, there might be a strong potential for improvements in the production process and the production technology.

Access to know-how or patents for new products or processes allows to add new products to the product mix. Flach and Irlacher (2015) model the role of access to foreign markets in process⁸ and product innovation: in larger market, firms will invest in new products and production processes. Iacovone and Javorcik (2010), Harding and Javorcik (2012) and Eckel et al (2015) show that the presence of FDI lead to higher unit-value exports. Multinationals using a country as export platform might produce either more sophisticated or higher-unit-value goods than those previously exported. Since foreign acquired firms are internationally more integrated, they are able to differentiate their products more across qualities and locations.

Further, according to Bloom et al (2012) productivity increasing activities can be related to the management structure. Forward or backward integration through vertical mergers reshapes the organizational structure. Transferring superior management skills to their acquired partners, foreign owned firms operate more efficiently and new production capacities are created in the host country. For these reasons, I hypothesize that a foreign partnership reduces a varieties fixed cost. By introducing a new product to an existing established product line, firms might amortize sunk costs related to innovation and establishing a brand for the respective product line.

FDI could encourage acquired firms as well to drop products. Changes in market orientation induced by foreign owners might lead to product dropping of internationally and nationally non-competitive products. Increased international competition, usually following trade and investment liberalization, forces MPFs to optimize their product range, by focusing on their core competency and dropping marginal high-cost varieties (Bernard et al, 2007; Eckel and Neary, 2010). Firms typically have a core competency in the production of specific product lines; outside these core competencies the production process is less efficient. To internalize the benefits of flexible manufacturing, products need to be closely related in their production process. Thus, foreign investors might have incentives to drop unrelated products from the product portfolio. Eckel and Neary

⁷ Unfortunately, Prowess does not have immanent information on the origin of the respective foreign acquirer. Nevertheless, according to the Indian Ministry of Commerce and Industry, the top investing countries FDI equity inflow into India are from Mauritius, Singapore, the U.K., Japan, the Netherlands, the U.S., Germany, Cyprus, France and Switzerland. These top ten countries account for more than 85 percent of total FDI inflows from 2000 to 2014. (see http://dipp.nic.in/English/Publications/FDI_Statistics/FDI_Statistics.aspx, 10/02/2016)

⁸ Process innovation leads to higher economies of scale (Dhingra, 2013).

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(2010) show that globalization further increases the pressure to reduce costs which in turn reduces a firm's product scope and its diversification across products.

Firms may decide to expand their product range by adding new varieties to their product portfolio or drop marginal products from their product mix to lower their production costs. The net effect of restructuring processes following a foreign acquisition is a priori unclear.

The degree of foreign partnership might play a role in determining the net effect on the product mix. As Javorcik and Saggi (2010) show, multinationals with high levels of technology prefer to wholly acquire their affiliates rather than initiating joint ventures. This higher technology may arguably translate into stronger technology upgrading, process and product innovation activities of the acquisition targets. Further, foreign owners are more likely to integrate wholly-owned affiliates completely into their international production network, transforming the product mix of their acquired firm according to their needs and using a developing country like India as “cheaper” production platform. However, for partially-owned firms, which operated pre-acquisition using lower levels of technology, there would be a higher technology gap between the target and the acquirer, hence, a higher level of technology and skill upgrading would be possible after the acquisition, altering the product mix drastically. Further, foreign firms might choose to engage in firms with an excessive product scope and an unbalanced product mix only with minority ownership.

3. Data

The product-wise firm-level information is from the Prowess database collected by the Centre for the Monitoring of the Indian Economy (CMIE). Prowess contains information primarily from income statements and annual reports of publicly listed companies. The data spans from 1989 to 2013, thus, it includes the period of India's investment liberalization phase. Prowess provides detailed firm-level information for a panel of medium and large manufacturing firms accounting for around 70 percent of economic activity in India's formal industrial sector (see Goldberg et al, 2010a, b).⁹ The panel structure of Prowess enables within and across firm comparisons of restructuring activities and performance changes over time. Though the panel is unbalanced, firms are usually observed for a continuum of years after entering the database. In total, I have more than 78,575 observations of more than 9,422 firms.

Due to the 1956 Companies Act to disclose product-level information on capacities, production and sales in their annual reports, a firm's product mix can be traced over time. Product-level information is available for about 80 percent of the manufacturing firms and the product-wise sales comprise 98 percent of the individual

⁹ Since foreign investors prefer to engage in partnerships with larger firms, the absence of small firms in the Prowess is not expected to alter my results.

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reported manufacturing output.¹⁰ Since product-level information on sales and quantity are reported for each product, Prowess is particularly well suited to analyze the effects of ownership changes on the product mix and product quality. Thus, with this dataset the underlying mechanism of firm-level adjustments in response to ownership changes that are typically hidden in other data sources can be analyzed while not being prone to measurement issues arising at the product level.

The definition of a product is based on the CMIE's internal product classification which builds on the Indian Trade Classification and Harmonized Commodity Description and Coding System. The internal CMIE product classification can be mapped to the Indian National Industrial Classification (NIC) 2008 which is comparable to the International Standard Industry Classification (ISIC) Revision 4 up to the four-digit level. This mapping allows me to assess product disaggregation and diversification at a very detailed level. There are 1729 products (at the five-digit product level) linked to 113 four-digit NIC industries across 23 sectors (two-digit NIC codes). The product coverage is similar to the U.S. (see Bernard et al, 2010)¹¹. Goldberg et al (2010b) show that products vary substantially in terms of how they are produced both within sectors and across sectors.

Products are further classified according to their end use into intermediate goods (capital and intermediates) and final goods (consumer goods, durables and nondurables) based on the Broad Economic Categories (BEC), Revision 4.¹² I distinguish between these two categories since the affiliation to a multinational enterprise might affect the scope of intermediate and final good production differently.

The Prowess database provides detailed information on the ownership and entity type of a corporation. Firms with foreign capital participation are defined as firms in which the share of subscribed capital (equity) owned by foreign investors is equal to at least 10 percent.¹³ Until 1991, Indian policy makers conducted a very restrictive trade regime, with high nominal tariffs and strict limitations to FDI. The protectionist License Raj favored more the development of large family-owned corporation than international active enterprises, while

¹⁰ Like Goldberg et al (2010a), I cross-checked this information. Since product-level information and overall sales information are provided in different data modules, this can be validated. The fiscal year ends usually in March in India, such that a particular year refers to the fiscal year-end that occurs in the following March. Several companies report different year end values. In order to render all companies comparable, companies with a year end up to July are assumed to refer to the previous year's result. Further, products deviating from their usual production cycle in one year (for example only 3 month instead of 12 month) are dropped to ensure comparability.

¹¹ The definition of a product is slightly more detailed than the definition used by Bernard et al (2010) for U.S. manufacturing data. Their data contains approximately 1500 products, defined as five-digit Standard Industrial Classification (SIC) codes, across 455 four-digit SIC industries. At the most disaggregated level, Prowess contains in total 3820 different products in the manufacturing sector. An example for the product classification of Prowess is given in Table A1 in the appendix.

¹² The matching of BEC and ISIC codes is done using the respective correspondence tables of the United Nations Statistics Division (<http://unstats.un.org/unsd/cr/registry/regot.asp?Lg=1>, 03/01/2016). Commodities from BEC categories 31 (primary fuels and lubricants), 52 (other transport equipment) and 7 (goods not elsewhere specified) cannot be unequivocally categorized as final or intermediate good. These commodities are therefore not included in the separate analysis of final and intermediate goods.

¹³ I supplement this data with information on the ownership type of firms for firms that have missing information. In detail, I consider firms that are classified as privately Indian owned to have zero percent foreign equity and privately foreign-owned firms to have 100 percent foreign equity.

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foreign capital was highly regulated. A balance-of-payments crisis following the rising oil price in the wake of the Gulf war forced the Indian government to drastically liberalize their economy as part of a structural adjustment program of the International Monetary Fund in 1991. Since then, the Indian government has abandoned its extremely restrictive trade policies, reduced its nominal tariffs and non-tariff barriers, delicensed products and opened up the economy to foreign investors. The aim of the reform was to increase domestic competition while simultaneously becoming internationally more competitive. A more favorable environment for global expansion was created. A significant inflow of FDI in India followed. Large corporations dominated the internationalization process of Indian firms (Sauvant et al, 2010). In particular, since the end of the 1990s FDI inflows have gained momentum.¹⁴ Thus, the investment liberalization offers a unique setting to observe the effects of foreign acquisitions over time and for a large number of firms. Wholly-owned foreign enterprises dominate the FDI distribution. Nevertheless, a sizable number of firms receive only a small share (less than 25 percent) of foreign equity.

Since acquisitions with high foreign ownership shares might have different operational implications than acquisitions with rather low foreign involvement, I follow Javorcik and Spatareanu (2008) and Girma et al (2015) and use different foreign ownership categories. Since previously existing restrictions on the foreign ownership degree had been lifted in course of the investment liberalization, the causal effects of different forms of foreign acquisitions on the product scope and the product mix can be identified. To be able to identify possible impacts of minority, majority and full ownership, I consider four foreign ownership categories. A firm with a foreign capital share lower than 25 percent has only a small minority of foreign involvement while firms with a foreign equity share higher than or equal to 25 percent but lower than 50 percent are regarded as minority foreign owned.¹⁵ Firms with at least 50 percent but lower than 100 percent foreign shares form the third category of firms with majority foreign ownership. The fourth and last category are wholly-acquired foreign firms that is firms with 100 percent foreign equity.¹⁶ Full ownership is the dominant ownership type of foreign investors. Majority foreign control accounts for 14.4 percent of firms with foreign involvement between 2000 and 2013. Joint ventures with minority foreign control is chosen by 10.8 percent of foreign investors. Local firms attracting a low level of foreign capital account for 11.2 percent of all firms which receive FDI. Due to lack of data availability, the different foreign ownership categories can only be used after 1999, until 1999 I can only distinguish between domestic and foreign ownership

¹⁴ See Table A 3.

¹⁵ I distinguish between minority and small minority foreign owned since pre-liberalization a maximum share of 40 percent of foreign shareholding was allowed, but only with governmental approval. The reform itself was unanticipated by Indian firms were suspicious about FDI. The protectionist License Raj fueled sceptics against foreign equity among domestic firms (Sauvant et al, 2010).

¹⁶ Table A 3 in the appendix shows the distribution of foreign acquired firm by year.

4. Characteristics of Indian Multi-product Firms

MPFs dominate the economy not only in the US, but as well in India. Table 1 breaks down the distribution of MPFs and domestic and foreign owned firms across my sample period. Though MPFs represent a minority of firms in India, they account for the majority of total manufacturing output. MPFs operate often across multiple industries and sectors. In alignment with the observation that foreign investors are more productive, foreign owned firms have a broader product range than purely domestic firms. Looking only at foreign firms in India, it becomes apparent that the majority of foreign firms are MPFs. Only 36 percent of all foreign owned firms are single product firms. Foreign owned MPFs account for 93 percent of the manufacturing output of all foreign owned firms in India. Further, in line with the theory by Mayer et al (2014) and Bernard et al (2010), I observe that more productive firms produce more diversified products and operate in more sectors. On average a domestic firms produces 4.1 products while foreign owned firms produce on average 5.6 products. The average number of products produced per firm is increasing after the investment liberalization in 1992. Figure 1 shows that the average product scope increases drastically from 1996 onwards, simultaneously with more FDI inflows. While product and sector diversification was raising, in particular for foreign firms, purely domestic standalone as well as private groups tend to concentrate their products more after the foreign investment activities in India gained momentum from 1996 onwards. Compared to domestic firms, foreign owned firms seem to be more active in changing their product mix. The descriptive Table 2 reveals that over a five year horizon not even half of all domestic firms engage in product switching activities, while three quarters of all foreign owned firms engage in product adding as well as in product dropping.

5. Investment Liberalization, Product Switching and Foreign Ownership

The following empirical analysis focuses on the effects of foreign ownership on the product scope and product switching behavior of MPFs in India. India's investment liberalization offers an ideal framework to investigate the impact of being acquired by a foreign investor.

To analyze the impact of foreign ownership on the product mix, I first look at correlations between foreign ownership and the product scope. A baseline model accounting for firm heterogeneity assesses the potential premium of being foreign owned on the product range, product differentiation, and the scope of intermediate and final goods. To identify the causal effects of a foreign acquisition, I set up a difference-in-difference approach in a second step. Precisely, I use a doubly robust propensity score reweighted covariate adjusted regression, the so-called doubly robust estimator, to account for potential selection of foreign investors into more productive firms with higher product scope.

Since process and product innovation activities are particularly related to product adding and product upgrading, I look as robustness check at changes in innovation activities and product quality.

5.1. Foreign Ownership and the Product Scope

Empirical model

To explore the differences between foreign and domestic ownership on the extensive product margin, I estimate the following equation:

$$\ln(n_{ijt}) = \beta_0 + \beta_f \text{foreign}_{ijt} + \gamma X_{ijt} + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ijt}, \quad (1)$$

where n_{ijt} is the number of products manufactured by firm i operating in industry j at time t . foreign is a foreign ownership dummy taking on the value one if a firm is foreign owned. The coefficient of interest is β_f , which captures the semi elasticity of a firm's product scope with respect to foreign ownership. Firm fixed effects (α_i) to control for time invariant firm characteristics, industry fixed effects (α_j) to account for industry specific heterogeneity¹⁷, and year fixed effects (α_t) to capture unobserved aggregate shocks, are included. ε is the error term.

Further, to account for the fact that larger, more established, more productive firms usually have a broader product scope, the vector X controls for firm characteristics like *productivity* measured by total factor productivity (TFP)¹⁸, *size*¹⁹, *age* and a dummy equal to one if the firm is (partly) state owned. State owned enterprises (SOE) enjoy in many instances privileges and immunities not available to their competitors. These advantages, which are not based on better performance, superior efficiency, better technology or superior management skills, reduce the threat of market competition for SOEs (Boardman and Vining, 1989, Bartels and Harrison, 2005). Inefficiencies and low incentives for cost reduction in SOEs lead to missing product cannibalization inducing an inefficient high product scope.²⁰

Main results

Table 3 reports the main results based on equation (1). The coefficients of the control variables are mainly as expected. Being more productive, larger and having a "competiveness advantage" by being a SOE significantly increases the product range. The age of a firm has, however, no statistically significant impact on the product scope. Column (3) and (4) include a squared term of productivity to account for a possible cannibalization effect, as argued by Feenstra and Ma (2008), Eckel and Neary (2010) and Hottman et al (2016). Since productive firms with a high market share are hurt more by additional cost that occur by introducing a

¹⁷ Firms switch their main industries. The main industry a firm is operating in, that is the industry accounting for most of a firms sales and most of its products, is used to account for industry specific characteristics.

¹⁸ TFP is constructed following the methodology of Levinsohn and Petrin (2003). Please see the appendix for details on the construction of TFP.

¹⁹ Size is approximated by log output.

²⁰ According to property right theory, private enterprises should perform more profitable and efficiently than public enterprises (see for example Alchian and Demsetz, 1973). Public choice theorists (for example Levy, 1987) stress that X-inefficiency factors arise from public ownership per se.

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new product line, the incentive to add more products are weak for firms with high market shares. Therefore, Feenstra and Ma (2008) assume an inverted U-shape relationship between productivity and the range of varieties produced. My result confirm this cannibalization behavior: the coefficient of productivity is significantly positive, while its squared term is significantly negative, and the estimated maximum is inside the data range. Firms with very high productivity face a substantial trade-off when introducing an additional product.

Turning to the variable of interest: the coefficient on foreign ownership is positive and statistically significant. Foreign ownership is associated with a higher scope of production than purely domestically owned firms. The estimate in column (1) implies that the premium of being foreign is related to a 9 percent higher product scope. Controlling for productivity and other firm characteristics in column (2), and (3) of Table 3 reduces the effect of foreign ownership. The coefficients of foreign ownership are statistically significant and economically meaningful: around 5 percent of product expansion can be attributed to foreign ownership. Column (4) restricts the sample to the first decade after the investment liberalization. The impact of foreign ownership for the reduced sample up to 2003 is of similar size, thus, the product scope premium of foreign ownership is persistent and seems not to be bounded to the immediate phase after the investment liberalization.

During the period of my analysis, the share of foreign owned firms increased by 11.4 percentage points between 1993 and 2013, while firms increased their product scope on average by 26.0 percent. Thus, my estimates imply that the foreign investment liberalization connected to the entrance of new foreign investors account for around 20.1 percent of the observed expansion in firms' product scope²¹. This can be compared to the findings of Goldberg et al (2010a)²². Their result implies that the reduction of import tariffs account for approximately 31 percent of the expansion in product scope in India. Goldberg et al (2010b) estimated that the net product expansion accounted for 25.2 percent of manufacturing output growth between 1989 and 2003 in India. Taking their estimate at face value and reproducing my estimation according to their sample size (see Table 3, column (4)), my estimates suggest that if India's investment liberalization and the following inflow of FDI impacted growth only through the expansion of the product scope, the increasing inflow of foreign capital contributed 5.6 percent to the overall manufacturing growth between 1989 and 2003.²³ This suggest

²¹ The calculation is based on the estimates in Table 3 column (3). Table A 3 in the appendix shows the number of foreign acquisitions by year after India's investment liberalization campaign in 1992.

²² Goldberg et al (2010a,b) use as well the Indian Prowess dataset.

²³ The estimate are based on Table 3, column (4). Foreign investment liberalization connected to the entrance of new foreign investors account for around 22.7 percent of the observed expansion in firms' product scope over the period from 1989 to 2003. Thus, combining this with the estimate of Goldberg (2010b), the contribution of foreign investors through the net extensive product margin on manufacturing output growth is calculated by $0.227 \cdot 0.252$. Nevertheless, considering also other impacts of FDI, for example on wages or productivity spillover to local firms, this constitutes only a lower bound of the potential impact of FDI on manufacturing growth.

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that India's trade and investment liberalization reform led to dynamic gains as these new introduced products fed into the domestic economy.

Table 4 shows additional results, including international trading activities. I include an import dummy equal to one if a firm imports raw materials and an export dummy equal to one if a firm exports a share of its products. Including exporting and importing activities and interacting them with foreign ownership may provide a hint of the position of the acquired firm in the global value chain. According to the theory (Bernard et al, 2007; Eckel and Neary, 2010), lower costs of importing goods from abroad will lead to a decline in firm scope as firms drop their marginal varieties sold on the domestic market. Firms importing raw materials, nevertheless, rather expand their product range. Importing raw materials from abroad is associated with an increase in product scope by around 3.8 percent (see Table 4, column (1) and (2)). This result might be driven by the input tariff reduction in the 1990s. As Goldberg et al (2010a) show, the input tariffs reduction in India drastically increased the number of varieties imported as well as the number of products produced. The size of the coefficient of my import dummy mirrors the effect of the Indian import tariff reduction found by Goldberg et al (2010a)²⁴. The coefficient on importing is lower for foreign owners compared to domestic firms, though the difference to domestic firms is statistically not significant.

Being an exporter is associated with increases in the product scope by around 10 percent. The effect is more pronounced for firms receiving foreign capital. Many foreign investors potentially increase the market size of the acquired firm by using India as production platform to sell parts of their products abroad or back home.

Splitting the products into intermediate goods and final goods allows to take into account different motives of FDI. Table 4, column (3) and (4) indicate a potential vertical integration motive of foreign investors, seeking lower production costs in a developing country like India. Foreign owned firm which produce mainly intermediate goods have a larger product scope than foreign investors with rather horizontal motives. I only find a significant effect of foreign ownership on product expansion for intermediate goods. Firms receiving foreign capital expand their product scope if the acquired firm mainly produces intermediate goods. Foreign ownership, however, does not seem to alter the product scope of final goods.

Sensitivity and robustness test

These results are robust to the choice of productivity measures and alternative estimation approaches. Table 5, column (1) and (2) report sensitivity checks with respect to the measure of productivity. Productivity is

²⁴ Goldberg et al (2010a) find that a 10-percentage fall in tariffs results in a 3.2 percent expansion of a firm's product scope. This evidence suggest that other industrial policies like delicensing, and the reduction of tariffs and non-tariff barriers which simultaneously affected the Indian economy do not bias my result. Unfortunately, I do not have the respective data on input and output tariffs, non-tariff barriers and delicensing of products to account for these policies directly.

alternatively approximated here by labor productivity.²⁵ The results are of similar magnitude as before. Table 5, column (3) to (5), report the result using count data models. The specification in column (3) is estimated using a Poisson model, with standard errors corrected for overdispersion, and in column (4) and (5) using a Negative Binomial count data model.²⁶ Quantitatively and qualitatively these models confirm my results. The effect of foreign ownership and its magnitude is remarkably stable across specifications, which provides further reassurance that the baseline model is not driven by model misspecification.

5.1.1. Varieties and Product Diversification

Product expansion can take place by expanding existing product lines at the core competence and by creating new varieties outside the core competency of a firm. To proxy the relatedness of products, I consider the five-digit product level as product line, and products within these different product lines as varieties. Estimating equation (1) using the average number of varieties within certain product lines as dependent variable, reveals that foreign owned firms are producing more varieties than domestic owned firms. Table 6 column (1) shows that foreign ownership is associated with a variety premium of 3.9 percent. Thus, foreign owned firms might use a more flexible manufacturing technology than domestic owned firms. To realize these synergy effects, similar manufacturing technology can be used in the production processes of similar goods. A better technology provided by more technological advanced foreign investors further facilitates the production of more diverse varieties. Thus, in markets in which products can be vertically differentiated, foreign owned firms may offer different qualities in equilibrium which allows them to relax price competition while maximizing profits.

Note the negative significant semi-elasticity of *SOE* on the number of varieties within product lines. In combination with the previous finding that SOEs seem to produce significant more products, the surprising relation of SOE production implies that these products seem to be quite diverse and, in contrast to highly competitive foreign owned firms, the manufacturing process might not be aligned to capture synergy effects.

Further evidence that foreign owned firms concentrate their product scope more around their core competency can be found by looking at the number of industries and sectors MPFs are operating in. Despite the higher number of products and varieties foreign owned firms produce, foreign ownership is not correlated with the number of industries and significantly negative associated with a lower number of sectors (see Table 6, column (2) and (3)). In Table 6, column (4), I look at product diversification directly. Product diversification is

²⁵ Since Prowess does not include reliable employment data, the number of employees needed to derive labor productivity is approximated using the available information on average wages per employee by industry and year.

²⁶ Since underlying distributional assumption of the Poisson model that the mean is equal to the variance seems to be violated due to the skewed distribution of the number of products, the standard errors of the estimated Poisson model are corrected for overdispersion. Nevertheless, the Negative Binomial count data model is preferred here over the Poisson model since it provides a better fit according to the goodness of fit test and the Akaike's Information Criterion.

measured by the Berry-Herfindahl-Index (Berry, 1971), $HHI = 1 - \sum_{n=1}^N (s_n)^2$, where $n \in [1, N]$ is the number of products the firm produces, and s_n is the share of a firm's number of product lines relative to the total number of products.²⁷ Foreign owned firms are associated with a higher concentration of products across different product branches. Thus, this confirms that foreign owned firms tend to produce more similar varieties together.

To highlight possible co-production of products firms tend to produce together, Table 7 follows Bernard et al (2010) and reports the average annual frequency (in hundreds) with which firms co-produce products within and across sectors. Products with dark blue and dark orange shading are significantly more often produced together than expected assuming that product lines are independent from each other.²⁸ Like Bernard et al (2010) showed for the US, also in India there are sectors for which the probability that a firm produces a product in the row sector conditional on production of a product in the column sector is relatively high within sectors as well as across sectors that appear related (for example Pharmaceuticals and Chemicals, or Computer Manufacturing and Electrical Equipment). In general, Table 7 confirms that firms do not choose their product mix randomly. This behavior is more pronounced for foreign firms. Industries with dark orange shading are identified further as those in which foreign owned firms produce within and across industries not only significantly more products together, but also produce significantly more products together than domestic firms.²⁹ Within industries and across related industries foreign firms co-produce significantly more products than domestic firms. For example, 640 foreign owned firms co-produce products categorized in the Electrical Equipment and Computer sector. This number of co-products is statistically higher than expected and foreign firms produce more goods in these sectors together than domestic firms. Co-production in less related sectors like Beverages and Automobiles occurs significantly less frequently than expected and relatively less frequent under foreign ownership than under domestic ownership (indicated by light orange shading). Thus, foreign acquired firms seem to focus their product lines significantly stronger around their core competence. Foreign owners seems to particularly dominate co-production in technological intensive sectors.

5.2. Product Switching and Ownership Changes

In the following, I use a doubly robust estimator to obtain the causal effect on product switching after a firm was acquired by a foreign investor. To identify the effect of foreign acquisitions following the investment liberalization on the changes in the product mix, the following analysis is confined to firms purely domestic in 1992. Of those, I define a treatment group as those firms that attracted foreign capital for the first time

²⁷ The index is normalized and constrained between 0 and 1 and increasing in product diversification.

²⁸ See the appendix for more details.

²⁹ This is tested by a simple t-test comparing the relative frequency of observed co-production within and across industry for domestic and foreign firms.

between 1993 and 2013³⁰. Those firms that remained in domestic hands during the observation period form my control group, necessary to construct the respective counterfactual that firms recently acquired by foreign investors had remained in domestic hands.³¹ Further, I impose that a firm has to be observed for at least four consecutive years in the sample. This panel allows me to control for pre-acquisition characteristics and evaluate the post-treatment effects on the year of acquisition and three periods following the acquisition. Table A 5 in the appendix provides summary statistics of pre-acquisition characteristics of the control group and the treatment group, and shows the necessity to correct for the pre-treatment differences using propensity score reweighting. Acquired firms are slightly more productive, younger, larger, less leveraged, pay higher wages, are more integrated into the international markets and are less often SOEs.

I consider two set-ups with two different treatment variables: the acquisition of foreign ownership (*foreign*) and the degree of foreign ownership (*foreign^d*).³² The treatment variable of the degree of foreign ownership $foreign_{ijt}^d$ is equal to one for all degrees $d \in [1, \dots, 4]$ if firm i that has been in domestic hands up to year $t-1$ is acquired by a foreign owner at time t with an investment share categorized as

$$d = \begin{cases} 1, & FDI \geq 10\% \wedge FDI < 25\% \\ 2, & FDI \geq 25\% \wedge FDI < 50\% \\ 3, & FDI \geq 50\% \wedge FDI < 100\% \\ 4, & FDI = 100\% \end{cases} .$$

In the following, I first look at the net effect of product switching and then in more detail at the decision to add or drop products from the product scope, depending on the foreign ownership degree.

5.2.1. Net Effect of Product Switching

Empirical framework

To evaluate the average treatment effect (ATE) of foreign ownership degree d , the difference between the mean outcome of all firms which received foreign capital within one category of foreign ownership, $d=1, \dots, 4$, and the mean outcome of firms had they not become foreign owned needs to be estimated, that means $ATE = E[N_{ijt+\tau}^d - N_{ijt+\tau}^0]$. Since investors choose their foreign investment locations according to specific firm characteristics, simply comparing the post-treatment effect on the product mix of the treatment and control group is problematic. To avoid a possible selection bias and a biased identification due to either model misspecification or missing confounders, I use the doubly-robust estimator which combines propensity score

³⁰ Using different ownership degrees as treatment variable limits the sample to the 1999 to 2013 period.

³¹ In general, in presence of multiple treatments, any pairwise combination of categories can be considered to estimate the desired treatment effect.

³² For notational brevity, in the following I explain the estimation procedure in more detail for the degree of foreign ownership. The procedure is analogues for *foreign* as treatment variable. The propensity scores are derived from a logit model in case *foreign* is the treatment variable.

reweighting with covariate adjusted regressions including a treatment and a function of the confounders. The doubly-robust estimator has the advantage of combining the selection correction from propensity score matching as well as confounders adjusted regressions (Wooldridge, 2007; Lechner, 2002). Further, the doubly-robust estimator is robust to model misspecification or biased propensity scores. Even if either the outcome model or the treatment model is incorrectly specified, the doubly-robust approach estimates the effect consistently and correctly.

The net effect on changes in the product mix is estimated by the propensity score-weighted regression

$$\ln(n_{ijt+\tau}) = \beta_0 + \beta_f \text{foreign}_{ijt}^d + \Gamma(X_{ijt-1}) + \mu_{ijt+\tau} \quad (2)$$

for all degrees of ownership, $d \in [1,4]$, with error term μ . The vector X includes, similar as before, productivity, a squared term of productivity, a dummy for SOE, age of firm i operating in industry j and a full set of firm, industry and time fixed effects. Due to the results of the previous section, I am confident that my reweighted covariate adjusted regression does not suffer from severe misspecification.

The doubly robust estimator requires to reweight the observation of the treatment group by the inverse propensity score p^d and the control group, respectively, by $\frac{1}{1-p^d}$. To obtain the propensity score, I estimate the determinants of the degree of foreign ownership using an ordered logistic regression from which I will generate the respective propensity score p^d .³³ The propensity score is derived from an ordered logit model of foreign ownership structure based on the four ownership categories $d=1, \dots, 4$. The propensity scores are computed according to Lechner (2002) and Girma et al (2015). The propensity score sets each predicted probability for each ownership degree, π_{ijt}^d , relative to the base category of purely domestic ownership:

$$p_{ijt}^d = \frac{\pi_{ijt}^d}{\pi_{ijt}^d + \pi_{ijt}^0}. \quad (3)$$

The ordered logit model is estimated conditional on Z_{ijt-1} , where Z is a vector of pre-treatment covariates that are assumed to impact the choice of foreign ownership acquisition and the respective degree. In my model, the vector Z consists of firm size, age, productivity, a dummy for *SOE* and a full set of firm, industry and time dummies. Further, I added a firm's leverage³⁴ as a proxy for access to finance, the wage bill as proxy for the skill level³⁵, and an export and import dummy to capture the integration in international markets. These covariates are typical determinants for foreign acquisition (see for example Harris and Robinson, 2003; Girma et al, 2015). The marginal effects, reported in Table A 4 in the appendix, are similar for all four degrees of ownership. Consistently with a large body of empirical literature, I find that foreign investors prefer to acquire

³³ The propensity scores are derived from a logit model in case *foreign* is the treatment variable.

³⁴ Measured as the ratio of total liabilities to total assets.

³⁵ The wage bill is measured in logs relative to the size of the firm.

younger, larger, and more productive firms employing higher skilled employees that are more integrated into the global value chain. Further, foreign investors seem to be less likely to acquire state-owned or indebted firms. This “cherry picking” behavior is increasing in the ownership degree and is most pronounced for wholly acquired foreign firms.

To ensure that the causal treatment effect can be identified, the overlap (or common support) condition is imposed, that is the probability of being acquired by a foreign firm with degree d conditional on Z is bounded between zero and one.³⁶ A series of balancing tests confirms that the propensity score matching is successful in controlling for firm differences in the pre-treatment period.³⁷

In the next step, the potential outcome of each treatment, \widehat{n}_{ijt}^d , is predicted based on the estimates of (2). By setting $foreign^d$ equal to one for all observations the potential net change in the product mix after foreign acquisition is obtained, by setting $foreign^d$ equal to zero the potential outcome of no foreign acquisition is obtained:

$$\widehat{n}_{ijt}^d = \Phi \left(\widehat{\beta}_0 + \widehat{\beta}_f + \widehat{\Gamma}(X_{ijt-1}) \right) \text{ and } \widehat{n}_{ijt}^0 = \Phi \left(\widehat{\beta}_0 + \widehat{\Gamma}(X_{ijt-1}) \right). \quad (4)$$

In the final step of the doubly robust procedure, the ATE is calculated as the average difference between these two potential outcomes:

$$ATE = \frac{1}{N} \sum_{i=1}^N (\widehat{n}_{ijt}^d - \widehat{n}_{ijt}^0). \quad (5)$$

Main results of the net effect of product switching

Table 8 presents the result of the ATE estimation of the causal effects of foreign acquisition on net changes in the product scope. To account for potential time lags and ongoing restructuring processes of the production, I consider not only the year of acquisition, but also one, two and three years after acquisition. Already in the year of acquisition, foreign acquired firms have on average a 9.9 percent higher product scope than if they had stayed domestically owned.³⁸ This effect is increasing in the post-acquisition phase.

This net effect of product expansion is driven by firms which are majority or wholly foreign acquired. On average these firms add at least one product.³⁹ After three years, majority owned firms produce on average 2.7 products more than their domestic counterparts. The effect on net product expansion increases over post-

³⁶ Hence, the combination of observed covariates can also be found among domestic firms.

³⁷ Table A 6 in the appendix shows the balancing test for foreign ownership. Table A 7 in the appendix shows the balancing test separately for each ownership degree.

³⁸ Note that this effect is in line with the results of Table 3, column (1).

³⁹ The calculation is based on the average number of products of the domestic firms of the control group. The coefficient of majority ownership translates even to an increase in product scope by 1.55 products.

acquisition time.⁴⁰ I assume that the increase in net product expansion is paired with stronger innovation activities of majority and wholly-acquired foreign firms. The adaption of new production technologies might lead to faster internalization of higher synergy effects.

Minority acquired foreign firms, in contrast, experience in the first years of acquisition a drop in the net extensive product margin. Firms seem to first rationalize their production process before adding new products to their product range. Foreign investors might induce firms to concentrate first on their core product in their core industries and churning products unrelated to their own interest. After two years of engaging in a joint venture with a foreign firm, they add new varieties to existing branches, expanding their product range on average by 0.8 products after three years.

Small minority ownership has no statistically significant impact on the net changes in the product mix. Nevertheless, this does not mean that these firms do not alter their product mix.⁴¹

5.2.2. Product Adding and Dropping

Since the net extensive product margin does not reveal product switching behavior, I look as well at the behavior of adding and dropping products following the acquisition by foreign investors.

Empirical framework

The decision to add or drop certain products is assumed to be a joint decision. Therefore, I model a confounders adjusted propensity-score reweighted bivariate Probit regression of the following form:

$$Pr(Add_{ijt+\tau} = 1) = \Phi_A(\beta_0^A + \beta_f^A \text{foreign}_{ijt}^d + \Gamma(X_{ijt-1}) + \varepsilon_{ijt}^A) \quad (6)$$

$$Pr(Drop_{ijt+\tau} = 1) = \Phi_B(\beta_0^D + \beta_f^D \text{foreign}_{ijt}^d + \Gamma(X_{ijt-1}) + \varepsilon_{ijt}^D) \quad (7)$$

$$\text{with } (\varepsilon_{ijt}^A, \varepsilon_{ijt}^D) \sim \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \right] \quad (8)$$

for all $d \in [1, \dots, 4]$, and error correlation parameter ρ . *Add* (*Drop*) is set equal to one if firm i changes its product mix by adding at least one product (suspending at least one product) between the pre-acquisition period $t-1$ and the post-acquisition period $t + \tau$, and set to zero otherwise. X is defined as before.

To obtain the average treatment effects from the reweighted bivariate Probit estimates I follow Girma et al (2015). The propensity scores are obtained from the same logit and ordered logit model as before. The potential

⁴⁰ Nevertheless, one has to be cautious: the difficulty of identifying the pure effect of foreign acquisition increases with the time after acquisition.

⁴¹ As can be seen in the following section, small minority acquired firms have a higher probability to add and drop products following the years after foreign acquisition than their domestic counterparts (see Table 9). Thus, they might only change their product mix, but not expand their product scope.

probability of adding (dropping) a product under each treatment, \widehat{Pr}_{ijt}^{Ad} (\widehat{Pr}_{ijt}^{Dd}), is calculated based on the bivariate probit model estimates by setting $foreign_{ijt}^d$ equal to one for all observations. The same potential probability is predicted for the control group by setting $foreign_{ijt}^d$ equal to zero for all observations, that means the predicted probability of no foreign acquisition is estimated as \widehat{Pr}_{ijt}^{A0} (\widehat{Pr}_{ijt}^{D0}).⁴² Thus,

$$\widehat{Pr}_{ijt}^{Ad} = \Phi_A \left(\widehat{\beta}_0^A + \widehat{\beta}_f^A foreign_{ijt}^d + \widehat{\Gamma}(X_{ijt-1}) \right) \text{ and } \widehat{Pr}_{ijt}^{A0} = \Phi_A \left(\widehat{\beta}_0^A + \widehat{\Gamma}(X_{ijt-1}) \right). \quad (9)$$

With the help of these, the average treatment effect of foreign acquisition on the probability to changes in the product mix is calculated by

$$ATE = \frac{1}{N} \sum_{i=1}^N (\widehat{Pr}_{ijt}^{Ad} - \widehat{Pr}_{ijt}^{A0}) \quad . \quad (10)$$

Main results of product adding and dropping

Panel A of Table 9 shows the effect of receiving foreign capital on product adding, while panel B of Table 9 shows the effects on product churning. To achieve a leaner production range and to internalize higher synergy effects, acquired firms drastically change their product mix by adding new products and dropping others.⁴³ On average recently acquired foreign firms are 10.2 percent more likely to add products than their domestic counterparts. Foreign owned firms are more active in changing their product mix than comparable firms in domestic hands. Within the first three years of acquisition foreign firms drop at least one product with a likelihood of 22.8 percent compared to their domestic counterparts. However, they add at least one product with a likelihood of 36.9 percent increasing in total their net extensive product margin as shown before.

In correspondence with Table 8, the results in Table 9 are driven by majority and wholly acquired foreign firms. The probability of a being innovative and adding new products to the product portfolio increases with the degree of foreign ownership and the length of the post-acquisition phase. Partly, this reflects a higher product innovation activity of foreign owned firms. Foreign owned firms are also more likely to drop products, potentially induced by the cannibalization effect. By introducing new products to their existing product lines they might encounter sales reduction in their own existing products. Hence, majority and wholly acquired firms not only restructure the production process, they potentially drop internationally non-competitive and unrelated product lines from their product portfolio. These changes in the product mix might reflect a different market orientation of foreign investors compared to their domestic counterparts. Foreign acquired firms export more and are more integrated in the international market. Stronger international competition and international

⁴² The estimation steps are equal if $foreign_{ijt}$ is the treatment variable. Equation (7) and (8) are analogues for product dropping.

⁴³ Though, the more similar products are within the product portfolio, the stronger is the cannibalization effect of the marginal variety. However, foreign firms seem to be able to be less prone to this cannibalization effect. Due to their multinational activities, they are able to differentiate their products across locations and quality such that they mitigate the cannibalization effect.

brand recognition of the respective products might force multinational companies to invest more in product innovation. Exporting via the foreign parent is associated with a higher product scope (see section 4.1) and, as Girma et al (2015), Guadalupe et al (2012), Lileeva and Trefler (2010) show, associated with higher innovation activities.

Minority acquired firms have a higher probability to drop products than adding products in the first three years after foreign acquisition. This is in line with the previous result that minority owned firms have in the first years after acquisition a negative impact on the net extensive product margin. Due to reduced ownership rights restructuring processes in management and manufacturing might take more time to be effective. Churning products to enhance productivity and competitiveness of the acquired partner could be one of their first action, while simultaneously engaging in product and process innovation.

The ATE of product adding and dropping is relatively small for small minority owned firms. Compared to similar domestic firms, small minority owned firms change their product mix only with a probability of around 5 percent within the first years. Lower control and voting rights and potentially lower technological transfers seem to reduce the impact of foreign investors on the product mix. Hence, the potential benefits on productivity through changes in the product mix might be smaller for firms with a lower foreign ownership degree.

5.3. Innovation

Since introducing a new product is associated with higher innovation activity, I also look explicitly at innovation activities and upgrading activities as sensitivity and robustness check.⁴⁴ Introducing new products usually assumes some degree of innovation activity, in particular related to product innovation.

Innovation is measured by the reported Research and Development expenditures. Innovation is set equal to one if there is an increase in the innovation activity between period t and $t+1$. Table 10, panel A, shows the ATE of the probability of engaging in innovation after receiving foreign capital.⁴⁵ As expected, foreign ownership is associated with a higher innovation activity. The probability of innovating increases over time. Unfortunately, I cannot distinguish whether the reported innovation expenditures are related to process or product innovation activities. Process innovation could increase the flexibility of the manufacturing process,

⁴⁴ Analyzing the effects of foreign ownership on upgrading activities related to cost reduction to separate product and process innovation is beyond the scope of this paper. It is a research question on its own to analyze the effect of investment liberalization on marginal costs, prices and mark-ups. See De Loecker et al (2016) for an analysis of the effect of a tariff reduction on marginal costs, prices and mark-ups of MPFs.

⁴⁵ I estimate the ATE again with a doubly robust estimator. The potential probabilities of engaging in innovation are based on the estimates of the inverse propensity score reweighted Probit model:

$$\widehat{Pr}_{ijt}^{1f} = \Phi_A \left(\widehat{\beta}_0^f + \widehat{\beta}_f^f \text{foreign}_{ijt} + \widehat{\Gamma}(X_{ijt-1}) \right) \text{ and } \widehat{Pr}_{ijt}^{10} = \Phi_A \left(\widehat{\beta}_0^0 + \widehat{\Gamma}(X_{ijt-1}) \right).$$

The vector X includes the same variables as before, except the squared productivity term.

lower marginal cost and increase the economies of scale. Product innovation is more related to a firm's effort to create new products or to upgrade products such that they are considered as new product.⁴⁶

In the following, I use the available unit values of products to proxy quality. I assume that a firm engages in product upgrading (or process innovation) if the price of existing, not churned products increases in the post-acquisition period. To account for changes in the product mix, I include the importance of a specific product for the firm, measured by the share of the product in the firm's total sales and the value of the firm sales of the product, as additional control variable. Table 10, panel B, shows the ATE of the probability of engaging in product upgrading. Foreign owned firms increase the quality of their products already in the year of acquisition. Due to access to new technologies and skills, foreign owned firms are 43.4 percent more likely to engage in product upgrading activities than if they had stayed in domestic hands. If an acquired firm keeps a product in its product portfolio, it improves its quality with a probability of around 50 percent in the years after acquisition compared to their domestic counterparts with similar products.

6. Outlook and conclusion

The introduction of new products plays an important role in international trade and economic growth. Various empirical and theoretical work has uncovered how trade liberalization and export behavior affects the product mix. Goldberg et al (2010) estimated substantial gains from the Indian trade liberalization in 1991 through access to new imported inputs. Simultaneously to the trade liberalization, India opened its markets for FDI.

In this paper, I use a unique firm-product-level dataset of Indian manufacturing firms to shed lights on the impact of FDI on the product mix. My result suggest that FDI inflows into India following the investment liberalization period have drastically restructured the within firm resource allocation and production processes. Foreign acquired firms have become leaner in their production structure while expanding their product scope. Being more active in product and process innovation than their domestic counterparts, foreign owned firms produce on average approximately one product more than if they had stayed in domestic hands. Further, with a probability of around 50 percent foreign owned firms upgrade existing products after acquisition. The higher the foreign control, the higher are potentially technological spillovers and the larger is the impact on the product mix. Majority acquired foreign firms are particularly active in changing their product mix. They expand their products scope by around 2.7 products within three years of foreign acquisition.

Compared to purely domestic firms, foreign owned firms use a more flexible manufacturing technology allowing them to produce more related goods together. Thus, foreign owned firms are able to realize higher synergy effects than if they stayed in domestic hands. Their cross-border activities might mitigate a potential

⁴⁶ Product innovation activities might also increase the quality of a product, though product innovation is more related to the introduction of new products than upgrading existing products (see Dhingra, 2013).

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cannibalization effect since foreign owned firms can diversify their products more across qualities and locations.

I show that FDI inflows induce higher product-level dynamics which are an important driver of productivity growth. Adopting new technologies and realizing synergy effects allows cost reduction and innovation. By analyzing product-level dynamics within firms, my paper reveals an important micro-level channel of productivity increases after foreign acquisitions. Access to developed countries' technologies and know-how through FDI affects firm performance by product scope expansion of acquired companies.⁴⁷

The introduction of new products is suggestive that India's trade and investment reform let to dynamic economic and welfare gains as these new and upgraded products fed into the domestic economy. Innovation and productivity improvements within firms account for a large fraction of productivity gains. As Hausman et al (2007) argue, the mix of goods that a country produces has important implications for economic growth. The FDI-induced product scope expansion and the increase of different varieties has potentially contributed to India's economic growth and its welfare gains in the last decades.

However, my analysis neglects possible spillover effects and potential repercussions on local firms. On one hand possible technological spillovers and increased competition in product brands might spur product innovation among domestic firms. On the other hand, the introduction of new, higher quality varieties by foreign owned firms might crowd out domestic varieties; local firms might not be competitive enough to manufacture the respective variety, and eventually exit the market. The overall effect of FDI on product differentiation and the product mix of a country is subject to more research.

My analysis focuses only of the restructuring process of firms acquired by foreign owners in the host country India, neglecting further possible restructuring processes in the home country. The interplay between the changes of the product mix and the product scope of the acquired firm in developing countries and possible changes in the product composition at home clearly deserve more research⁴⁸.

⁴⁷ Additional research requires a more detailed look on how mark-ups and marginal costs of each product changes after foreign acquisition. De Loecker et al (2016) recently developed a method to disentangle prices, mark-ups and marginal costs for each product of MPFs.

⁴⁸ The drain of organizational capital might for example drop the marginal products from production at home, thus, reducing the product scope at home.

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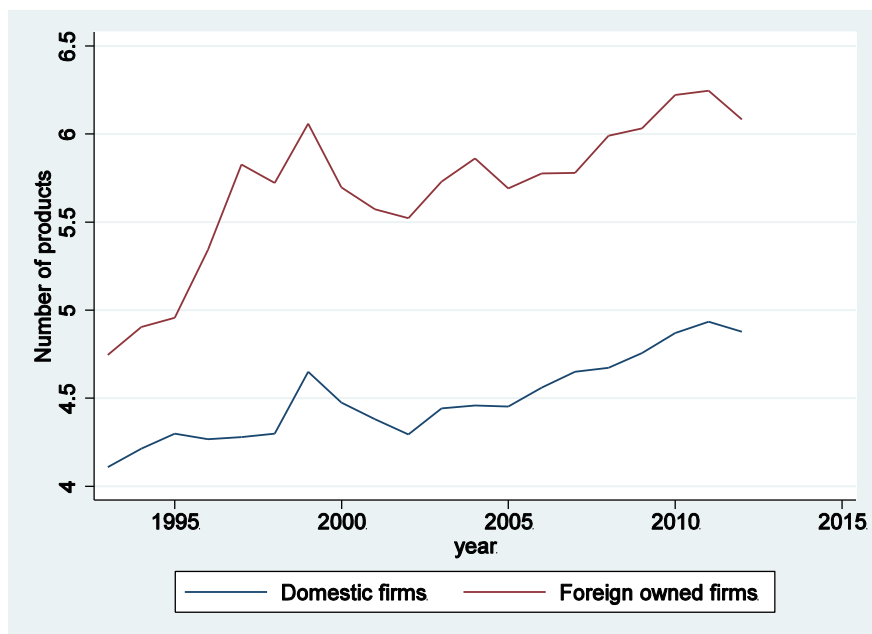
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Figure 1: Average number of products per firm over time



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Table 1: Prevalence of multi-product firms in India

	Share of firms	Share of output	Mean Products, industries or sectors per firm
<i>domestic</i>			
Multi-product	0.44	0.78	4.07
Multi-industry	0.44	0.77	3.94
Multi-sector	0.43	0.76	2.90
<i>foreign</i>			
Multi-product	0.64	0.93	5.64
Multi-industry	0.61	0.82	4.62
Multi-sector	0.50	0.82	2.60

Note: The table categorizes firms according to whether they produce multiple products (at the five-digit product categories), industries (four-digit NIC categories), or sectors (two-digit NIC categories).

Table 2: Product switching activities by Indian manufacturing firms

	Annual Average		Five-years Average	
	Domestic	Foreign	Domestic	Foreign
No activity	70.0%	60.1%	56.6%	24.4%
Drop product(s) only	12.9%	16.3%	24.7%	20.5%
Add product(s) only	9.6%	12.7%	7.4%	3.7 %
Both add and drop	7.4%	10.9%	11.3%	51.4%

Note: Table classifies continuing firm activity into four mutually exclusive groups: no activity, add only, drop only, and both. A product addition is defined as a firm adding a product in period t that it did not produce in the previous period. A drop is defined as a firm's dropping a product in period t that it produced in the previous time period.

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Table 3: Product scope and foreign ownership

	Total sample (1989-2013)			1989-2003
	(1)	(2)	(3)	(4)
Foreign	0.0865*** (0.0251)	0.0458* (0.0234)	0.0472** (0.0234)	0.0449* (0.0253)
Productivity		0.0155** (0.0061)	0.0180* (0.0094)	0.0425*** (0.0090)
Productivity ²			-0.0058*** (0.0015)	-0.0036** (0.0017)
Age		0.0032 (0.0055)	0.0033 (0.0055)	0.0301*** (0.0041)
Size		0.0453*** (0.0034)	0.0440*** (0.0034)	0.0015 (0.0081)
SOE		0.1554*** (0.0573)	0.1555*** (0.0581)	0.1901*** (0.0704)
Constant	0.9241*** (0.0535)	0.7976*** (0.1749)	0.7581*** (0.1753)	0.7741*** (0.1990)
Observations	78,575	52,116	52,116	19,867
R-squared	0.115	0.115	0.115	0.1361
Number of firms	9,422	7,810	7,810	5,100

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firm, industry and year fixed effects included in all regressions. Productivity measured by TFP. The difference in the number of observation between the first three columns can be attributed to missing values in the TFP estimation. Replicating column (1) with the sample of column (2) or (3) yields a coefficient of similar significance and magnitude for foreign ownership.

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Table 4: Product scope, foreign ownership and the position in the global value chain

	All Goods		Intermediates	Final Goods
	(1)	(2)	(3)	(4)
Foreign	0.0467** (0.0233)	0.0464** (0.0231)	0.0479** (0.0207)	0.0128 (0.0287)
Productivity	0.0180* (0.0093)	0.0181* (0.0093)	0.0292*** (0.0078)	0.0056 (0.0073)
Productivity^2	-0.0052*** (0.0015)	-0.0053*** (0.0015)	-0.0047*** (0.0011)	-0.0021* (0.0013)
Age	0.0369*** (0.0033)	0.0369*** (0.0033)	0.0210*** (0.0034)	0.0196*** (0.0046)
Size	0.0027 (0.0055)	0.0027 (0.0055)	0.0094* (0.0052)	-0.0081 (0.0056)
SOE	0.1554** (0.0613)	0.1576*** (0.0598)	0.1312* (0.0788)	-0.0233 (0.0573)
Imports	0.0443*** (0.0115)	0.0472*** (0.0117)	0.0469*** (0.0120)	0.0409** (0.0187)
Imports*Foreign		-0.0351 (0.0379)		
Exports	0.1033*** (0.0117)	0.1023*** (0.0120)	0.0639*** (0.0121)	0.0567*** (0.0170)
Exports*Foreign		0.0108*** (0.0037)		
Constant	0.7557*** (0.1746)	0.7546*** (0.1746)	0.7270*** (0.1677)	0.7239*** (0.1962)
Observations	52,116	52,116	39,395	18,833
R-squared	0.120	0.120	0.191	0.261
Number of firms	7,810	7,810	6,222	3,081

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firm, industry and year fixed effects included in all regressions. Productivity measured by TFP.

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Table 5: Sensitivity and robustness test

	Labor productivity		Number of products		
	(1)	(2)	(3)	(4)	(5)
Foreign	0.0397*** (0.0129)	0.0404*** (0.0149)	0.0715*** (0.0099)	0.0849*** (0.0265)	0.0717* (0.0433)
Productivity	0.0137*** (0.0048)	0.0272*** (0.0049)	-0.0122 (0.0124)	-0.0156 (0.0146)	0.0353*** (0.0127)
Productivity ²	-0.0014*** (0.0005)	-0.0015*** (0.0005)	-0.0040*** (0.0015)	-0.0034 (0.0021)	-0.0013*** (0.0005)
Age	0.0026 (0.0041)	0.0031 (0.0086)	0.1368*** (0.0020)	0.0038*** (0.0006)	0.1138*** (0.0059)
Size	0.0153*** (0.0028)	0.0731*** (0.0027)	0.0039*** (0.0002)	0.1266*** (0.0048)	0.0051*** (0.0005)
SOE	0.0758 (0.2072)	0.0777*** (0.0114)	0.2354*** (0.0627)	0.2808 (0.2171)	0.1010 (0.1535)
Imports		0.0488*** (0.0122)			0.0968*** (0.0199)
Imports*Foreign		0.0698* (0.0382)			0.0492** (0.0199)
Exports		0.0660*** (0.0125)			0.0897* (0.0507)
Exports*Foreign		-0.0320 (0.0403)			0.0141 (0.0501)
Constant	0.4534*** (0.1291)	0.8230*** (0.1990)	0.3283*** (0.0307)	0.4202*** (0.0489)	0.4023* (0.2298)
Observations	48,718	40,816	53,557	53,557	41,846
R-squared	0.115	0.189	0.061	0.083	0.091
Number of firms	7,534	6,447			

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firm, industry and year fixed effects included in all regressions. Productivity is measured by labor productivity in column (1) and (2) and by TFP in column (3) to (5). In column (3) to (5), the number of products is the dependent variable. Column (3) estimates a Poisson model, while column (4) and (5) are estimated using a Negative Binominal model. The Poisson model in column (3) corrects for overdispersion by rescaling the standard errors according to Pearson X²-based dispersion. The coefficients of the count data models are shown. The R-squared of the count data models correspond to McFadden's adjusted Pseudo-R-squared.

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Table 6: Product skewness and foreign ownership

	No of varieties within product lines	No of industries	No of sectors	HHI
	(1)	(2)	(3)	(4)
Foreign	0.0385** (0.0167)	0.0048 (0.0190)	-0.0371** (0.0182)	-0.0197* (0.0112)
Productivity	0.0087 (0.0071)	-0.0653*** (0.0089)	-0.0586*** (0.0083)	-0.0237*** (0.0068)
Productivity ²	-0.0002 (0.0010)	0.0028*** (0.0010)	0.0026*** (0.0009)	0.0001 (0.0008)
Age	-0.0038 (0.0034)	0.0090* (0.0051)	0.0076 (0.0048)	0.0053* (0.0030)
Size	0.0184*** (0.0033)	0.0685*** (0.0039)	0.0619*** (0.0037)	0.0338*** (0.0030)
SOE	-0.1006* (0.0562)	0.0984 (0.1170)	0.1346 (0.1363)	0.0482 (0.1241)
Constant	0.3257*** (0.1073)	0.1919 (0.1574)	0.1702 (0.1494)	0.3121*** (0.0937)
Observations	56,995	54,963	54,963	54,963
R-squared	0.00126	0.143	0.132	0.0547
Number of firms	8,068	8,046	8,046	8,046

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Firm, industry and year fixed effects included in all regressions. Productivity is measured by TFP. The HHI index is normalized and constrained between 0 and 1.

Table 7: Product coproduction within foreign owned firms, 1989-2013

Sector	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Food	135	6	1	2	1	2	0	1	0	0	54	11	1	1	0	0	2	1	7	0	0	0	0
Beverages	6	4	0	0	0	0	0	0	0	0	6	5	0	0	0	0	0	0	0	0	0	0	0
Tobacco	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles	2	0	0	24	4	0	0	1	0	0	10	3	1	0	1	0	3	1	3	0	0	0	0
Wearing apparel	1	0	0	4	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Leather	2	0	0	0	1	6	0	0	0	0	5	0	0	0	0	0	0	1	0	1	0	0	0
Wood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paper	1	0	2	1	0	0	0	5	0	0	5	3	2	0	1	2	3	1	3	0	0	0	0
Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke & Petroleum	0	0	0	0	0	0	0	0	0	1	2	0	0	0	2	0	0	1	0	0	0	0	0
Chemicals	54	6	0	10	2	5	0	5	0	2	275	95	8	3	10	3	12	6	14	0	0	0	3
Pharmaceuticals	11	5	0	3	0	0	0	3	0	0	95	176	2	4	1	1	8	1	1	0	0	0	5
Rubber & Plastic	1	0	0	1	0	0	0	2	0	0	8	2	27	1	2	2	4	2	4	0	5	0	0
Non-metallic mineral products	1	0	0	0	0	0	0	0	0	0	3	4	1	7	1	0	5	4	2	0	1	0	0
Basic metals	0	0	0	1	0	0	0	1	0	2	10	1	2	1	47	15	8	10	23	1	10	0	0
Fabricated products	0	0	0	0	0	0	0	2	0	0	3	1	2	0	15	14	3	7	19	0	12	1	0
Computer	2	0	0	3	0	1	0	3	0	0	12	8	4	5	8	3	73	64	27	0	7	0	1
Electrical equipment	1	0	0	1	0	0	0	1	0	1	6	1	2	4	10	7	64	71	36	0	9	0	1
Other machinery	7	0	0	3	0	1	0	3	0	0	14	1	4	2	23	19	27	36	127	2	17	1	1
Automobiles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	1	2	0	0
Other transport equipment	0	0	0	0	0	0	0	0	0	0	0	0	5	1	10	12	7	9	17	2	6	0	0
Furniture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Other manufacturing	0	0	0	0	0	0	0	0	0	0	3	5	0	0	0	0	1	1	1	1	0	0	1

Notes: Table summarizes co-production at level five of the CMI product classification across multiple-product firms. Each cell contains a count (in 100s) of the average number of foreign owned firms observed producing at least two products in the noted first tier product sector from 1989 to 2013. Firms with more than two products may be counted more than once in each cell. Dark and light blue shading indicate statistically significantly higher and lower co-production at the 1 percent level, respectively, than is implied by a null hypothesis of random co-production. The absence of shading indicates the absence of statistically significant differences from this null hypothesis. Dark orange and light orange shading indicate further statistical significantly higher and lower co-production at the 1 percent level of foreign firms compared to domestic firms. Thus, the orange shading on top of the blue indicates whether the non-random co-production behavior is statistically more or less pronounced by foreign owned firms.

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Table 8: Foreign ownership types and the development of the Average Treatment Effect of the change in the product mix up to three years after foreign acquisition

Time after acquisition	t	t+1	t+2	t+3
	(1)	(2)	(3)	(4)
<i>Foreign ownership</i>				
Foreign	0.0993*** (0.00266)	0.110*** (0.00199)	0.103*** (0.00225)	0.211*** (0.00278)
Observations	33,693	33,693	33,693	33,693
<i>Foreign ownership type</i>				
Small minority	0.0771 (0.0668)	0.0764 (0.0873)	0.0473 (0.0901)	0.111 (0.172)
Observation	30,542	30,542	30,542	30,542
Minority	-0.172** (0.0719)	-0.131** (0.0610)	0.125** (0.0619)	0.186*** (0.0613)
Observation	24,220	24,220	24,220	24,220
Majority	0.372*** (0.0677)	0.472*** (0.0694)	0.582*** (0.0759)	0.604*** (0.0713)
Observation	28,806	28,806	28,806	28,806
Full ownership	0.223*** (0.0741)	0.598*** (0.163)	0.625*** (0.221)	0.330*** (0.0504)
Observations	28,977	28,977	28,977	28,977

Note: Bootstrapped standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. ATE of receiving foreign capital on the (log) number of products is derived from the doubly robust estimator as described in the text. The control group is being domestically owned. Industry and year fixed effects included.

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Table 9: Average Treatment Effect of product switching after foreign acquisition

	t	Within the first 3 years	Within the first five years
<i>Panel A: Add</i>			
Foreign	0.102*** (0.00985)	0.369*** (0.00385)	0.471*** (0.00413)
Observations	31,072	31,072	31,072
<i>Foreign ownership type</i>			
Small minority	0.0165 (0.0568)	0.0491*** (0.00748)	0.199*** (0.0529)
Observation	29,394	29,394	29,394
Minority	0.0976*** (0.00885)	0.116** (0.0533)	0.380*** (0.0694)
Observation	30,425	30,895	30,895
Majority	0.114** (0.0533)	0.448*** (0.0381)	0.528*** (0.0647)
Observation	30,425	30,425	30,425
Wholly acquired	0.132*** (0.0180)	0.578*** (0.00421)	0.618*** (0.0531)
Observation	30,241	30,241	30,241
<i>Panel B: Drop</i>			
Foreign	0.0377 (0.0695)	0.228*** (0.0037)	0.397*** (0.0423)
Observations	31,072	31,072	31,072
<i>Foreign ownership type</i>			
Small minority	0.0255 (0.0547)	0.0533** (0.0276)	0.361*** (0.0454)
Observation	29,394	29,394	29,394
Minority	0.205*** (0.0301)	0.331*** (0.0866)	0.365*** (0.0469)
Observation	30,895	30,895	30,895
Majority	0.0289*** (0.00662)	0.237*** (0.0510)	0.386*** (0.0648)
Observation	30,425	30,425	30,425
Wholly acquired	0.0497*** (0.0148)	0.214*** (0.0578)	0.425*** (0.0534)
Observations	30,241	30,241	30,241

Note: Bootstrapped standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. ATE of receiving foreign capital on the product adding and dropping is derived from the doubly robust estimator as described in the text. The control group is being domestically owned. Industry and year fixed effects included.

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Table 10: Average Treatment Effect of product upgrading after foreign acquisition

Time after acquisition	t	t+1	t+2	t+3
	(1)	(2)	(3)	(4)
<i>Panel A: Innovation</i>				
Foreign	0.0690***	0.0816***	0.101***	0.116***
	(0.000185)	(0.000128)	(0.000154)	(0.000309)
Observations	32,772	32,772	32,772	32,772
<i>Panel B: Product upgrading</i>				
Foreign	0.434***	0.503***	0.560***	0.495***
	(0.0810)	(0.0784)	(0.0795)	(0.0975)
Observations	77,115	73,638	70,638	68,127

Note: Bootstrapped standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. ATE of receiving foreign capital on innovation is estimated at the firm level while ATE on product upgrading is derived at the product level using the doubly robust estimator as described in the text. The control group is being domestically owned. Industry and year fixed effects included.

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7.1 Appendix

Table A1: Examples of industries, sectors and products

NIC		Description																								
22	<i>Sector</i>	Manufacture of rubber and plastic products																								
2211	<i>Industry</i>	Manufacture of rubber tyres and tubes, retreading and rebuilding of rubber tyre																								
		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 10%; text-align: center; vertical-align: middle;"><i>Products</i></td> <td>Rubber tyres and tubes for motor vehicles, motorcycles, scooters</td> </tr> <tr> <td>11031001000000</td> <td></td> <td>Bus and lorry tyres</td> </tr> <tr> <td>11031001020000</td> <td></td> <td>Aero tyres</td> </tr> <tr> <td>11031001030000</td> <td></td> <td>Scooter 2 wheeler tyres</td> </tr> <tr> <td>11031001040101</td> <td></td> <td>Scooter 3 wheeler tyres</td> </tr> <tr> <td>11031001040102</td> <td></td> <td>Cycle tyres</td> </tr> <tr> <td>11031001050000</td> <td></td> <td></td> </tr> <tr> <td>...</td> <td></td> <td></td> </tr> </table>		<i>Products</i>	Rubber tyres and tubes for motor vehicles, motorcycles, scooters	11031001000000		Bus and lorry tyres	11031001020000		Aero tyres	11031001030000		Scooter 2 wheeler tyres	11031001040101		Scooter 3 wheeler tyres	11031001040102		Cycle tyres	11031001050000			...		
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11031001040101		Scooter 3 wheeler tyres																								
11031001040102		Cycle tyres																								
11031001050000																										
...																										
2219	<i>Industry</i>	Manufacture of other rubber products																								
		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 10%; text-align: center; vertical-align: middle;"><i>Products</i></td> <td>Hoses, tubes and pipes of vulcanised rubber</td> </tr> <tr> <td>11030801000000</td> <td></td> <td>Vacuum brake hoses</td> </tr> <tr> <td>11030801010000</td> <td></td> <td>Fire fighting hose</td> </tr> <tr> <td>11030801050000</td> <td></td> <td>Rubber gloves</td> </tr> <tr> <td>11031401000000</td> <td></td> <td>Rubber aprons</td> </tr> <tr> <td>11031402000000</td> <td></td> <td>Rubber balloons</td> </tr> <tr> <td>11039901000000</td> <td></td> <td></td> </tr> <tr> <td>...</td> <td></td> <td></td> </tr> </table>		<i>Products</i>	Hoses, tubes and pipes of vulcanised rubber	11030801000000		Vacuum brake hoses	11030801010000		Fire fighting hose	11030801050000		Rubber gloves	11031401000000		Rubber aprons	11031402000000		Rubber balloons	11039901000000			...		
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2220	<i>Industry</i>	Manufacture of plastic products																								
		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 10%; text-align: center; vertical-align: middle;"><i>Products</i></td> <td>Synthetic leather baggage</td> </tr> <tr> <td>11020903020000</td> <td></td> <td>Cassettes</td> </tr> <tr> <td>14160199060000</td> <td></td> <td>Audio cassettes</td> </tr> <tr> <td>14160199060100</td> <td></td> <td>Compact Discs</td> </tr> <tr> <td>14160199060700</td> <td></td> <td></td> </tr> <tr> <td>...</td> <td></td> <td></td> </tr> </table>		<i>Products</i>	Synthetic leather baggage	11020903020000		Cassettes	14160199060000		Audio cassettes	14160199060100		Compact Discs	14160199060700			...								
	<i>Products</i>	Synthetic leather baggage																								
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14160199060700																										
...																										
		...																								

Note: Only a subset of the available products are listed for the respective industries in the manufacture of rubber and plastic products sector. For NIC 2211 there are a total of 37 products, for NIC 2219 there are a total of 60 products and for NIC 2220 there are a total of 82 products. The five-digit product classification comprises the first ten numbers of the product code.

Total Factor Productivity

To estimate the production function, firm level labor, capital and materials are needed. Since Prowess does not have reliable employment information, I use the total wage bill¹ as measure for labor. Material inputs are measured by the firm wide consumption of commodities in the process of manufacturing or transformation into products. Capital is measured by the gross fixed assets², which includes movable and immovable assets. For the estimation, all relevant values are deflated using all-India wholesale sector-specific price indices provided by the Office of the Economic Adviser of the Indian Ministry of Commerce and Industry³.

TFP is constructed following the methodology of Levinsohn and Petrin (2003)⁴. Assuming a Cobb-Douglas production function, the estimated equation for company i in industry j at time t is

$$y_{ijt} = \beta_o + \beta_k k_{ijt} + \beta_l l_{ijt} + \beta_m m_{ijt} + \beta_e e_{ijt} + \omega_{ijt} + \eta_{ijt} , \quad (11)$$

where y_{ijt} refers to firm i 's output at time t , k is the capital stock, l is labor and m are intermediate inputs and e is energy used. All variables are expressed in natural logarithm. ω_{ijt} is the respective time-varying productivity shock of firm i and η_{ijt} is the measurement error in output, uncorrelated with input choices. According to Levinsohn and Petrin (2003), if the demand function for intermediate inputs is monotonic in the firm's productivity for all given levels of capital, $m_{ijt} = m_{ijt}(\omega_{ijt}, k_{ijt})$, raw materials can serve as a valid proxy for unobserved productivity shocks and consistent estimates of the parameters of the production function can be obtained. In a first estimation stage, the intermediate input demand function is inverted and substituted in equation (11), such that the coefficients of l and e can be obtained by using semi-parametric methods. β_k and β_m are obtained in a second stage by GMM estimation techniques assuming that capital adjusts slowly and productivity follows a Markov process.⁵ To account for industry specific effects, parameters of the production function are obtained for each industry j . A Hicks-neutral TFP is then obtained by subtracting the predicted output of firm i from its actual output at time t .

¹ The total wage bill includes bonuses as well as contributions to employees' provident funds.

² Gross fixed assets constructed by the perpetual inventory method rather than net fixed assets are used since no detailed information on the economic rate of depreciation are available for the Indian manufacturing industry.

³ Retrieved from <http://www.eaindustry.nic.in/home.asp> (03/01/2016).

⁴ The choice of the methodology to derive TFP does not affect the results of this paper. The results are qualitatively and quantitatively similar using fixed effects, or estimating (2) without energy as additional intermediate to obtain TFP. All TFP measures are highly correlated (see also Van Beveren, 2010).

⁵ Please see Levinsohn and Petrin (2003) for more details. Since no firm-specific deflators are available, the productivity measure is likely to include as well technical efficiency and price-cost markups (Katayama et al, 2009).

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Table A 2: Summary statistic

Variable	Observations	Mean	Std. Dev.	Min	Max
Foreign	108754	0.100971	0.3012917	0	1
Productivity	60160	3.98614	0.623967	-3.593524	11.88802
Productivity ²	60160	16.27864	5.494841	0.0000878	141.325
Output (Size)	60160	32.25154	368.0753	0.0001569	35957
Raw Materials	60160	17.75768	246.9611	0.0001744	23836.52
Wage	60160	1.289278	8.289216	0.000091	487.0954
Capital	60060	16.70906	229.8519	0	22735.71
Age	59824	22.56653	17.79665	1	150
SOE	60160	0.11137	0.0333538	0	1
Export Dummy	60160	0.5239029	0.4994325	0	1
Import Dummy	60160	0.485256	0.4997867	0	1
Number of Products	57590	4.430666	4.018674	1	131
Number of Industries	57590	3.039392	2.484343	1	39
Number of Sectors	57590	2.179379	1.433255	1	14
HHI	60160	0.6178336	0.4054427	0	1
Number of Final Goods	20806	2.561953	2.916392	1	66
Number of Intermediate Goods	43994	2.878597	2.711868	1	110
Research and Development Expenditures	33926	0.7745174	5.567138	0	228.5958
Product Unit Values	251333	0.3902446	14.6342	2.14e-10	1774.012

Note: Productivity is measured as log TFP. Output, raw materials, wage, capital, research and development expenditures, and the unit values of the manufacturing products are measured in thousand US Dollar.

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Table A 3: Foreign direct investment in India's manufacturing sector after India's investment liberalization

Year	No. of foreign acquisitions	Percent of foreign firms	Foreign direct investment, net inflows (% of GDP)
1993	20	1.85	0.19
1994	13	2.40	0.29
1995	27	2.69	0.58
1996	18	2.94	0.61
1997	20	3.44	0.85
1998	39	4.53	0.61
1999	201	5.51	0.46
2000	316	8.23	0.75
2001	102	8.69	1.11
2002	127	8.91	1.07
2003	111	8.85	0.70
2004	94	8.85	0.80
2005	105	9.05	0.87
2006	183	9.52	2.11
2007	104	9.46	2.04
2008	57	9.42	3.55
2009	51	9.57	2.61
2010	76	9.80	1.60
2011	58	10.06	1.99
2012	185	11.24	1.31
2013	155	13.25	1.51

Note: The number of foreign acquisition and the percent of foreign firms is calculated based on the Prowess database. The net inflow of foreign direct investments as a share of GDP is obtained from the World Development Indicators of the World Bank.

Co-production

To highlight possible co-production of products firms tend to produce together, Table 7 follows Bernard et al (2010) and reports the average annual frequency (in hundreds) with which firms co-produce products within and across sectors. Firms with more than two products may be counted more than once in each cell.

Like Bernard et al (2010) I assume that the expected frequency of coproduction follow an independent Poisson distribution. The observed co-production frequencies, o_{rc} , in row r and column c are compared to those that would be expected according to a null hypothesis that the decision to produce a certain product is independent from another. The expected frequencies of co-production, e_{rc} , is calculated under the null hypothesis as the total observed co-production multiplied with the total frequency of co-production in all row industries and the total frequency of all column industries. The statistic for testing whether the entire coproduction matrix is generated by random coproduction,

$$\sum_{r,c} (o_{rc} - e_{rc})^2 / e_{rc} \tag{12}$$

with o_{rc} and e_{rc} being the observed and expected frequencies in row r and column c , respectively, is chi-squared distributed. The null hypothesis that a firm produces a certain product independently of other products is rejected (p-value<0.01).

Products with dark blue and dark orange shading are significantly more often produced together than expected assuming that product lines are independent from each other. Dark and light blue shading indicate statistically significantly higher and lower co-production at the 1 percent level, respectively, than is implied by a null hypothesis of random co-production. The absence of shading indicates the absence of statistically significant differences from this null hypothesis. Dark orange and light orange shading indicate further statistical significantly higher and lower co-production at the 1 percent level of foreign firms compared to domestic firms. Thus, the orange shading on top of the blue indicates whether the non-random co-production behavior is statistically more or less pronounced by foreign owned firms. This is tested by a simple t-test comparing the relative frequency of observed co-production within and across industry for domestic and foreign firms.

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Table A 4: Determinants of foreign acquisition: Average marginal effects obtained from the logit model and the ordered logit model

	Foreign	Foreign acquisition structure			
	(1)	Small minority (2)	Minority (3)	Majority (4)	Full Ownership (5)
Productivity	0.00902*** (0.00168)	0.00241*** (0.000336)	0.00245*** (0.000346)	0.00351*** (0.000472)	0.00714*** (0.000931)
Age	-0.00868*** (0.000809)	-0.00192*** (0.000206)	-0.00195*** (0.000209)	-0.00279*** (0.000271)	-0.00568*** (0.000536)
Size	0.00395*** (0.000498)	0.000731*** (0.000108)	0.000745*** (0.000109)	0.00107*** (0.000155)	0.00217*** (0.000298)
Leverage	-0.000444 (0.000422)	-0.000225 (0.000741)	-0.000735 (0.00242)	-0.000968 (0.00318)	-0.00155 (0.00509)
Wage	0.00985*** (0.000980)	0.00242*** (0.000243)	0.00247*** (0.000248)	0.00353*** (0.000315)	0.00719*** (0.000595)
SOE	0.0419*** (0.0127)	0.00870*** (0.00232)	0.00886*** (0.00235)	0.0127*** (0.00335)	0.0258*** (0.00660)
Exports	0.00350** (0.00162)	0.000995*** (0.000354)	0.00101*** (0.000364)	0.00145*** (0.000512)	0.00295*** (0.00103)
Imports	0.00476*** (0.00168)	0.00131*** (0.000368)	0.00134*** (0.000374)	0.00191*** (0.000532)	0.00390*** (0.00108)
Observations	40,738	33,235	33,235	33,235	33,235

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Column (1) shows the average marginal effects obtained from the logit model, column (2) to (5) show the average marginal effects obtained from the ordered logit model. Margins are calculated at means. Industry and year fixed effects included in all regressions. Productivity is measured by TFP.

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Table A 5: Summary statistic of pre-acquisition characteristics

	Productivity	Age	Size	Leverage	Wage	SOE	Exports	Imports
<i>Non-acquired Firms</i>								
Mean	3.970	24.017	8.617	3.083	5.617	0.051	0.615	0.571
Std. deviation	0.642	18.846	1.921	20.445	1.741	0.023	0.487	0.495
Observation	33377	33377	33377	33377	33377	33377	33377	33377
<i>Acquired Firms</i>								
Mean	3.975	23.929	9.633	2.528	6.674	0.001	0.851	0.805
Std. deviation	0.513	19.456	1.859	5.716	1.699	0.011	0.356	0.396
Observation	3167	3167	3167	3167	3167	3167	3167	3167
<i>Overall</i>								
Mean	3.970	24.010	8.705	3.035	5.708	0.047	0.635	0.591
Std. deviation	0.632	18.899	1.937	19.612	1.762	0.022	0.481	0.492
Observation	36544	36544	36544	36544	36544	36544	36544	36544

Note: This summary statistic compares the characteristics of non-acquired firms with the pre-acquisition characteristics of foreign acquired firms. Since foreign acquired firms differ in their characteristics from non-acquired firms it is necessary to take the selection decision of foreign investors into account.

Table A 6: Balancing tests for differences in observed pre-treatment characteristics for foreign ownership

Propensity Score	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	(1)	(2)	(3)	(4)	(5)
Productivity	0.057 (0.093)	0.089 (0.066)	0.063 (0.254)	0.001 (0.014)	-0.064 (0.110)
Age	2.355 (1.652)	1.688 (1.260)	6.258 (0.875)	-0.429 (0.564)	-1.473 (0.988)
Size	0.151 (0.206)	0.504 (0.109)	0.025 (0.074)	-0.237 (0.463)	-0.383 (0.370)
Leverage	2.299 (3.988)	0.083 (0.375)	-0.149 (0.226)	0.238 (0.193)	-0.153 (0.177)
Wage	0.115 (0.146)	0.402 (0.860)	0.033 (0.059)	-0.276 (0.237)	-0.331 (0.231)
SOE	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.019 (0.021)
Export	-0.034 (0.042)	-0.021 (0.032)	-0.005 (0.020)	0.001 (0.011)	-0.015 (0.025)
Import	-0.014 (0.033)	0.001 (0.032)	-0.026 (0.021)	-0.012 (0.010)	0.003 (0.004)

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. To ensure that the propensity score is successful in controlling for firm differences in the pre-acquisition period, for each control group and acquired firms pairing, the sample is divided by propensity score quintiles, and for each subsample the equality in means of the pre-treatment covariates between acquired and non-acquired firms is tested.

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Table A 7: Balancing tests for differences in observed pre-treatment characteristics for different foreign ownership degrees

Panel A: Domestic versus small minority acquisition firms

Propensity Score	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	(1)	(2)	(3)	(4)	(5)
Productivity	-0.161 (0.353)	0.134 (0.162)	-0.061 (0.126)	-0.147 (0.169)	-0.078 (0.142)
Age	3.125 (9.124)	-6.161 (4.762)	-5.484 (4.525)	-1.435 (2.750)	-0.180 (1.763)
Size	0.761 (0.838)	0.866 (0.412)	-0.801 (0.386)	-0.707 (0.448)	-0.658 (0.376)
Leverage	1.090 (3.730)	0.077 (1.345)	0.733 (1.241)	-0.023 (0.549)	0.066 (0.248)
Wage	0.635 (0.700)	0.328 (0.356)	-0.470 (0.340)	-0.326 (0.226)	-0.447 (0.369)
SOE	0.001 (0.002)	0.001 (0.003)	0.000 (0.001)	0.002 (0.003)	0.001 (0.002)
Export	0.125 (0.210)	-0.002 (0.125)	-0.029 (0.103)	-0.053 (0.049)	-0.051 (0.032)
Import	0.320 (0.209)	0.073 (0.124)	-0.050 (0.115)	-0.054 (0.058)	-0.071 (0.136)

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. To ensure that the propensity score is successful in controlling for firm differences in the pre-acquisition period, for each control group and small minority acquired firms pairing, the sample is divided by propensity score quintiles, and for each subsample the equality in means of the pre-treatment covariates between acquired and non-acquired firms is tested.

Panel B: Domestic versus minority acquisition firms

Propensity Score	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	(1)	(2)	(3)	(4)	(5)
Productivity	-0.175 (0.386)	-0.259 (0.350)	0.041 (0.129)	-0.049 (0.118)	0.095 (0.470)
Age	-9.499 (9.875)	-9.496 (10.877)	0.948 (4.627)	-0.136 (4.780)	0.540 (1.980)
Size	-0.002 (0.912)	-1.454 (0.933)	0.452 (0.396)	-0.409 (0.429)	0.296 (0.199)
Leverage	1.113 (3.154)	0.263 (3.193)	-1.913 (1.154)	0.409 (0.957)	0.215 (0.573)
Wage	0.410 (0.765)	-0.583 (0.810)	0.355 (0.349)	-0.498 (0.394)	0.090 (0.191)
SOE	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Export	-0.164 (0.236)	-0.117 (0.287)	0.074 (0.102)	-0.024 (0.084)	0.003 (0.036)
Import	0.331 (0.235)	0.154 (0.289)	-0.073 (0.115)	0.003 (0.099)	-0.026 (0.040)

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. To ensure that the propensity score is successful in controlling for firm differences in the pre-acquisition period, for each control group and minority acquired firms pairing, the sample is divided by propensity score quintiles, and for each subsample the equality in means of the pre-treatment covariates between acquired and non-acquired firms is tested.

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Panel C: Domestic versus majority acquisition firms

Propensity Score	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	(1)	(2)	(3)	(4)	(5)
Productivity	-0.342 (0.451)	-0.328 (0.361)	-0.161 (0.251)	0.040 (0.143)	0.037 (0.051)
Age	11.950 (11.635)	14.310 (10.861)	9.116 (9.050)	-4.878 (5.708)	2.456 (2.106)
Size	-1.269 (1.064)	1.068 (0.944)	-0.562 (0.769)	-0.076 (0.514)	0.183 (0.212)
Leverage	-3.462 (4.453)	1.047 (2.979)	1.182 (2.426)	-0.494 (1.155)	0.249 (0.292)
Wage	-0.065 (0.892)	0.968 (0.818)	-0.512 (0.678)	-0.087 (0.469)	0.025 (0.203)
SOE	0.001 (0.000)	0.023 (0.000)	0.001 (0.000)	0.000 (0.000)	0.000 (0.000)
Export	-0.005 (0.271)	-0.384 (0.289)	-0.207 (0.202)	0.008 (0.102)	0.019 (0.039)
Import	0.322 (0.270)	0.128 (0.288)	-0.287 (0.226)	-0.042 (0.120)	-0.012 (0.043)

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. To ensure that the propensity score is successful in controlling for firm differences in the pre-acquisition period, for each control group and majority acquired firms pairing, the sample is divided by propensity score quintiles, and for each subsample the equality in means of the pre-treatment covariates between acquired and non-acquired firms is tested.

Panel D: Domestic versus wholly-acquired firms

Propensity Score	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	(1)	(2)	(3)	(4)	(5)
Productivity	0.159 (0.587)	0.575 (0.370)	-0.158 (0.243)	0.108 (0.249)	0.010 (0.100)
Age	5.986 (14.825)	4.443 (11.056)	9.919 (8.789)	7.065 (9.901)	2.626 (4.213)
Size	-0.229 (1.373)	0.557 (0.962)	0.405 (0.782)	0.830 (0.890)	1.065 (0.819)
Leverage	1.461 (6.829)	1.436 (3.043)	-0.371 (2.179)	-0.871 (1.957)	0.621 (0.593)
Wage	-0.976 (1.119)	-0.928 (0.833)	1.123 (4.278)	0.776 (0.808)	0.834 (0.801)
SOE	0.000 (0.004)	0.000 (0.000)	0.001 (0.002)	0.000 (0.000)	0.000 (0.000)
Export	-0.480 (0.330)	-0.535 (0.488)	0.078 (0.189)	-0.107 (0.179)	-0.045 (0.077)
Import	-0.691 (0.327)	-0.239 (0.286)	-0.242 (0.214)	-0.160 (0.211)	0.112 (0.086)

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. To ensure that the propensity score is successful in controlling for firm differences in the pre-acquisition period, for each control group and wholly-acquired firms pairing, the sample is divided by propensity score quintiles, and for each subsample the equality in means of the pre-treatment covariates between acquired and non-acquired firms is tested.

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Eidesstattliche Erklärung

Ich erkläre hiermit, dass ich meine Doktorarbeit "Aid, Trade and FDI" selbstständig und ohne fremde Hilfe angefertigt habe und dass ich als Koautor maßgeblich zu den weiteren Fachartikeln beigetragen habe. Alle von anderen Autoren wörtlich übernommenen Stellen, wie auch die sich an die Gedanken anderer Autoren eng anlehnenden Ausführungen der aufgeführten Beiträge wurden besonders gekennzeichnet und die Quellen nach den mir angegebenen Richtlinien zitiert.

Kiel, June 2016

Birgit Elisabeth Meyer