FDI Spillovers in Developing Countries: Channels, Conditions, Challenges

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This research was funded by Utrecht University.

ISBN 978-94-91870-42-2
U.S.E. Dissertation Series
USE 056
Printed by Ridderprint | www.ridderprint.nl

FDI spillovers in developing countries: channels, conditions, challenges

FDI spillover-effecten in ontwikkelingslanden: kanalen, voorwaarden, uitdagingen

(met een samenvatting in het Nederlands)

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de
Universiteit Utrecht
op gezag van de
rector magnificus, prof.dr. H.R.B.M. Kummeling,
ingevolge het besluit van het college voor promoties
in het openbaar te verdedigen op

maandag 23 maart 2020 des middags te 12.45 uur

door

Dea Tusha

geboren op 9 mei 1992
te Skrapar, Albanië

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Dr. J.A. Jordaan

For my parents

ACKNOWLEDGEMENTS

On September 1st, 2015 I embarked upon the journey that ultimately led to this thesis. Quite early into my PhD, I got the chance to attend the defense of PhD colleagues in the department, who were kind enough to share the wisdom accumulated over the years with us "newbies". I clearly remember two thoughts flashing through my mind then: First, I was puzzled by how stressed they looked just prior to reaching that desired and illusive finish line. Being fresh off my Master's, where I was pressed for time on every project, and the longest lasting research I had ever worked on was my Master's thesis, I found it hard to believe that at the end of three or more years one may still struggle to wrap everything up neatly. Three years felt like an eternity! Second, the moment I started reading other people's acknowledgements, in my mind I started working on my own. Mind you, my research was far from crystallised at that point, but my acknowledgements were on good track already. Four and a half years later, this is where I stand: I fully empathize with my fellow PhDs – three years is not an eternity, it is barely enough time to have 1.5 papers[1] go through the publication process. But I am glad I started writing my acknowledgements in my head early on, because this has been an incredible journey, during which I have grown and developed alongside my research. And as the saying about journeys goes: "If you want to go fast, go alone. If you want to go far, go together". The people that accompanied me throughout this experience, and the ones I met along the way, not only pushed me to go further, but made it all worthwhile.

First and foremost, I would like to thank my supervisors, Charles van Marrewijk and Jacob Jordaan, for their guidance and support. Charles, I have learned a lot from our discussions and interactions: they helped to structure my thoughts, take stock of where I was and put things into perspective. Ever the optimist by nature, even when it came to the feasibility of my research ideas, I ultimately appreciated your input in helping to keep me grounded and pushing me to be more efficient. Jacob, I consider myself very lucky to have had you as my daily supervisor. Talking about research with you has always come easy. Our brainstorming sessions have been some of the most productive and inspiring discussions I have had, and I truly believe my work is better as a result. Besides being a supervisor, you have also been a great mentor – showing continued interest in my personal development and supporting and

[1] The average length of reviews and revisions cycles for Economics journals is about two years (Ellison, G. (2001). *The Slowdown of the Economics Publishing Process*. 52.)

advising me throughout my career trajectory. I am excited to continue working with you and to explore new research ideas, but also to just have a chat, whether in person, on Skype or over a long email thread.

I would also like to thank Holger Görg, Steven Brakman, Niels Bosma and Joost de Laat for agreeing to be part of my reading committee and putting in the time and effort to read my thesis and provide comments. I would like to give a special thank you to Anna Salomons, not only for being part of my reading committee, but for the feedback and advice that she has given me throughout my PhD years at U.S.E. I got to know her as my Econometrics tutorial teacher during my Bachelor's studies, and she has been a role model and source of inspiration ever since. Her work ethic and ambition, and the enthusiasm with which she approaches everything, from research, to teaching, and even to gym classes have pushed me to try harder and led me by example.

Through a very fortunate constellation of circumstances, during my PhD I got the chance to work as an intern at the United Nations Industrial Development Organisation (UNIDO), and as a consultant for the World Bank. Both experiences enriched my understanding of the topic I was working on and expanded it further, by allowing me to consider more practical and policy-oriented approaches. Chapters 4 and 5 of this dissertation are based on the projects I worked on during my time at these institutions. I am grateful to my supervisors and co-authors, Adnan Seric at UNIDO and Shawn Tan at the World Bank, for having given me the opportunity to work under their supervision, and to combine my work there with the research for my PhD. My internship at UNIDO was my first encounter with doing research outside academia. Adnan helped to make that transition easy, by offering his guidance and introducing me to a great team of researchers and economists at UNIDO. Since I started working as a consultant at the World Bank, my experience has been a steep learning curve in terms of content, work ethics, and the practicalities of working for an international organisation. I owe most of what I've learned to Shawn, and his readiness to guide me through this process, by always finding the time to discuss everything thoroughly, from new research ideas, to recommendations for places to visit in D.C.

Many consider a PhD to be a solitary endeavour: finding someone to confide in that understands and empathises with you as you go through the trials and tribulations, the dead ends, the self-doubt, and the day-to-day frustrations caused primarily by data that just refuses to cooperate, is difficult. In this regard I consider myself quite lucky, because I managed to find two. Franziska and Vincent, you have been there for me from our Research Master's days, when we bonded over homework in that small, poorly-ventilated room in the Descartes building. Having you as my paranymphs is not only a source of comfort and joy, it also feels like the most natural extension of our friendship. Franziska, during the PhD we shared so much more than a flat: opinions, feelings, fears, good news, bad news, good TV, bad TV (and of course TV so bad, it's good), delicious recipes and travelling experiences. I have learned and continue to learn so much from you – from thinking in a structured manner, to being more aware of and sensitive toward social issues, to appreciating a well-deserved holiday and a good weekend breakfast. Vincent,

we have been known to turn a question about Dutch expressions into a full-blown philosophical discussion. I have enjoyed those talks as much as I have found our heart-to-hearts comforting, and our chats about research helpful and inspiring. Game of Thrones may be over, but knowing the three of us, I am sure we will never run out of reasons and ways to get together and enjoy a good meal, a great conversation, and with some luck, as Vincent would put it, an **epic** episode of something or other.

I also want to thank the people that made going to work something to look forward to, be it on busy days when I did not have time to talk and was brooding over my laptop (and they were understanding), or days when I needed to vent (and they were there to let me), or every other day, when it was just nice to have a chat with them. My office mates in Room 2.07– Ronja, Tim, Jeroen, An, and Alex – I already miss our chats, the dinners (especially the ones An hosted), and the overall homey feeling of the office. The configuration of the people in the room may change (welcome Sebastiaan and Emiel!), but just like our amazing office plant, I am sure the *gezelligheid* of the office will always remain, nurtured by every new inhabitant.

Just as importantly, the PhD experience would not have been the same without our PhD lunches. When I first joined U.S.E. as a fresh and pretty clueless PhD candidate, lunches in the kitchen (a.k.a. the designated PhD lunch room back in the good old days) were my one source of essential information for surviving and navigating the PhD. I looked up to Ioana, Krista, Swantje, Werner, Ian, Daan and Joyce as PhD Jedi masters, and was grateful to them for passing their knowledge to us younglings. Making sure that the lunch tradition continues is very much a passing-of-the-torch ritual, and eventually I felt the responsibility fall upon my shoulders, as well as those of my companions: Leydi, Rebean, Sara, Yingyang, Peter. Therefore I was happy and relieved to see that the new PhD cohort not only kept some traditions, but expanded them further (into PhD dinners). I want to give a shoutout to my girl Lucia, for always coming up with the most original ideas; my walking, dancing, and Eurovision buddy Timo; Zori, whose knowledge of the nuts and bolts of life at U.S.E. is only rivalled by her willingness to share it with everyone in need of help; the everything-Utrecht expert Bora; Thomas and his Harry Potter cup; Milande and Margot, with whom every conversation feels as sweet and delightful as a Tony's Chocolonely bar; Jordy and Milena, with whom I will always share the equally special bonds of teaching and grading Empirical Economics for the first time and attending a Balkan Beats party at Tivoli; Wanxiang and his board-gaming skills, and Merve, whose passion makes every conversation twice as interesting. You know you do not want to stop being part of a community like this when it has been over a year since you have last been around, and you still haven't muted the Whatsapp group chat (Go U.S.E. your peers!).

I arrived at U.S.E. as a fresh eighteen year old, knowing barely anything about life in general, and Economics in particular. U.S.E. became my temple of learning and the backbone of my intellectual growth. I got to know the teaching staff at U.S.E. as my lecturers and professors, and over the years

came to think of them as mentors, and later colleagues. For a girl whose prior educational background was strongly rooted in the more hierarchical Albanian education structure, this transition would not come naturally. However, thanks to people like Stephanie, Adriaan, Wolter, Loek, Mark, Kris, Hein, Maarten and Martijn, who always showed a genuine interest in my work and were always keen to offer their support, my trajectory within U.S.E. has been a smooth and memorable one. I also wanted to thank Emilie and Elena, whom I am sure I could go to for advice on econometrics, life and everything in between, before, after, or even during a Body Attack class. Finally, thank you to Cynthia, for brightening up my day with cappuccino and her friendly, upbeat attitude.

My academic career benefitted greatly from the conferences and summer schools I attended, and the people I met there. In particular, I would like to thank Marta, Robert, Frauke and Birgit, for always giving me useful feedback after presentations and making the rest of the conference an enjoyable experience. I would also like to thank the LEG PhD council, and my fellow PhD day co-organisers, Leonie, Franziska and Jeroen, for making me feel part of something bigger, that was hopefully helpful and interesting to my fellow PhDs.

My life in the last ten years in the Netherlands would not have been the same without the two friends I made since moving to that flat at the wooded edge of Zeist in September 2010. Michalis and Jessica, I have cherished every dinner, trip, and adventure we have embarked upon together. Michalis, I cannot think of anyone whose opinion on good cinema, literature, and music I would trust more, probably because you helped to shape so much of my tastes over the years. Jessica, we learned to cook together, got to see each-other's home countries, went through so many important milestones in our lives together, and even briefly became flatmates again last summer (thank you for hosting me!), bringing our whole shared Dutch experience full-circle. Over time, our small Zeist nucleus expanded, as Krzysztof, Eleni, Franziska, and Martin joined our little group. Through the many Wednesdays spent at Florin's pub quiz (even grabbing a first place victory, despite usually sucking at the music round), the passionate discussions over important issues like the right order to watch Star Wars, and the get-togethers over weekends and holidays, you became my international family, my home away from home.

So much of my adult life has revolved around Utrecht, that I feel I owe a "thank you" to the city itself. But although I came to love the city for its beauty and vibrance, I am sure I would not have enjoyed it half as much, if it weren't for the people I met while living there. Zhili, you have been a friend and a confidante from that first day we met during the introduction days of our Bachelor's. You have been there to offer a helping hand, complement my "book smarts" with your "street smarts", lend an ear and a long, warm hug every time I felt I needed one. Marina, from our dinner dates with red wine and Albanian movies, to your and Bram's unmissable parties, I will always appreciate having someone who could understand my process of immersion into a new society, and more importantly, could joke about it with me in Albanian. I would also like to thank Robbert and Grietje, for making nerdy dinners so

much fun; Bono and Michiel, for our epic tapas reunions; Adomas, for the nice memories in Zeist and Vilnius; Frank, for always making sure I appreciate my Dutchness; and Sergi, for introducing me to the idea of studying in Utrecht. The amazing ladies of the Book club for the women of Utrecht, have expanded my reading horizon, and everyone who joined the dinners of the Louis Bonaparte Society, has expanded my horizon on so many other topics, including some I had never considered before.

No matter how much I have loved my time in Utrecht, I am really happy to have had the chance to explore and live in two other great cities during the last four years. My time in Vienna was short, but memorable. This was partly due to the city's inherent beauty, especially in spring, but mostly due to the friends I made there. My office mates: KyungHyun, Mariana, Vassiliki, Ah-young and Maria; the researchers at UNIDO: Alessandra, Alejandro, Anna and Michele; and the great network of UNIDO interns that acted as a support team for everyone who was new in town and in the building, helped to turn so many moments during those four months into fond memories.

I moved to Washington D.C. in October 2018, elated that I would finally get to realise my dream of working at the World Bank, but also quite certain that this would be a very short-term arrangement (I did have a PhD to finish after all). Hence, I decided to remain oblivious to the fact that I was moving not only to a new city where I didn't know anyone, but to a whole new country across the ocean. Work during the week, PhD during the weekend for five months – that was pretty much my whole plan for that period. Almost a year and a half since then, I can say with certainty that my plan did not quite work out that way, but I am happy it did not, because I would not have met all the wonderful people I did otherwise. I want to thank my fellow World Bank consultant friends: Tatiana, Peter, Kay, and Diana, for welcoming me into their midst and treating me as part of the group from that first dim sum trip. I want to give special thanks to Anne, for taking time off from her genuinely busy schedule on most days to come along with me to seminars, random events around DC, and most importantly, lunch. Anne, you were a great colleague, and I miss you. I also want to thank Alessandro, and my flatmates, Deidre and Eslah, with whom I can go back to my nerdy roots in very different ways. I want to thank Aida, who claims she forced me into joining her group of friends, when in reality we both know they pretty much adopted me. Prerna, Melanie, Ruth: thank you for teaching me the value of brunch as a social support mechanism. I also want to thank Mike, who got to know me in a pretty stressful period of my life, but was able to see through that. Thank you for pushing me to explore new parts of the US and myself, and for being too nice to me.

Finally, going through location, intellectual and emotional changes comes easy when you have something constant to always rely on. My constant are my childhood friends, and my family. Imelda, Eni, Esi, Melina: I feel that over the years we have lost and re-found each-other many times, in different reiterations of ourselves and our relationships, but always holding on to that same bond we made as young girls. You have shaped so much of who I am, and continue to do so to this day.

Acknowledgements

Dua të falënderoj të afërmit e mi, të cilët më kanë shtyrë të vazhdoj përpara, duke besuar tek unë dhe duke qenë krenarë për mua. Në mënyrë të veçantë, Nona, Gjyshi, Irini, Elda: faleminderit për dashurinë dhe kujdesin tuaj të pakusht!

I want to thank my brother Elio, for being generally cool. They say we do not get to choose family, but I am glad that even after all these years we have spent growing up apart, I would choose you as my brother. I often find myself missing simply hanging out with you on a Saturday afternoon, or trying (and often failing) to sing along with you on a family road trip. I hope we get to do all that again soon. I love you, and I like you.

To my parents, Miranda and Bari, whom I owe everything. I cannot remember anymore how I made the decision to go abroad for my studies, although I am sure you do. But I can clearly remember the sacrifices you made that allowed me to even consider that option, and later follow through with it: from moving to Tirana, away from your families and your own support systems to make sure Elio and I got a good basic education, to working two jobs to support our higher education abroad. But beyond the financial support, I cannot put in words how much your emotional support has meant to me. Any decision, big or small, that I have had to make became a smaller burden, because you were always on Skype to let me vent it all out and share the load with me. You have encouraged me to seek the path that I found most fulfilling, even if at times that path led me further away from you. But regardless of where I am, I will always be a walking reflection of the values that you have instilled in me since childhood. Ju e dini që nuk më vjen natyrshëm të shpreh ndjenjat, por dua ta mbyll këtë falënderim shumë thjesht: mami dhe babi, ju dua shumë!

Dea Tusha

March 2020, Washington D.C.

LIST OF ABBREVIATIONS*

Name	Abbreviation
Institutions and Organisations	
Association of Southeast Asian Nations	ASEAN
Badan Koordinasi Penanaman Modal (Indonesian Investment Coordinating Board)	BKPM
Badan Pusat Statistik (Indonesian Statistics Office)	BPS
International Monetary Fund	IMF
Organisation for Economic Co-operation and Development	OECD
United Nations Conference on Trade and Development	UNCTAD
United Nations Industrial Development Organisation	UNIDO
Viet Nam General Statistics Office	GSO
World Trade Organisation	WTO
Data sources and classifications	
Annual Indonesian Manufacturing Enterprises Survey	MS
Cost of Doing Business Survey	CODB
Input-Output Table	IO
Klasifikasi Baku Komoditas Indonesia (Indonesian Standard Commodity Classification)	KBKI
Klasifikasi Baku Lapangan Usaha Indonesia (Indonesian Standard Industrial Classification	KBLI
OECD database for Structural Analysis	STAN
Trade Analysis Information System	TRAINS
United Nations' International Standard Industrial Classification of All Economic Activities	ISIC
Vietnam Investor Survey	VIS
Wholesale Price Index	WPI
World Bank Enterprise Survey	WBES
World Integrated Trade Solution	WITS
Other	
Foreign Direct Investment	FDI
Gross Domestic Product	GDP
Intellectual Property	IP
Most Favoured Nation	MFN
Multinational Corporation/Enterprise	MNC/E

*Abbreviation based on name in own language (in italics). English translation in brackets.

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Chapter 1 INTRODUCTION

Globalisation is bad.

Globalisation is good.

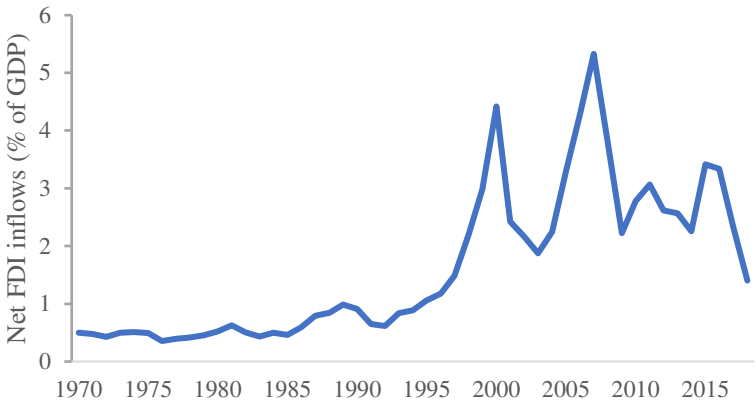
In today's world, there is an almost equal chance that one will be confronted with either of those two statements if one sets out to capture and understand the general sentiment on this hottest of topics. It is also telling that these odds remain roughly the same regardless of whom one asks – whether it is average Joe or Jane on the street, the head of government of a developed or developing country, or leading economists who have worked and researched the topic for years.[2] The spread in opinion is largely owed to the fact that, as Bhagwati (2004, p.6) argues, globalisation (not strictly defined as economic globalisation) is a multifaceted issue. It covers phenomena ranging from the perpetuation of cultural interactions and integration as a result of rising numbers of international student exchange programmes, to the establishment of global production networks facilitated by advances in technology, and increasing openness to trade and Foreign Direct Investment (FDI). As an important part of globalisation, FDI – and its more easily recognisable representatives to the public, Multinational Corporations (MNCs) – have received a similar reception: heralded by some as a panacea for economic growth and development, lambasted by others as the root cause of some of the worst ailments affecting society today, including inequality and environmental degradation.

Changes in perception toward FDI over time have been closely mirrored by its development trajectory, although it is hard to say which one preceded the other and even harder to draw lines of causation. Global FDI trends picked up in the early 1980s (Figure 1.1), a point in economic history widely regarded as a win for economic liberalisation and internationalisation. The move toward openness was helped by national policies that promoted trade and financial liberalisation, while international policy coordination was facilitated by the work of institutions like the World Bank, the International Monetary Fund (IMF), and multilateral organisations like the World Trade Organisation (WTO). Among developing countries that welcomed and benefitted from internationalisation in general and FDI in particular were East and Southeast Asian countries, whose economies saw levels of growth of up to ten per cent. Singapore, Taiwan, South Korea, and ultimately, China were all held as success stories for combining sound industrial policy with a shift toward internationalisation (Chenery, 1986; Birdsall et al., 1993). Hence –

[2] For an example of a prominent advocate, see Bhagwati's "In defense of Globalization" (2004). For a more cautionary tale, refer to Rodrik's "The globalization paradox" (2011). Although, true to their profession (and rightly so), neither simply argues definitively in favour or against globalization, but rather each presents justifications or caveats that place them in the support and opposition camps, respectively.

following the introduction of these policies in the 1980s – the 1990s and early to mid-2000s (until prior to the 2008 financial crisis) were characterised by a boom in FDI inflows, together with a rapidly growing political and public consensus that the operations and effects of MNCs constitute the solution to many economic problems, especially in developing and transition economies.[3]

Figure 1.1: World FDI, net inflows



Source: The World Bank
Note: Based on Balance of Payments data, as percentage of World GDP

Concurrently, it became the goal of many developing countries' governments to attract FDI, in the hopes and expectation of reaping the much lauded benefits for host economies (i.e. the countries receiving FDI): higher capital investment and accumulation, new employment opportunities, industrialization and structural change through the introduction of new industrial activities, and knowledge and technology transfers to indigenous firms (Dunning and Lundan, 2008; Navaretti et al., 2006). At the same time, research on the economic impact of FDI rapidly gained a prominent role in the International Economics, International Business, and Development Economics literature. Early theoretical contributions to the literature on the relationship between FDI and economic growth made the argument that foreign investment contributed to endogenous growth by increasing the rate of human capital accumulation (Romer, 1990); accelerating technological progress by enhancing competition and innovation (Grossman and Helpman, 1991); increasing the number of available products; and adding to the stock of knowledge and capital necessary for research and development (Helpman, 2009). Empirical studies provided corroborating evidence, but also highlighted the fact that host economies needed to comply with some necessary conditions for FDI-driven endogenous growth to materialise. These included possessing a certain initial level of human capital (Borensztein et al., 1998; Bengoa and Sanchez-Robles, 2003); the presence of well-functioning complementary export-promotion policies (Balasubramanyam et al., 1996), and well-developed financial markets (Alfaro et al., 2004).

[3] For example, the 2003 World Investment Report (UNCTAD, 2003) reported that in 2002 MNCs were more important than trade in delivering goods and services. They also employed 53 million people abroad.

In efforts to zoom in on each of the channels through which FDI contributes to economic growth, already in the mid- to late 1970s a strand of literature that focused on benefits from FDI through effects on the productivity of domestic firms started to emerge. The earliest contribution to this literature was a seminal paper by Caves (1974), who laid the groundwork for subsequent studies by distinguishing spillovers as externalities from foreign firms from the direct effects that these firms create by intentionally introducing new technologies and entrepreneurial knowledge to host economies:

"The host nation's private sector does not benefit directly because the foreign subsidiary is efficient, or brings to its shores skilled entrepreneurship or productive knowledge. Rather its gains depend on spill-overs of productivity that occur when the multinational corporation cannot capture all quasi-rents due to its productive activities, or to the removal of distortions by the subsidiary's competitive pressure."

Caves (1974, p.176)

It was followed by a wave of theoretical (Findlay, 1978; Wang and Blomström, 1992; Coe and Helpman, 1995) and empirical studies (Globerman, 1979; Kokko, 1992; Kokko et al., 1996) that found generally positive effects of foreign firms on the performance of local firms.

However, as the anti-globalisation movement began to gain traction, the tide of positive reception toward FDI began to turn on several fronts. During the Asian financial crisis in 1997-1998 foreign investment was quick to turn on its heels, leaving the destination countries reeling and in need of capital injections (Carson and Clark, 2013). It became clear that the motives for investment and the level of local embeddedness of foreign firms in the countries they chose to invest in were not to be taken for granted. Governments and the public alike, in both developing and developed countries became wary of the overwhelmingly positive narrative that had been associated with FDI. While in developed countries, outward FDI and MNCs were associated with the closing down of plants and jobs being taken away to countries where it was cheaper to produce, in developing countries the image of footloose investment operating in a vacuum of foreignness, without connecting or contributing in any way to the local economy started to crystallise (Yamin and Sinkovics, 2009). The emergence of global networks that fragmented production among several locations did not help to improve this image, as they were considered to essentially use developing countries as cheap workshops where low value-added product assembly processes were carried out, only for the final products to be exported back to the economic North (Neilson et al., 2014, p.4).

Supporters of globalisation (and FDI) will be quick to point out that much of this discourse is nothing but protectionist politicians blowing smoke in an effort to either incite discontent toward trade and financial openness and gain support for nationalist policies, or to find an outlet to channel existing

discontent.[4] While at times this may indeed be the case, part of the scepticism actually originated from new research that often provided less favourable findings on the impact of FDI. In fact, as the literature on FDI and growth continued to expand, evidence contradicting the earlier findings of positive effects from FDI started to amass. At the macroeconomic level, this was reflected in studies that found that after using more robust methods of estimation, the positive relationship between FDI and growth could not be confirmed (see e.g. Carkovic and Levine (2005), who use a General Method of Moments estimation), or that although it materialised, there was stronger evidence of causality going in the opposite direction (see e.g. Choe (2003), who uses a panel VAR model), with fast growing countries attracting more FDI, rather than FDI fostering economic growth.

Similarly, as more disaggregated data became available, and new econometric methods were employed, the original findings that foreign subsidiaries created positive productivity effects to local firms operating in the same sectors became less clear and robust. In an important paper by Aitken and Harrison (1999), empirical findings for Venezuelan manufacturing firms showed that the presence and operations of FDI may lower productivity levels of domestic firms. Estimated negative productivity effects from FDI suggest that superior foreign firms were crowding out domestic firms, thus leading to negative spillovers. In the years that followed, the number of industry- and firm-level studies on FDI spillovers increased rapidly, covering a larger number of different host economies and time periods; applying different and more robust estimation methods and measures of foreign presence; and controlling for the effect of various firm characteristics and other possible determinants of FDI spillovers. The only clear conclusion that resulted from this largely extended body of empirical evidence is that the evidence on intra-industry FDI spillovers is inconclusive.

Several reasons for the growing heterogeneity and inconclusiveness of evidence on intra-industry FDI spillovers can be distinguished. First, part of this inconclusiveness is due to substantial reasons: the world (of firms) is different, and it is constantly changing. As such, it is difficult (though not impossible) to pin down the determinants for the occurrence of spillovers. In this respect, two major contributions have been especially helpful to the progress made by the literature: First, theoretical insights from trade theory on models of firm heterogeneity (Melitz and Redding, 2012) that are easily extendable to FDI and provide theoretical underpinnings that can serve as a starting basis for empirical research. Second, the increasing quantity and quality of data that allows us to capture the different firm characteristics that may play a role in determining spillovers. As a result, we have moved away from simply trying to identify spillovers, toward trying to understand their determinants and channels. We now know that firm-level characteristics, and industry-, region- and country-level institutional settings and business

[4] Globalisation is often seen less favourably following economic downturns, as the anti-globalisation backlash in the developed world, especially in the United States, after the Great Recession; or the discontent of EU citizens after the Euro Debt crisis, have shown (Frieden, 2019).

environment conditions are important factors that affect the materialisation of spillovers. Moreover, the interactions between these factors are just as important, and they are not static: often they have both a time and a spatial dimension, which further complicates the relationship between them and FDI spillovers.

Second, it is difficult to capture the actual mechanisms and transmission channels through which FDI spillovers can materialise. Theoretical contributions in this field have helped to distinguish between spillover channels of competition, demonstration effects, labour mobility and inter-firm linkages (Kokko, 1996; Blomström and Kokko, 1998; Hamida, 2013). However, the majority of empirical studies on FDI spillovers place foreign presence and a number of other controls on the right hand side of the equation and domestic firm productivity on the left, but the mechanism through which these spillovers occur is often left as a black box. Few studies (mostly in developed countries with more data availability) are able to identify specific channels (e.g. the labour mobility channel by linking employer-employee data to firm-level data to measure the effect of workers moving from foreign to domestic firms on the productivity of the latter), but their findings are hard to generalise. Most often these channels are hinted at or hypothesized, but not measured or tested empirically. Identifying and quantifying the channels is especially important for policy implications: it is difficult to draft policies to promote spillovers from FDI if it is not clear how these spillovers arise.

Third, empirical findings on FDI spillovers are often affected by the use of incomplete or non-representative datasets, and the lack of estimation methods that address endogeneity issues (which often arise as a result of absent or problematic data), thus leading to unreliable results. In the same vein, it can be argued that a large part of the variation in findings may not be a result of actual differences in underlying characteristics of firms and/or economic mechanisms. Instead it is caused by differences in data collection, variable definitions and estimation methodologies (Görg and Strobl, 2001; Wooster and Diebel, 2010; Hanousek et al., 2011). A systematic and unifying approach to measuring FDI spillovers would go a long way toward alleviating the issue of confounding factors and therefore allow for a better identification of FDI spillovers and the underlying reasons for heterogeneous evidence.

At this point, it is important to note that all the issues mentioned above are especially relevant for and, regrettably, more acute in settings of developing countries. Acting as host economies to large amounts of FDI inflows, it is especially important for these countries to develop the right institutional and policy frameworks that would allow them to reap the benefits from incoming FDI. Often however, local firms and institutions in these countries do not possess the necessary capabilities to extract the desired benefits from the presence of foreign firms in the country. For instance, domestic firms often lack the technical capability to serve as suppliers to foreign firms, lowering the possibility that FDI spillovers can be transmitted. Even when they do interact with foreign firms, they often lack the necessary absorptive capacity to benefit from these interactions (Jordaan, 2016; Reyes, 2017). Similarly, developing host

countries often lack the institution framework (Gorodnichenko et al., 2014), financial infrastructure (Alfaro et al., 2004), and business environment conditions that are required to induce spillovers from FDI.

It is also especially difficult to capture the transmission channels of spillovers in developing countries. Identifying these channels usually requires very detailed data, such as matched employer-employee data (to capture the labour mobility channel), detailed transaction-level data (to capture inter-firm linkages), or patent data (to capture demonstration effects). More often than not, many of these are not available from statistics offices in developing countries. It is also difficult to generalise findings from studies conducted in developed countries that possess appropriate data to the setting of developing countries, because the mechanisms at play are often different. For example, the lack of adequate Intellectual Property (IP) rights in developing countries may have adverse effects on foreign firms' willingness to engage with local firms or to hire and fire local employees, for fear of intellectual property losses.

More generally, data availability and quality in developing countries is a challenging issue. Not only does it make the investigation of FDI spillovers difficult, but it may also lead to biased and unreliable results. In developing countries – where firms often conduct a good part of their activity in the shadow economy – responses to survey questionnaires, which are the main source of information for FDI spillover estimations, are often inaccurate or misleading. Firms are afraid that sensitive information on production inputs and profitability will spill over to competitors or tax authorities, and as such do not report true values. More seriously, these patterns of non-response or false responses are not random. Hence, data from developing countries may suffer from selection bias already at the stage of survey implementation.

1.1 CONTENTS OF THESIS

In this thesis I set out to investigate these issues in a systematic manner, in order to understand and provide some insights into the question that has sparked so much discussion in the literature: why do we not have a definitive answer on the spillover effect of FDI in their host economy? In trying to answer this question, I also deal with the closely related questions of how to make the best use of the information that is available, and what the important lessons are for the future. In answering these questions, I also tackle some of the more implicit assumptions made by the literature on FDI spillovers. Every chapter of this thesis is an empirical investigation of a different dimension of FDI spillover estimations in the setting of a developing country. The resolution to focus on developing countries is so that I can highlight some of the unique challenges that these countries face to attract FDI in the first place and subsequently, to make it work for development. At the same time, I also want to highlight some of the unique challenges that researchers working with developing country data face in their research.

This thesis is meant to provide a cohesive account of the challenges, channels and conditions for FDI spillovers. As such, the chapters are meant to build on and add to each-other in terms of content, and at times, data. However, to allow the reader to focus on any specific chapter, or to read them in a different order, each chapter is presented as a self-contained, independent piece of work. This also means that some overlap and repetition of concepts and methods is inevitably present.

Chapter 3 is based on a joint working paper with Jacob Jordaan. Chapter 4 is based on joint work with Jacob Jordaan and Adnan Seric and served as a background paper to a United Nations Industrial Development Organization (UNIDO) report on *Global Value Chains and Industrial Development: Lessons from China, South-East and South Asia* and to an OECD-UNIDO report on *Integrating Southeast Asian SMEs in Global Value Chains: Enabling Linkages with Foreign Investors.* Chapter 5 is joint work with Shawn Tan and is submitted for revision to the World Bank's Working Paper Series. In the remainder of this chapter, I briefly outline each of the consecutive chapters, summarise their findings and place them in the larger context of this thesis.

1.2 OUTLINE OF THE THESIS

In Chapter 2, I start out by conducting a replication study with data from the Annual Indonesian Manufacturing Enterprises Survey – *Survei Tahunan Perusahaan Industri Manufaktur* (henceforth MS) for the time period 2002–2013. The chapter is meant to fulfil two main objectives: firstly, it is meant to provide an answer to the question of whether FDI spillovers are easily generalisable over different time periods, possibly characterised by different economic and political conditions. I do so by replicating a previous study on FDI spillovers in Indonesia by Blalock and Gertler (2008), that uses the same data sources and methodologies, but covers a different time period (1980-1996). By following the same methods and building the same variables, I am able to isolate the effect of the different time period. I find that spillovers from FDI in Indonesia have changed over time, and I proceed to lay out and discuss several arguments as possible explanations for these results. The second objective of the chapter is to provide a more elaborated description of the data and methodology employed in this chapter. However, as there are many overlaps with the following chapters in terms of variable definitions and estimation methodologies, this chapter is also meant as a helpful guide for a reader interested in the finer details of preparative work for empirical investigations in the other chapters.

In Chapter 3, I use the same data from MS to tackle one of the issues I touch upon above, namely data challenges. I conduct an empirical examination of biases that arise when estimating FDI productivity spillovers with incomplete datasets. I treat the World Bank Enterprise Survey (WBES) as an example of an incomplete dataset to show how sampling methodology and sample size can result in biased and unreliable estimates of FDI spillovers. To do so, I estimate FDI spillovers for Indonesia, comparing findings from a WBES dataset with findings obtained with the MS dataset. Furthermore, I conduct various estimations on large numbers of random samples drawn from the MS, following the sampling

methodology of the WBES. The estimations show that estimates of FDI spillovers based on this sampling framework are inaccurate, caused by measurement error in the variables of horizontal and vertical FDI participation, strong sample presence of small firms, and small sample size. Relaxing the WBES sampling criteria and using FDI industry participation variables calculated with the MS dataset produces substantially more reliable findings.

In Chapter 4, I tackle the issue of identifying one of the channels of FDI spillovers, namely linkages with foreign buyers. Instead of making the assumption often made (implicitly) by the literature on backward FDI spillovers that foreign and domestic firms form similar linkages with their suppliers, I set out to test this assumption. Using a unique dataset of foreign and domestic manufacturing firms in Vietnam, I investigate the extent and intensity of vertical linkages between local suppliers and domestic and foreign firms inside and outside Vietnam acting as their buyers. After controlling for a number of biases, I find that foreign firms located within and outside Vietnam tend to develop more linkages with other foreign firms in the country than with domestic firms. My subsequent analysis of the relation between linkages and productivity shows that there is potential for productivity increases for domestic firms from selling directly to FDI firms in Vietnam (while not to foreign buyers abroad), but the necessary conditions need to be created for knowledge intensive linkages to develop.

In Chapter 5, I tackle the issue of using available data from developing countries to both identify firm characteristics that act as determinants of FDI spillovers, and to find a proxy for spillovers through the labour mobility channel. I use a novel dataset of the universe of Moldovan firms to investigate FDI spillovers through the labour market channel. I circumvent the issue of missing employer-employee data for developing countries by combining firm-level administrative panel data with labour market conditions from an annual survey on the Cost of Doing Business (CODB). I exploit variations over time, sectors and regions in firms' evaluation of labour market restrictions to examine whether labour market conditions affect productivity spillovers from FDI. The findings from this chapter show that there are positive and significant spillovers from foreign firms to their Moldovan suppliers in upstream sectors (backward FDI), but not to domestic firms in their own (horizontal FDI) or downstream sectors (forward FDI). However, there is heterogeneity in spillover effects as a result of both domestic and foreign firm characteristics. Improvements in labour market regulations, such as formal contracts and less complex layoff procedures that can be assumed to facilitate labour mobility are positively correlated with backward FDI spillovers.

Finally, *in Chapter 6* I offer some concluding remarks, point out limitations of the current research, and propose avenues for future research.

Chapter 2 A SIGN OF THE TIMES

A Replication Study of FDI Spillovers in Indonesia with a New Time Frame

2.1 INTRODUCTION

Since its independence in 1945, FDI in Indonesia has promoted capital investment, created new employment opportunities, and contributed to the industrialization and structural change of the Indonesian economy (Ing et al., 2017). In the last 25 years the country has seen its FDI stock as a share of GDP almost triple, from 8.4 per cent in 1995 to 22.1 per cent in 2018. According to the World Investment Report 2019, Inward FDI flows reached a record high in 2018, at nearly 22 billion dollars (UNCTAD, 2019). However, neither the growth trajectory of FDI, nor its impact on economic growth have been straightforward to estimate (Khaliq and Noy, 2007). Despite the growing level of inward FDI in the last few decades, scholars of the Indonesian economy have characterised its approach to globalisation as "precariously open" (Hill, 2015). It has earned this characterization as its integration can be interpreted to be in line with the East Asian approach toward economic openness as a tool for industrialization, while still experiencing bouts of nationalist and protectionist approaches in its international economic policies.

In the last three decades Indonesia has become the subject of a large number of studies on FDI and its impact on firm-level performance. This is partly due to its changing relationship with FDI, which led to variation in FDI inflows over time. It is also due to the thorough record-keeping of these trends by the Indonesian Statistics Office – *Badan Pusat Statistik* (BPS), which allowed researchers access to a rich dataset at a very disaggregated level. The consensus from this growing empirical literature is that FDI has had an overall positive effect on local firms, measured in increases in value added, labour productivity, total factor productivity, employment and wages (Lipsey and Sjöholm, 2004). However, most, if not all of the literature that reports evidence of positive productivity spillovers in Indonesia stems from the same source of data that covers a very specific period in the Indonesian economy, namely the second part of the "New Order" regime, that spans from early 1980s to the Asian financial crisis.

This period was characterised by active FDI promotion policies and increasing FDI inflows, following a period of restrictive policies and FDI stagnation that started in mid-1970s. Hence, while it clearly makes for a good setting to study the operations and effect of foreign firms in Indonesia, it also raises the question of whether the same findings would still hold in a different time period, with possibly different policy and business environment configurations. Moreover, in his seminal 1978 paper on "*Relative backwardness, FDI and technology transfer*", Findlay's theoretical argument is that technological progress in "backward" regions is larger if the relative technological gap between the "backward" and the "advanced" region investing in it is larger. Thus, over time, with incoming FDI

accounting for a larger share of the country's capital stock, and originally positive productivity spillovers helping to close the gap in productivity between foreign and domestic firms, we would expect technology transfers to diminish. Hence, more generally, we are interested in finding out if the empirical findings of the studies on FDI spillovers can be generalised beyond the specific time period they are covering.

To do so, we take advantage of a new wave of firm-level data from the BPS that covers the time period 2002-2013. To isolate the effect of the different time period, we choose to replicate one of the earlier studies on FDI spillovers in Indonesia, Blalock and Gertler (JIE, 2008, henceforth BG). By using the same data sources and methodologies, and building the same variables as BG, which instead covers the time period 1980-1996, I am able to remove these confounding factors and to isolate the effect of the different time period. The reasons we decide to focus on this study for our replication are threefold: first, the paper pursues a rigorous identification strategy that tries to account for and address a number of endogeneity issues that confound the findings in other empirical investigations. It also estimates both intra- and inter-industry FDI spillovers, being among the first ones to do so after the contribution to the literature on spillovers through backward linkages by Javorcik (AER, 2004). As of March 2020, it has been cited 919 times on Google Scholar, which is a fairly high citation count for articles on this topic[5]. Second, it uses the same source of data as our study, namely the Annual Indonesian Manufacturing Survey (MS), a firm-level census of all manufacturing firms with more than 20 employees, which has been collected by BPS since 1975. We are also able to use the same secondary data sources for additional data in our analysis, including data on price deflators and Input-Output (IO) tables. Third, it provides a thorough documentation of all the research steps, from data cleaning, matching, and manipulation; to variable definition and construction; to choice of identification strategy and methodology specification. This facilitates replication and lowers the chance of confounding factors, thereby providing more reliability to the claim that we are able to isolate the "different time period" effect in case of a divergence in findings. In fact, we conclude that for the time period of our study, horizontal spillovers are insignificant, which is in line with BG's finding, but spillovers from foreign firms in downstream sectors are significant and negative, which is a stark divergence from BG's finding of positive and significant backward FDI spillovers. We also offer a number of possible reasons for the divergence in the discussion section.

Thus, this replication chapter contributes to the existing literature by providing an assessment of the generalisability of empirical findings on spillovers over time. It also provides a description of the investment climate in Indonesia during the time period covered by the original BG study and this

[5] The most influential papers on FDI spillovers, by Javorcik (2004) and Aitken and Harrison (1999) are cited 3,955 and 5,288 times since their publication, respectively. However, the average citation count of articles appearing on the first page of Google Scholar after searching "Foreign Direct Investment productivity spillovers" is 216.9.

replication study, which helps to shed light on possible reasons for the divergence in findings. In the process of replicating the BG study, it also provides a thorough description and discussion of the data and methodology used in both studies. This has some internal value for the rest of this thesis, as many of the issues regarding data, variables and methodology that are discussed in this chapter recur in the following chapters as well. Thus, although each chapter is meant to be self-contained, it may be helpful for the reader to turn to this chapter for elaborations on data and methodology issues. It may also have some external value, as it documents common practices in the FDI spillovers literature strand, and goes some way into discussing the implicit assumptions that are made by seemingly innocuous and at times unquestioned choices in the research process. Finally, it adds to the empirical literature on FDI spillovers in Indonesia, by providing findings with new data.

The rest of the chapter is organised as follows: Section 2.2 provides an overview of FDI in Indonesia in its recent history and of the studies on FDI in Indonesia. Section 2.3 describes the estimation methodology and measurement of the FDI variables. Section 2.4 describes the data, and the undertaken steps to build the final dataset for estimation purposes. Section 2.5 shows the results from the replication and discusses possible reasons for our findings, and Section 2.6 concludes.

2.2 INDONESIA

2.2.1 FDI in Indonesia

Indonesia is a suitable case for the study of FDI spillovers: it is part of the East-Asian block of countries that is often heralded by the International Economics literature as a success story for the combination of opening up the economy to globalization forces and sound national industrial policies. However, despite being a member of ASEAN and experiencing increasing levels of FDI inflows in the last fifty years, Indonesia lags behind in terms of openness compared to its neighbouring countries. Lipsey and Sjöholm (2011) argue that low FDI inflows, especially in manufacturing, are lower than one would expect, given the size of its population and economy, making the country somewhat of an outlier in the region. This has been the result of the implementation of cautionary policies and a general level of scepticism and distrust toward foreign business.

However, there has been quite some variation over time, both in terms of policies toward openness and FDI, and of the levels, types and motives of incoming FDI. These changes have often been associated with changes in the political landscape, where several long-governing regimes are associated with clearly demarcated different eras of economic development and inward FDI. Following decolonization from the Dutch in the 1940s, the first post-colonization Indonesian government led by Sukarno (1945-1967) did not put much importance on developing policies to promote economic growth and openness (Khaliq and Noy, 2007). Sukarno's regime (known as the "Old Order") was followed by Suharto, who governed Indonesia from 1967 to 1998 (the "New Order"), and is widely credited by both economic and historic scholarship with the development of the country to the highest levels of growth it has known

in its recent history. In fact, his regime was so long, that in a historical review of FDI in Indonesia in the last fifty years, Lindblad (2015) divides it in two phases (1966-1982 and 1982-1996) that were characterised by very different policy approaches toward inward FDI.

The first phase, starting in 1966, saw a switch toward policies that promoted FDI growth and industrialization. It took time for this to translate into any measurable effects on the economy however, as at the time economic growth was slowing down (Lindblad, 2015). New legislation allowing FDI into the country led to an inflow of FDI focusing on Indonesia's natural resources sector, with FDI originating mainly from Western countries. FDI policy took a step in the opposite direction in early to mid-1970s, by introducing new restrictions and impeding bureaucracy. This was reflected in falling rates of FDI inflows, but also in a change of its origins: there was an increase in the share of FDI from neighbouring countries focusing in manufacturing at the expense of Western FDI that was concentrated in natural resources and mining (Lindblad, 2015).

The second phase of Suharto's regime was characterised by a switch toward the most open and liberal policies toward industrialisation, trade, and inward FDI. It involved promoting privatisation, trade, and FDI by opening industrial zones, assigning priority industries, allowing foreign firms to participate in the privatisation of Public Enterprises, removing tariffs and non-tariff barriers (NTBs), and switching to a flexible exchange rate (Hill, 1996). This, in turn, led to a general increase in exports, FDI inflows, value added and total factor productivity in the economy that lasted all through the 1980s and peaked in 1996, just prior to the Asian Financial Crisis (Suyanto et al., 2009). The policies set in place were clearly accommodating toward FDI, as they gradually allowed for higher shares of foreign equity within a firm's ownership structure, culminating in a government regulation in 1994 that allowed 95-100 per cent foreign ownership and facilitated divestment practices. This led not only to *more* incoming FDI, but, one might argue, also to *better* incoming FDI. The structural change of the Indonesian economy away from agriculture toward manufacturing, construction and services was also reflected in the type of inward FDI. Inward FDI was increasingly focused on economic sectors including chemicals and pharmaceuticals, paper and printing, food, and metal, machinery and electronics – most of them sectors with high value added, where the potential for technology and knowledge transfers and spillovers is also higher. In fact, Lindsey and Sjöholm (2011) argue that Indonesia had a much lower share of FDI in labour-intensive manufacturing sectors than one would expect when considering that FDI towards the ASEAN countries was often motivated to exploit relatively low labour costs.

Thus, the Asian Financial Crisis of 1997-1998 found Indonesia at the peak of its economic development and openness, yet also increasingly subject to the dangers of an open economy at the time of a financial crisis. Indeed, while it suffered a major contraction in economic growth, Indonesia also experienced a massive net FDI outflow, as footloose investment quickly left the country once the economy was hit by the crisis. Due to a slow economic recovery in general, and a return of the distrust in foreign firms after

this episode, the business and political climate in the period after the crisis (starting in 1998 and ending in 2014) was anything but conducive to FDI inflows. The early 2000s were characterised by fragility, uncertainty, and corruption, which made Indonesia an unattractive country to invest in (Lindblad, 2015). With the new decade-long regime of Yudhoyono starting in 2004, the period known as Reform (2004-2014) was marked by a dichotomy between policy and practice: in theory, the government introduced regulations to facilitate and promote FDI. In practice, these reforms were undercut by bureaucracy and mixed signals, including a revision of the Negative Investment List (a list of business sectors not open to foreign firms) (Duggan et al., 2013) and investment licenses that depended on the discretion of the national investment authority – Indonesian Investment Coordinating Board – *Badan Koordinasi Penanaman Modal* (BKPM). Thus, despite reforms on paper, the investment climate and conditions for FDI in Indonesia in this period were bad and very slow to pick up pace again. From 2014, the new government led by Joko Widodo has reintroduced openness to globalisation as one of their main policy goals, but we have yet to see whether these policies have been effective (The Economist, 2016).

2.2.2 Literature on FDI spillovers in Indonesia

Another reason why Indonesia makes for an interesting research setting for FDI spillovers is the fact that this topic has already been investigated quite extensively in the literature with similar firm-level data from the Annual Manufacturing Survey. One set of studies has focused on the differences between foreign and domestic firms, while another strand focuses on FDI spillovers to domestic firms[6]. Studies on differences between foreign and domestic firms find that foreign firms are more productive, both in terms of productivity levels (Takii and Ramstetter, 2005) and in terms of productivity growth (Okamoto and Sjöholm, 2005). Moreover, employing a propensity score match and difference-in-difference analysis, Matthias-Arnold and Javorcik (2009) show that foreign firms are not only more productive than domestic firms, but they also increase productivity levels of local plants that they acquire. Other studies focusing on alternative measures of firm performance, such as exports (Sjöholm and Takii, 2008) and wages (Sjöholm and Lipsey, 2006) also present evidence of a clear foreign ownership premium.

In the mid- to late 2000s and early 2010s, several studies investigating FDI spillovers in Indonesia, using data from the Annual Manufacturing Survey were published. Overall, there was a consensus in the empirical evidence presented by these studies that FDI in Indonesia had a positive effect on the productivity of domestic firms. Besides BG, who find positive spillovers from foreign firms in downstream sectors but no significant horizontal spillovers, positive spillovers were also documented by Sjöholm (1999a, 1999b); Todo and Miyamoto (2006) – although only for foreign firms engaging in

[6] For a more comprehensive list and literature review, see Lipsey and Sjöholm (2011).

R&D activities; Suyanto et al. (2009), who focus on the chemicals and pharmaceuticals sector; and Takii (2005, 2011).[7]

Although the evidence indicates the presence of positive and statistically significant spillovers, it should be noted that all the studies mentioned above focus on the same time frame – 1980-2001 – or a shorter period within that time frame. In fact, despite expanding over a period of nearly two decades in terms of publication year (1999 – 2019),[8] none of the studies above go past 2001 in their investigation. Among studies that do extend the analysis to later years, Javorcik and Poelhekke (2017) focus on divestment from 1990 to 2009 and find that these are associated with falls in total factor productivity, but they do not study spillovers from FDI in this time period. Using a stochastic frontier analysis, Sari et al. (2016) find positive horizontal spillovers and negative backward spillovers on the productivity of Indonesian firms in the period 2003-2009. Similarly, Karentina (2019) investigates FDI spillovers for the period 2010-2014 and finds that horizontal spillovers in the short run are negative, but turn positive in the long run, and she finds evidence of negative backward spillovers. Hence, despite the large number of studies finding positive effects from FDI in Indonesia, the results should be interpreted alongside the consideration that this was the period characterised by having the most favourable FDI policies in Indonesia's recent history, high FDI inflows in general (following a period of FDI restriction), structural change and high economic growth. This is not to say that these conditions invalidate the findings from these studies. On the contrary, they may offer useful insights into the necessary conditions that lead to positive spillovers from FDI.

2.3 METHODOLOGY

2.3.1 Firm productivity

To capture FDI spillovers, BG estimate the effect of horizontal and downstream FDI on the productivity of domestic firms. For the majority of their analysis, they estimate the effect of FDI variables on log(output), after controlling for other inputs (labour, capital, raw materials and energy) with a trans-log specification (hence, all inputs enter the regression in logarithmic form, and their squared and interaction terms are included as additional regressors).[9] As part of their robustness checks, they also estimate the effect of downstream FDI on log(output) after controlling for the endogeneity of firms' input choices by using the semi-parametric estimation method introduced by Olley and Pakes (1996, henceforth OP). As the literature on productivity measurement has evolved considerably from the time

[7] Takii (2011) finds that there are positive spillovers from Multinationals from other East Asian countries, but no spillovers from MNCs from other origin countries.
[8] Sjöholm's contributions to the literature in 1999 were based on data from 1980 and 1991. The latest study by Brucal et al. with Indonesian firm-level data on the relationship between foreign acquisitions and energy intensity of the acquired firms was published in the Journal of International Economics in 2019 and covered the period 1983-2001, although in robustness checks they extend the period of study to 2008.
[9] In Chapter 3 we follow the same specification.

of publication of BG's article, several new methods to estimate productivity by accounting for input endogeneity have emerged that have been shown to capture the Data Generating Process more accurately and deal with the endogeneity issue more effectively. In this subsection, we briefly review the main theoretical contributions in the econometric literature on available methods to estimate firm-level Total Factor Productivity (TFP).[10] We discuss their main assumptions, advantages and disadvantages and relate these to the case of the Indonesian manufacturing sector in the period 2002-2013. In Table 2.1, we present descriptive statistics on productivity estimates with the different methods, and point out the differences and similarities in findings. Finally, in the results section we show differences in estimates of FDI spillovers from estimations where the TFP estimates from the estimations below serve as dependent variables.

i. *The problem: endogeneity of input choices*

Total factor productivity is measured as the residual from a production function estimation with output on the left hand side and inputs on the right hand side. The simplest form of such a function is a Cobb-Douglas functional form, as in equation (2.1).

$$Y_{it} = A_{it} K_{it}^{\beta_k} L_{it}^{\beta_l} M_{it}^{\beta_m} E_{it}^{\beta_e} \qquad \textbf{(2.1)}$$

where K_{it}, L_{it}, M_{it} and E_{it} represent inputs (namely capital, labour, raw materials, and energy), and Ait denotes firm and time specific productivity, which is unobservable to the econometrician and can only be estimated as a residual. We follow BG in adopting a trans-log production function, as they argue that it controls for both input levels and economies of scale effects. Analogously, in our case $log(A_{it})$ would be the residual from the trans-log production function specified in equation (2.2):

[10] In discussing these methods, we need to point out that this list is not exhaustive. Additional approaches not addressed here include, but are not restricted to Instrumental Variables (IV), General Method of Moments (GMM), as well as the methods introduced by De Loecker (2007), Wooldridge (2009) etc. For a more comprehensive literature review on productivity estimation methods, see Van Beveren (2012).
Another relevant, but hard to tackle issue that has emerged in the literature more recently, is the estimation of revenue based TFP (TFPR) instead of quantity based TFP (TFPQ). The problem with estimating TFPR instead of TFPQ lies in the fact that TFPR does not control for input and output prices, which affects input choice and productivity. While more recent studies address this issue by using available data on physical quantities and firm-level prices (Mairesse and Jaumandreau, 2005; Foster et al., 2008), for most studies in the FDI spillover literature, this level of data disaggregation has not been feasible. As a result, this strand of the literature has developed quite separately from the literature on productivity estimations, relying heavily on estimates of productivity through semi-parametric methods. Hence, in this subsection we decide to focus on these latter methods, as they are the ones most often used in the FDI spillovers literature. However, for a thorough discussion of production function estimations and other econometric tools used to analyze market outcomes, we direct the reader to the chapter by Ackerberg, Benkard, Berry and Pakes in the Handbook of Econometrics (2007).

$$\begin{aligned} logY_{it} = \beta_0 &+ \beta_k\, log\, K_{it} + \beta_l\, log\, L_{it} + \beta_m\, log\, M_{it} + \beta_e\, log\, E_{it} + \beta_{k2}\, log^2 K_{it} \\ &+ \beta_{l2}\, log^2 L_{it} + \beta_{m2}\, log^2 M_{it} + \beta_{e2}\, log^2 E_{it} + \beta_{kl}\, log\, K_{it}\, log\, L_{it} \\ &+ \beta_{km}\, log\, K_{it}\, log\, M_{it} + \beta_{ke}\, log\, K_{it}\, log\, E_{it} + \beta_{lm}\, log\, L_{it}\, log\, M_{it} \\ &+ \beta_{le}\, log\, L_{it}\, log\, E_{it} + \beta_{me}\, log\, M_{it}\, log\, E_{it} + \varepsilon_{it} \end{aligned} \quad \textbf{(2.2)}$$

where $logA_{it} = \beta_0 + \varepsilon_{it}$ and β_0 is the mean productivity across firms in an industry[11] and over time, and ε_{it} is the firm-specific deviation from that mean. This term can be decomposed further as in equation (2.3):

$$\varepsilon_{it} = \vartheta_{it} + u_{it} \quad \textbf{(2.3)}$$

where ϑ_{it} is a firm- and time-specific productivity shock that is observable to the firm, but not to the econometrician, and u_{it} is an i.i.d error term. Thus the production function to be estimated is:

$$\begin{aligned} logY_{it} = \beta_0 &+ \beta_k\, log\, K_{it} + \beta_l\, log\, L_{it} + \beta_m\, log\, M_{it} + \beta_e\, log\, E_{it} + \beta_{k2}\, log^2 K_{it} \\ &+ \beta_{l2}\, log^2 L_{it} + \beta_{m2}\, log^2 M_{it} + \beta_{e2}\, log^2 E_{it} + \beta_{kl}\, log\, K_{it}\, log\, L_{it} \\ &+ \beta_{km}\, log\, K_{it}\, log\, M_{it} + \beta_{ke}\, log\, K_{it}\, log\, E_{it} + log\, L_{it}\, log\, M_{it} \\ &+ \beta_{le}\, log\, L_{it}\, log\, E_{it} + \beta_{me}\, log\, M_{it}\, log\, E_{it} + \vartheta_{it} + u_{it} \end{aligned} \quad \textbf{(2.4)}$$

and the estimated log(TFP) is:

$$\widehat{\omega}_{it} = \hat{\beta}_0 + \hat{\vartheta}_{it} \quad \textbf{(2.5)}$$

For Ordinary Least Squares (OLS) to produce consistent estimates, input quantities need to be exogenous (i.e. $E(x_{it}\omega_{it}) = 0$). However, since the firm can observe its productivity level and any productivity shocks, it will take this knowledge (or prior beliefs about its productivity levels) into account prior to making its input decisions (Griliches and Mairesse, 1995). More specifically, a positive productivity shock will likely be associated with an increase in input volumes, while the firm may decide to accommodate a negative productivity shock by scaling back on production, and therefore on input purchases. This simultaneity issue will lead input choices to be correlated to the productivity residual. Hence, OLS estimates that fail to account for this will be inconsistent.

ii. *Fixed effects*

One of the first attempts to deal with the endogeneity issue in the literature was to control for firm fixed effects in the production function. The main assumption in this case is that endogeneity in the OLS

[11] We follow Javorcik (2004) and others in the literature and estimate the production function separately for each industry. This allows estimated input coefficients to differ across industries, thus allowing for heterogeneity in production dynamics across different industries.

estimates is a result of unobserved firm-specific, but *time-invariant* firm characteristics that affect input choice and productivity. Therefore, controlling for firm fixed effects in panel data analysis should take care of the issue of endogeneity and yield unbiased estimates. The advantage of this methodology is that it controls for time-invariant endogeneity issues, and with an increasing number of available panel datasets at the firm level, its implementation is rather straightforward. However, the main disadvantage is that it cannot control for *time-varying* endogeneity issues, and as such, shocks in productivity that affect both inputs and output in specific periods would remain unaccounted for, biasing the estimated coefficients of the inputs. In more practical terms, fixed effects has been shown to produce consistently low coefficient estimates for capital (Van Beveren, 2012), which is something we observe in our estimations as well.

iii. *Olley-Pakes (1996)*

In their 1996 seminal paper, Olley and Pakes (OP) introduce a semi-parametric method to estimate the production function, where they exploit the nature and timing of different input choices to account for the endogeneity of inputs. More specifically, OP assume that in the production process, capital is a state variable: a firm's capital input in period t is already fully determined in period t-1, which is when the firm decides on the level of investment:

$$K_{it} = K_{it-1} + I_{it} \qquad \textbf{(2.6)}$$

Thus, in determining investment in period *t-1* (and therefore capital in period *t*) the firm does not take into account any productivity shocks in period *t* that would be visible to the firm, but not to the econometrician. OP make use of this lag in the realization of investment decisions to use investment as a proxy for productivity shocks. First, they introduce a strictly monotonic, second or third degree polynomial function of investment on capital and productivity in period *t-1* (hence, in deciding investment for this period, the firm can only take into account last year's productivity). They then make use of the assumption of monotonicity of the investment function to express the productivity shock as an inverse function of capital and investment. In the first stage, they regress output on variable inputs (inputs that are assumed to vary freely and be determined by the firm in the same period as the observance of shocks, such as labour) and the inverse function, by means of OLS. In the second stage they use the predicted function from stage one to obtain the coefficient for capital and the TFP residual non-parametrically. OP also account for the survival of firms, by introducing an intermediate step that makes the firm's decision to exit or stay in the market dependent on the productivity shock proxied by investment. However, with the use of unbalanced panel data for estimation purposes, the selection bias due to endogenous exiting strategies is greatly alleviated, and later extensions of the OP method leave this intermediate step out.

The method relies on a few essential assumptions, among which the monotonicity of the function that establishes the relationship between productivity, the state variable – capital, and the proxy variable –

investment (i.e. investment is assumed to be monotonically increasing in productivity levels). It also relies on investment being strictly positive, an assumption that is not always borne out in the data. In fact, many empirical studies making use of the OP methodology to estimate productivity have bypassed this theoretical requirement of the model by transforming the investment variable (by adding a small constant) and introducing an indicator dummy for firms with zero investment, instead of dropping these firms from the analysis, since in many cases (especially in developing countries) a large proportion of firms reports zero investment. As we discuss in Subsection 2.4.3, the issue of zero investment is quite severe for our data, which may make the OP method unsuitable for productivity estimations in our case.

iv. *Levinsohn-Petrin (2003)*

The following methods build on the OP methodology, by tweaking some of the stricter assumptions that it relies on. In their 2003 paper, Levinsohn and Petrin (LP) introduced their semi-parametric method, which used intermediate inputs as a proxy, instead of investment. By doing so, LP do away with the requirement of strictly positive investment that is increasing in productivity, since firms usually report positive levels of raw materials (or electricity). In the meanwhile, they still keep the desirable two stage estimation procedure, which ensures unbiased estimates of the capital and labour coefficients. The main assumption that the method relies on is that intermediate inputs are chosen in the same period as labour, but their coefficient is only estimated in the second stage, since they are now part of the inverse productivity function, alongside capital. Another difference with the OP method is that LP remove the intermediate stage that accounts for selection bias in OP. In their paper, LP provide empirical evidence for the argument that by using an unbalanced panel, the additional benefits of introducing an exit function are marginal.

v. *Ackerberg-Caves-Frazer (2015)*

The main critique of the Levinsohn-Petrin method is the issue of multicollinearity between labour and intermediate inputs, since the timing of these input choices is very close, but their estimation is dealt with differently. In their paper, Ackerberg, Caves and Frazer (ACF, 2015) point out that in theory, since labour and intermediate inputs are both chosen in period *t*, after the firm observes the productivity shock, their parameters would suffer from severe multicollinearity, which theoretically should not allow us to identify the labour coefficient in the first stage. Although in practice we can still estimate a labour coefficient, due to this multicollinearity issue, this estimate would be biased.

Hence, instead of assuming that labour is determined freely in period t, after the productivity shock is observed, ACF include labour in the productivity function, and therefore the labour coefficient is also estimated in the second stage. However, the first stage is still necessary to estimate the coefficient on the productivity function and net out the error component. The coefficients for all the inputs in the second stage are estimated by doing a grid search with Non Linear Least Squares, or by employing GMM. Using GMM allows ACF not to make any assumptions on the exogeneity of labour: labour can

still be correlated with the productivity shock in the same period, but in this case its identification is done by using previous lags of the variable as instruments. Hence, as long as lagged values of labour inputs are valid instruments, this method would produce the most reliable estimates. Moreover, it is also more feasible in practice, as it incorporates the benefits of the original approach by OP with the fact that raw materials (or intermediate inputs) can be used as a proxy for productivity.

vi. *Estimating productivity in practice*

Several literature reviews and meta-studies have investigated the differences in the estimated coefficients from the use of these different methodologies. Moreover, by now each of the semi-parametric methods discussed above has been accompanied by a Stata user-written command to facilitate its implementation in practice.[12] In each case, it is possible to estimate total factor productivity as the residual of the dependent variable, once a model of the Cobb-Douglas or trans-log production function with the estimated parameters has been fitted. While most of the reviews in the productivity estimation literature focus on differences in estimated coefficient parameters, our variable of interest is the residual log(TFP). Table 2.1 gives a summary of descriptive statistics for total factor productivity estimated according to the different methods described above. For brevity and consistency, we report the results obtained by using the user-written Stata command *prodest* to estimate all TFP residuals with semi-parametric methods. Results obtained with the other user-written commands, as well as those obtained by our own implementation of the OP method are in line with the corresponding estimates from *prodest* and are available upon request.

Table 2.1: Descriptive statistics of log(TFP) by different estimation methods

Method	Observations	Mean log(TFP)	Std. Dev.	Min.	Max.
Pooled OLS (PO)	245,848	-0.0000	0.4143	-11.4064	7.7264
Fixed effects (FE)	245,836	-0.0000	0.452	-9.6668	7.7934
Olley-Pakes (OP)	240,322	5.8575	1.3268	-4.8762	14.2458
Levinsohn-Petrin (LP)	240,322	3.5427	1.1378	0.0131	16.1008
ACF, with investment (ACF-OP)	240,310	9.8449	3.894	-12.8167	29.918
ACF, with raw materials (ACF-LP)	240,310	8.2974	2.8766	-24.2021	23.4909

Source: Author's own estimations, using data from MS, 2002-2013.
Note: OP,LP, and ACF methods estimated using the user-written Stata command, prodest.

[12] See the user-written command opreg for the estimation of productivity following OP, by Yasar, Raciborski and Poi (2008); levpet for estimation following LP, by the authors and Poi (Petrin et al., 2004); acfest for estimation following ACF, by Manjon and Manez (2016); and prodest a user-written Stata command by Mollisi and Rovigatti (2017) that allows for the estimation of production functions according to any of the methodologies described above.

From Table 2.1 it is clear that the size of the estimated log(TFP) residuals depends greatly on the used estimation methodology. The estimates obtained with semi-parametric methods report ω_{it} as it is defined in equation (2.5) (intercept + residual). On the other hand, for fixed effects and Pooled OLS estimations, the residual does not contain β_0, which helps to explain the large difference between the estimates. Among estimates from semi-parametric methods, those obtained by using the ACF method are on average larger and have a larger variance. While higher average values would not necessarily affect spillover estimations, the difference in variance will affect the size and statistical power of the spillover estimates, as the only changing variable across the different estimations will be the dependent variable. We turn to the question on whether these differences are large and systematic enough to yield significant differences in the estimated spillover coefficients in the results section.

2.3.2 Identification and specification

To estimate whether domestic firms in sectors with more foreign firms or in sectors that sell more to foreign firms also produce more, *ceteris paribus,* we adopt the identification strategy of BG. We follow their specification exactly, and estimate the regression in equation (2.7):

$$\omega_{it} = \beta_1 \Delta Horizontal\ FDI_{jrt} + \beta_2 \Delta Backward\ FDI_{jrt} + \alpha_i + \tau_t + \gamma_{jt} + \lambda_{rt} + \varepsilon_{it} \quad \textbf{(2.7)}$$

where ω_{it} is log(TFP), α_i is the firm-specific fixed effect, $\tau_t, \gamma_{jt}, \lambda_{rt}$ are year, industry-year and island-year fixed effects respectively, and ε_{it} is an identically and independently distributed (i.i.d) idiosyncratic error term.[13] Thus, we estimate a fixed-effects regression at the level of the establishment, and control for other time, industry and region specific shocks by including controls for all these dimensions. It should be noted here that despite defining regions at the province level for the purpose of building FDI variables, BG control for region fixed effects at the level of islands, as provinces may be too small to reflect regional market dynamics in Indonesia[14]. We also cluster standard errors at the island-industry level and report the results of the estimation on two samples: the whole sample of firms, including foreign firms (in which case we control for foreign ownership) and the sample of domestic firms only.

2.3.3 FDI variables

To construct the horizontal FDI variable we use a formula that calculates the share of FDI in industry *j*, region *r* and year *t* as the ratio of industry output produced by foreign firms to the total industry output,

[13] BG allow ε_{it} to be endogenous and use the OP method to address the endogeneity and estimate FDI spillovers simultaneously. To study the effect of using different estimation methods to estimate productivity, we address the endogeneity issue by estimating log(TFP) first, and then use the estimated TFP residuals to estimate spillovers in a second stage. However, in Chapter 3, we follow BG and include FDI variables directly into the production function.

[14] However, it may make more sense to define smaller regional markets for FDI spillovers, as previous literature has shown that they are usually bound by geographical distances (see Jordaan and Monastiriotis, 2018) for a review of the literature dealing with this issue.

as in Equation (2.8). We follow BG and define foreign output as total output produced by foreign firms, which are firms with a foreign equity share of 20 per cent or more.[15]

$$Horizontal\ FDI_{j,r,t} = \frac{\sum_{i \in s} Foreign\ output_{j,r,t}}{\sum_{i \in s} Output_{j,r,t}} \quad \textbf{(2.8)}$$

Following Javorcik (2004) and remaining consistent with the methodology of BG, we define backward FDI as "the share of an industry's output that is sold to foreign buyers across all other industries". Starting from our measure of horizontal FDI, we can construct backward FDI of industry *j* as a weighted sum of the horizontal FDI of every other industry *k*. The weights are shares of industry *j*'s output purchased by other industries and are derived from the Input-Output table.

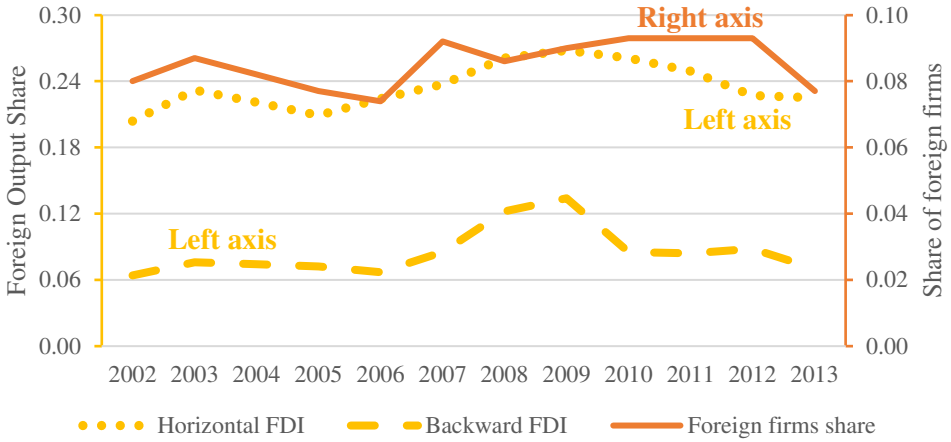
$$Backward\ FDI_{j,r,t} = \sum_k \alpha_{jk} Horizontal\ FDI_{k,r,t} \quad \textbf{(2.9)}$$

Figure 2.1 shows the development of average FDI concentration at the industry and region level over time for the time period 2002-2013. The share of foreign firms in the country has remained quite stable over this period, with a slight increase just prior to the 2008-2009 financial crisis, and a decrease in 2012. During the crisis we notice no increase in the share of foreign firms, but there is an obvious increase in horizontal and backward FDI, indicating that foreign output was less affected by the crisis, and therefore accounted for a larger share of industry output.

[15] This is in contrast to e.g. Javorcik (2004), who constructs horizontal FDI share as a ratio of the weighted sum of total output with shares of foreign equity in each firm as weights, to total output. How foreign output is defined is important for the estimation, but it also makes implicit assumptions about the dynamics of FDI spillovers within an industry. Weighing output of a firm by its "degree of foreignness", which is dependent on the share of foreign equity, supports the view that there are differences between e.g. a fully foreign-owned firm and a firm with only partial foreign equity, in terms of their potential to lead to productivity spillovers to domestic firms in the same sector. In contrast, the assumption behind using a dummy variable to capture type of ownership and then aggregating output or employees over foreign-owned firms to calculate the industry foreign participation measure is that any firm with foreign participation above a certain threshold should count fully toward the FDI industry measure. While there have been studies showing that there are differences between fully foreign-owned firms and joint ventures in terms of productivity spillovers, these have not been conclusive about the direction of the effect (for example, Merlevede et al., (2014) find that majority foreign-owned firms create larger spillovers than minority foreign-owned ones, whereas studying the same country, Romania, Javorcik and Spatareanu (2008) find that fully foreign-owned firms do not generate positive backward spillovers, while firms with some local participation do). However, by weighing the contribution to the industry measure of foreign participation by foreign equity share, this method is not only assuming that there is a difference, but it is making the additional assumption that firms with less foreign equity should count less, which should instead be an empirically testable hypothesis.
At the same time, simply defining a threshold of foreignness completely ignores these differences. Moreover, it is open to issues arising from the arbitrariness in choosing the threshold level. In fact, different studies use different levels as a threshold, from any foreign share (i.e. foreign equity larger than zero) to 10, 20, 50 or 100% foreign equity. A more systematic way to account for the difference between full and partial foreign ownership without assuming anything about the direction, functional form or size of its effect, is to estimate these as separate variables (see Chapter 5). Hence, for the purposes of our replication, we follow BG's methodology as described above, but building separate variables for fully foreign-owned firms and joint ventures might be preferred over both other options described here.

While foreign firms comprise less than ten per cent of the total firm population throughout the period, their output share (Horizontal FDI) constantly accounts for over 20 per cent of the total industry output. However, these ratios are not carried through along the supply chain, as the share of sales to foreign firms in downstream industries (Backward FDI) is lower.

Figure 2.1: Average FDI firm and output shares over time



Source: Author's calculations using data from MS.
Note: Horizontal and Backward FDI measured on the left axis, share of foreign firms in the sector on right axis

2.4 DATA

2.4.1 The Indonesian Manufacturing Survey and other data sources

The main source of data for our analysis is the Annual Indonesian Manufacturing Survey, a census of all medium and large manufacturing firms in Indonesia with 20 employees or more. The census is conducted by the Indonesian Central Bureau of Statistics (BPS), and is based on live on-site interviews by trained enumerators. Survey data has been collected by BPS since 1975, while the data available for this replication study spans the time period between 2002 and 2013. The survey provides extensive information at the level of the enterprise. According to the metadata, an enterprise is defined as a unit of production at a certain geographic location that conducts economic activity that aims to change a good mechanically, chemically or by hand, to become a new object, or a product of a higher value added and closer in nature to the product acquired by the end user. The questionnaire covers information on the location, ownership, industrial activity, output, employment, and other inputs (raw materials, electricity and fuels) used by the firm. It also provides data on the export activity of the firm[16], and in specific years, it provides more detailed information on research and development activity, as well as the education level of employees by gender and type of contract (permanent vs. temporary).

[16] In most years this is a dummy variable that takes a value of one if the enterprise has engaged in exporting activities in that year, and zero otherwise. For some years, more detailed information is available, as enterprises are asked to report the percentage of sales that was exported.

i. *Industry classification*

Industrial activity is registered according to the Indonesian Standard Industrial Classification for economic activities – *Klasifikasi Baku Lapangan Usaha Indonesia* (KBLI). KBLI is published by BPS, and is a national classification system that closely follows United Nations' International Standard Industrial Classification of All Economic Activities (ISIC). Industry aggregation is at the level of five-digit sectors. In the time period covered by the data used in this replication study, KBLI was revised once in 2009, to reflect the revision of ISIC Rev.3.1 to ISIC Rev.4. Hence, industrial activity in the original survey dataset is reported according to the KBLI 2005 revision for the years 2002-2009, and according to the KBLI 2009 revision for the years 2010-2013. We follow the classification changes and report KBLI 2005 industry codes for the years 2002-2009 and KBLI 2009 codes for the years 2010-2013. This is not an issue for the main part of the analysis, since we are able to follow firms over time by using their unique identifier and do not have to rely on industrial codes to identify them. Moreover, for the purposes of the replication, we construct industry-level FDI variables on a yearly basis, only estimate contemporaneous FDI spillover effects, and include industry-year fixed effects. Hence, any industry effect on the estimated regression coefficients is consistent and contained within the year-to-year definitions of industry. Therefore, changes in industry classifications should not affect within firm changes in productivity, or the estimated effect of industry-level variables on their productivity.

However, industry code correspondence becomes important as soon as we start estimating dynamic models of FDI spillovers (e.g. estimating the lagged effect of industry-level FDI variables), or pool observations from different years based on the industry they belong to[17], instead of estimating fixed effects models at the level of the firm. Moreover, the matching of firm-level data with information from Input-Output tables or price deflators is done at the industry level. BPS offers correspondence tables between the industry codes used by these information sources and KBLI, but these correspondence tables are often only available for a specific KBLI revision. Hence, an intermediate step of transforming KBLI 2009 codes to KBLI 2005 codes (and vice versa) is necessary for these cases. To do so, we use a concordance table published by BPS that matches each five-digit KBLI 2005 industry code to a five-digit KBLI 2009 code (the published concordance table allows for both types of conversion). In some cases, a KBLI 2005 code does not uniquely correspond to a KBLI 2009 code and vice-versa. In these cases, the first step was to check manually that the description of activities for both codes was a match. Once the best matches based on the qualitative description of the activities were determined, but more than one code was determined to be an appropriate qualitative match, the choice between the remaining matching codes was made randomly, so as to avoid any kind of bias in the matching process (e.g. by always linking a code from KBLI 2005 to the first match in KBLI 2009 based on the order that activities are listed in the classification – this would bias correspondence toward overrepresentation of industries

[17] This is how we estimate TFP with semi-parametric methods – see Subsection 2.3.1 for more information.

that appear in the classification tables first (agriculture, mining, manufacturing) and underrepresentation of the industries at the end of the classification table (construction, wholesale and retail trade, services)). The number of industries appearing in the survey differs per year, but on average there are 359 five-digit manufacturing industries.

ii. *Price deflators*

We deflate current values of output and materials, using price deflators based on the Wholesale Price Index (WPI). BPS collects information on commodity prices every month and calculates a monthly WPI, as well as an average yearly WPI, which we use to deflate output and materials. To account for variation in prices at the most disaggregated level available, we match the five-digit KBLI industry codes to the closest commodity code from the Indonesian Standard Commodity Classification – *Klasifikasi Baku Komoditas Indonesia* (KBKI), based on the Industrial activity – Commodity Correspondence Table published by BPS, as well as on qualitative descriptions of both codes. Whenever a WPI code correspondence at the highest level of disaggregation is not possible, we use the second-highest level WPI code (which is an average of all the sub-categories in that specific category) and so on. This matching technique is employed for both KBLI 2005 and KBLI 2009 industry classification codes.

We use petroleum prices as price deflators for energy. We also use price indices for construction materials, imported electrical and non-electrical machinery and transportation equipment to construct weighted price deflators for capital, where each fixed asset component (land, buildings, vehicles, and machinery) is weighted by its value share in total fixed assets in the MS. The price indices reported by BPS have different base years (earlier series use 2000 prices as baseline, and later series switch to 2005 and 2010 baselines). We combine information from WPI tables from different years to convert all price indices to the same base year, namely 2000. We then calculate real values of all deflated variables for each observation *i* in sector *k* in year *t* based on the reported nominal values and the yearly price deflator for the sector that firm *i* operates in, according to formula (2.10):

$$\boldsymbol{Real\ Values_{ikt}} = \frac{\boldsymbol{Nominal\ Values_{ikt}}}{\boldsymbol{WPI_{kt_{2000}}}} \qquad \textbf{(2.10)}$$

iii. *Input-Output tables*

To construct vertical FDI participation variables at the industry level, we use national Input-Output (IO) tables provided by BPS. BPS publishes IO tables every five years, since shares of sales across industries change rather slowly. In this study we use the 2005 IO table for the years 2002-2009 and the 2010 table for the years 2010-2013. We opt to use the 2005 IO table for the first period because using shares from the 2000 IO table may not be a good proxy for inter-industry relationships in 2009, as the economy may have undergone substantial structural changes during such a long time period. For the same reason, we believe that it is not advisable to use 2010 shares to proxy industry IO shares in 2002, or 2005 shares to

calculate industry weights in 2013. The other extreme would be to use IO tables published on a yearly basis to reflect the most up to date industry shares. However, this is neither practically feasible (since the publishing frequency of IO tables is only once every five years), nor necessarily theoretically desirable. Contemporaneous IO shares may suffer from endogeneity issues, as unobserved industry shocks that affect the productivity of firms in that industry may also affect the shares of inputs and/or outputs that the industry buys from/sells to other industries (hence biasing industry weights and consequently, vertical FDI measures based on these weights). Fixing industry weights to specific years makes them less dependent on yearly shocks and therefore goes some way toward alleviating endogeneity concerns.

Following international standards for the publication of IO tables, BPS publishes the tables at both producers'[18] and purchasers' prices[19]. BG use shares from IO tables at domestic producers' prices to construct industry weights to exclude confounding factors like transport costs. However, we cannot do the same, because this information is not available in both 2005 and 2010 IO tables. While it is possible to calculate industry weights based on domestic *producers'* prices in 2005, in 2010 BPS reports only domestic *basic* prices, which are calculated as producers' prices minus taxes and subsidies[20]. While using producers' prices is a better option to construct weights of industry participation for the reason mentioned above, we opt for consistency over the years in our measure and instead build industry weights based on total (i.e. domestic and import) *purchasers'* prices. By using the same price measure for both IO tables, we can safely assume that changes in industry weights are only due to changes in input-output linkages between industries, rather than changes in taxes and subsidies (although this choice comes at the expense of making the additional assumption that variation of transport costs across industries has either not changed substantially from 2005 to 2010, or that these changes are not systematically correlated to any industry-level shocks that might bias our estimations). A comparison of the weights constructed from both producers' and purchasers' prices shows that although purchasers' prices contain information on other factors that we cannot distinguish, the weights calculated from them are very similar to those calculated from producers' prices.

The matching of industry codes to the IO table codes was also done based on correspondence tables published by BPS. We matched the codes from the 2005 IO table to the KBLI 2005 industry codes on

[18] The producer's price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any VAT, or similar deductible tax, invoiced to the purchaser; it excludes any transport charges invoiced separately by the producer (OECD, 2008).
[19] The purchaser's price is the amount paid by the purchaser, excluding any deductible VAT or similar deductible tax, in order to take delivery of a unit of a good or service at the time and place required by the purchaser; the purchaser's price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place (OECD, 2008).
[20] The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, on that unit as a consequence of its production or sale; it excludes any transport charges invoiced separately by the producer (OECD, 2008).

a case by case basis. Since IO codes classify manufacturing activities on a more aggregate level than five-digit KBLI codes, several KBLI codes were matched to the same IO industry code. On the other hand, some KBLI codes corresponded to more than one IO code. In those cases, we took the same approach as concordance between KBLI 2005 and KBLI 2009 and assigned each KBLI 2005 code randomly to one of the corresponding IO table codes, provided that the description of activities also fit. Once a correspondence was established in this manner, all firms in that KBLI category were assigned the same matching IO table code. To match KBLI 2009 codes to IO 2010 table codes, we took an intermediate step of matching KBLI 2009 five-digit industries to commodity codes, based on the KBLI-KBKI concordance tables published by BPS. The KBKI codes are then matched to IO codes based on concordance tables provided as an appendix to the 2010 IO tables. In total, there are 175 IO codes in 2005, out of which 100 correspond to the manufacturing sector. In 2010 activities are divided across 185 IO table categories, of which 90 are manufacturing. Since we can only build vertical FDI participation variables at the level of aggregation of the IO table codes, effectively our definition of industry for inter-industry FDI spillovers estimation purposes is more highly aggregated than the five-digit KBLI level. For consistency and following BG, we use the same level of aggregation used by IO tables to construct all other industry-level variables and use this definition of industries for estimation purposes.

2.4.2 Data cleaning and manipulation

Filling in the Annual Indonesian Manufacturing Survey is mandatory for all enterprises with more than 20 employees in Indonesia. Data collection is done through in-person visits to the establishments' facilities and carried out by trained BPS enumerators. Despite the rigorous data collection and manipulation process, the raw version of the dataset provided by BPS still suffers from keypunch and inputting errors. Hence, prior to constructing the variables for our estimations, we performed a number of steps to clean the data, starting from checking for and removing duplicates. We also removed from the final dataset used for the analysis all cases of observations with negative values for any of the variables of interest. We follow the same procedure for observations with values above 1 or below 0 for variables that measure shares or ratios (e.g. export rate), and observations reporting unusual values for dummy variables[21].

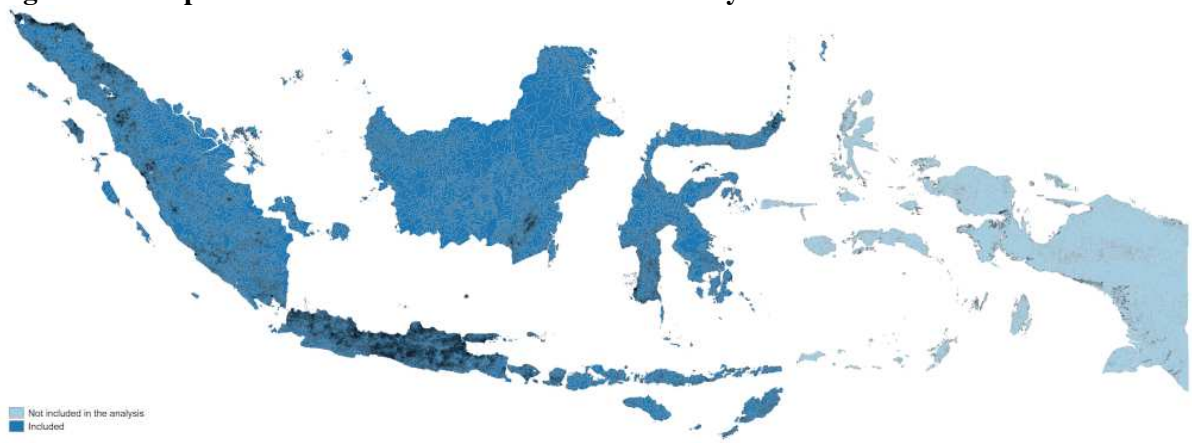
As a second step, we follow BG and check for variables with missing values. If a firm is missing information on a variable used in the estimation for more than two consecutive years, we exclude the firm from the analysis. If a firm is missing information for up to two years, we try to fill in the missing values by means of interpolation. In our sample, the only variable with a substantial number of missing values is capital. We use a two-step interpolation method to fill in missing values for capital: in the first

[21] For example, exporting dummy is coded as 1 for firms engaged in exporting activities and 2 for firms not engaged in exporting. We exclude from the analysis all observations with reported values other than 1 or 2.

step, we use linear interpolation by firm and interpolate capital on intermediate inputs, since there are fewer missing values for intermediate inputs. Hence, for each firm in the panel, we estimate the relationship between capital and intermediate inputs and use available information on the latter to predict capital in years when it is missing. In the second step, we interpolate the remaining missing values for capital by using a linear time trend interpolation at the firm level. This increases the sample size for the analysis by 25,580 observations.

To be consistent with BG's analysis, we also exclude some islands from the analysis, and limit the sample to establishments located in the islands of Sumatera, Jawa, Kalimantan, Sulawesi and the Lesser Sunda Islands (where Bali is located). However, since most of the population and economic activity is clustered in these regions, this only reduces the estimation sample by 4,020 observations in total, despite leaving out a vast area of land, as shown in Figure 2.2. To build FDI shares at the sector, region and year level, we define regions at the level of provinces. Despite the changes in Indonesia's administrative configuration[22] from the period covered in BG's analysis to the time period of our study, limiting the analysis to the islands listed above means that the number of provinces covered by our analysis is the same as that of BG, namely 27 provinces.

Figure 2.2: Map of Indonesian islands included in the analysis



Source: Author's calculations using data from MS.
Note: Islands included in the analysis in dark blue, excluded in light blue.

2.4.3 Variable construction, definitions and descriptive statistics

Based on the regression specification in Subsection 2.3.2, Table 2.2 provides a list of the variables used in the analysis and a description of the way they were constructed.

To estimate Total Factor Productivity, we take the natural logarithm of the dependent variable (real output) and of all inputs entering the production function on the right hand side. As many firms report values of zero for one or more of these variables, and the logarithm of zero is undefined, the problem

[22] Eight new provinces were added since 1998, with the latest addition being North Kalimantan in 2012, bringing the total number of provinces to 34 ("House Agrees on Creation of Indonesia's 34th Province", 2012).

of missing values for the purposes of our estimation is inflated. This is especially true for capital. Although the source of such a large number of observations with zero capital is not known to us, an analysis of differences in firm characteristics between firms reporting zero capital and the rest of the firms in the sample may provide some insights. In

Table 2.3 we see that it is most likely not the case that these firms are not performing any economic activity, since they report positive values of other inputs and sales. The zero values could then be attributed to reporting or input errors, or intentional misrepresentation of these values by the responding firms. In fact, anecdotal evidence from data collection in developing countries points to firms' reluctance to report the true values of such variables,

Table 2.2: Description of variables used in replication analysis

Variable	Description
log(output)	Natural logarithm of real production output, based on total revenues from production activities, deflated by industry-specific WPI with base year 2000, transformed
log(capital)	Natural logarithm of real capital, based on total market value of fixed assets (accounted for depreciation), deflated by weighted capital deflators with base year 2000, transformed
log(raw materials)	Natural logarithm of real value of used raw materials, deflated by industry-specific WPI with base year 2000, transformed
log(energy)	Natural logarithm of real value of used energy, based on the sum of used electricity, fuels and other types of energy, deflated by petroleum price indices with base year 2000, transformed
log(labour)	Natural logarithm of number of full-time employees
log(value added)	Natural logarithm of real value added, calculated as total revenues – energy and raw materials, deflated by industry-specific WPI with base year 2000, transformed
log(investment)	Natural logarithm of real investment, based on yearly change in real capital stock.
Foreign	Dummy variable=1 if foreign equity share is 20 per cent or higher; 0 otherwise
Horizontal FDI	Share of foreign output over total output in an industry and province
Backward FDI	Weighted sum of horizontal FDI in downstream sectors. Weights are calculated as shares of sector's output used as inputs in downstream sectors.
Export rate	Percentage of total output that is exported
Human capital	Ratio of non-production to production full-time employees

for fear that the information does not remain confidential[23]. If this is indeed the case, and if reports of zero capital are not randomly distributed among firms[24], dropping all observations with zero capital from the analysis (as would be the case when taking logarithms) would introduce a selection bias in our estimations, in addition to reducing the sample size substantially.

[23] Jensen et al. (2010) investigate the issue of non-response and false responses on questions about corruption using firm-level data from the World Bank Enterprise Surveys and indeed find that these phenomena are stronger and more persistent in developing countries with politically repressive regimes.

[24] In fact, based on summary statistics from

Table 2.3, it seems that on average firms that report zero capital report higher values for all other variables, which would indicate that they are larger.

Hence, we follow common practice by previous literature (Osborne, 2006) and transform all variables by adding a small constant value (in our case, $c = 1$), prior to taking the logarithm. The disadvantage of this approach is that if the true values of the variables for these observations are not zero, including them in the estimation sample drives the average values of the variables downward. To account for this during the estimation, we also introduce an indicator dummy equal to one for firms that reported zero original capital and control for it both in the estimation of log(TFP) residuals and in the regressions of FDI spillovers.

Table 2.3: Summary statistics for firms with zero and positive values of capital

	Firms with zero capital			Firms with positive capital		
Variable	Observations	Mean	Std. Dev.	Observations	Mean	Std. Dev.
log(output)	84,409	15.355	2.119	179,343	14.561	2.153
log(labour)	84,409	4.330	1.245	179,343	4.111	1.153
log(materials)	37,223	14.319	2.301	83,950	13.514	2.346
log(energy)	36,083	9.676	2.354	81,578	9.059	2.284
Foreign ownership	84,409	0.103	0.303	179,343	0.077	0.267

Source: Author's own calculations, based on data from MS

Finally, Table 2.4 reports summary statistics for the main variables by foreign ownership status. There are significant differences between foreign and domestic firms, with foreign firms being on average larger, as measured by their level of sales and number of employees.

Table 2.4: Descriptive statistics, main firm characteristics, by type of ownership

	Domestic					**Foreign**				
Variable	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max
log(output)	241,212	14.59	2.05	6.95	25.13	22,540	17.27	1.92	7.45	24.94
log(labour)	241,212	4.06	1.11	3.00	10.82	22,540	5.44	1.30	3.00	10.27
log(capital)	231,088	9.25	6.56	-0.82	29.68	21,955	9.89	8.04	0.00	28.89
log(materials)	231,007	13.71	2.29	-1.18	23.79	20,880	16.35	2.21	-0.78	24.51
log(energy)	237,725	9.79	2.32	-0.87	21.48	21,953	12.14	2.21	-2.24	20.26
Human capital	241,135	0.30	1.52	0.00	269.50	22,531	0.43	1.14	0.00	84.75
log(imp. materials)	241,212	2.13	5.16	0.00	23.27	22,540	9.23	8.28	0.00	24.97
Export rate	240,841	9.8	26.85	0.00	100	22,523	32.22	41.56	0.00	100

Source: Authors' calculations, based on data from MS

They are also more capital intensive, and use more raw materials and energy as inputs. Moreover, the ratio of non-production to production workers is higher for foreign firms, indicating that on average

they have a higher share of human capital. Most prominently, foreign firms have much higher export rates – the average export rate for domestic firms is 9.8 per cent, while foreign firms export 41.56 per cent of their output on average.

2.5 EMPIRICAL ANALYSIS AND DISCUSSION

2.5.1 Replication results

Table 2.5 shows the results of the estimation of productivity spillovers from foreign firms in downstream sectors (upper panel) and within the sector (lower panel), when these variables enter the regression separately. The left panel focuses on estimations with the full sample of firms, while the right panel focuses on the sample composed of domestic firms only. The first thing to notice is that differences in TFP estimates that were pointed out in Subsection 2.3.1 do have an effect on the size and significance of FDI spillovers, but not on their nature. In fact, focusing on the upper panel first, we find evidence of significant and negative spillover effects from foreign firms in downstream sectors. These findings are persistent across the two different samples, though more significant and slightly larger (in absolute terms) for the sample of domestic firms. The inclusion of foreign firms in the estimation sample attenuates negative spillover effects slightly, while we find evidence of a foreign ownership premium in some but not all estimations.

The results for intra-industry spillovers are more mixed and inconclusive: while we find no significant horizontal spillovers for either sample using PO, FE, OP and LP estimates of TFP as dependent variable, we do find evidence of negative effects on the productivity of domestic samples when we use estimates of TFP from the ACF method. Hence, once we correct for endogeneity and alleviate the issue of the upward bias, we find that there are negative effects from higher foreign participation in the same industry as domestic firms. This is in line with previous findings in the literature on market stealing effects (Aitken and Harrison, 1999). Using the same estimate for productivity as BG (estimates from the original OP method) yields insignificant effects from Horizontal FDI for both samples. Thus, when using the same methodology and variable definitions as BG, our findings for Horizontal FDI are consistent with theirs.

Table 2.6 shows the results from the estimations where we introduce both FDI variables to the regression simultaneously. We find that the results remain very consistent with those of Table 2.5: significant and negative backward FDI spillovers; no significant horizontal FDI spillovers, except for the cases where the productivity variable is estimated by the ACF method; in samples where we include local foreign firms, they are shown to have a productivity premium, but it is not consistent across all estimations. The sizes of the estimated coefficients are also very similar for both specifications.

Table 2.5: FDI spillover estimates with different TFP measures – Backward and Horizontal FDI separately

	All firms							Domestic					
Method	Backward	Foreign	Obs.	Panels	Within R^2	Between R^2	Overall R^2	Backward	Obs.	Panels	Within R^2	Between R^2	Overall R^2
PO	-0.026*	0.0069	245,847	43,337	0.0419	0.0017	0.0005	-0.0343**	225,464	41,391	0.0446	0.0000	0.0000
	(0.0149)	(0.0093)						(0.0155)					
FE	-0.026*	0.0239***	245,835	43,337	0.0429	0.0063	0.0044	-0.0332**	225,452	41,391	0.0457	0.0000	0.0001
	(0.0147)	(0.0089)						(0.0153)					
OP	-0.0449***	0.0132	240,321	43,046	0.2368	0.0471	0.0236	-0.0576***	220,745	41,102	0.2408	0.0314	0.0066
	(0.0162)	(0.0102)						(0.0169)					
LP	-0.0559***	0.0212*	240,321	43,046	0.1695	0.4229	0.3646	-0.0669***	220,745	41,102	0.1763	0.4567	0.3543
	(0.0178)	(0.0111)						(0.0188)					
ACF-OP	-0.1565**	0.0705**	240,309	43,046	0.4038	0.1127	0.0938	-0.1585**	220,733	41,102	0.4085	0.0774	0.0461
	(0.0715)	(0.0349)						(0.077)					
ACF-LP	-0.1363**	0.0389	240,309	43,046	0.3751	0.1732	0.1479	-0.1384**	220,733	41,102	0.3788	0.2691	0.2158
	(0.0626)	(0.0307)						(0.0674)					
Method	Horizontal	Foreign	Obs.	Panels	Within R^2	Between R^2	Overall R^2	Horizontal	Obs.	Panels	Within R^2	Between R^2	Overall R^2
PO	0.0033	0.0065	245,847	43,337	0.0419	0.0018	0.0005	-0.0054	225,464	41,391	0.0445	0.0000	0.0000
	(0.0064)	(0.0093)						(0.0066)					
FE	0.0065	0.0231***	245,835	43,337	0.0429	0.0063	0.0044	-0.0103	225,452	41,391	0.0457	0.0000	0.0001
	(0.0062)	(0.0089)						(0.0065)					
OP	-0.0019	0.0132	240,321	43,046	0.2368	0.047	0.0235	-0.0119	220,745	41,102	0.240	0.0309	0.0065
	(0.0076)	(0.0102)						(0.008)					
LP	0.0067	0.0203*	240,321	43,046	0.1695	0.4233	0.3651	-0.0163*	220,745	41,102	0.1762	0.4565	0.3542
	(0.0081)	(0.0111)						(0.0087)					
ACF-OP	-0.077*	0.0783**	240,309	43,046	0.4038	0.1118	0.093	-0.1663***	220,733	41,102	0.4086	0.0766	0.0457
	(0.0403)	(0.0352)						(0.0449)					
ACF-LP	-0.0448	0.0432	240,309	43,046	0.3751	0.1727	0.1473	-0.1287***	220,733	41,102	0.3789	0.2701	0.2164
	(0.0376)	(0.0311)						(0.0421)					

Source: Author's own estimations, using data from MS

Note: Year, industry-year and island-year fixed effects included, but not reported. Clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.6: FDI spillover estimates with different TFP measures – Backward and Horizontal FDI simultaneously

Method	Horizontal	Backward	Foreign	No. Obs.	No. groups	Within	Between	Overall
			All firms					
PO	0.0031	-0.0258*	0.0065	245,847	43,337	0.0419	0.0018	0.0005
	(0.0064)	(0.0149)	(0.0093)					
FE	0.0063	-0.0257*	0.0232***	245,835	43,337	0.0429	0.0063	0.0044
	(0.0062)	(0.0147)	(0.0089)					
OP	-0.0023	-0.045***	0.0134	240,321	43,046	0.2368	0.047	0.0236
	(0.0076)	(0.0163)	(0.0102)					
LP	0.0062	-0.0556***	0.0205*	240,321	43,046	0.1695	0.4233	0.365
	(0.0081)	(0.0179)	(0.0111)					
ACF-OP	-0.0783*	-0.1599**	0.0788**	240,309	43,046	0.4038	0.1121	0.0934
	(0.0403)	(0.0711)	(0.0352)					
ACF-LP	-0.046	-0.1382**	0.0437	240,309	43,046	0.3752	0.1732	0.1479
	(0.0376)	(0.0624)	(0.0311)					
			Domestic firms					
PO	-0.0058	-0.0346**		225,464	41,391	0.0446	0.0000	0.0000
	(0.0066)	(0.0155)						
FE	-0.0107	-0.0337**		225,452	41,391	0.0457	0.0000	0.0001
	(0.0065)	(0.0154)						
OP	-0.0126	-0.0583***		220,745	41,102	0.2408	0.0312	0.0065
	(0.008)	(0.0169)						
LP	-0.017*	-0.0679***		220,745	41,102	0.1763	0.4566	0.3542
	(0.0087)	(0.0188)						
ACF -OP	-0.1682***	-0.1678**		220.733	41,102	0.4087	0.0772	0.046
	(0.0449)	(0.076)						
ACF-LP	-0.1304***	-0.1457**		220,733	41,102	0.3789	0.2704	0.2168
	(0.0422)	(0.0667)						

Source: Author's own estimations, using data from the Annual Manufacturing Survey;
Note: Year, industry-year and island-year fixed effects included, but not reported. Clustered standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

2.5.2 Discussion

The finding of negative backward FDI spillovers, which is not in line with either the results from BG's analysis or the general consensus in the literature on FDI spillovers, deserves further investigation and interpretation. Comparing the results across different estimates of TFP from the upper panel of Table 2.5, it is clear that the choice of the right productivity specification is important for the quantification of the size of the backward spillover effect: while there is a clearly significant negative effect (especially for the sample of domestic firms), it ranges from -0.034 for Pooled OLS to -0.159 for the ACF method with investment as proxy. We expect results from Pooled OLS to be biased upward, so these results are in line with our expectation. However, the results from the ACF method, which is supposed to perform best in terms of addressing issues of input endogeneity, show a very large negative spillover effect: an

increase in backward FDI from 0 to 1 would lead to a decrease in domestic firm productivity in upstream sectors by almost 16 per cent. If we focus on results from the original OP estimation instead, which is the closest estimation method to the one used by BG, the negative effect is -0.0576. As BG argue, common increases in the backward FDI share are at the rate of 20 per cent, which means that domestic firms would experience a fall in productivity by 1 per cent (0.2*-0.0576) from a typical change in foreign participation downstream, ceteris paribus. While this is not a very substantial effect, the fact that we find negative spillovers, when both BG and previous literature find overwhelming evidence of positive productivity effects from foreign firms in downstream sectors remains puzzling.

Several arguments could be offered as explanation for our findings: First, compared to other studies that estimate backward FDI spillovers using industry-level variables and information from Input-Output tables, the reason for divergence could be a result of different aggregation levels. Most firm-level surveys and IO tables only offer information at much higher levels of industry aggregation (usually, at the two-digit level of industry classification). This is important, because by disaggregating industry-level FDI variables, effects that would normally count as horizontal FDI now count as backward FDI. Findings of negative spillovers from horizontal FDI are less uncommon in the literature and are usually explained as a result of less productive domestic firms suffering productivity losses as a result of market stealing from more productive foreign firms, which may be eventually driven out of the market (Aitken and Harrison, 1999).

Another concern when using such a narrow classification of industries is that we do not count for multiproduct firms or firms operating in several sectors. In manufacturing surveys like the Indonesian Annual Manufacturing Sector, the assigned five-digit industry code is based on the *main* sector of the firm's activity. However, many firms engage in more than one production activity. As these activities are often related, the higher the level of reported sector aggregation, the higher the chance that all of the firms' activities and products are covered by that sector. However, for very disaggregated sectors, it could be that domestic firms may act as suppliers to foreign firms in their main reported sector of activity but compete for market share with the foreign firm for one of their other activities. Because we only classify firms into one industry and these industries are defined quite narrowly, this competition effect would be captured by the backward FDI variable instead, and therefore would bias the spillover effect downward.

A third reason could be that bringing in FDI in downstream sectors only leads to positive productivity spillovers if foreign firms choose to buy their inputs from domestic suppliers. If, on the other hand, they come into the country to e.g. use cheap labour inputs, perform assembly work, and/or use the country as an export hub to the region, but keep sourcing their inputs from abroad, spillovers to domestic

suppliers through the linkage channel would not occur[25]. Moreover, they might open domestic suppliers up to competition from imports and firms abroad, which may be more productive and may drive domestic firms out of the market. From Table 2.4, we saw that foreign firms are indeed importing much more of their raw materials from abroad, compared to domestic firms. In fact, on average, for foreign firms half of their raw materials are imported from abroad, which provides support for this argument. This issue might have become more acute during the years of the financial crisis, with foreign firms in Indonesia switching to imports from abroad as a result of the low competencies and reliability of domestic suppliers, especially in a time of economic downturn and more stringent financial constraints for domestic firms.

While these arguments could help to explain divergences from other studies investigating backward FDI spillovers using different levels of industry aggregation, measures of industry-level FDI variables, estimates of productivity, and other potential sources of variation, they do not explain the divergence from the findings of BG. The main potential source of divergence between our findings and those of BG is the different time period under investigation, since we use the same variable definitions, levels of aggregation, methods of estimation and data sources as BG. One explanation could be that the arguments listed above could have become more important over time, thus leading to negative spillover effects outweighing positive spillovers. For this to be the case, in the time period following the time frame covered by the analysis in BG we should see an increase in e.g. the number of multiproduct firms. However, due to data availability, we are not able to say whether this was indeed the case.

Instead, we offer an alternative explanation that relies on the changes that the institutional and economic landscape in Indonesia went through in the years prior to and during the time frame covered by our study. As was discussed in Subsection 2.2.1, there are stark differences in the business climate for FDI in Indonesia in the periods covered by this study and BG. Whereas FDI was actively promoted throughout the 1980s and 1990s, in the 2000s the country lagged behind both in terms of trade and FDI policy reforms, and in terms of logistics, infrastructure and import-export procedures that would make it attractive for FDI. In an assessment of the Indonesian economy during the Yudhoyono era, Hill (2015) argues that Yudhoyono's government failed to remove these obstacles, and as such, during this time, Indonesia was losing out to its competitors (the Philippines and Vietnam) on the opportunity to participate in and capitalize on global production networks taking place in the region. These networks are focused on high value added sectors, operate through MNCs, and bring new employment and technical upgrading opportunities to the participating countries.

[25] See Chapter 4 for a more in-depth analysis of linkages between FDI and domestic suppliers, and FDI spillovers through this channel, where using data from Vietnam, we find that indeed, these linkages have potential for productivity benefits to the suppliers through knowledge transfers but are generally lacking.

As mentioned in Subsection 2.2.1, the literature has already established that these policy and business conditions had an impact on the quantity of FDI coming into the country in the post-Asian crisis era. Based on the findings of our replication, we would argue that they may also have had a role on the spillovers from FDI: if foreign firms do not trust the business environment of the country and have logistic and bureaucratic difficulties in their operations, they will limit the level of linkages and interaction with local firms, preferring to import from abroad instead. This could lead to local suppliers facing fiercer competition from abroad. Foreign firms may also engage in hold-up behaviour or use their bargaining power to make unfavourable contractual arrangements for their local suppliers, that would squeeze out and erode the latter's profitability (Sari et al., 2016). This would explain why the period of positive and significant backward FDI spillovers was followed by strong evidence of negative effects from foreign firms in downstream sectors.

2.6 CONCLUSIONS

This chapter uses data from a new wave of surveys from the Indonesian Manufacturing sector covering the period 2002-2013 to conduct a replication of a previous study by Blalock and Gertler (2008). They investigate welfare gains to Indonesian firms from foreign presence in their own and in downstream sectors for the period 1980-1996. By using the same data sources, variable definitions and estimation methodologies as the original study, we are able to isolate the effect of the different time period on the divergence in findings.

After building the dataset and providing additional insights on new estimation methods that address endogeneity issues, we find that by using the same estimation method as BG, there is no evidence of significant productivity spillovers from foreign firms operating in the same sector as domestic firms. This is in line with the findings from the original study. However, this finding is not robust across different specifications of the dependent variable, which points to the importance of the estimation methodology for the identification of spillovers.

At the same time, we find significant evidence of negative spillovers from foreign firms in sectors that purchase inputs from domestic firms. This finding goes in the opposite direction of the findings by BG for the period 1980-1996 but is supported by other empirical studies investigating FDI spillovers in Indonesia with more recent data. Thus, studying a different time period leads to different results for FDI spillovers. However, this effect is not a result of the inherent time period (or some sort of time trend, as we control for time fixed effects). Instead, we need to investigate the changes that happened in the country setting and in conditions for FDI that would explain the change in FDI spillovers. Based on the changes in the political and business environment during the time period under investigation by the two studies, we believe that this may explain our results to some extent. Unfavourable conditions for FDI will not only lead to lower FDI inflows, but also to lower potential for beneficial spillovers from FDI, as foreign firms will be more reluctant to interact with local firms and transfer technologies.

These findings provide policy implications for the new Indonesian government established in 2014 that has made FDI promotion part of its policy priorities. To derive positive spillovers from FDI, it needs to look at the conditions under which FDI operated during the time period covered by the study by Blalock and Gertler: that is, provide foreign firms with more flexibility, more assurances, and better infrastructure and logistics. At the same time, it is important to make sure that these policies do not leave the country open to threats from footloose FDI, by ensuring that FDI is linked and embedded in the local economy. Finally, if part of the reason for negative spillovers is that domestic firms are suffering productivity losses because they are not able to compete with imports, the government should start programmes that would help to develop the capabilities of local suppliers. The study also provides revenues for future research: the replication study points out the differences in findings, and our discussion provides possible explanations for these differences, but future research should try to identify and quantify these spillover determinants empirically.

Chapter 3 ONLY AS GOOD AS THE DATA

An Empirical Examination of Biased FDI Spillovers in Incomplete Datasets*

3.1 INTRODUCTION

Many governments are actively engaged in the attraction of foreign direct investment (FDI) into their economies. These government policies are often motivated by the expectation that domestic firms benefit from the presence of FDI via the occurrence of positive externalities. Through channels including demonstration effects, inter-firm labour turnover and inter-firm linkages, FDI firms may disseminate new technologies, resulting into positive productivity spillovers among domestic firms (Blomström and Kokko, 1998; Görg and Greenaway, 2004; Smeets, 2008). However, despite the popular belief that positive FDI spillovers are prevalent, the empirical evidence on these effects is mixed and inconclusive (Hanousek et al., 2011; Irsova and Havranek, 2013; Havranek and Irsova, 2011). Whereas some studies present evidence of positive FDI spillovers in developed or developing countries (Keller and Yeaple, 2009; Blalock and Gertler, 2008; Girma et al., 2015), other studies report negative or insignificant associations between the presence of FDI firms and productivity of domestic firms (Aitken and Harrison, 1999; Konings, 2001; Javorcik and Spatareanu, 2008).

The FDI spillovers literature has explored several reasons for the marked degree of heterogeneity of the evidence. First, differences in definitions and measurement of the level of FDI presence have been linked to the variability of empirical findings (Görg and Greenaway, 2004). Second, findings of positive spillovers from early studies are based on cross-sectional industry-level data, which may have biased estimated FDI effects upwards (Aitken and Harrison, 1999; Jordaan, 2011a). In comparison, more recent studies benefit from the use of firm-level panel data, controlling for time-invariant firm-level fixed effects and endogeneity concerns (Javorcik, 2004; Meyer and Sinani, 2009). Third, not all studies distinguish between FDI participation within and between industries. Studies that capture inter-industry links between input-producing domestic firms and FDI client firms show that these links may generate positive spillovers (Javorcik and Spatareanu, 2008; Blalock and Gertler, 2008). Finally, several studies argue that FDI spillovers are more accurately identified when controlling for the effects of firm heterogeneity. These studies link the occurrence of FDI spillovers to characteristics of both FDI and domestic firms, including firm size, technology gap, human capital and export status (Damijan et al., 2013; Blalock and Gertler, 2009; Abraham et al., 2010; Jordaan, 2017).

In comparison, the question whether dataset characteristics influence the degree to which FDI spillovers can be estimated accurately has received much less attention. In particular, the use of incomplete datasets for the estimation of FDI productivity effects may be a contributing factor to the varied nature of the

* This chapter is based on a working paper with Jacob Jordaan.

evidence. As Eapen (2013) notes, firm-level datasets derived from manufacturing surveys often omit small firms, whereas secondary datasets such as Compustat only contain publicly listed firms.[26] Conducting a set of Monte Carlo simulations, Eapen (2013) shows that the estimated spillover effect of FDI with incomplete datasets is potentially biased. This could be due to problems surrounding the measurement of the level of industry participation by FDI firms and the presence of a selection bias where firms of particular size classes are over- or under-represented in the data.

Horizontal or intra-industry FDI spillovers are estimated by relating the industry level of FDI participation – measured as the share of FDI in industry employment or output - to the productivity level of domestic firms operating in the same industry. Incomplete datasets are characterised by the omission of certain segments of the population of firms from which samples are drawn. Indicators of the industry level of FDI participation that are calculated with such incomplete datasets are therefore error prone, as they are not calculated with information from the full population of firms. Any under- or overrepresentation of FDI firms in incomplete datasets will generate inaccurate indicators of the level of industry participation by these firms. Importantly, this also affects indicators of inter-industry or vertical FDI participation. For a given industry, the level of vertical FDI participation is usually calculated as a weighted average of the levels of intra-industry FDI in the other industries, using coefficients of an input-output table of the host economy as weights (see e.g. Javorcik, 2004; Blalock and Gertler, 2008). Consequently, errors that are incorporated into indicators of horizontal FDI are carried over into indicators of vertical FDI. As a result, the biases that the use of incomplete datasets may generate affect the estimated effects of both horizontal and vertical FDI spillovers.

In this chapter, we conduct an empirical examination of the causes and severity of the biases that may occur when using incomplete datasets to estimate FDI spillovers. Our study differs from Eapen (2013) in the following ways. First, Eapen (2013) presents a Monte-Carlo based assessment of biases that may arise when FDI industry participation contains a specified measurement error and when small firms are underrepresented in the dataset. In this chapter, we examine biases that may arise from estimations with an incomplete dataset by using the concrete case of the World Bank Enterprise Survey (WBES). The World Bank conducts firm-level surveys in a large number of developing and emerging countries, creating rich datasets containing a range of firm-level characteristics and indicators (see e.g. Beck et al., 2008; Dethier et al., 2011). These datasets have been used by several researchers to estimate FDI spillovers (e.g. Gorodnichenko et al., 2014; Monastiriotis, 2014; Farole and Winkler, 2012). As type of ownership is not one of the sampling stratification criteria that is used for the selection of firms, it is unclear whether FDI participation can be measured accurately with these datasets, suggesting that error measurement may impact estimated spillover effects.

[26] Smaller firms are also often under-represented in datasets obtained from ORBIS/AMADEUS (see Kalemli-Ozcan et al., 2015).

Second, we also examine whether the sample size of WBES datasets and the strong presence of small firms in the datasets affect the estimated FDI spillover effects. Not only may the large presence of small firms influence the measurement of FDI industry participation, it may also affect the level and/or significance of FDI spillovers, as firm size has been identified as a factor influencing the occurrence of these externalities (Aitken and Harrison, 1999; Keller and Yeaple, 2009). This relation between firm size and FDI spillovers may affect estimated FDI spillovers when particular firm size classes are strongly represented in the datasets.

Third, whereas Eapen (2013) focuses specifically on biases that may impact the estimated spillover effect of horizontal FDI, we also examine whether the use of incomplete datasets influences the estimated effect of vertical spillovers. Because vertical FDI is built based on horizontal FDI in downstream sectors, measurement errors that affect indicators of horizontal FDI are by construction carried over into indicators of vertical FDI.

To examine these issues, we use Indonesia as case study. Indonesia offers a fruitful setting to study FDI spillovers, as existing evidence for the 1990s suggests that FDI firms create positive spillovers in this host economy (Blomström and Sjöholm, 1999; Takii, 2005; Blalock and Gertler, 2008). In our analysis, we first estimate horizontal and vertical FDI spillovers using a firm-level dataset from the WBES for 2009. We then compare the findings with results that we obtain from using a much larger firm-level dataset from the Annual Indonesian Manufacturing Survey (MS) from the Indonesian Office of Statistics for the years 2008-2009.

Next, we conduct sets of estimations on large numbers of random samples drawn from the MS, using the WBES sampling criteria. We treat the findings from the larger MS dataset as representing FDI spillovers among the population of manufacturing firms in Indonesia, against which we can compare findings from the simulated incomplete datasets. This allows us to assess to what extent measurement error in the variable capturing FDI industry participation, strong representation of small firms and also limited sample size create biases in the estimated FDI spillover effects. In extension, by relaxing the WBES sampling criteria and by combining information from the WBES and MS datasets, we assess under which conditions we obtain results that approach the estimated spillover effects that we obtain with the full MS dataset.

The remainder of the chapter is constructed as follows. In section 3.2 we discuss the research problem in more detail. Section 3.3 describes the research setting, datasets and the specification of the regression models. Section 4.4 presents our main empirical findings, which can be summarised as follows: first, we find no evidence of horizontal or vertical FDI spillovers with the WBES dataset. In contrast, the MS dataset produces findings of significant positive vertical FDI spillovers, indicating that the use of an incomplete dataset does affect the estimated FDI effects. Second, the sets of findings with the simulated incomplete datasets clearly show that small sample size, strong sample presence of small firms and

measurement error of the level of industry FDI participation all contribute to the unreliability of the estimated FDI spillover effects. Third, we only obtain results from our estimations with the simulated incomplete datasets that are similar to those obtained with the full population of firms when the following conditions are fulfilled: the indicators of horizontal and vertical FDI are measured with the MS data, and the effects of small sample size and strong sample presence of small firms are accounted and corrected for. Finally, section 3.5 summarises and concludes.

3.2 RESEARCH PROBLEM

3.2.1 FDI spillovers with WBES data

Datasets from the WBES are frequently used to estimate FDI spillovers for a variety of developing and emerging economies. Overall, evidence on FDI spillovers from these WBES datasets is very heterogeneous. Gorodnichenko et al. (2014) use WBES data for 17 transition economies and find that FDI firms generate positive vertical FDI spillovers through backward linkages to domestic suppliers, whilst finding no evidence for the presence of horizontal FDI spillovers. In contrast, Monastiriotis (2014), using data for 28 transition economies, focuses specifically on horizontal FDI spillovers and presents evidence that FDI firms generate significant negative productivity effects. Dunne and Masiyandima (2016) use data for a number of Sub-Saharan African countries and find that positive horizontal spillovers materialise in only a few of these countries. Farole and Winkler (2012) estimate FDI spillovers in 78 low- and middle-income countries and find that FDI firms generate negative horizontal spillovers, although in a few of these countries the spillover effect turns positive among domestic firms with a sufficient level of absorptive capacity. Finally, Waldkirch (2014) uses WBES data for 114 countries and finds no evidence of any significant horizontal spillovers.[27]

The variability of findings from WBES datasets is in line with the heterogeneous nature of the general body of evidence on FDI spillovers. Next to issues of whether or not studies distinguish and account for horizontal and vertical FDI spillovers, and whether estimations allow for the effects of firm heterogeneity, it is likely that findings based on WBES datasets are affected by measurement error of the degree of FDI industry participation. Such measurement error is likely to affect most studies on FDI spillovers, as datasets usually omit parts of the underlying population of firms of a host economy (Eapen, 2013). Whereas many studies use datasets that only include publicly listed firms, other datasets based on manufacturing surveys do not contain the smallest types of firms. Given that the level of industry participation by FDI firms is calculated with information from the firms that are included in these datasets, it is likely that this indicator contains a measurement error. The WBES datasets, especially given their small sample size, are likely to be affected by this issue.

[27] For studies that use WBES data to estimate FDI spillovers in individual countries, see e.g. Bwalya (2006), Brambilla et al. (2009), Laborda Castillo et al. (2014) and Chhair and Ung (2014).

3.2.2 Measurement error, small firms and sample size

To understand the issues that arise when estimating FDI spillovers with incomplete datasets such as the WBES, it is important to consider their sampling procedure. The WBES datasets are based on a uniform stratified sampling methodology that is applied in all the countries (Enterprise Surveys, n.d.). The sampling is carried out by randomly selecting samples from previously separated, non-overlapping, groups of elements in the population of firms in a country. Such stratification is preferred, as it provides unbiased estimates for the population of firms as a whole, as well as for the different subsets. It also ensures a weighted representation of the entire population of firms. Compared to non-stratified random sampling, such sampling achieves lower standard errors and higher significance levels (Lohr, 2019).

The stratification of the population of firms is done by main sector of activity, firm size, and geographical location. Type of ownership (domestic or foreign-owned) is not part of the stratification criteria. This means that there is no guarantee that the selected sample captures the industry distribution of foreign-owned firms in the firm population of the country under analysis. Researchers use information from the domestic and foreign-owned firms that are included in the sample to measure horizontal FDI by calculating the share of FDI in industry employment or output. It is therefore likely that these indicators incorporate measurement error, resulting in biased estimates of horizontal and, by design, also vertical FDI spillovers.

Another way in which the stratified sampling may be problematic for the estimation of FDI spillovers is the strong presence of small firms in WBES datasets. The economies of most of the countries covered by the WBES are characterised by a large presence of (very) small firms. Therefore, the firm size stratification criterion leads to samples with a high ratio of small firms over medium and large firms. This increases the possibility that indicators of the level of FDI industry participation in the form of the share of FDI in industry employment or output contain errors. On the one hand, as small firms are less likely to be foreign-owned (Altomonte and Pennings, 2009), the strong presence of small firms in the dataset is likely to result in calculated FDI industry shares that are too low, as the dataset contains a low number of firms that may be foreign-owned. On the other hand, supposing that the sample does contain a representative number of FDI firms, their calculated level of industry participation may be too high. Due to the presence of a large number of small domestic firms with low levels of output and number of employees, the share of FDI firms in industry output or employment may be overestimated. Therefore, the estimated FDI spillover effect is likely to be affected by errors in the indicators of FDI industry participation caused by the strong presence of small firms in the sample.

Furthermore, even in the case where the measurement error itself would be limited, a large presence of small firms in the sample is likely to influence the estimated magnitude and possibly also the sign of FDI spillovers. Several studies present evidence that small domestic firms are either subject to negative FDI spillovers or are less able to benefit from positive spillovers. Small firms are less likely to be able

to compete with FDI firms, which can result in negative externalities as a result of a market stealing effect (Aitken and Harrison, 1999). Firm size may also be related to the capacity of domestic firms to absorb new technologies that are disseminated by FDI firms, resulting in small firms being less able to benefit from positive spillovers (Zhang et al., 2010). Therefore, the strong presence of small firms in the datasets makes it more likely that estimated spillover effects are insignificant or negative, compared to FDI spillover studies that use datasets that are larger in size and usually do not include firms with less than 20 (or even 50) employees[28].

Finally, it may be the case that the limited sample size of the WBES amplifies the problems of measurement error and strong sample presence of small firms. The sample size of the WBES is calculated based on the estimated size of the population of firms in an economy, with the target of achieving a 7.5 per cent precision level at the 90 per cent confidence level for estimates of variables such as the logarithm of firm-level sales and of variables expressed as population proportions at the industry level (Enterprise Surveys, n.d.). Given the use of stratified sampling, this level of precision needs to be obtained for each industry stratum. Assuming the highest variance for proportion estimates, the sample size that the WBES uses is 120 firms per industry. For a large economy, nine main industries are usually distinguished, resulting in a total sample size of 1,080 firms. As the WBES relies on the voluntary participation by firms, item non-response is a major concern. Therefore, the sample size for large economies is usually increased by 25 per cent, giving a total of 160 firms per industry.

However, the non-response rate for key variables such as number of employees, cost of labour, and especially the value of assets is usually considerably higher than 25 per cent, resulting in a reduction of the effective sample size that can be used to estimate FDI spillovers. Depending on the severity of the decrease in sample size, the margin of error of the estimated FDI spillover effect and the overall power of the estimation to identify significant FDI spillovers will be affected. Furthermore, the decrease in the number of observations is likely to increase the measurement error of the FDI industry participation variables. Also, depending on whether particular firm size classes are overrepresented in the subsample that remains after taking out cases with missing observations, the estimated FDI spillover effects may be influenced by a change in the relative sample participation by small, medium and large firms.

Summarising, the suitability of datasets to estimate FDI spillovers accurately does not feature strongly in the FDI spillover literature as a possible reason for the heterogeneity of the body of evidence. However, as most datasets that are used to estimate FDI spillovers are characterised by varying degrees of incompleteness, it is likely that biases that result from the use of incomplete datasets contribute to the marked variability of reported spillover effects. Given its characteristics, the WBES constitutes a good case to examine the effects from using incomplete datasets to identify FDI spillovers. In particular,

[28] For a review of firm size definitions in the FDI spillovers literature, see e.g. Crespo and Fontoura (2007).

biases are likely to arise due to errors in the measurement of horizontal and vertical FDI, the strong sample participation by small firms and the limited sample size.

3.3 DATA AND MODEL SPECIFICATION

Indonesia provides a good setting to estimate FDI spillovers and examine the issue of incomplete datasets. Starting in the late 1970s, the country has undergone important economic reforms, gradually removing requirements and limitations on inward FDI (Blalock and Gertler, 2008). In recent years, Indonesia has persistently ranked high in the world economy in terms of the level of inward FDI, belonging to the top 15 FDI destination countries (UNCTAD, 2014).

Several studies provide evidence of significant FDI spillovers during the 1990s. Blomström and Sjöholm (1999) use cross-sectional firm-level data for 1991 from the MS and identify positive horizontal FDI spillovers. These findings are corroborated by a firm-level panel data study by Takii (2005), using data from the MS for the period 1990-1995. Blalock and Gertler (2008, 2009) use firm-level panel data from the same data source for the period 1988-1996, distinguishing between the effects of horizontal and vertical (backward) FDI spillovers. Whereas they find clear evidence of positive FDI spillovers among Indonesian firms in input-supplying industries, they do not find evidence of significant horizontal spillovers.

3.3.1 Data

For the analysis we use a dataset from the WBES for Indonesia for 2009 and a dataset from the MS for the years 2008-2009. The original sample of the WBES contains a total number of 1,444 observations for the nine most industrialized provinces in Indonesia. After taking out firms that operate in services and accounting for missing observations, the maximum number of observations is 1,164 firms, operating in seven two-digit ISIC Rev.4 manufacturing industries. In comparison, the MS dataset is much more comprehensive in coverage. It contains over 20,000 observations in 2008 and 2009 each, with firms operating in 337 five-digit ISIC Rev.4 manufacturing industries. To conduct estimations at the same level of industry aggregation, we reclassify the firms in the MS dataset into the seven two-digit manufacturing industries used by the WBES.

The key variables that we want to examine are horizontal and backward FDI. We follow the literature (e.g. Blalock and Gertler, 2008) by calculating the level of horizontal FDI as the ratio of output in industry *j* produced by FDI firms over total industry output:

$$Horizontal\ FDI_{\ j} = \frac{\sum_{i \in j} Foreign\ output_i}{\sum_{i \in j} Output_i} \quad \textbf{(3.1)}$$

Following Javorcik (2004) and Blalock and Gertler (2008), we define backward FDI as the share of an industry's output that is sold to foreign buyers across all other industries. This means that backward FDI

of industry *j* is constructed as a weighted sum of horizontal FDI of the other industries. The weights – labelled a_{jk} – are the shares of industry j's output purchased by the other industries, which we take from the 2005 Indonesian input-output table from the OECD Structural Analysis (STAN) database:

$$Backward\ FDI_j = \sum_k a_{jk}\ Horizontal\ FDI_k \quad \textbf{(3.2)}$$

Table 3.1 presents the industry indicators of horizontal and vertical FDI that we obtain from the WBES and MS samples. Looking first at horizontal FDI, both samples indicate that the industry of Chemicals has the highest level of FDI participation, followed by the umbrella category of Other Manufacturing. For both industries, the WBES appears to over-estimate the level of horizontal FDI, compared to the MS dataset. The ordering for the other industries is mixed. The WBES produces higher levels of horizontal FDI for the industry of Plastics & Rubber; for the other industries the WBES sample provides

Table 3.1: Horizontal and backward FDI: WBES and MS samples

World Bank Enterprise Survey				
ISIC2 category	Industry	Observations	Horizontal FDI	Vertical FDI
15	Food	392	0.076	0.019
17	Textiles	133	0.252	0.298
18	Garments	139	0.293	0.272
24	Chemicals	107	0.864	0.111
25	Plastics & Rubber	108	0.445	0.032
26	Non-metallic mineral products	144	0.164	0.009
3	Other manufacturing	141	0.814	0.038
Manufacturing Enterprise Survey				
15	Food	5507	0.309	0.079
17	Textiles	2441	0.332	0.717
18	Garments	1999	0.407	0.669
24	Chemicals	1015	0.646	0.322
25	Plastics & Rubber	1545	0.303	0.203
26	Non-metallic mineral products	1595	0.384	0.038
3	Other manufacturing	7865	0.537	0.059

Source: Authors' calculations, based on data from WBES and MS
Note: Values are for 2009 for both samples.

indicators of horizontal FDI that fall below the indicators of the MS sample. As for vertical FDI, the difference is more uniform. In both samples the industries of Textiles, Garments and Chemicals have the highest levels of vertical FDI. In all three cases, the level of vertical FDI in the WBES sample is substantially lower than in the MS sample. The ordering of the other industries is more varied, but in all cases the WBES shows levels of vertical FDI below those obtained from the MS sample.

3.3.2 Model specification

In order to estimate the effects of horizontal and vertical FDI and to compare the effects between the WBES and MS samples, we estimate regression models following two empirical specifications. The first specification adopts the regression model from Blalock and Gertler (2008), allowing us to directly compare the results between the two samples, as well as with the findings from their estimations. The

drawback of the WBES data is its cross-sectional nature, which does not allow us to control for time-invariant firm-level fixed effects. This may pose a problem when estimating the effect of horizontal FDI, when FDI firms gravitate toward industries with high productivity firms, causing an upward bias in the estimated FDI effect (Aitken and Harrison, 1999; Jordaan, 2011a). Having said this, when we estimate FDI spillovers with the WBES sample and with the 2009 observations from the MS, both estimations are subject to the same potential bias, therefore still allowing us to compare the estimated effects between the two samples.

Following Blalock and Gertler (2008), we specify a flexible trans-log production function, relating firm-level output to labour, capital, raw materials, energy expenses, their squared terms and interactions, industry dummies, a variable capturing the industry level of competition and variables capturing horizontal and backward FDI. We estimate the model on the full set of firms and on a subsample containing only domestic firms, giving the following model for firm *i* in industry *j*:

$$lnY_{ij} = \beta_0 + \beta_1 Horizontal\ FDI_{ij} + \beta_2 Backward\ FDI_{ij} + \beta_3 lnK_{ij} + \beta_4 lnL_{ij} + \beta_5 lnM_{ij} + \beta_6 lnE_{ij} + \beta_7 ln^2K_{ij} + \beta_8 ln^2L_{ij} + \beta_9 ln^2M_{ij} + \beta_{10} ln^2E_{ij} + \beta_{11} lnK_{ij} lnL_{ij} + \beta_{12} lnK_{ij} lnM_{ij} + \beta_{13} lnK_{ij} lnE_{ij} + \beta_{14} lnL_{ij} lnM_{ij} + \beta_{15} lnL_{ij} lnE_{ij} + \beta_{16} ln\,M_{ij}\, ln\,E_{ij} + \beta_{17} Herfindahl_j + \beta_{18} Foreign_i + \beta_{19} Industry_j + \varepsilon_{ij} \quad \textbf{(3.3)}$$

where $ln\,Y$ is the natural log of the total value of sales and $ln\,L$, $ln\,K$, $ln\,M$ and $ln\,E$ are the natural logs of total number of permanent employees, book value of total assets, total value of raw materials and total expenses on electricity and fuels respectively. The Herfindahl index captures the degree of market competition and is measured as the sum of squared market shares of the firms in each industry. The variable Foreign is a dummy variable equal to one when at least 20 per cent of a firm's assets are in foreign hands; the variable Industry captures structural productivity differences between the two-digit industries.

The second regression model that we estimate takes advantage of the panel data nature of the MS sample for 2008-2009. To account for firm-specific time-invariant characteristics we control for firm (a_i) fixed effects. We also control for year (ϑ_t), and region-year ($r_r * \vartheta_t$) effects. This gives the following model for firm *i* in industry *j* in year *t*:

$$TFP_{ijt} = \gamma_0 + \gamma_1 Horizontal\ FDI_{jt} + \gamma_2\ Backward\ FDI_{jt} + Herfindahlindex_{jt} + a_{ij} + \vartheta_t + r_r * \vartheta_t + \mu_{ijt} \quad \textbf{(3.4)}$$

To estimate equation (3.4) we need to obtain an indicator of firm-level TFP. One approach is to add firm-level inputs to regression model (3.4). The drawback of this approach is that it does not account for the issue that input decisions should be treated as endogenous to the production process (Griliches and Mairesse, 1995). In particular, productivity shocks that are observed by the firm (but not by the

econometrician) affect a firm's choice of inputs, thereby biasing coefficients obtained with OLS estimates. Starting with Olley and Pakes (1996) and Levinsohn and Petrin (2003), the productivity literature has developed semi-parametric methods in which observable variables such as a firm's level of investment or raw materials are used as proxies for any uncaptured productivity shocks. Importantly, Ackerberg, Caves and Frazer (2015) point out that these methodologies suffer from collinearity issues that have to do with the timing of the input decisions. They correct for this by using a two-step estimation method. In the first step, they produce estimates for the productivity shock; in the second step the input coefficients and the TFP residual are estimated.[29] We follow other studies in the FDI spillovers literature (e.g. Javorcik and Spatareanu, 2011; Lenaerts and Merlevede, 2015) that use the ACF method to estimate TFP as a residual separately for each of the main industries, using an inverse, polynomial function of capital and raw materials as proxy for unobserved productivity shocks. Subsequently, we regress the estimated TFP residuals from the ACF method on horizontal and vertical FDI, controlling for market competition and firm, year, and region-year fixed effects.

3.3.3 Simulations

To assess whether and how the estimation of FDI spillovers is affected by the use of an incomplete dataset, we conduct a series of simulations. Following the sampling criteria from the WBES, we draw 1,000 random samples from the MS data for each of the simulations that we carry out, treating the MS dataset as representing the true population of firms. If the sampling methodology of the WBES achieves its objective of being representative of the population of firms and achieving estimated parameters with a 7.5 per cent precision level at the 90 per cent confidence level, the results that we obtain from the simulations should converge to the results that we obtain with the MS sample.

Treating the MS sample as the true population of firms is only an approximation, as, similar to other samples based on manufacturing surveys, it does not contain the smallest types of firms. In the case of the MS data, firms with less than 20 employees are not included. As such, the MS dataset is also an incomplete dataset. However, as Eapen (2013) also argues, given that a sample such as the MS contains many more firms, it is less incomplete than the sample obtained from the WBES. Therefore, although there may be a bias in the estimated spillover effects with the MS sample, we can still assess whether the use of incomplete datasets biases estimated FDI spillovers, by comparing the results obtained with a potentially strongly incomplete dataset (WBES) with the results obtained with a weakly incomplete dataset (MS).

For stratification purposes, we redefine the firm-size classes to be used in the stratified sampling applied to the MS. We define firms with fewer than 30 employees as small, firms with 30 to 100 employees as

[29] For an in-depth discussion of these methods, their assumptions, advantages and disadvantages, and applicability to the Indonesian Manufactoring Sector data, see Chapter 2, section 2.3.1 on productivity estimation.

medium sized and firms with more than 100 employees are classified as large. The main difference with the WBES is that the category of small firms for the MS contains slightly larger firms, as small firms in the WBES dataset are firms with more than 5 and less than 20 employees. As small firms are less likely to be foreign-owned, our definition of small firms that incorporates slightly larger firms may, if anything, lower the measurement error of industry FDI, resulting in estimates of FDI spillovers that are closer to those that we obtain with the full MS sample.

3.4 EMPIRICAL FINDINGS

3.4.1 FDI spillovers: WBES and MS samples

Table 3.2 presents the findings from our estimations of regression models (3.3) and (3.4). Columns 1 and 2 contain the results when we estimate the flexible trans-log production function for all firms and

Table 3.2 Horizontal and Backward FDI spillovers: WBES and MS estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	WBES	WBES	MS	MS	MS	MS	MS	MS
Year	2009	2009	2009	2009	2008-2009	2008-2009	2008-2009	2008-2009
Firms	All	Domestic	All	Domestic	All	Domestic	All	Domestic
Dependent variable	lnY	lnY	lnY	lnY	lnY	lnY	TFP (ACF)	TFP (ACF)
Horizontal FDI	-0.288 (0.41)	-0.236 (0.428)	0.126 (0.11)	0.106 (0.112)	1.379 (1.233)	1.438 (1.279)	1.384 (1.938)	1.709 (2.054)
Backward FDI	4.587 (8.45)	4.155 (9.06)	3.212*** (0.37)	3.311*** (0.375)	0.272** (0.107)	0.246** (0.106)	0.969** (0.266)	1.062** (0.319)
lnK	0.05 (0.275)	0.0162 (0.31)	0.078*** (0.021)	0.075*** (0.023)	0.116** (0.04)	0.122** (0.04)		
lnL	0.565 (0.58)	0.444 (0.63)	0.683*** (0.055)	0.666*** (0.06)	0.942*** (0.04)	1.029*** (0.04)		
lnM	-1.132*** (0.22)	-1.197*** (0.234)	0.116*** (0.035)	0.051 (0.038)	0.192** (0.08)	0.128 (0.08)		
lnE	1.359*** (0.33)	1.522*** (0.38)	0.275*** (0.024)	0.305*** (0.027)	0.302*** (0.035)	0.319*** (0.02)		
Foreign	0.152 (0.116)		0.130*** (0.018)		0.032 (0.056)		0.08 (0.136)	
Herfindahl			-0.282** (0.128)	-0.390*** (0.136)	0.658 (0.38)	0.635 (0.378)	-1.00 (0.92)	-0.627 (1..03)
Constant	11.06*** (2.60)	10.77*** (2.564)	3.592*** (0.228)	3.957*** (0.244)	2.970*** (0.643)	3.016*** (0.697)	5.258*** (0.762)	5.058*** (0.793)
Nobs	699	637	12541	11661	25246	23528	26333	24496
adj. R^2	0.924	0.910	0.966	0.963	0.807	0.818	0.010	0.011
Nr of panels					15031	15583	15583	14532

Notes: ** p<0.05; *** p<0.01. Estimations 1-4 also contain squared and interaction terms of the input variables and industry effects. Estimations 5-8 also control for firm, year, industry-year and region-year effects. Robust standard errors (clustered at the industry level) reported in parentheses. TFP (ACP) uses TFP indicator estimated following Ackerberg et al. (2015). The Herfindahl index was dropped from estimations 1 and 2 due to multicollinearity.

for domestic firms using the WBES sample. Both for all firms and for domestic firms, the findings show no significant effect of either horizontal or backward FDI. In contrast, and similar to the findings presented by Blalock and Gertler (2008, 2009), the results from estimating the model on the MS sample

– columns 3 and 4 – show a significant positive effect of the backward FDI variable, suggesting that FDI firms are creating positive productivity spillovers among domestic input suppliers. Horizontal FDI does not appear to create significant spillover effects, although the sign of the estimated effect also differs from the results with the WBES sample. Therefore, the strong differences between the findings from the two samples suggest that the results obtained with the WBES data may be affected by the incompleteness of the sample.

Columns 5-8 report the results from using the MS panel data set. Columns 5 and 6 contain the results when we estimate regression model (3.4) with firm-level inputs, market competition, year effects, industry-year effects, region-year effects and firm-level fixed effects. The findings are similar to those that we obtain with the cross-sectional estimations, with backward FDI carrying a significant and positive coefficient. The decrease in magnitude of the estimated effect of vertical FDI reflects that we now control for firm-level fixed effects. Columns 7 and 8 contain the findings when we use as dependent variable the estimated TFP variable that is not affected by endogeneity of input choices, following the routine by Ackerberg et al. (2015). The findings on the spillover effects from FDI are similar, with insignificant horizontal FDI spillovers and significant and positive backward FDI spillovers.

3.4.2 FDI spillovers: simulations

The results in the previous section show that whereas we obtain evidence of positive backward FDI spillovers with the MS dataset, the estimations with the WBES dataset do not produce significant FDI spillovers effects. There may be several reasons for this, which we examine sequentially with several sets of simulations.

First, the results could be specific to the particular WBES sample. The sample constitutes one draw from the population of firms, and it may simply be that this particular sample does not produce significant backward spillovers. To test the validity of the WBES sampling methodology, we estimate regression model (3.4) on 1,000 stratified random samples taken from the MS, using the exact sampling criteria of the WBES.

Second, the results from the WBES sample may be the result of small sample size, affecting the power of the estimation and the margin of error of the estimated FDI spillovers. To examine the severity of this issue, in a second round of simulations we estimate the model on 1,000 random samples that are based on twice the number of firms in each stratum, whilst keeping the same stratification criteria from the WBES.

Next, we address the issue of measurement error of the FDI variables. We add an additional "foreign output share" stratification criterion in order to ensure that the share of foreign output in each industry is accurately represented. To do this, we measure the share of foreign output in each industry in the MS dataset, and subsequently estimate how many foreign firms need to be sampled from each industry-region-size cell with the WBES sampling to reach the same foreign output share in each simulation

sample. This ensures that foreign firms are sampled from each cell where they are present in the population, and since foreign firms tend to be larger, adding this criterion indirectly increases the number of large firms in the sample.

However, applying the additional foreign output share criterion does not solve the issue of measurement error of industry FDI completely. Due to the small size of the drawn samples, cells with small but non-zero foreign output shares in the population are rounded down to zero foreign firms in the simulation samples. Hence, while improving selection bias by increasing the share of large, foreign firms in each industry, random samples drawn with this strategy will still suffer from rounding errors that do not allow for a one-to-one reproduction of population FDI measures. To see the effect of introducing fully accurate and population representative FDI measures, we also run simulations with random samples drawn according to the strategies mentioned above, whilst using measures of horizontal and vertical FDI taken directly from the MS dataset.

Finally, we look at the effect of the strong presence of small firms in the WBES sample. Comparing the two datasets, we find that the share of small firms in the WBES sample is significantly higher than in the MS sample, at the expense of medium-sized and large firms. To assess whether the presence of small firms influences the estimated FDI spillovers, we remove firm size as stratification criterion. We keep the other sampling criteria and run two sets of simulations, one without and one with the additional foreign output share sampling criterion. In these simulations, the average share of each firm size category in the samples is closer to their share in the population of firms, by decreasing the number of small firms and increasing the number of medium-sized and large firms[30].

The results from the simulations are presented in Table 3.3. We report the mean coefficient estimate of horizontal and backward FDI from the sets of 1,000 estimations. We also report the mean t-statistic and the mean standard error of testing the hypothesis that the estimated coefficient significantly differs from 0. Subsequently, we test for bias in the estimated coefficients by testing the hypothesis that the estimated coefficients obtained with the simulations are not significantly different from the estimated population coefficients as reported in column 8 in Table 3.2. We also report for each set of estimations the percentage of cases where the estimated FDI coefficients are similar to the coefficients obtained with the full MS sample[31].

[30] After removing the size criterion and introducing the foreign output share criterion, the average firm size shares in the simulated samples are 32.4 per cent small firms (MS sample 35 per cent, original WBES sampling 47.3 per cent), 38.2 per cent medium-sized firms (MS 38.3 per cent, original WBES sampling 29.7 per cent) and 29.4 per cent large firms (MS 26.5 per cent, original WBES sampling 23.1 per cent).

[31] For space considerations, we report the findings from the simulations on samples containing only domestic firms. Findings for samples containing both domestic and foreign firms are similar to those presented in Table 3.3 and are available upon request.

Table 3.3: Results from simulations with varying sample designs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	WBES sampling	WBES sampling x 2	Foreign output share criterion	WBES sampling without firm size criterion	Foreign output share, no size criterion, x2	WBES sampling	WBES sampling x2	Foreign output share criterion	WBES sampling without firm size criterion	Foreign output share, no size criterion, x2
	FDI variables measured from random samples					FDI variables taken from MS sample				
	Horizontal FDI									
Mean β estimate	-0.042	0.006	0.211	0.039	-0.056	1.674	1.823	1.569	1.139	0.888
Mean s.e.	0.597	0.580	0.627	0.544	0.645	2.887	2.729	3.077	2.587	2.353
Mean t-stat	-0.172	0.047	0.447	0.185	-0.274	0.739	0.777	0.612	0.560	0.532
Different from population β	YES (0.101)	NO (0.113)	NO (0.152)	YES (0.095)	NO (0.116)	NO (0.501)	NO (0.567)	NO (0.510)	NO (0.474)	NO (0.522)
% similar to population β	23.5	27.1	33.3	22.7	26.8	87.1	93.8	89.8	86.2	92.2
	Backward FDI									
Mean β estimate	0.170	0.011	0.280	0.529	0.543	0.907	0.841	0.943	1.188	1.191
Mean s.e.	1.219	0.779	0.671	1.279	0.670	0.893	0.663	0.984	0.881	0.641
Mean t-stat	0.262	0.142	0.579	0.633	1.233	1.226	1.537	1.194	1.663	2.219
Different from population β	NO (0.285)	NO (0.257)	NO (0.258)	NO (0.351)	NO (0.326)	NO (0.436)	NO (0.474)	NO (0.464)	NO (0.437)	NO (0.487)
% similar to population β	58.6	54.7	52	67	67.3	78.8	86.1	83.8	81	86.7
Mean nr. obs.	1345.3	2705.7	1272.8	1358.2	2572.1	1354.3	2707.2	1271.9	1357.7	2573.7
Mean nr. Panels	760.8	1527.7	718.7	766.5	1453.3	764.9	1528.7	718.5	766	1453.5
Mean overall adj. R^2	0.128	0.127	0.152	0.107	0.119	0.130	0.122	0.130	0.107	0.109

Notes: values in parentheses are mean p-values from 1,000 tests on whether estimated coefficient in each drawn sample differs from population estimate. WBES sampling: samples drawn according to WBES sampling criteria. WBES sampling x 2: WBES sampling + double sample size. Foreign output share: WBES sampling + representative foreign output share in each industry. No size criterion: size stratification criterion removed.

Column 1 presents the results when we estimate regression model (3.4) on 1,000 randomly drawn samples following exactly the WBES sampling methodology. As not all firms feature in the 2008 and 2009 MS samples, the number of observations for each estimation generally falls below 2,238 (2 times 1,164). Additionally, similar to the case when using the WBES dataset, the estimations are affected by attrition problems due to missing values, causing the number of panels to decrease.

The results show that on average the estimated beta coefficients of horizontal and backward FDI are smaller than the population coefficients. Moreover, neither of the two effects is significant, and the mean absolute values of the t-statistic are very low. Therefore, sampling according to the WBES methodology, in combination with small sample size, yields consistently biased results, as indicated especially by the insignificance of the estimated effect of backward FDI. Moreover, with an average p-value of 0.1, the estimated sample coefficients for horizontal FDI are significantly different from the population coefficient, further indicating the presence of bias. Overall, the estimated coefficient does not differ significantly from the population coefficient in only 24 per cent of the estimations in the case of horizontal FDI; for backward FDI, this is closer to 60 per cent.

Column 2 shows the results when we use samples that are twice as large as those obtained with the original WBES sampling methodology, to assess whether small sample size is the primary cause of the differences in the estimated effects. The findings suggest that this is not the case. The estimates of horizontal FDI do not improve and in the case of backward FDI the estimations even perform worse. The mean horizontal FDI estimate now carries the same sign as the population estimate whilst remaining insignificant, whereas the estimate of backward FDI spillovers is on average less significant. The percentage of biased horizontal FDI spillovers estimates is only slightly lower than in the first round of simulations, and in the case of backward FDI this share has even increased. Therefore, a simple increase of the sample size does not alleviate the bias in the estimated spillover effects.

Column 3 shows the results from estimations based on adding an additional stratification to the WBES sampling methodology, requiring an accurate FDI output share for each stratum. On average, the estimated coefficients that we obtain get closer to the population estimates – both in terms of magnitude and sign – although both effects remain insignificant. The improvement of the findings from this set of estimations indicates that measurement error of the FDI participation variables does bias the findings obtained with the WBES dataset. At the same time, it is not the only source of bias, as the findings with the additional sampling criterion still differ from the population estimates. There is a clear improvement of the mean t-statistics in comparison with the findings in the previous columns. However, although the share of biased estimates of horizontal FDI spillovers decreases, this is not the case for backward FDI spillovers.

The last factor that may generate biases in the estimated effects from FDI is the strong presence of small firms in the incomplete dataset. As smaller firms are less likely to be able to benefit from positive

spillovers and may be subject to negative spillovers, strong sample presence of small firms may force estimated positive spillover effects downward or render them insignificant. To examine this, we remove firm size as a stratification criterion when drawing samples from the population of firms. As the findings in column 4 show, the findings improve when dropping firm size as sampling criterion. The mean beta coefficient of backward FDI increases from 0.17 with the original WBES sample to 0.58, and its mean t-statistic also increases. On average, the estimated coefficient remains insignificant, however. Also, although the removal of the size criterion increases the share of non-biased estimates of backward FDI spillovers, it decreases this share for horizontal FDI spillovers.

So far, our analysis confirms our expectations that the sampling design used by the WBES contributes to making the estimated FDI spillover effects biased and unreliable. Moreover, we find that while horizontal FDI spillovers are affected mostly by a measurement error of the industry level of FDI, this effect is less pronounced for backward FDI. Instead, for this type of FDI effect the overrepresentation of small firms appears to play a bigger role. This may be reflecting that in general small firms are less able to absorb new technologies from foreign-owned client firms, but also that these small firms may be less likely to operate as suppliers to FDI firms, preventing them from being exposed to potential inter-industry technology spillovers.

As an additional check, we combine the three modifications of columns 2-4. We run the simulations on a stratified sample with foreign output share as additional stratification criterion, removing firm size as stratification criterion and with double sample size. The results are shown in column 5. Estimations on random samples with these characteristics produce estimates for backward FDI that on average have improved further, with an increase in significance (mean t-statistic = 1.233) and with a magnitude closer to the population estimate. The findings for horizontal FDI are less clear; on average the estimated coefficients remain insignificant and the share of unbiased estimates has not improved.

The second panel of findings in Table 3.3 shows the results when we exclude measurement error of the industry level of FDI as a source of bias. Whereas in the previous columns we use information from the randomly drawn samples to calculate horizontal and backward FDI, we now run the estimations using the indicators of horizontal and backward FDI taken from the MS sample, representing the full population of firms. Using these indicators improves the results substantially. Looking first at horizontal FDI, we find that the mean beta estimate is much larger and closer in size to the population coefficient. Its estimated effect remains insignificant, similar to the findings with the MS sample. The findings from our preferred specification – double sample size, foreign output share stratification and no firm size stratification – as reported in column 10 outperform all the other estimates in terms of low t-statistic and a high share of unbiased estimates. With this simulation, in more than 80 per cent of the estimations we obtain sample estimates of horizontal FDI spillovers that do not differ from the population coefficient.

The exclusion of measurement error by using the FDI variables from the MS dataset also improves the reliability of the estimates of backward FDI spillovers substantially. Overall, the results in columns 6-10 show that on average the sample estimated coefficients are much closer in size to the population coefficient. Looking at the results from our preferred specification in column 10, we obtain an average sample coefficient that is significant with a t-statistic of 2.219. Moreover, the share of unbiased backward FDI spillovers estimates is generally much higher in these estimations; on average, around 80 per cent of the sample estimates in the simulations do not differ significantly from the population coefficient. Therefore, when taking out measurement error of the FDI industry participation variable, correcting for the strong presence of small firms and improving the power of the estimation by increasing the sample size, the simulations show that we obtain estimated FDI spillovers that approximate the estimated coefficients for horizontal and vertical FDI from the population of firms as represented by the MS dataset.

3.5 SUMMARY AND CONCLUSIONS

Despite popular belief that domestic firms in host economies benefit from FDI firms in the form of positive productivity spillovers, the evidence on these externalities is mixed and inconclusive. Although the FDI spillovers literature discusses several reasons for the heterogeneous nature of the empirical evidence, the question whether the use of incomplete datasets may affect estimated FDI spillovers has received limited attention. Incomplete datasets such as those from the WBES are commonly used to estimate FDI spillovers, as they contain the required firm-level variables on inputs, output and type of ownership. However, as their sampling methodology does not require an accurate representation of the industry presence of FDI firms, it is likely that the indicators of horizontal and vertical FDI contain measurement errors. These measurement errors are reinforced in the case of strong sample presence of small firms and limited sample size. Furthermore, the strong presence of (very) small firms makes it less likely that positive spillovers are identified and the limited sample size increases the margin of error and lowers the overall power of the estimation to identify any significant spillovers.

Using Indonesia as case study, we find no evidence of horizontal or vertical FDI spillovers with the WBES sample. In contrast, using the much larger MS sample produces evidence of significant and positive vertical FDI spillovers[32], suggesting that the use of incomplete datasets such as the WBES sample affects the estimated FDI spillover effects. To examine this, we conduct sets of estimations on simulated incomplete datasets, created by applying the sampling methodology of the WBES to draw random samples from the MS dataset. The findings from the sets of estimations show that small sample size, strong sample presence of small firms and measurement error in industry FDI participation all

[32] In Chapter 6 (Conclusions) we compare and discuss our findings from this chapter and Chapter 2, which both deal with data from MS.

contribute to inaccurate estimates of horizontal and vertical FDI spillovers. When we weaken the effects of these factors by sequentially relaxing the WBES sampling criteria, we obtain estimates of FDI spillovers that are closer to the effects that we identify with the MS sample. Having said so, the estimated effects do persist to differ. Only when we use indicators of horizontal and vertical FDI calculated directly with the MS sample in our estimations on the simulated incomplete datasets, whilst also increasing the sample size and clearing the samples from the strong presence of small firms, do we obtain results that approximate those obtained with the underlying population of firms.

In conclusion, our findings provide clear evidence that the use of incomplete datasets affects estimated FDI spillover effects. As such, they indicate that the quality and completeness of the datasets that are used in FDI spillover studies constitute additional possible reasons for the considerable degree of inconclusiveness that characterises the body of empirical evidence. Therefore, researchers that use incomplete datasets to estimate FDI spillovers should assess the degree of incompleteness of their datasets and examine how this may impact upon their findings. Provided that the sample size is sufficiently large, our results suggest that one possible solution for the use of an incomplete dataset in the estimation of FDI spillovers is to obtain information on the underlying population of firms regarding the degree of industry FDI participation to calculate indicators of horizontal and vertical FDI. Using these indicators of FDI industry participation will result in estimations that are less sensitive to sampling irregularities and will produce more reliable estimates of FDI spillover effects.

Chapter 4 ALL YOU NEED IS LINKAGES

Knowledge transfers through backward linkages with foreign firms and productivity spillovers+

4.1 INTRODUCTION

Starting with Javorcik's seminal paper that identified positive FDI spillovers occurring through backward linkages between FDI and local suppliers (Javorcik, 2004), findings of productivity benefits for domestic firms operating in sectors that supply inputs to sectors with high levels of foreign firm participation constitute one of the most robust pieces of evidence in the FDI spillovers literature. This is in contrast to evidence on spillovers through forward channels (from sectors with high levels of FDI penetration to domestic firms in downstream sectors) for which the effects are mostly insignificant[33], or intra-industry spillovers, where evidence is more mixed and inconclusive[34]. The mechanism through which these *backward FDI* spillovers usually take place is through inter-firm linkages between FDI firms and local suppliers, which are conducive to the voluntary and involuntary transmission of knowledge and technologies to domestic suppliers. Moreover, other domestic firms in the sector that do not act as suppliers to foreign firms themselves may also benefit from these linkages if the knowledge and technologies later spill over to them (e.g. via demonstration effects).

Most empirical studies estimating backward FDI spillovers use (slightly modified) versions of the backward FDI measure introduced by Javorcik (2004). This is a sector-level composite measure of FDI participation, constructed in the following manner: for each sector *i,* the FDI shares of total output or employment in all other sectors are weighed by the share of sector *i*'s output that serves as inputs in the production process of those sectors (Blalock and Gertler, 2008). Information on output shares is usually taken from Input-Output (IO) tables, which do not distinguish between foreign and domestic input sourcing and output selling patterns. Thus, by using IO tables to construct backward FDI measures, an implicit assumption made by the literature is that there are no differences in supply chain linkages between foreign and domestic local firms. Hence, we should expect domestic and foreign suppliers to establish vertical linkages in the same way, which would be reflected in similar shares of their output going to foreign and domestic buyers.

To our knowledge, the only study that points out and tests this assumption is Barrios et al. (2011). Besides the assumption of similar input-sourcing behaviours between foreign and domestic firms, they argue that using the traditional backward spillover variable also assumes that firms use the same shares

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+ This chapter is based on a working paper with Jacob Jordaan and Adnan Seric (UNIDO).

[33] With the exception of Newman et al. (2015), who find that upon controlling for both knowledge transfers through vertical linkages and the spillover measures commonly used in the literature, there are positive and significant forward spillovers.

[34] Initial studies focusing on spillovers within the industry found positive and significant effects, but starting with Aitken and Harrison (1999), the estimated effects were negative or in many cases, insignificant.

of domestically produced and imported inputs (because imported intermediate inputs are included in the calculation of weights from IO tables); and that the share of foreign output in a sector is a good indicator of their level of use of local inputs (because share of foreign buyers in downstream sectors is proxied by foreign output share). Using data from the manufacturing sector in Ireland, they are able to build alternative measures of backward FDI that relax these assumptions. More specifically, they only focus on domestic inputs from IO tables, measure amounts of used domestic inputs for each foreign firm specifically, and use information from IO tables based on the origin country of foreign firms to proxy their input-sourcing behaviour. They find positive backward spillovers with the less restrictive measure, but no evidence of spillovers with the traditional backward FDI measure, indicating that the assumptions made by the literature are indeed invalid.

In this paper, we focus more specifically on the assumption that foreign and domestic buyers develop similar linkages with local suppliers. In fact, neither theory, nor anecdotal evidence or empirical studies, especially in developing and transition countries, provide support for this assumption. Rodriguez-Clare (1996) develops a theoretical model that shows that the extent of vertical linkages that foreign firms establish with domestic suppliers depends on how intermediate input intensive the production process of foreign firms is, how similar intermediate inputs from host and home countries are, and how costly it is to transport inputs between the two home and host economies. Depending on the levels of these characteristics, in equilibrium foreign firms may not establish linkages with domestic firms, preventing the materialisation of benefits from the entrance of foreign firms. Alfaro and Rodriguez-Clare (2004) test this model empirically with data from Latin-American countries and find that in absolute values, foreign firms source less intermediate inputs locally than their domestic counterparts. However, they also argue that the measure of vertical linkages should reflect the relative share of domestically sourced intermediate inputs to the number of workers they hire. Based on this alternative measure of linkages, the paper shows that for some of the Latin-American countries under investigation, foreign firms in fact source more intermediate inputs domestically than domestic firms. In any case, both the theoretical model of Rodriguez-Clare (1996) and its empirical extension by Alfaro and Rodriguez-Clare (2004) show that foreign and domestic firms establish different levels of linkages.

More evidence on these differences comes from the International Business literature, which despite sharing many ideas and concepts with the FDI spillovers literature strand in Economics, has developed rather separately, especially in terms of methodologies and datasets (Amendolagine et al., 2013; Giroud and Scott-Kennel, 2009; Jordaan, 2016). In many of these studies, a distinction is made between the *extent* or *quantity*, and the *intensity* or *quality* of linkages. The former concepts refer to the amount of goods and services bought or sold locally, while the latter measure the level of interactions and potential knowledge exchanges between foreign and local firms (Jindra et al., 2009).

We make use of these concepts to answer our first research question: Do FDI firms differ from local firms in the level of use of local suppliers and the nature of linkages that they create? Thus, we estimate differences in extent and intensity of vertical linkages between foreign and domestic firms and their local suppliers in Vietnam. For this, we use a unique dataset from a UNIDO survey of foreign and Vietnamese firms. The survey, which was targeted at foreign and domestic investors specifically, covers a wide array of in-depth questions on numbers of suppliers by ownership type, the amounts of inputs bought, and the different types of support offered to them. Importantly, as firms in the survey serve as both suppliers and buyers in the value chains in which they operate, they also provide information on linkages from the perspective of being suppliers.

Theoretical and empirical evidence has shown that foreign firms enjoy a productivity premium over their domestic counterparts (Melitz, 2003; Javorcik, 2004). However, it is not clear whether this productivity premium would translate into productivity spillovers for local firms. For this to happen, foreign firms would have to develop more and better linkages with local firms. Hence, we estimate differences in establishing vertical linkages between domestic and foreign firms in Vietnam by using a propensity score matching analysis. To isolate the *true effect of foreign ownership,* we first match foreign and domestic firms that share similar characteristics through a Propensity Score Matching analysis. Subsequently, we estimate whether there are consistent and significant differences in the extent and intensity of linkages that these matched firms develop. To alleviate the potential issue of firms' subjectivity in reporting the quality of their linkages, we perform the analysis from the perspective of suppliers as well as buyers located in Vietnam. This gives us a unique opportunity to contrast the perceptions of firms that are either on the giving or the receiving end of knowledge transfers and other types of support.

The second research question that we address concerns the productivity effect that domestic suppliers may experience from linkages with foreign firms located inside and outside of Vietnam. A few studies have examined how the level of linkages impacts domestic firms' productivity (Javorcik and Spatareanu, 2009; Newman et al., 2015; and Görg and Seric, 2016). Jordaan (2011b, 2017) uses a self-reported measure of the importance of linkages with FDI firms by domestic firms to capture the impact on the performance of domestic firms. Görg and Seric (2016) focus on the impact of direct linkages on the performance of domestic firms, defined as either product innovation or labour productivity. The issue with these measures, as the authors point out, is that a positive correlation between the level of linkages and firm performance may not necessarily be a *result* of the linkages. Conversely, it could be caused by a selection bias that arises when the *already* more productive domestic firms develop more linkages with foreign firms. Javorcik and Spatareanu (2009) try to account for this source of endogeneity by instrumenting the level of direct linkages with a number of instruments.

Both Javorcik and Spatareanu (2009) and Görg and Seric (2016) estimate the effect of direct linkages with foreign firms explicitly without controlling for the effect of industry-level spillovers. However, the original concept of FDI spillovers as knowledge externalities relies on the idea that FDI presence in an economy may have effects on the performance of all domestic firms in a sector with higher exposure to FDI in upstream and downstream sectors, regardless of their own level of linkages. For example, domestic firms that do not supply to foreign firms, but are in the same sector as domestic firms that do, may still benefit from demonstration effects from the foreign firm suppliers in their sector. Hence, while it is important to be able to quantify the actual level of linkages between foreign firms and their local suppliers to account for the potential knowledge transfer through this channel, we should also still control for the overall level of FDI concentration in upstream and downstream industries to avoid biasing the estimated effect of direct linkages. To the best of our knowledge, Newman et al. (2015) are the only ones to do so, by controlling for both direct and indirect spillovers. By including both terms and their interaction in their estimation, they not only control for potential omitted variable bias, but are also able to provide a comparison of the magnitude of each effect. In this paper, we follow Newman et al. (2015) and estimate both direct and indirect effects of backward FDI on productivity. Moreover, we address issues of endogeneity arising from simultaneity bias at the sector level (foreign firms may decide to invest in certain sectors in the country to make use of specific suppliers in upstream industries) by introducing instruments for our measures of sector-level backward FDI in 2SLS and 3SLS regressions. Thus our second contribution to the literature is the estimation of direct and indirect productivity effects from linkages with foreign firms whilst controlling for several sources of endogeneity.

Finally, our data allows us to distinguish between foreign buyers located in the host economy and abroad. We take advantage of this distinction to compare established linkages with different types of foreign buyers. We are able to estimate the effects that each type of foreign buyer has on the productivity of domestic suppliers. Learning opportunities from exporting to foreign buyers abroad are well-documented in the learning by exporting literature[35] and have gained even more attention in the literature on upgrading by being part of global value chains (Giuliani et al., 2005). However, the issue of self-selection in the estimation of these learning effects is just as problematic, as domestic firms may be selected as exporters due to their superior productivity (Clerides et al., 1998; De Loecker, 2013). In this paper we instrument both sector-level export shares and direct linkages with foreign buyers. Thus, our third contribution to the literature is a comparison of the direct and indirect productivity effects from linkages with foreign client firms located in the host economy and foreign firms located abroad. This is an important question that relates directly to policy making for developing countries like Vietnam that

[35] See Martins and Yang (2009) for a meta-analysis and Keller (2010) for a review of the literature. Crespo et al. (2008) offer an analogous analysis to ours by focusing on exporting relationships with specific clients, as opposed to the more commonly used measure of exporting/non-exporting used in the literature.

are trying to find the most beneficial and effective ways to increase the productivity of their domestic firms.

Governments of developing countries put great emphasis on investment promotion, based on the belief that having foreign firms in the country facilitates linkages with domestic firms and that this in turn leads to higher levels of knowledge transfers. Our study helps to establish if these linkages are indeed present, if they lead to knowledge transfers and other types of support, and finally, if they have an impact on the productivity of domestic suppliers. We also establish if there is a productivity premium for domestic firms establishing linkages with foreign firms in the country, as opposed to foreign firms abroad. Our empirical findings show that there are significant differences between foreign and domestic firms, acting as both buyers and suppliers. After matching domestic and foreign firms on a number of observable characteristics, we find that domestic firms establish more linkages with other domestic firms and with foreign firms located abroad than with foreign firms located in Vietnam. This finding is supported by the responses from foreign firms: foreign buyers located in Vietnam source a larger share of their inputs from other foreign firms in the country or in the form of imports, and less from domestic firms. These findings show that in Vietnam the first condition for spillovers through the backward linkages channel – i.e. backward linkages – is missing, as foreign firms seem to operate in their own enclaves. However, conditional on the existence of linkages, domestic firms that serve as suppliers to foreign firms in Vietnam seem to get more support than their counterparts. Furthermore, our IV 2SLS and 3SLS productivity analysis shows that linkages with foreign firms lead to productivity benefits for domestic suppliers, while the same is not true for linkages established with foreign client firms located abroad. Therefore, our findings help to inform investment policy in the direction of promoting qualitative linkages between foreign and domestic firms, as these seem to be the most beneficial in terms of fostering positive productivity impacts among domestic firms.

The rest of the paper is organized as follows. In the next section we discuss the literature on linkages and provide a context for our research questions. Section 4.3 provides information on the Vietnamese setting by focusing on prior literature and on evidence from our data that document the evolution and patterns of FDI inflows in the country so far. Section 4.4 covers data and methodology, Section 4.5 focuses on the empirical analysis, and Section 4.6 concludes.

4.2 LINKAGES

The FDI spillovers literature is characterised by a strong focus on estimating the existence and size of backward FDI spillovers among domestic firms. Yet, the exact channels through which these spillovers take place remain under-examined. As mentioned previously, the International Business literature provides richer empirical evidence on the extent and intensity of linkages between foreign firms and local suppliers. Focusing on the extent of linkages first, Hansen (2014) studies foreign firms in African countries and finds that not only are these linkages with local firms rare, but they are also usually made

with local affiliates of other foreign firms, thereby creating foreign enclaves in the host economies that do not interact with domestic firms. While Hansen concludes that there is potential for more inclusive linkages, other studies show that this depends on a number of determinants. For example, Belderbos et al. (2001) look at the local sourcing behaviour of Japanese multinationals' affiliates in 24 countries. They find that host country characteristics, such as larger supplier industries and better infrastructure affect the extent of linkages positively. Additionally, acquired foreign affiliates, joint ventures and affiliates in less R&D intensive sectors are more likely to develop vertical linkages. These findings are supported by evidence on foreign affiliates in transition economies, which also shows that more autonomous affiliates develop more linkages (Jindra et al., 2009). These studies help to show that unless certain conditions are fulfilled, the mere presence of foreign affiliates in a developing country does not equate to them developing linkages with domestic firms. By ignoring this important caveat, the approach of proxying linkages by using input-output shares may not yield a good measure of the actual extent of backward linkages.

Conditional on the extent of linkages, studies using industry-level measures of backward FDI also assume that there are no differences in the intensity or quality of linkages between foreign firms and domestic suppliers (with the exception of Barrios et al., 2011). However, this could be an important factor to consider when studying FDI spillover channels. Would we expect knowledge spillovers from a foreign firm that provides technology transfers, trainings for employees, product and quality upgrades, or financial support to its suppliers, to be the same as those from a foreign firm that only establishes arm's length supply relations? If not, then estimating whether foreign firms establish more or less qualitative vertical linkages with their local suppliers than domestic firms becomes an additional determinant that we need to control for when estimating backward FDI spillovers. There is some empirical evidence on the differences between foreign and domestic buyers, and on firm characteristics that determine the linkage intensity. Jordaan (2011b) looks at the supportive activities of foreign firms in the case of Mexican maquiladoras and finds that foreign firms are more supportive than domestic ones, but this finding is conditional on a number of firm characteristics, including the absorptive capacity and technology gap between foreign and domestic firms (Jordaan, 2011c; 2017). Giroud et al. (2012) use a self-perception variable of foreign firms as a source of technological knowledge for their suppliers to measure the intensity of backward linkages and find that the technological capability of foreign affiliates affects the intensity of backward linkages positively. Overall, assessing the evidence on linkage quality in a systematic manner is difficult, as there is no unifying definition of quality and the concept can be defined to include a myriad of measurement alternatives.

By measuring the extent and intensity of linkages with foreign firms, these studies shed light on the actual channels through which knowledge transfers, and consequently, potential knowledge spillovers happen. Moreover, by focusing on the actual firm-level linkages, they do not have to rely on strict assumptions of homogeneous linkages and can account for differences between foreign and domestic

firms acting as either buyers or suppliers in the supply chain. However, due to differences in methodology and data, it is difficult to translate these findings from the International Business literature directly to econometric studies of FDI spillovers.

First, capturing both the extent and intensity of linkages requires detailed firm-level information that is usually not available in datasets that national statistics offices create. Therefore, the International Business literature usually relies on the use of purpose-built surveys to obtain this data. As this is an expensive and time-consuming endeavour, it is not feasible to obtain this information for e.g. the entire manufacturing sector of a country. Instead, these studies tend to collect data from a specific industry (e.g. Gentile-Lüdecke and Giroud (2012) look at the Polish automotive sector), from case studies, or from small samples of firms that are usually not representative. Thus, these datasets are very rich in terms of information, but not in terms of coverage, making it difficult to generalise their findings.

Second, data sources usually consist of surveys and interviews with foreign firms, and therefore often the measured quality of linkages is a subjective self-assessment of the multinational enterprises' (MNEs) interactions with domestic suppliers and clients. While some self-reporting issues are inherent to survey-based analyses in general, providing information from the side of both foreign and domestic firms would help to mitigate the self-reporting bias and to provide a more objective measure of linkages (Crone and Roper, 2001).

Third, a majority of these studies focus on the measurement of linkages, but stop short of estimating their effect on the productivity of domestic firms. In cases when this relationship is estimated, due to lack of data on domestic firms' output and production inputs, outcome variables are usually subjective measures of performance indicators, reported by either foreign or domestic firms. For example, Gentile-Lüdecke and Giroud (2012) use data from a survey of foreign affiliates and domestic suppliers and find that linkages are important for knowledge transfer. Potter et al. (2003) reach the same conclusion with data from a survey of foreign firms and their domestic suppliers in the UK. However, both studies measure the effect on performance as a self-reported measure from the suppliers, instead of an objective measure of productivity. Thus, it could be that the variation in impact is not necessarily a result of actual variation in performance, but rather a reflection of the variation in the subjective perceptions of different suppliers. To produce estimates of productivity spillovers that materialise through backward linkages that are comparable to findings from existing studies in the spillover literature, a relationship between direct measures of linkages and objective measures of productivity is necessary.

In this paper we try to provide a more systematic approach to the investigation of FDI spillovers through vertical linkages, by addressing each of these issues. We start by using information on firm-level characteristics to match similar domestic and foreign firms and estimate the differences between them, both in terms of extent and intensity of linkages. In doing so, we try to alleviate issues of subjectivity in responses by juxtaposing results on linkage formation from firms acting as buyers to those from the

perspective of firms acting as suppliers. Subsequently, we estimate the effect of these linkages on suppliers using an objective measure of productivity of the domestic firms (Total Factor Productivity estimated from the firms' accounting information). This allows us to link the quantity and quality of vertical linkages between domestic firms with foreign buyers located inside and outside of Vietnam to objective measures of their productivity.

4.3 FDI IN VIETNAM

Given its economic history in the last thirty years, especially in terms of the development patterns of FDI, Vietnam makes a great case study to investigate FDI knowledge transfers through vertical linkages. In 1986 Vietnam introduced its Doi Moi policy, which was set in place to implement policies that would make the transition of the country from a planned economy to a market economy. The three main objectives of the Doi Moi were trade liberalisation, FDI promotion and recognition of private ownership (Giroud, 2002). The initial policy reforms and consequent developments, such as the signing of bilateral investment treaties, simplification of the trade system, becoming a member of ASEAN in 1995 and its accession to the WTO in 2007 all helped to transition Vietnam from a low income country with a centralized economy in the 1980s to an open, lower middle income economy in 2011 (World Bank, 2013). Following the example of other countries in the South East Asian region, growth rates in Vietnam in the last 25 years have been very high, despite a slowdown during the global crisis. Vietnam has also undergone important structural changes, upgrading from an agricultural economy to an industrialized one.

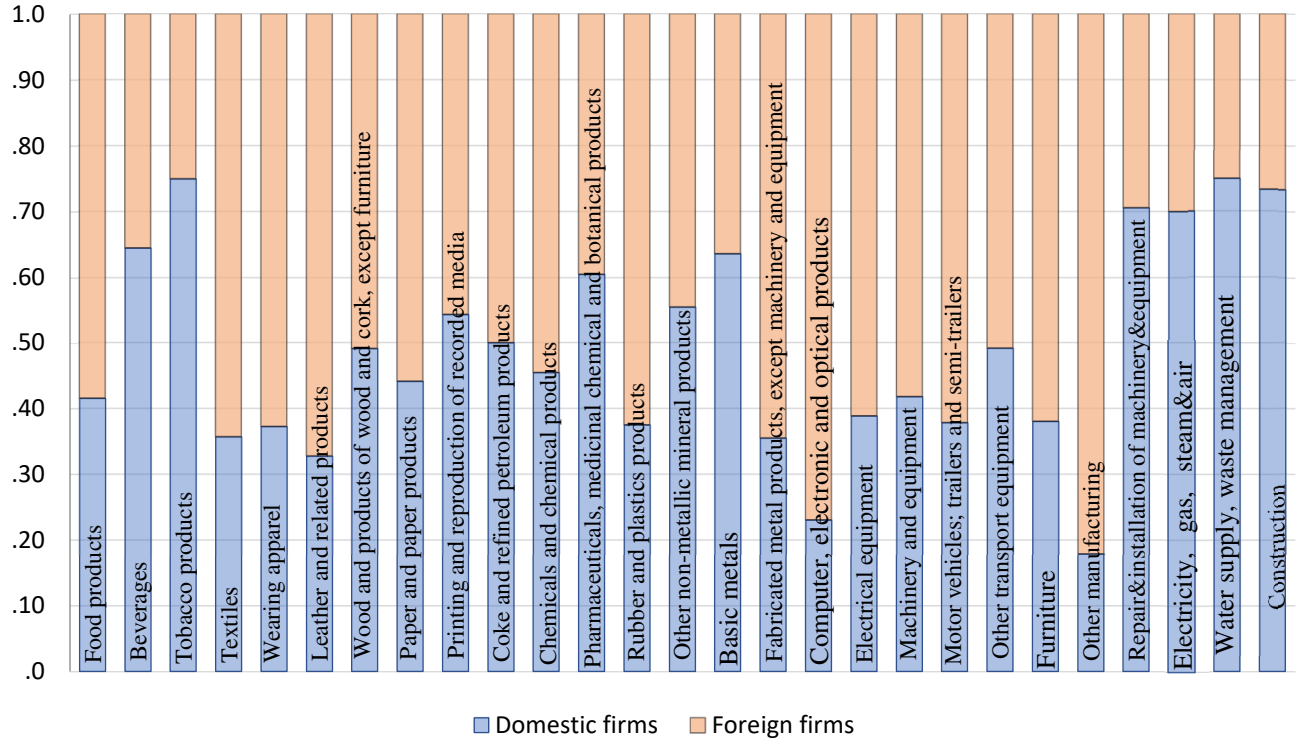
FDI inflows in the country have also experienced a remarkable development since the start of the liberalization reforms. They reached a record $15.8 billion in 2016 (Reuters, December 2016) and in 2011 accounted for 20 per cent of Vietnam's GDP (Dinh, 2014). It has also contributed to a great extent to the industrialization of the country, as most FDI investment is focused on the manufacturing sector. Despite the overall positive contribution of FDI to economic growth, several key features of foreign investment in Vietnam have not allowed the country to reap the full benefits from such high levels of investment.

Firstly, investment has concentrated mainly in low productivity sectors. With the increase of wage levels in China, foreign investors have turned to Vietnam to exploit low labour costs in the production of light manufacturing goods such as textiles and apparel. Even major investors in more productive, high technology industries such as electronics (e.g. Sony and Samsung) use their Vietnamese affiliates mostly for the assembly of parts and components that are produced elsewhere, activities that do not lead to substantial knowledge creation. The fact that most international firms use their Vietnamese subsidiaries to perform assembly style production activities means that the level of value added that is created in the country remains low. Instead, raw materials and intermediate inputs are imported from abroad,

assembled in Vietnam and final products are exported. This reduces the opportunities to develop linkages with local suppliers.

These anecdotal observations are borne out in our data too. Figure 4.1 shows the shares of foreign and domestic firms in the sample by industry. Since the focus of the survey was to investigate relationships and linkages between foreign and domestic firms, its sampling methodology is not representative of the actual shares of firms with foreign ownership in the Vietnamese economy, as foreign firms are highly overrepresented in the survey (for further details, see Section 4.4).

Figure 4.1: Share of firms in sample by type of ownership



Source: Authors' own calculations using data from VIS.
Note: Foreign ownership defined as having 10 per cent or more foreign equity

However, the relative distribution of firms across sectors is still very telling: foreign firms are more highly concentrated in low productivity, low value-added sectors with abundant cheap labour, like leather, textiles and wearing apparel. The other sector that attracts a relatively high share of foreign firms (besides the umbrella sector "Other manufacturing") is the computer and electronics sector. This is not surprising, as the survey targeted large foreign manufacturers in Vietnam and, as mentioned earlier, many of these firms have established affiliates in Vietnam for the assembly of parts and components of electronic products.

Foreign firms that source inputs in Vietnam have a preference to use other foreign-owned suppliers. Table 4.1 shows the share of inputs that firms source from different types of suppliers. Foreign firms in Vietnam receive the major part of their inputs from foreign suppliers, with the majority of suppliers

located abroad (38.86 per cent). On the other hand, on average domestic firms receive most of their supplies domestically (40.82 per cent). Moreover, foreign buyers in Vietnam buy almost twice as much of their inputs from other foreign suppliers located in Vietnam than their domestic counterparts (20.22 per cent for foreign firms and 11.46 per cent for domestic firms).

Table 4.1: Extent of linkages with different types of suppliers, by ownership type of buyers

	Overall Mean	Obs.	Mean Domestic	Obs.	Mean Foreign	Obs.	Difference (Std. error)
Percentage of inputs provided by domestic suppliers	33.09	942	40.82	493	24.6	449	16.22*** (-2.066)
Percentage of inputs provided by foreign suppliers in Vietnam	16.94	679	11.46	254	20.22	425	-8.752*** (-1.924)
Percentage of inputs provided by foreign suppliers outside Vietnam	31.83	774	18.78	271	38.86	503	-20.08*** (-2.497)

Source: Authors' own calculations using data from VIS
Note: *** p<0.01, ** p<0.05, * p<0.1

These findings are corroborated by information from firms that act as suppliers. In Table 4.2 we focus on sales percentages to different types of long-term buyers, as reported by foreign and domestic suppliers in Vietnam.

Table 4.2: Extent of linkages with different types of buyers, by ownership type of suppliers

	Overall Mean	Obs.	Mean Dome-stic	Obs.	Mean Foreign	Obs.	Difference (Std. Error)
Percentage of sales sold to long-term domestic buyers	39.76	857	48.4	469	29.31	388	19.09*** (-2.432)
Percentage of sales sold to long-term foreign buyers in Vietnam	21.18	598	12.24	235	26.97	363	-14.73*** (-2.307)
Percentage of sales sold to long-term foreign buyers outside Vietnam	44.39	768	28.63	255	52.23	513	-23.60*** (-3.073)

Source: Authors' own calculations using data from VIS
Note: *** p<0.01, ** p<0.05, * p<0.1

At first glance, it seems that the firms in our sample are heavily export-oriented, as on average the majority of outputs produced by suppliers is going to foreign buyers abroad (44.39 per cent). However, this average is driven mostly by the high representation of foreign firms in the sample and their export orientation. Foreign firms producing in Vietnam are acting as long-term suppliers mostly to foreign firms abroad (52.23 per cent), while domestic firms sell the majority of their output to other domestic firms (48.4 per cent). The lack of linkages between domestic suppliers and foreign firms in the country is made clear by the statistically significant difference in the mean shares of sales going to long-term foreign buyers in Vietnam: while domestic suppliers sell only 12.24 per cent of their output to foreign firms in the country, foreign suppliers sell on average 26.97 per cent to other foreign firms in Vietnam. Thus, the finding by Dinh (2014) that although foreign firms produce a substantial part of the country's

output, they are not very integrated with domestic firms and most of their output is exported abroad is confirmed by our data.

These descriptive statistics reveal clear differences in sourcing patterns between foreign and domestic firms and indicate that high levels of inward FDI may not generate meaningful spillovers among domestic suppliers. Not only is it less likely that intentional knowledge transfers occur when there are limited linkages between domestic firms and FDI, there is also less potential for unintentional productivity spillovers to materialise. This is also reflected in the empirical evidence on FDI spillovers in Vietnam. Newman et al., (2015) distinguish between knowledge transfers that are directly linked to actual linkages, and indirect spillovers that are linked to the inter-industry presence of FDI. Their findings show that when distinguishing between direct and indirect spillovers and controlling for both, as well as for their interaction, positive effects are found for knowledge transfers through direct linkages, that would usually be missed by using the standard definition of FDI spillovers. Interestingly, they also find evidence of positive effects of forward linkages, suggesting that domestic firms that purchase inputs from foreign suppliers experience productivity increases. However, Anwar and Nguyen (2014) find that there is a regional dimension to these productivity effects: only domestic suppliers located in regions of Vietnam that contain agglomerations of economic activity benefit from productivity spillovers, while in other provinces that do not contain such agglomerations spillovers do not materialise. Finally, Kubny and Voss (2014) focus on Chinese investors in Vietnam and find that while they develop more forward linkages than foreign firms from developed countries, the potential for productivity benefits from backward linkages is limited. As reasons for this they reiterate the fact that foreign investors develop few linkages with local suppliers. Also, most linkages that are established concern the sourcing of low technology, low value-added goods that limit the scope for productivity spillovers. According to their study, this relates directly to the limited capacity of domestic firms.

4.4 Data and Methodology

4.4.1 Data

For the analysis we use cross-sectional data from the Vietnam Investor Survey (VIS), a firm-level survey conducted by the United Nations Industrial Development Organisation (UNIDO) in 2010. The survey covers 1,493 foreign and domestic enterprises across nine provinces in Vietnam. It provides detailed information on the operations of firms in all the two-digit ISIC subsectors of the manufacturing sector, as well as a small number of firms in service sectors that assist manufacturing. We focus on the manufacturing sector in our analysis and leave out the firms in the service sector. This reduces the number of firms to 1,426. As Figure 4.1 in Section 4.3 shows, the focus of the survey on foreign investment is clearly reflected in its sampling methodology, which is not representative of the number of foreign firms in the entire firm population of Vietnam. According to the Vietnam Industrial Investment Report (UNIDO, 2011), foreign firms constitute the majority of firms in the sample (namely

51.7 per cent), while the share of foreign firms in the population from the 2009 Census conducted by the General Statistics Office (GSO) is estimated at 2.6 per cent. Part of the discrepancy arises from different definitions of foreign ownership: while GSO uses a stricter definition, the Industrial Investment Report (2011) follows the definition used by the OECD and IMF and considers a firm to be foreign-owned if 10 per cent or more of its equity belongs to foreign owners. In our analysis, we follow the definition of the report.

Table 4.3: Number of firms by province and foreign ownership

Province	Domestic	Foreign	Total
Hanoi	131	79	210
Vinh Phuc	8	15	23
Bac Ninh	14	17	31
Hai Phong	63	47	110
Da Nang	17	14	31
Binh Duong	92	283	375
Dong Nai	39	184	223
Ba Ria Vung Tau	18	15	33
Ho Chi Minh City	208	182	390
Total	590	836	1,426

Source: Authors' calculations based on data from VIS

Moreover, the focus on foreign firms also means that the geographical distribution of firms in the sample is not representative of the geographical distribution in the population, since regions where foreign firms are more concentrated are overrepresented in the sample. Thus, the majority of firms in the sample are located in the Hanoi and Ho Chi Minh areas. However, we believe that having a higher share of foreign firms in the sample allows us to get more in-depth information on the types of linkages that foreign firms and local suppliers establish. Our PSM analysis, which matches foreign and domestic firms on observed characteristics prior to estimating differences in extent and intensity of linkages, should also not be affected by the unrepresentative nature of our data. This feature becomes a bigger concern for our productivity analysis, where we estimate the effect of industry-level backward FDI on the productivity of local firms. The overrepresentation of foreign firms could lead to a mismeasurement of FDI output shares in downstream sectors. However, we mitigate this issue by using instruments for our industry-level FDI variables that are not based on the sample's industry composition.

The survey provides detailed information on a number of key variables that allow us to measure both the extent and the intensity of vertical linkages. To measure the extent of linkages with buyers or suppliers, we can rely on both the absolute number of buyers (suppliers) and the share of inputs (output) bought (sold) from (to) a certain type of supplier (buyer). We measure the intensity of linkages by using the respondents' self-reported measure of support received or provided across six categories: product quality upgrade, production process efficiency upgrade, access to finance, worker trainings, technology transfer and joint product design. For each of these categories, each firm acting as a supplier reports a

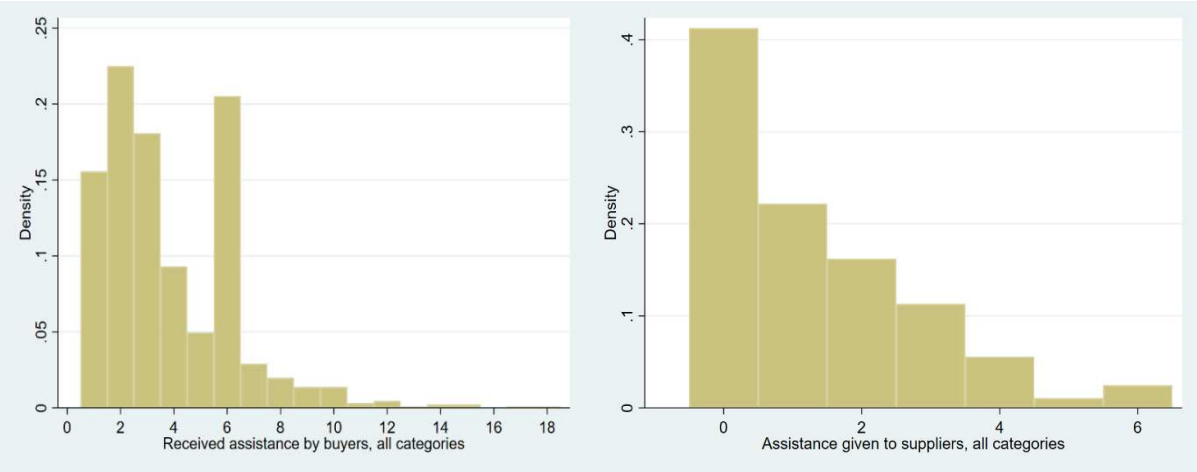
value of one if they have received support from their buyers and each firm acting as a buyer reports a value of one if they have given support to their suppliers. Based on these answers, we build a measure of overall support *received* by a supplier as a sum of the zeros and ones reported in all six categories by all three types of buyers (domestic buyers, foreign-owned buyers in the country and foreign buyers abroad). Hence, the variable of support received from buyers ranges from zero for a firm that reports not getting any type of support from any type of buyer to 18 for firms that report receiving all types of support from all types of buyers. When reporting support *provided* to local suppliers, firms are only asked to distinguish between the types of offered support, but not the ownership type of the suppliers receiving this support. Therefore, the variable measuring support given to local suppliers only ranges between zero (for firms that do not report giving any support) and six (for those that report giving all six types of support).

Figure 4.2 shows the distribution of both variables. A striking takeaway from these graphs is the high concentration of firms that report not giving any support to local suppliers, while there are very few supplier firms that report receiving no support at all. This finding may be affected by the way the information is collected and how the variable is constructed. Many firms that offer various degrees of little support may choose to report that as no support. Moreover, if they are offering support in any other dimension not covered by the six categories of the survey questionnaire, this would not be accounted for either. Finally, the degree of support here is measured by how many diverse types of support are being offered, but not by how much support supplier firms are offering (measured by e.g. the share of firms' expenses going into support activities for their suppliers). Thus, the results from the analysis on linkage intensity should be considered with these caveats in mind. However, comparing the scores for support relative to each-other within the context of the survey is still a valid exercise, since the same methods were used to come up with the support scores for both buyers and suppliers. Moreover, since most firms in the manufacturing sector serve as both buyers and suppliers along the value chain, most firms report being on both the giving and the receiving end of support from vertical linkages. Therefore, the issue of overreporting sometimes associated with surveys focusing exclusively on foreign firms that act as buyers to local firms should be less of a concern for us. Having said that, Figure 4.2 still seems to indicate that what counts as support to suppliers may not be perceived as such by buyers, which could be interpreted as a type of spillover.

Additional to the information on linkages, the survey also provides information on a number of firm characteristics such as age, size, skill ratio of employees, exporter status and level of exports. To control for the level of technology we make use of the OECD technological classification of manufacturing sectors (OECD, 2017) to classify firms based on their main sector of activity. Table 4.4 shows some summary statistics of the main firm characteristics by type of ownership. As expected, foreign firms are on average larger, both in terms of the number of employees and the level of production. They are also more capital intensive, have higher value added and export several times more than domestic firms. On

average, they are younger than domestic firms. A table describing all the variables is available in Appendix A.

Figure 4.2: Distribution of support received and support provided



Source: Authors' calculations based on data from VIS

Table 4.4: Characteristics of firms in the sample, by ownership type

	Mean Domestic	Mean Foreign	Overall Mean
Labour (No. of employees)	425	708	587
Log(output)	15.36	15.811	15.615
Log(capital)	14.346	15.046	14.74
Log(value added)	13.991	14.726	14.397
Total Exports (Millions)	2.629	19.767	13.231
Age (years)	18.27	10.3	13.71
GVC participation	.236	.695	.505

Source: Authors' calculations based on data from VIS
Note: For definition of variables and how they are constructed, see table A1 in Appendix A

Finally, we build industry-level backward FDI by using information from the Input-Output table for Vietnam, provided by the OECD's STAN database to construct industry weights (see Subsection 4.4.2 for an explanation on how the industry-level variables are constructed).

4.4.2 Methodology

i. *Differences between foreign and domestic firms in linkage extent and intensity*

To answer our first research question on whether foreign and domestic firms differ in the extent and intensity levels of linkages they develop, we consider local firms both in their role as buyers and as suppliers. To compare the extent of linkages that suppliers develop with domestic and foreign buyers, we measure the difference in the mean number of foreign buyers between foreign and domestic firms. However, as Table 4.4 showed, foreign firms in the country are different from domestic ones with regards to several important characteristics, which are likely to affect the degree to which they create supply linkages with client firms. Therefore, in order to isolate the effect of foreign ownership on the number of foreign buyers, we need to control for these characteristics. Although this can be done using

a simple OLS framework, doing so would be imposing a linear relationship between these characteristics and the outcome variable (Caliendo and Kopeinig, 2005). To avoid making any assumptions of linearity, instead of controlling for these characteristics by means of OLS, we employ a propensity score matching analysis, where we start by treating foreign ownership as a treatment variable. Thus, we estimate a firm's propensity of being foreign while controlling for a number of observed covariates (Inggrid, 2015). We then proceed to match domestic and foreign firms with similar propensity scores and estimate the difference in the average number of foreign buyers they have. We perform the same analysis from the perspective of buyers. We control for the buyer's propensity to be foreign and compare the difference in the average number of linkages with domestic suppliers.

To measure differences in the *intensity* of linkages, we compare the level of support local suppliers receive by matching them on their propensity to become suppliers to foreign firms. We then extend the same analysis to the level of support foreign and domestic buyers offer to their local suppliers by matching them on their propensity to be foreign-owned. By doing so, we isolate the true difference in the level of support that foreign and domestic firms offer to their suppliers, regardless of other characteristics that may affect their decision to offer support. As measures of support are quite subjective, by using reports of support from both buyer and supplier sides, we can also see if there are differences in the way firms in different positions along the supply chain perceive giving and receiving support.

ii. *Linkages with foreign firms and productivity*

We start our productivity analysis by estimating FDI spillovers according to the traditional definition used in the literature, i.e. the effect of FDI presence in downstream sectors on the total factor productivity of local firms, without focusing on the firms' actual linkages with foreign firms in the country. For this, we employ the definition of backward FDI initially used by Javorcik (2004):

$$Backward\ FDI_{jr} = \sum_k \alpha_{jk} Horizontal\ FDI_{kr} \qquad \textbf{(4.1)}$$

where α_{jk} is the share of output of sector *j* that serves as input in sector *k (*where k comprises all sectors, including sector *j*), and $Horizontal\ FDI_{kr}$ is measured as the share of foreign output in sector *k* and region *r* over total output in that sector and region:

$$Horizontal\ FDI_{kr} = \frac{\sum_{i \in kr} Foreign\ output_i}{\sum_{i \in kr} Output_i} \qquad \textbf{(4.2)}$$

Thus, in calculating the backward FDI variable we diverge from the usual method that excludes the own industry. As Lenaerts and Merlevede (2011) argue, especially when using highly aggregated sector data, the own industry should not be excluded. It is likely that highly aggregated industry data captures firms that develop supplier-buyer relationships with foreign firms which should be seen as vertical FDI. Since

we only have information at the two-digit ISIC level, we believe that it makes sense to include own sector in the measure of backward FDI.

Our definition of the backward FDI variable is based on the argument that FDI spillovers have a local dimension and dissipate over larger distances. This is driven both by foreign firms, for whom it is easier to find local suppliers in their proximity due to agglomeration effects (Jordaan, 2016), and by domestic firms, for whom closer distance makes it easier to learn and imitate new technologies from foreign firms. Thus, we follow previous literature that measures both horizontal and backward FDI at the sector and region level (Blalock and Simon, 2009; Javorcik et al., 2018).

In a similar fashion, we estimate the effect of an industry's exporting intensity on the total factor productivity of the firms in that sector. We define exporting intensity as the share of a sector's total output that goes toward exporting, but we do not introduce a regional dimension to this measure:

$$Exportshare_j = \frac{\sum_{i \in j} Exports_i}{\sum_{i \in j} Output_i} \quad \textbf{(4.3)}$$

To compare the effects of backward FDI and export intensity we introduce both variables simultaneously and run the following regression by means of OLS:

$$\log (TFP)_i = \beta_0 + \beta_1 BackwardFDI_j + \beta_2 Exportshare_j + \beta X_i + \varepsilon_i \quad \textbf{(4.4)}$$

where $\log (TFP)_i$ is the natural logarithm of the total factor productivity of firm i, and X_i is a vector of other control variables, including firm characteristics like foreign ownership, size, age, skill ratio, productivity gap (measured by the productivity difference with the most productive firm in the sector and region), and the technological level of the sector. We estimate TFP by using a simple Cobb-Douglas function, controlling for labour, capital, raw materials and energy:

$$Y = AL^{\alpha} K^{\beta} M^{\gamma} E^{\delta} \quad \textbf{(4.5)}$$

Due to the cross-sectional nature of the data, we cannot control for the endogeneity of input choices in estimating total factor productivity, which is widely discussed in the productivity estimation literature. However, we are able to control for productivity differences at the sector level, since we estimate the TFP residual for each two-digit ISIC sector separately.

Following Newman et al. (2015), we also estimate a regression where we include both measures of indirect spillovers and of direct technology transfers through firm-level linkages, as well as their interaction term. Besides the endogeneity in input choice, a major concern for our productivity estimation is endogeneity due to simultaneity bias: foreign firms may choose to locate in regions and sectors where they can find more productive suppliers in upstream sectors. Newman et al. (2015) address this issue by exploiting the panel nature of their data and controlling for time-invariant unobserved heterogeneity at the firm level (thereby wiping out any sector effects). Our cross-sectional data does not

allow us to do the same, so we introduce instruments for industry-level backward FDI and export intensity, as well as for the measures of direct linkages (see Subsection 4.5.3).

4.5 ANALYSIS

To investigate differences in extent of vertical linkages with foreign firms between foreign and domestic suppliers in Vietnam, we perform a Propensity Score Matching Analysis. We use four different kinds of matching algorithms (kernel matching, nearest neighbour matching with one and two nearest neighbours, and radius matching) and choose the one that performs best in terms of bias reduction, matched and unmatched variance ratio and other post-estimation statistics displayed in Table 4.5. After choosing the matching algorithm, we compute bootstrapped standard errors of the outcome variable over 500 bootstraps. Our outcome variable is the average treatment effect (ATE). In every table we also show the number of observations off common support and regression coefficients of the explanatory variables used in the propensity score probit estimations.

4.5.1 Extent of Linkages

Table 4.5 shows the results from the PSM analysis for the extent of linkages. We treat foreign ownership as our treatment variable and compare the outcome variables between matched domestic and foreign firms. Columns 1 and 2 show the results from local suppliers. We find that among matched foreign and domestic suppliers, foreign firms have on average a higher absolute number of foreign buyers in Vietnam (ATE is equal to 8.76, meaning that on average foreign firms have 8.76 more foreign buyers than domestic firms with similar characteristics). This effect is significant. However, when the outcome variable includes the number of foreign buyers inside and outside Vietnam, the matched difference between foreign and domestic firms is not significant anymore. Thus, after controlling for firm characteristics, foreign ownership affects only the extent of linkages with foreign firms in the country. This confirms the stylized facts discussed in Section 4.3 about foreign firms operating within enclaves in the country. From the propensity score estimation regression, we see that age, exporter status, capital, and productivity are all firm characteristics that matter for the prediction of foreign ownership. We also introduce a measure of GVC participation, which we define as a dummy variable that takes a value of one if the firm both exports and imports, and zero otherwise. We find that being both an importer and an exporter is positively correlated with being foreign. In columns 3-5 we investigate whether foreign ownership leads to different input sourcing strategies, once we have controlled for a number of other relevant characteristics. Across all measures of outcome variables, we find that foreign firms develop significantly fewer linkages with local suppliers than their domestic counterparts. In this case a domestic counterpart would be a counterfactual domestic firm with (roughly) the same size, age, capital intensity and productivity as the foreign firm and therefore, with the same probability of being foreign. This is supportive of our earlier finding that foreign firms purchase most of their inputs in the form of imports. They also have a significantly lower absolute number and share of domestic suppliers. When the

outcome variable concerns the domestic subset of local suppliers, the differences between foreign and domestic buyers become even more significant at one per cent level of significance. Thus, the extent of linkages with domestic suppliers for foreign firms remains lower than that of domestic firms, even after controlling for the propensity of being foreign.

Table 4.5: Extent of linkages by ownership type of suppliers and buyers

Treatment variable	>10% foreign ownership	>10% foreign ownership	>10% foreign ownership	>10% foreign ownership	>10% foreign ownership
	Firms as suppliers		Firms as buyers		
	(1)	(2)	(3)	(4)	(5)
Outcome variable	No. of foreign buyers in Vietnam	No. of foreign buyers overall	No. of local suppliers in Vietnam	Share of domestic suppliers	Share of inputs by dom. suppliers
No. observations	607	894	965	943	659
Off common support	55	59	56	52	50
Unmatched difference	10.46	9.5692	-3.4948	-27.9067	-15.5812
ATE	6.6172 **	5.1956	-20.982**	-25.7173***	-13.0366***
S.E.	2.5835	3.3466	10.5753	2.5304	3.0602
Z-value	2.56	1.55	-1.98	-10.160	-4.260
P-value	0.01	0.121	0.047	0.000	0.000
Matching algorithm	Kernel matching	Kernel matching	Kernel matching	Nearest neighbour (2)	Kernel matching
Propensity score Probit regression explanatory variables					
Age	-.0588***	-.0600***	-.0602***	-.0592***	-.0542***
Size Medium	-.2236	-.2192	-0.1592	-.1701	-.1169
Size Large	-.1372	-.0703	-0.075	-.0897	-.0982
Exporter	.755***	.6333 ***	.8203***	.8156***	.665***
Log(capital)	.2013***	.1592***	.1652 ***	.1645***	.1988***
TFP	.2203**	.226***	.228***	.2144**	.1633*
GVC	.5911***	.6007***	.6055***	.6023***	.7745

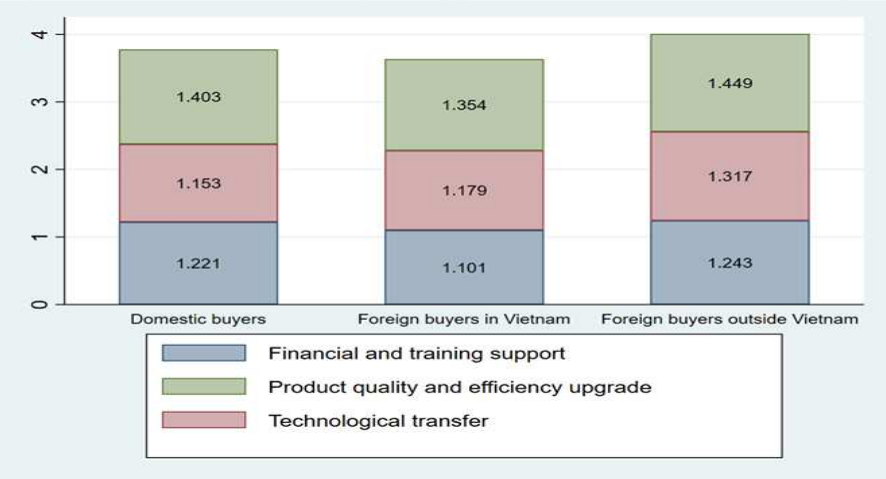
Notes: Results obtained using Propensity score matching analysis; *** p<0.01, ** p<0.05, * p<0.1

4.5.2 Intensity of Linkages

Next, we consider the *intensity* of linkages, by looking at the differences in the types and levels of support that local suppliers report receiving from different types of buyers, and that buyers report giving to local suppliers. Figure 4.3 shows that local suppliers report receiving on average most support from foreign buyers outside Vietnam and the least support from foreign buyers in Vietnam. For simplicity we have grouped the six types of support according to the areas they aim to improve. We find that across all types of buyers, most of the support is going toward product quality and efficiency upgrade. Thus, all buyers are first and foremost interested in offering support in the areas that would affect their inputs more directly. There are some differences among domestic and foreign buyers with respect to the other types of support they provide: whereas domestic buyers are reported to give more support in terms of

access to finance and employee training, foreign buyers (in Vietnam and abroad) offer more support in terms of technology transfer and joint product designs.

Figure 4.3: Intensity of linkages (support received by buyers), by type of support



Source: Authors' calculations based on data from VIS

This is in line with the stylized facts and anecdotal evidence that foreign firms are technologically superior, but also the fact that many foreign firms use Vietnam as an assembly point (hence, product design becomes an important feature of cooperation with suppliers).

Table 4.6 shows the same analysis as Figure 4.3, but from the perspective of firms providing support to their local suppliers. Interestingly, the level of support reported by buyers is consistently lower than the level of support reported by suppliers across all types of support. Thus, there are interactions between suppliers and buyers along the supply chain that are not perceived as support from those providing them but are perceived as such by the suppliers receiving them. This type of unintentional knowledge transfer is an example of knowledge spillovers from buyers to suppliers through direct linkages. This reinforces our argument that comparing perspectives of both suppliers and buyers is important, as these "knowledge spillovers" would not have come to light if we focused on the perspective of foreign firms acting as buyers only. In terms of types of support, reports from buyers are in line with those from suppliers: buyer firms report giving by far the most support in product quality and efficiency upgrade. This is followed by technology transfer, and financial support and employee training.

Table 4.6: Intensity of linkages (support given to suppliers), by type of support

	Overall Mean	Obs.	Mean Domestic	Obs.	Mean Foreign	Obs.	Difference (Std. error)
Product and quality upgrade to local suppliers	0.7015	1,491	0.765	638	0.654	853	0.111** (-0.0417)
Financial and training support to local suppliers	0.2716	1,491	0.312	638	0.242	853	0.0704* (-0.0309)
Technology transfer to local suppliers	0.3413	1,491	0.395	638	0.301	853	0.0937** (-0.0308)

Note: Scale of zero (no support) to two (support across both categories). *** p<0.01, ** p<0.05, * p<0.1

It could be that foreign buyers in Vietnam choose more productive firms that need less support, and the descriptive statistics above are only capturing this, while there is no inherent difference between foreign and domestic buyers. To ensure that the finding that local suppliers receive less support from foreign firms in Vietnam is robust to any sort of selection bias, we run a PSM analysis, where we match local firms based on their propensity to serve as suppliers to foreign firms. Among firm characteristics that might determine a local firm's status as supplier to foreign firms, we include age, size, exporter status, capital and GVC participation. Based on the analysis on extent of linkages, foreign ownership is an important determinant of linkages with foreign firms. Therefore, we include foreign ownership as an additional variable in the first stage Probit regression used for matching.

In columns 1 and 2 of Table 4.7 we estimate the effect that having any foreign buyers has on the support that local firms receive. We find that having at least one foreign buyer in the country does not lead to a significant difference in support. However, firms that have at least one foreign buyer overall receive more support than similar firms that only have domestic buyers. Thus, having linkages with FDI in the country may not lead to a premium in the intensity of linkages, but linkages with foreign buyers overall helps to bring in more support. The same findings apply when we compare firms with more foreign than domestic buyers in columns 3 and 4 of Table 4.7: Intensity of linkages from the perspective of suppliers and buyers. Through this treatment effect we aim to capture the orientation of the supplier, which can be supplying mainly to FDI in the country or be more export-oriented. Firms with more foreign buyers both inside and outside Vietnam report receiving more support than firms that only supply to domestic firms. Thus, it seems that in terms of support, foreign firms abroad are more supportive than domestic and foreign firms in Vietnam, even after controlling for the propensity of local firms to become their supplier in the first place.

Table 4.7: Intensity of linkages from the perspective of suppliers and buyers

Treatment variable	At least one foreign buyer in Vietnam	At least one foreign buyer overall	More foreign than domestic buyers	More foreign buyers overall	>10% foreign ownership
		Firms as suppliers			Firms as buyers
	(1)	(2)	(3)	(4)	(5)
Outcome variable	Support by the buyers	Support by the buyers	Support by the buyers	Support by the buyers	Support to local suppliers
No. observations	1,140	1,278	1,112	1,112	1,034
Off common support	0	144	3	3	11
Unmatched difference	0.5117	1.2543	-0.1112	0.2271	-0.1261
ATE	0.4579	.8027**	0.2255	.4478***	-0.1527
S.E.	1.2158	0.3746	0.1859	0.154	0.1260
Z-value	0.38	2.14	1.21	2.91	-1.21
P-value	0.706	0.032	0.225	0.004	0.226
Matching algorithm	Nearest Neighbour (1)	Nearest neighbour (2)	Kernel matching	Kernel matching	Kernel matching

Note: Results obtained using PSM analysis; Probit estimations regressors include age, size, foreign ownership, TFP, log(capital), GVC participation, estimates not reported. *** p<0.01, ** p<0.05, * p<0.1

Finally, column 5 of table 7 shows how buyers perceive the support they give to local suppliers. We find that conditional on a number of characteristics, foreign firms in Vietnam acting as buyers do not differ significantly from their domestic counterparts in terms of offered support. This is not very surprising considering our finding above that buyers perceive themselves as not providing much support, thereby possibly supressing the differences along the ownership dimension.

Thus, our analysis has shown that there are differences in the way that buyers and suppliers perceive the intensity of linkages they develop along the value chain. Moreover, foreign firms in Vietnam seem to develop fewer linkages with local firms (and especially with domestic firms) than domestic firms. They also seem to provide less support than foreign firms abroad. Next, we turn to the productivity analysis, to understand what our findings on differences in extent and intensity of linkages with FDI mean for the productivity of local suppliers.

4.5.3 Effect of Linkages on Local Firm Productivity

We start the productivity analysis by estimating the effect of backward FDI and of industry export intensity on the productivity of local firms by means of OLS. Following Newman et al. (2015), we also estimate these effects after controlling for the extent of linkages with foreign buyers and introducing an interaction term between the industry and firm-level measures. In columns 1 and 2 of Table 4.8 we show the results from the analysis with TFP as the dependent variable. Prior to controlling for direct linkages at the firm level, the results from the OLS analysis in column 1 do not reveal any significant effects from export intensity of the industry, while effects of Backward FDI are weakly significant and positive at the 10 per cent level. Hence, there is some indication of an effect of industry-level Backward FDI on productivity. In column 2, we add the share of foreign buyers in Vietnam and foreign buyers abroad as controls and introduce interaction terms between the industry-level and firm-level measures. A significant and positive interaction term between backward FDI and the share of foreign buyers in Vietnam would mean that for local firms with a higher share of foreign buyers, indirect spillovers from FDI in downstream sectors would be higher. However, neither the extent of direct linkages with foreign firms (both within and outside Vietnam), nor the interaction terms are significant. However, after controlling for direct linkages and the interaction terms, the effect of Backward FDI becomes larger and statistically significant. The effect of industry export intensity remains insignificant. Hence, based on the OLS results, we would conclude that there are positive and significant spillovers effects from foreign presence in downstream sectors, and these effects are neither affected, nor moderated by direct linkages with foreign firms in the country. Moreover, because there is an own effect of backward FDI on local firm productivity, we should not be able to use this as an instrument for linkages, as in Javorcik and Spatareanu (2009), because it would violate the exclusion restriction.

However, as we argued in the methodology section, we expect our estimate of the effect of backward FDI to be biased, due to simultaneity bias. Since we cannot rely on a long panel to alleviate the

Table 4.8: Effect of Backward FDI and Industry Export Intensity – OLS and IV estimation

VARIABLES	(1) TFP	(2) TFP	(3) TFP	(6) TFP
	OLS		IV – 2SLS	
Backward FDI_{jr}	0.113*	0.216**	0.251	-0.0203
	(0.0672)	(0.105)	(0.153)	(0.313)
Industry export $intensity_j$	0.105	0.0408	0.146	-0.484*
	(0.0699)	(0.110)	(0.157)	(0.290)
Share of foreign buyers in Vietnam		0.254		-0.533
		(0.254)		(0.751)
Share of buyers outside Vietnam		-0.0414		-0.428*
		(0.142)		(0.258)
Backward FDI_{jr}*Share of foreign buyers in Vietnam		-0.504		0.861
		(0.365)		(1.219)
Industry export $intensity_j$*Share of buyers abroad		0.0425		1.617*
		(0.373)		(0.939)
Foreign	0.0673*	0.0590	0.0453	0.0474
	(0.0363)	(0.0591)	(0.0398)	(0.0656)
Log(buyers)	0.0117	0.0192	0.0103	0.0221
	(0.0102)	(0.0163)	(0.0106)	(0.0183)
Skill ratio	0.00527***	0.00347**	0.00553***	0.00315*
	(0.00125)	(0.00173)	(0.00129)	(0.00174)
Productivity gap	0.00404**	0.00717***	0.00405*	0.00647***
	(0.00206)	(0.00244)	(0.00207)	(0.00246)
6 - 10 years	0.149***	0.173**	0.150***	0.213***
	(0.0539)	(0.0742)	(0.0542)	(0.0791)
11-20 years	0.118**	0.0941	0.119**	0.120
	(0.0569)	(0.0817)	(0.0570)	(0.0864)
20+ years	0.0857	0.0675	0.104	0.0906
	(0.0650)	(0.0883)	(0.0661)	(0.0940)
Medium	0.0939**	0.0418	0.0954**	0.0297
	(0.0433)	(0.0622)	(0.0435)	(0.0625)
Large	0.0438	-0.0181	0.0421	-0.0440
	(0.0403)	(0.0543)	(0.0405)	(0.0591)
Medium-tech manufacturing	0.0479	-0.0129	0.0724	0.0327
	(0.0482)	(0.0623)	(0.0590)	(0.0808)
Low-tech manufacturing	0.0909**	0.104*	0.118**	0.117
	(0.0387)	(0.0551)	(0.0512)	(0.0730)
Non-manufacturing	-0.0140	-0.186		
	(0.127)	(0.217)		
Constant	-0.476***	-0.453***	-0.565***	-0.247
	(0.0845)	(0.122)	(0.145)	(0.152)
Observations	1,156	552	1,142	546
R-squared	0.059	0.088	0.055	0.036

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

endogeneity issue, in columns 3 and 4 of Table 4.8 we introduce an IV estimation, where we instrument both industry-level backward FDI and export intensity with similar measures calculated for Indonesia in 2009 and the sector-level tariff rate in Vietnam.

To instrument backward FDI in Vietnam we follow Jordaan (2011a) and use the same measure of Backward FDI for the manufacturing sector in Indonesia in 2009. We use industry export share in Indonesia as an instrument for industry export share in Vietnam. To build the instruments for the industry-level variables of backward FDI and export share we use FDI and export data from the firm-level Indonesian Manufacturing Survey and the Indonesian Input-Output table for the year 2009. Both variables are constructed as analogues to the backward FDI and export measures for Vietnam.

We believe that our instruments fulfil both conditions of *relevance* and *exogeneity* (Wooldridge, 2013, p.528). By capturing the general tendency of some industries to become suppliers to industries with higher foreign concentration, the variable of backward FDI in Indonesia should be positively correlated with our measure of Backward FDI in Vietnam. As a country with similar inward foreign investment patterns as Vietnam, we believe that Indonesia provides a good setting for our instrument. At the same time, we argue that investment in Indonesia is not correlated with the outcome variable (i.e. productivity of local firms in Vietnam) other than through the endogenous regressor, because the choice of foreign firms locating in Indonesia should not be dependent on the productivity of Vietnamese firms. Thus, our instrument should also fulfil the exogeneity condition. We argue the validity of our instrument for the industry export share along the same lines.

We also introduce a third instrument, namely the average export tariff rate at the sector level in Vietnam in 2008. The data was collected from the World Bank's World Integrated Trade Solution (WITS), an online source of tariff data based on data and methodology from UNCTAD's Trade Analysis Information System (TRAINS). The tariff variable is measured as an ad-valorem Most Favoured Nation (MFN) tariff rate. It is easy to argue the relevance of this measure as an instrument for industry export share: higher tariffs make Vietnamese exports more expensive and should be negatively correlated to the industry export share. It is less straightforward to determine the direction of the effect of tariffs on backward FDI: on the one hand, foreign firms may decide to relocate to Vietnam and use local suppliers as imports from Vietnam are more expensive. This should lead to a positive correlation between tariffs and backward FDI. On the other hand, as foreign firms usually produce in Vietnam but sell their products on international markets, they may choose not to relocate to Vietnam, since higher tariffs would make their products less competitive in the global market. In this case, we would expect the correlation between tariff rates and backward FDI to be negative. Furthermore, tariff rates would not be affected by the productivity level of any particular local firm, so we believe this instrument to be exogenous. Thus, we re-estimate equation (3.4) above by using Two Stage Least Squares and instrumenting both backward FDI and industry export share.

Column 3 shows the results from the analysis without interaction terms, while column 4 includes measures of direct linkages and interactions of the instrumented regressors with the direct linkages variables. The instrumented backward FDI is no longer significant in either specification, and neither is its interaction with direct linkages to foreign firms in the country. Interestingly, the industry-level export intensity and the share of foreign buyers abroad are weakly associated with lower productivity, but their interaction is weakly positive. The negative correlation between productivity and export intensity at both the industry and the firm level could be explained by the nature of Vietnam's exports: the most export-intensive sectors are low-productivity, low value-added sectors. Hence, the negative association is not very surprising. The weakly positive interaction term, on the other hand, indicates that among these low productivity firms in low productivity sectors, firms with more linkages to foreign firms abroad have higher productivity.

Table 4.9: Effect of Backward FDI and industry export intensity – 2SLS, 1st stage regressions

	1st stage IV – No interactions		1st stage IV – With interactions	
	(1)	(2)	(3)	(4)
VARIABLES	Backward FDI	Export Share	Backward FDI	Export Share
Indonesian Backward FDI	1.127***	-0.231***	0.324	-0.299***
	(0.173)	(0.0657)	(0.211)	(0.0918)
Indonesian Export Intensity	-0.00244***	0.00910***	0.00261	0.0144***
	(0.000610)	(0.000429)	(0.00195)	(0.00174)
MFN Tariff rate	-0.00581***	-0.00400***	-0.00592***	-0.00258***
	(0.000900)	(0.000594)	(0.00125)	(0.000855)
Indo. BFDI#Share of For. buyers in Vietnam			2.278***	0.0299
			(0.719)	(0.284)
Indo. export intensity#Share of buyers abroad			-0.0110***	-0.00861***
			(0.00300)	(0.00230)
Share of foreign buyers in Vietnam			0.0443	0.00408
			(0.0732)	(0.0409)
Share of buyers abroad			0.179***	0.0853***
			(0.0551)	(0.0313)
Observations	1,142	1,142	546	546
F-test of excluded instruments	53.48	216.90	21.22	42.58
Underidentification test Chi-sq	149.76		31.698	
Weak identification test F-stat	39.56		6.797	
Weak-instrument-robust inference p-value	0.2496		0.1811	
Hansen J overidentification test p-value	0.144		0.1231	

Notes: Robust standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1

In Table 4.9 we show the results from the first stages of the 2SLS IV estimations of Table 4.8, and report the post-estimation statistics for instrument relevance, underidentification, weak identification and overidentification[36]. Since we include interactions of endogenous regressors in the specification of

[36] We only show the excluded instruments here. The estimates for the other exogenous variables that enter the first stage as additional instruments are available upon request.

column 4 in Table 4.8, we also introduce interactions of their instruments with the same interaction variables.

We find that both Backward FDI and industry export intensity in Indonesia are relevant instruments for the Vietnamese variables: they are positively and significantly correlated with the endogenous regressors, thus capturing the overall sectoral investment and export patterns in these countries. The tariff rate is also a relevant instrument for both instrumented variables, as it is significantly and negatively correlated to both. The effect of Backward FDI in Indonesia becomes insignificant once we introduce the instrumented interaction term, but the effect of the interaction term is positive and significant. Moreover, both first stages from both specifications pass the test of instrument relevance ($F>10$), as well as tests for weak instruments, underidentification and overidentification.

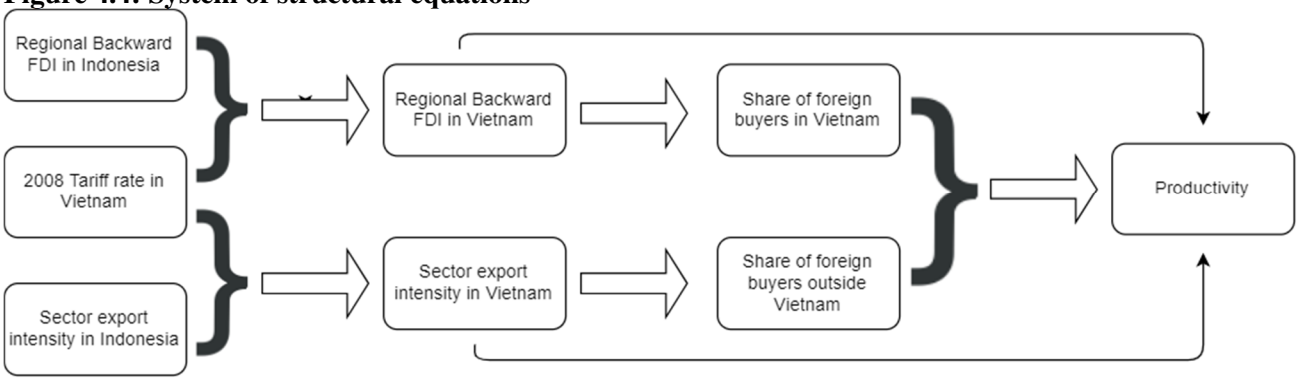
Thus, once we instrument for backward FDI, we find that it no longer has a significant effect on the productivity of local firms. Given the performance of our instruments in the first stage, the literature's concern with the endogeneity introduced by simultaneity bias in OLS estimations, especially in cross-sectional datasets, and the fact that the bias of the OLS estimates is in the direction that we would expect, we consider our findings from the 2SLS analysis to be more reliable.

Next, we want to estimate the direct effect of linkages to foreign firms in and outside Vietnam on the productivity of local suppliers. However, our measure of linkages may be suffering from the same endogeneity issue as the industry-level variables: foreign firms may choose to develop linkages with more productive suppliers or suppliers could self-select into supplying foreign firms, which would bias our estimates of the effect of linkages. To correct for this, Javorcik and Spatareanu (2009) introduce industry-level Backward FDI as an instrument for firm-level linkages with foreign buyers inside the country. They argue that the instrument is relevant, because the level of linkages to foreign firms of each local supplier should be positively correlated with the sector's level of backward FDI. This is to be expected, as firms in industries that supply more to foreign firms in downstream sectors have a higher chance of becoming suppliers to foreign firms. They also argue that each individual domestic supplier is too small to affect the industry level of backward FDI, which would make this an exogenous instrument. However, this argument only holds if industry-level backward FDI does not lead to productivity effects on local firms other than through their linkages. In other words, this instrument is only exogenous if we find that there are no indirect backward FDI spillovers. The same argument should hold for using industry export share as an instrument for linkages with foreign buyers outside Vietnam.

Hence, to estimate the effect of linkages on productivity, we follow a stepwise approach. We can only use industry-level FDI and export variables as instruments for firm-level linkages if the previous analysis shows that they do not have an independent effect on local firms' productivity. As our analysis in Table 4.8 showed that we no longer find an effect of industry-level measures on productivity of local firms

once we instrument them[37], we use the instrumented values of Backward FDI and industry export intensity as instruments for the firm-level measures of linkages. Figure 4.4: below depicts the mechanism through which FDI and exports could affect the productivity of local supplier firms. We first estimate this system of structural equations by means of 2SLS, following the argument by Lorentzen et al. (2008) that this estimation is valid as long as we can assume that "the total effect of [in our case, backward FDI and industry export share] is exhausted by the channel variables that we specified [in our case, firm-level linkages to foreign firms]" (Lorentzen et al., 2008, p. 97). However, as the error terms from our industry and firm-level variables may be correlated, there are efficiency gains to be made from using a Three Stage Least Squares regression instead. Thus, besides the 2SLS estimation, we also estimate a 3SLS regression, which allows us to use a system of structural equations to model the complexity of productivity spillovers through the linkages channel. According to Tavares and Wacziarg (2001)[38], who use 3SLS to estimate the effect of democracy on economic growth, the 3SLS estimator is an IV-GLS estimator that "achieves consistency through instrumentation and efficiency through appropriate weighting" (Tavares and Wacziarg, 2001, p. 1351).

Figure 4.4: System of structural equations



The results from the system of structural equations where instrumented endogenous regressors in one stage are used as instruments for endogenous regressors in the next stage in accordance with Figure 4.4, estimated by 2SLS and 3SLS, are depicted in Table 4.10. We find that once we instrument direct linkages, both the extent of linkages with foreign firms in the country and with foreign firms abroad are significant. However, the direction of the effect is the opposite: while having a higher share of foreign buyers abroad is negatively correlated to local firm productivity, having a higher share of foreign buyers in Vietnam increases the productivity of domestic firms. This finding holds across both 2SLS and 3SLS

[37] Industry export intensity is only weakly significant at 10%.
[38] They lay out an exhaustive system of structural equations modelling the different channels through which democracy affects growth, including physical and human capital accumulation, income inequality, government size and trade openness. The assumption is that these channels fully capture the effect of the exogenous variable (democracy) on growth.

estimations. However, as 3SLS allows for correlation of error terms across equations, this increases its efficiency, so the findings from the 3SLS analysis have more statistical power across the board.

Columns 2-5 and 7-10 show the results from the other stages estimated simultaneously. The correlations among the endogenous regressors and their instruments for that equation are all significant and in the directions that we would expect. So, higher backward FDI and higher industry export intensity in Indonesia are positively correlated with backward FDI and industry export intensity in Vietnam, while higher tariff rates are negatively associated with both industry-level measures. These measures, in turn, serve as instruments for the firm-level linkages, following the argumentation in the previous section that firms in sectors that supply sectors with higher foreign presence would be expected to have a higher share of foreign buyers in the country. Likewise, firms in more export-intensive sectors would be expected to have a higher share of buyers abroad. Both expectations are borne out in our estimations. The instruments are relevant and strong (F-statistic for each regression is higher than 10). Besides the endogenous regressors, we include a number of exogenous control variables that serve as additional instruments in each regression. We report the first-stage estimates in Table 4.11 (the first stages are the same for both 2SLS and 3SLS estimations).

The results in Table 4.10 are obtained by using the reg3 command in Stata, which assumes that error terms are homoskedastic, and does not allow for heteroskedasticity-robust standard errors. After running the 2SLS and 3SLS estimations, we perform heteroskedasticity tests on the specific equations and on the overall system of equations. We find that although only some of the individual equations have heteroskedastic error terms, the overall system also suffers from heteroskedasticity. To correct for this, we perform 1000 bootstraps of the 2SLS and 3SLS estimations and obtain bootstrapped standard errors. The results from the heteroskedasticity tests and the bootstrapped estimations are shown in Appendix A. Although the results are less significant, the findings from the non-heteroskedasticity robust analysis still hold.

The results from the 2SLS and 3SLS analysis offer important insights into the differences between exporting firms and firms that supply to foreign firms in the country. The same argument for the findings with the 2SLS analysis in Table 4.8 could hold for the interpretation of the estimated negative effect associated with the extent of linkages to foreign buyers abroad: firms that export to foreign buyers abroad could be less productive firms performing assembly tasks in low productivity sectors. This argument would be in line with our previous finding from the PSM analysis on linkage quality, where we found that local suppliers reported receiving significantly more support from foreign firms abroad.

Table 4.10: 2SLS and 3SLS estimations for system of structural equations

	2SLS					3SLS				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
VARIABLES	TFP	Share of foreign buyers in Vietnam	Share of buyers abroad	Backward FDI	Industry export intensity	TFP	Share of foreign buyers in Vietnam	Share of buyers abroad	Backward FDI	Industry export intensity
Share of foreign buyers in Vietnam	0.536**					0.865***				
	(0.240)					(0.233)				
Share of buyers abroad	-0.268**					-0.437***				
	(0.126)					(0.122)				
Backward FDI		0.619***					0.841***			
		(0.0930)					(0.0878)			
Industry export intensity			0.541***					0.704***		
			(0.131)					(0.126)		
Indonesian BFDI				0.383***					0.224*	
				(0.127)					(0.121)	
MFN tariff rate				-0.00621***	-0.00587***				-0.00504***	-0.00522***
				(0.00108)	(0.000713)				(0.00104)	(0.000699)
Indonesian export intensity					0.0102***					0.0105***
					(0.000923)					(0.000909)
Constant	-0.0542	-0.109**	0.134***	0.541***	0.252***	-0.0704	-0.216***	0.0929***	0.537***	0.239***
	(0.0481)	(0.0460)	(0.0361)	(0.0233)	(0.0150)	(0.0470)	(0.0435)	(0.0352)	(0.0225)	(0.0147)
Observations	546	546	546	546	546	546	546	546	546	546
"R-squared"	-0.070	-0.032	-0.024	0.076	0.248	-0.209	-0.242	-0.065	0.071	0.247
F-stat	3.2	44.22	17.19	22.44	89.75	9.02	91.69	31.03	14.08	88.83
P-value	0.0409	0	0	0	0	0.0001	0	0	0	0

Note: Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1

However, the same does not hold for domestic firms selling to foreign firms in Vietnam. It could be that compared to firms with higher shares of foreign buyers abroad, these firms are more productive. A more causal interpretation of these results could relate to the effect that the different markets that these firms operate in have on their productivity. Domestic firms selling to foreign firms in the country are competing with other domestic firms or imports. Hence, they may not face as much competition. Firms selling to buyers abroad are competing on the global market, and therefore may suffer productivity losses due to competition with more productive firms in this market. Normally, firms suffering productivity losses would be driven out of the market and only the more productive firms would continue to export. However, we are not able to see if this is the case, as identifying productivity development and exiting patterns over time would require modelling a dynamic model, which our cross-sectional dataset does not allow for.

Hence, based on our findings we can conclude that if there are positive productivity effects from linkages with buyers abroad, these are still not large enough to dominate the selection effect, the competition effect or a combination of the two. On the other hand, once we control for endogeneity issues, we find that local firms with more linkages to foreign buyers in the country have higher total factor productivity. These findings hold even after we control for foreign ownership. Columns 2 and 3 of Table 4.11 show that while foreign ownership is positively correlated with a higher share of foreign buyers both in and outside Vietnam, it does not have a significant effect on total factor productivity, once we have controlled for extent of linkages and a number of other firm characteristics (column 1 of Table 4.11). Combined with our findings from the PSM analysis, these findings have important implications for our understanding of spillovers from FDI and learning from exporting: most productivity benefits from FDI are only materialised through linkages, whereas indirect effects from backward FDI or export intensity of the sector are not significant once we account for endogeneity issues.

4.5 Conclusions

This paper looked at the extent and intensity of vertical linkages that local firms in Vietnam develop with domestic firms, foreign firms in Vietnam and foreign firms abroad in downstream sectors. We use data from a unique dataset collected by UNIDO in 2011 by surveying foreign and domestic firms in the main economic regions of Vietnam. The rich amount of information provided by the survey on vertical linkages allows us to identify differences between different types of firms and the linkages that they develop with local suppliers.

We use propensity score matching analysis to determine if there are indeed differences between the linkages that foreign and domestic firms develop, once we control for a number of characteristics that could be driving these differences otherwise. We find that after controlling for the propensity of being foreign, foreign local suppliers still have a higher number of foreign buyers than domestic firms with

similar observed characteristics. Moreover, local firms that sell to foreign buyers overall receive more support than similar firms that serve the domestic market alone. When we consider the perceptions of firms that act as buyers, most of these findings are supported. However, there is a discrepancy in the level of support that suppliers and buyers report receiving and giving, hinting at a potential for unintentional knowledge transfers, i.e. knowledge spillovers. Thus, this analysis reveals that the potential of knowledge-intensive linkages with foreign firms is possible, but foreign firms need to develop more linkages with domestic firms.

Table 4.11: First stage regressions of 2SLS and 3SLS estimations of structural equations

	TFP	Share of foreign buyers in Vietnam	Share of buyers abroad	Backward FDI	Industry Export intensity
	(1)	(2)	(3)	(4)	(5)
MFN tariff rate	0.0010518	0.0004784	-0.0009741	-0.0066617***	-0.0030063***
	(0.0027696)	(0.0011521)	(0.0013633)	(0.001194)	(0.0007813)
Indonesian export intensity	0.0014541	0.0014438	0.0038306**	-0.0012987	0.0106429***
	(0.0033179)	(0.0013802)	(0.0016332)	(0.0014304)	(0.000936)
Indonesian BFDI	0.4523427	0.0451063	-0.0603482	0.589299***	-0.2916086***
	(0.3067442)	(0.1275989)	(0.1509889)	(0.1322428)	(0.0865341)
Log(buyers)	0.0244242	0.0076579	-0.0931337***	0.0158591**	-0.0112002**
	(0.0162589)	(0.0067633)	(0.0080031)	(0.0070095)	(0.0045867)
Skill ratio	0.0038616**	-0.0023182***	-0.0024624***	-0.0013025*	-0.0010794**
	(0.0017848)	(0.0007424)	(0.0008785)	(0.0007695)	(0.0005035)
Productivity gap	0.0069779***	0.0003962	-0.0010235	-0.0000323	-0.0002306
	(0.0013658)	(0.0005682)	(0.0006723)	(0.0005888)	(0.0003853)
6-10 years	0.1826641**	0.0595178*	-0.0478251	0.0057356	-0.0169127
	(0.0744607)	(0.030974)	(0.0366518)	(0.0321013)	(0.0210057)
11-20 years	0.0855498	-0.0319589	-0.0210141	-0.0489291	-0.0327469
	(0.0777069)	(0.0323244)	(0.0382497)	(0.0335008)	(0.0219215)
21+ years	0.0486557	-0.0107668	-0.0523257	-0.0683086	-0.0147178
	(0.0963431)	(0.0400766)	(0.047423)	(0.0415352)	(0.0271789)
Medium	0.0372522	-0.0499571*	0.01415	-0.0436373	-0.0135032
	(0.0658332)	(0.0273852)	(0.0324051)	(0.0283819)	(0.0185719)
Large	-0.0195517	-0.0491942**	0.105669***	-0.0056418	0.0179529
	(0.0572534)	(0.0238162)	(0.0281819)	(0.024683)	(0.0161515)
Medium-tech	0.005372	0.0340231	-0.044782	-0.0544688*	-0.0790801***
	(0.0664013)	(0.0276215)	(0.0326847)	(0.0286268)	(0.0187321)
Low-tech	0.1003126	-0.0025793	0.0492568	0.0322225	-0.1715244***
	(0.0687836)	(0.0286125)	(0.0338574)	(0.0296538)	(0.0194042)
Foreign	0.0759402	0.1928318***	0.1417996***	0.1533375***	-0.007356
	(0.0535387)	(0.0222709)	(0.0263534)	(0.0230815)	(0.0151035)
_cons	-0.4586811***	0.0946619*	0.5042546***	0.4671605***	0.4050073***
	(0.1213573)	(0.050482)	(0.0597358)	(0.0523193)	(0.0342355)
Observations	546	546	546	546	546
R-squared	0.0855	0.2202	0.422	0.2075	0.3678
F-stat	3.55	10.71	27.69	9.93	22.07

Note: Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1

We also analyse the effect that the extent of linkages with foreign firms has on the productivity of local suppliers. By introducing both direct linkages and indirect spillover effects at the sector level we are able to firstly answer the question of whether productivity benefits from FDI in downstream sectors is a result of knowledge transfers from foreign buyers to their local suppliers through their linkages, or a true "spillover" effect to all firms in sectors that supply to sectors with higher FDI presence. We use instrumental variables for both firm-level linkages and industry-level measures of backward FDI and export intensity to correct for simultaneity and selection bias and find that results from OLS analysis are indeed biased. After correcting for endogeneity, we find that having a higher share of foreign buyers in Vietnam affects the productivity level of local suppliers positively, even after controlling for a number of other variables. On the other hand, linkages with foreign firms outside Vietnam are negatively correlated with productivity, while industry-level measures do not have any significant effect.

These findings, paired with the findings from our PSM analysis emphasize the importance of providing the right conditions to develop linkages with FDI in the country: after correcting for endogeneity, there is potential for a productivity increase for domestic firms, as long as they are able to increase the extent of linkages with foreign firms in downstream sectors in Vietnam. For this, linkages between domestic and foreign firms need to be encouraged further. Similar to the findings from Chapter 2 on Indonesia, this suggests that Vietnam should work on supplier development programmes to facilitate linkages between FDI buyers in Vietnam and domestic suppliers. This is important because as the findings of our analysis show, such linkages create positive productivity spillovers.

Our study has several limitations. The main limitation is the cross-sectional nature of the data. Even after using instrumental variables to correct for the endogeneity of the extent of linkages, we cannot account for dynamic processes including self-selecting into exporting and firms exiting the market. Moreover, we cannot control for the endogeneity in input choice, which could also bias our estimation of productivity. Another issue that arises from the nature of our data is that while it provides excellent information on the linkages with foreign firms, it also overestimates the presence of foreign firms in the population of firms in Vietnam. Instead, it is necessary to provide a measure of FDI presence representative of each industry's output or employment share provided by FDI. These issues highlight the necessity of reliable data that can encompass the qualitative richness of survey information within a longitudinal, representative sample of firms. Therefore, the continuation of such surveys over a longer period and their extension to cover more countries (especially developing countries) is of utmost importance for the advancement of applied research on inclusive and sustainable industrial development.

Chapter 5 MOVE ON UP(STREAM)

Firm Heterogeneity, Labour Market Restrictions and FDI Spillovers in Moldova[^]

5.1 INTRODUCTION

Many developing countries actively encourage inward foreign direct investment (FDI) to promote economic growth through productivity spillovers from foreign to domestic firms. Although a large body of research has focused on estimating these spillover effects, empirical evidence is mixed. Starting with the seminal work of Javorcik (2004), most studies find that domestic firms supplying to sectors with high FDI presence (backward FDI) benefit from positive productivity spillovers. There is less conclusive evidence on spillovers within the same sector (horizontal spillovers, see for example Aitken and Harrison, 1999), or from upstream sectors in the supply chain (forward FDI, see for example Newman et al. (2015)). With theoretical contributions on the importance of firm heterogeneity (Melitz, 2003) and better data availability at the firm level, empirical studies in the last two decades have made significant contributions to the literature on the determinants of FDI spillovers. These determinants vary from firm characteristics (Damijan et al., 2013), to institutional differences in host countries (Gorodnichenko et al., 2014), to differences in estimation methods, variable measurements and even publication bias.[39]

While our understanding of the determinants has deepened, it is more difficult to identify the workings of the channels through which FDI spillovers can materialise. The literature distinguishes between four possible channels for the occurrence of spillovers (Blomström and Kokko, 1998; Görg and Greenaway, 2004): demonstration effects, where domestic firms imitate and learn from foreign firms; competition effects, where domestic firms become more productive to compete with foreign firms; inter-firm linkages, where foreign firms transfer knowledge to domestic firms along the supply chain; and labour mobility, where workers in foreign firms bring their knowledge to domestic firms. The paucity of data usually makes it difficult to identify the workings of these channels empirically. In this study, we make use of a novel dataset of Moldovan firms to shed light on one of these channels, namely labour mobility. Identifying labour movements can be challenging for studies on developing countries as it requires matched firm and employee data, which is often only collected or made available in more developed countries. We circumvent this issue by combining firm-level administrative panel data on the universe of firms in Moldova with labour market conditions from an annual survey on the Cost of Doing Business

[^] This chapter is based on a working paper with Shawn W. Tan (The World Bank)

[39] See meta-studies by Havranek and Irsova (2013), and Görg and Greenaway (2004) for a complete overview.

in Moldova for the years 2005-2014. Thus, we exploit variations over time, sectors and regions in firms' evaluations of labour market restrictions to identify the effect of labour mobility on productivity spillovers from FDI.

Besides providing a new way to investigate the labour mobility channel without using matched employer-employee data, our identification strategy also helps to distinguish between inter- and intra-industry spillovers that may be influenced by the labour market. We provide a rationale for the occurrence of backward FDI spillovers through the labour market, which incorporates inter-firm linkages, especially with firms that supply foreign firms. We argue that under less restrictive labour market conditions, backward FDI spillovers are likely to materialise as a result of workers moving from foreign to domestic firms in supplying sectors, or by establishing new firms that may act as suppliers to foreign firms. However, for this to be the case, foreign firms need to be embedded and have linkages to the local market. Through our empirical analysis, we identify which firm characteristics are important for the development of these linkages and in turn, how they affect FDI spillovers through the labour market. Our analysis is further supported by insights from interviews we conducted with business associations representing foreign and domestic firms in Moldova. The main findings from our interviews are that (i) foreign firms commonly only start purchasing inputs from domestic firms after a few years of establishment, (ii) domestic suppliers tend to be large-sized firms that can provide the required quality and are able to meet the relatively large scale of demand for inputs that foreign firms have, and (iii) young and small domestic firms outside the capital face higher barriers to develop linkages with foreign firms. We test the first two findings and control for regional differences in our analysis to control for the third.

Our baseline estimation results reconfirm the existence of backward FDI spillovers throughout all specifications, but we find no significant effects on the productivity of domestic firms from horizontal or forward FDI. These findings are in line with other research on transition economies (Javorcik, 2004; Gorodnichenko et al., 2014). However, insights from the qualitative interviews and our heterogeneity estimations show that firm characteristics are important. FDI spillovers differ by size, age and productivity of domestic firms. Moreover, foreign firm characteristics are just as important for the occurrence of spillovers. We find that benefits to domestic firms in upstream sectors are positive for both fully foreign-owned FDI and joint ventures, but are larger for the former. However, joint ventures need less time in the market for positive spillovers in upstream sectors to materialise, while fully foreign -owned firms only lead to significant backward FDI spillovers when they are older. This is in line with the idea that fully foreign-owned firms may need more time compared to joint ventures to become embedded in the local economy and develop linkages with suppliers. We also find that labour market conditions affect FDI spillovers, as backward FDI effects are generally higher in sectors and regions that have more flexible labour markets. Combining the interaction between labour market conditions

and FDI presence with firm characteristics reveals that these effects are heterogeneous for different segments of the population of Moldovan firms.

This chapter contributes to the literature in three ways. First, we add to the small body of research that provides evidence of FDI spillovers through the labour mobility channel and we distinguish between different types of FDI spillovers through this channel. Some studies use employer-employee data to examine the productivity spillovers when workers move from foreign to domestic firms (see for example, Görg and Strobl, 2005; Poole, 2012; Balsvik, 2010). Few studies examine how subnational institutional differences affect FDI spillovers (Gorodnichenko et al., 2014; Xiao and Park, 2018). We follow the Rajan-Zingales (1998) method by interacting the labour market conditions with FDI spillover variables to identify spillovers through the labour mobility channel. Moreover, our estimation strategy allows us to do so without having to rely on detailed matched employer-employee data previously used to investigate labour mobility as a channel for spillovers from FDI. This provides an interesting avenue for further research as there are other surveys in developing countries that capture a country's business environment, institutional framework and labour market conditions (for example, the World Bank's subnational Doing Business surveys and Enterprise Surveys).

Our second contribution is the identification of firm characteristics that lead to different FDI spillovers. Existing literature has shown the importance of domestic firm characteristics when estimating FDI spillovers (see for example, Aitken and Harrison, 1999; Girma, 2005). We contribute to this strand of literature by considering firm heterogeneity in the context of a small, developing country like Moldova. We extend the literature by considering firm heterogeneity of foreign firms by introducing foreign firm age and type of foreign ownership in our FDI variables. This analysis helps us to identify which foreign and domestic firms are more likely to develop linkages that lead to spillovers. We then incorporate firm characteristics into our investigation of the labour mobility channel and provide evidence that different segments of the firm population react differently to the presence of FDI under certain labour market conditions. These results could be helpful in designing more specific and targeted policy recommendations.

Finally, to our knowledge, this is the first study examining FDI spillovers in Moldova. We use new firm-level administrative data and combine it with survey data on labour market conditions, a combination that has not been explored previously in the literature on FDI spillovers. As one of the poorest countries in Europe, the strong emphasis on FDI and exports by the government and the growing presence of foreign firms over the period (comprising ten per cent of all firms annually) makes our findings particularly relevant for policymakers in Moldova. Moreover, as a small, post-transition country heavily dependent on trade and investment, Moldova provides an interesting setting to study FDI spillovers with potentially important implications for the effect of labour markets and firm characteristics on FDI spillovers in similar developing countries.

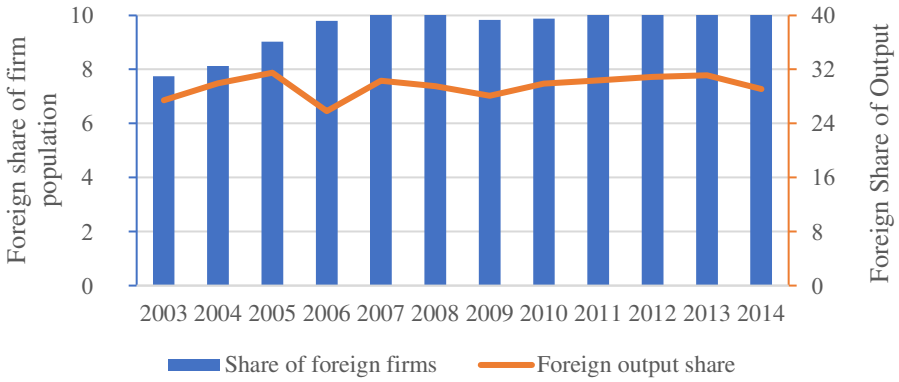
The rest of the paper is structured as follows: Section 5.2 offers insights on FDI, labour markets and their interactions in Moldova, based on data analysis and qualitative interviews in the country. Section 5.3 briefly reviews existing literature on firm heterogeneity and the labour mobility channel, and provides the conceptual framework for our empirical analysis. Section 5.4 describes the data and estimation strategy. Section 5.5 discusses results, and Section 5.6 concludes.

5.2 FDI IN MOLDOVA

There is little research on FDI and its impact in Moldova, except for country reports by international organisations like the World Bank and UNCTAD. In spite of this, Moldova presents an interesting case for the study of FDI spillovers due to its history, geography and the large presence of FDI in its economy. Moldova is a low-income developing country and is the poorest country in Europe. In the last decade, the economy has improved, as the growth rate has averaged five per cent and the poverty rate has more than halved between 2007 and 2014 (Merotto et al., 2016). The economy has undergone a large transition in the last three decades. The post-Soviet Union transition period was associated with a massive loss in productivity and production capacity, especially in the manufacturing sector, and very high rates of emigration (UNCTAD, 2013). Moldova is a landlocked country, situated between Romania and Ukraine, with few natural resources and a small population (about three million). It is a small, open economy that relies heavily on imports and foreign investment.

The Moldovan government has been receptive to foreign firms and has highlighted FDI attraction as one of the main avenues for the development of the economy and private sector. Harmonization of tax and customs policy with the EU framework has introduced reforms that aim to improve the investment and business climate. Moreover, to attract FDI the government has introduced tax incentives, created seven Free Economic Zones and developed Industrial Parks with preferential terms for both foreign and domestic firms operating in them (PwC, 2016). Foreign firms are attracted to the low wages, and the educated and bilingual (Romanian and Russian speaking) labour force. While FDI inflows may be generally low compared to similar countries in the region (National Bank of Moldova, 2015), Moldova experienced an increasing trend in FDI since the 2000s, following several large privatisation projects in the energy and telecommunication sectors, and some greenfield investment in manufacturing (UNCTAD, 2013). The strong focus on FDI attraction, combined with a small economy, has resulted in a large presence of foreign investment in the country. Figure 5.1 shows that foreign firms make up about ten per cent of the total firm population and about 30 per cent of total output.

Figure 5.1: Foreign firms and foreign output share, 2003-2014



Source: Authors' elaborations with data from the National Bureau of Statistics.
Note: Calculations based on the sample of firms from manufacturing and services sectors (NACE Rev.1 sectors 15-74). Agriculture, mining and public service sectors are excluded. Shares in percentages.

Foreign companies can establish in Moldova as fully foreign-owned, or as joint ventures (JVs). The definition of a JV according to the Moldovan legislation includes any enterprise whose capital comprises both foreign and national investment (i.e. investment made by a Moldovan individual or legal entity). In our analysis, we are able to distinguish between fully foreign-owned companies and JVs, but our data does not contain information on the share of foreign equity in the company. As Figure 5.2 shows, the shares of fully foreign-owned and joint venture enterprises in Moldova are very similar, around 4.4 per cent and 4.5 per cent of the entire firm population respectively. Foreign investments are mainly focused in business services, food and non-food manufacturing, and energy resources. Fully foreign-owned firms are concentrated in the financial and business service sectors, while JVs are more prevalent in manufacturing industries.

Figure 5.2: Industry composition by type of foreign ownership

Source: Authors' elaboration based on data from the National Bureau of Statistics.
Notes: Sector shares calculated by taking the average over time of the sector's output as share of total output in that year (manufacturing and services sectors, NACE Rev.1 sectors 15-74). Shares in percentages.

On average, foreign firms in Moldova are larger, more capital intensive and generate more sales revenues than domestic firms. They are also more productive, as measured by output per worker (Table

5.1). These differences between foreign and domestic firms, as well the rising share of FDI, indicate that there is potential for knowledge and productivity spillovers. However, for these spillovers to materialise, foreign firms need to be embedded in the local economy and domestic producers need to be exposed to their presence through any or all of the channels described in Section 5.3 below.

Table 5.1: Domestic vs. Foreign firm characteristics

	Domestic firms			Foreign firms		
Variable	Observations	Mean	Std. Dev.	Observations	Mean	Std. Dev.
Labour	383,693	10	113	37,378	19	84
Log(sales)	299,577	12.435	3.691	22,731	13.058	4.567
Log(capital)	253,177	10.683	3.868	22,853	11.829	4.147
Log(output/worker)	299,577	11.076	3.219	22,731	11.288	3.881

Source: Authors' calculations using data from the National Bureau of Statistics

In order to support our quantitative analysis, we conducted qualitative interviews with the private sector in Chisinau, Moldova in May 2019. We spoke with the American Chamber of Commerce, the Foreign Investors Association, the European Business Association, and the Alliance of Small Enterprises from Moldova, which collectively represent over 300 foreign and domestic firms in Moldova. From these interviews, we learned that some foreign firms are not embedded in the local economy, as they often lack supplier linkages with domestic firms. Some foreign firms cannot find local suppliers for their main inputs so they may encourage their suppliers to establish a foreign branch in Moldova to serve them. Even when local suppliers are available, some foreign firms prefer to source strategic inputs from either their own suppliers abroad, or other foreign firms in the country because Moldovan firms often do not meet the necessary quality requirements, do not comply with international standards, or are not reliable.

We find that firm characteristics of domestic and foreign firms can determine the extent of their linkages, and in turn spillovers from FDI. Size and absorptive capacity are the main domestic firm characteristics that can explain if a domestic firm supplies foreign firms. From our interviews, we learned that domestic suppliers are often too small and lack administrative and operational capabilities, which makes investing in product quality upgrades and applying for the necessary standard certifications prohibitively costly. In addition, the size and age of foreign firms also play a determining role in establishing linkages. Large foreign firms, especially in the automotive sector, prefer to rely on their exclusive suppliers abroad, or to relocate their foreign suppliers in Moldova instead of sourcing from domestic firms. Smaller foreign firms source a larger part of their inputs locally. Foreign firms are

also more likely to use local suppliers if they have been established or operating in Moldova for a longer period (such as three to five years). One of the reasons put forward by the interviewees for this change of sourcing strategy is that older foreign firms may switch to employing local managers that are more familiar with potential local supplier markets. Hence, we expect both firm characteristics and the labour market channel to be important factors in determining spillovers from FDI and will explore them in the empirical analysis.

Finally, both foreign and domestic firms in Moldova reported that there is competition for good workers. While foreign firms are regarded as better employers because they offer higher salaries, more training and other benefits and opportunities for workers, domestic firms have a competitive edge due to the informal market. Foreign employers are less flexible in terms of offering informal contracts or operating in the shadow economy, and therefore are at a disadvantage relative to their domestic competitors in the labour market. On the other hand, their size and capabilities make it easier for foreign firms to adopt new reforms and changes in the legal framework (e.g. complying with minimum salary requirements and dealing with complex accounting procedures). Anecdotal evidence from our interviews suggests that especially smaller firms in lower-technology sectors (that overwhelmingly tend to be domestic) have a harder time interpreting and implementing these changes. Thus, even though labour market rules are the same for foreign and domestic firms, labour market restrictions could still vary depending on firms' capabilities to adopt these rules, and how much room for informality there is across sectors and regions in Moldova. We make use of these variations to investigate how labour market conditions affect labour mobility, and consequently, FDI spillovers.

5.3 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

5.3.1 FDI spillovers and firm heterogeneity

The literature on FDI spillovers on the productivity of domestic firms in host countries has developed rapidly in the last few decades, mostly as a result of better data availability. With the exception of a few studies that provide a theoretical framework and model the spillover channels,[40] most studies have approached the question empirically. There is a large degree of heterogeneity in the results, but in general, the most robust finding is that of positive and significant inter-industry spillovers. More specifically, starting with Javorcik (2004), who estimates spillovers from FDI in downstream industries (backward FDI), the consensus in the literature is that domestic firms supplying to foreign entities benefit from these supplier linkages (Blalock and Gertler, 2008; Javorcik and Spatareanu, 2008). On

[40] Early theoretical contributions include Rodriguez-Clare (1996), who provides a model exploring the conditions under which linkages from multinationals benefit the host economy. He finds that distance to headquarters and multinationals' intensity of intermediate input lead to positive spillover effects. Glass and Saggi also model technology transfers from multinationals, either through imitation and innovation channels (1998) or through labour mobility (2002).

the other hand, evidence of spillovers from foreign firms in the same industry (horizontal FDI) is more mixed, with studies finding positive (Haskel et al., 2007; Keller and Yeaple, 2009), insignificant (Javorcik, 2004; Blalock and Gertler, 2008; Girma et al., 2001), or even negative effects (Aitken and Harrison, 1999; Bwalya, 2006).[41] Likewise, there is scarce evidence of spillovers from foreign firms that act as suppliers to domestic firms (forward FDI).

The divergence of empirical findings, as well as the growing literature on the importance of firm heterogeneity, led to a new wave of studies focusing on differential spillover effects as a result of firm characteristics. Among the main characteristics that act as determinants of FDI spillovers are domestic firm size, age, and absorptive capacity. At the same time, foreign firm characteristics, such as country of origin, type of investment and reasons to invest are also shown to have an effect on spillovers. In light of these findings, omitting the varying effect of firm characteristics on FDI spillovers risks ignoring a large degree of heterogeneity that can have implications for FDI policy. Meyer and Sinani (2009) argue that how firm characteristics affect FDI spillovers may differ based on the country setting and level of economic development. Being a low-income, post-transition country with a large degree of foreign penetration, Moldova provides an interesting setting to study the effects of firm heterogeneity on FDI spillovers.

The literature also examined how FDI spillovers can vary by domestic firm size, age, and technology gap.[42] So far, results on the effect of firm size have been inconclusive: Aitken and Harrison (1999) look at firm size for Venezuela and find that the negative crowding out effects of foreign competition are only significant for small firms, while Girma and Wakelin (2001) conclude that in the UK small-sized firms are the only ones to benefit from FDI presence. The divergence in findings could be due to the above-mentioned differences in host country settings. The conflicting theoretical predictions on the effect of technological gap and absorptive capacity of domestic firms have led to a large, but ultimately inconclusive body of empirical evidence as well: a large technological gap could reflect a greater potential for spillovers, but if the gap is too large the domestic firm could lack the necessary technological absorptive capacity to benefit from foreign presence (e.g. through demonstration effects). Thus, while some studies find that a larger gap leads to larger spillover effects (Castellani and Zanfei, 2003; Jordaan, 2017), others find the opposite. Girma (2005) estimates an endogenous threshold regression and finds that the relationship between technology gap and spillovers is non-linear and in fact follows an inverse U-shaped curve. Surprisingly, there is little empirical evidence on the effect of

[41] For extensive literature reviews of theoretical and empirical findings of FDI spillovers, see Görg and Greenaway (2004), Smeets (2008), Meyer and Sinani (2009), Harrison and Rodriguez-Clare (2010), Havranek and Irsova (2011), and Irsova and Havranek (2013).

[42] In a study spanning ten transition countries, Damijan et al. (2013) conclude that although controlling for domestic firm heterogeneity is important, only some general patterns for domestic firm characteristics can be drawn and there is a lot of variation across countries.

domestic firm age on spillovers. While some studies include age as an additional control in productivity regressions (Kathuria, 2010), the interaction between domestic firm age and FDI presence has been left largely unexplored in empirical literature. However, as age may be another determining factor of domestic firms' absorptive capacity, we would expect it to have a moderating effect on spillovers from FDI.

Foreign firm characteristics are equally important determinants of FDI spillovers. Among the characteristics highlighted in the literature are foreign firm age, country of origin, motives for investment, and degree of foreign ownership. We focus on age and degree of foreign ownership based on the argument that they both affect foreign firms' embeddedness in local markets, and as such, their linkages with local firms. The literature has used foreign firm age as a proxy for embeddedness. Saliola and Zanfei (2009) hypothesize that more mature firms develop more knowledge-intensive value chain linkages, but do not find any significant evidence supporting this hypothesis in Thailand. Scott-Kennel (2007) investigates the same for New Zealand and finds supportive evidence for this hypothesis. From our interviews with the private sector in Moldova, the time foreign firms had spent in the country affected their sourcing strategies. Thus, we expect older FDI to be more embedded in the local economy, and therefore generate more productivity spillovers for domestic firms, especially those supplying foreign firms.

The expectation for the effect of type of foreign ownership however, is less straightforward. Previous empirical literature has found evidence of larger spillovers from joint ventures between foreign and domestic firms, especially with minority foreign ownership (Dimelis and Louri, 2004; Abraham et al., 2010), because of easier access to foreign knowledge and technology for domestic firms. However, Javorcik and Saggi (2010) show that joint ventures are less preferable entry modes for foreign firms with more sophisticated technologies, thereby limiting potential spillovers. The firm's entry mode decisions can be further affected in emerging markets with weak institutions and poorly regulated business environment, where the risk of losing proprietary knowledge to local competitors by entering into joint ventures is higher.[43] The degree of foreign ownership could also have different effects on different types of FDI spillovers: Javorcik and Spatareanu (2008) find that domestic participation in FDI has a positive effect on inter-industry spillovers, while attenuating the negative effect of intra-industry spillovers. The study, which uses data from Romania and defines joint ventures as all firms with foreign equity share ranging from 10 to 99 per cent, finds significant evidence to support the

[43] The same study by Javorcik and Saggi (2010) tests the effect of differences in Intellectual Property Rights (IPR) regimes across ten transition economies in Eastern Europe. They find that IPR regimes can affect attraction of FDI but have no effect on entry mode choices. However, their study focuses on differences in IPR legislation only, which will not account for other forms of weak institutions.

hypothesis that joint ventures may facilitate linkages with local suppliers, which is not the case for fully foreign-owned firms.

5.3.2 Channels for FDI spillovers and labour market conditions

While incorporating firm heterogeneity has helped to further refine the findings on FDI spillovers, it does not shed light on the channels through which spillovers happen. The literature has identified four main channels for spillovers (Blomström et al., 1999): demonstration effects, competition effects, inter-firm linkages and labour mobility. Demonstration effects arise when domestic firms learn how to upgrade their product quality, technology or management practices by being in close proximity, observing, and copying or learning from foreign firms. Competition effects are at play when domestic firms are forced to compete with technologically superior foreign firms for market shares, and in the process are forced to improve their productivity. However, competition with foreign firms can also lead to a crowding out of domestic firms, if they are too inefficient to survive in the product market. A third channel concerns linkages of firms across different industries as part of value chains, and the productivity effects from technology and knowledge transfers to domestic firms acting as suppliers to foreign firms. Finally, domestic firms can benefit from the tacit knowledge of foreign firms through labour mobility. If employees of foreign firms move to existing domestic firms or establish new firms, they bring knowledge and training acquired in the foreign firms that can increase the productivity of the domestic firms they move to. These workers can also use their connections with the foreign firms to establish vertical linkages between domestic and foreign firms.

The theoretical contributions of Glass and Saggi (2002), Fosfuri et al. (2001), and Dasgupta (2012) model a host economy characterised by technologically superior multinationals hiring local labour force, while Markusen and Trofimenko (2009) model knowledge transfer to domestic firms when these firms hire foreign managers that provide training to domestic employees. Thus, whether through learning effects, or by receiving on the job training, employees working with multinationals are equipped with tacit knowledge that could increase the productivity of domestic firms. Positive spillovers to the host economy therefore arise either as increased productivity of domestic firms from hiring the labour force formerly trained by multinationals, or as higher wages for local employees working for multinationals, to prevent them from transferring their knowledge to domestic competitors.

Empirical studies investigating the labour mobility channel are scarce and focus mostly on developed countries, for whom matched employer-employee data is more readily available. These studies follow managers and skilled labour that move from foreign to domestic firms and estimate the effect of hiring workers previously employed by foreign firms on the productivity or other outcome variables of domestic firms. In one of the few studies focusing on a developing country, Görg and Strobl (2005) run this analysis with data from Ghana and find that newly established domestic firms whose owners had worked in a multinational company are more productive than other domestic firms in the country. This

finding is further supported by studies on Norway (Balsvik, 2010), Brazil (Poole, 2012) and Estonia (Masso and Vahter, 2019). Poole (2012) measures indirect FDI spillovers as increases in the productivity and wages of incumbent workers in domestic firms that hired workers who previously worked for multinationals. The channel of spillovers in this case are the interactions between workers that lead to knowledge sharing and diffusion. Besides productivity effects, Masso and Vahter (2019) also find that the labour spillover channel leads to increased export propensity and breadth of export markets for domestic firms. In all these studies, there is evidence of positive spillovers through the labour mobility channel. However, so far little focus has been placed on distinguishing between the intra- and inter-industry dimension of this spillover channel. For example, neither Balsvik (2010) nor Poole (2012) make a distinction between workers moving within or between industries. Görg and Strobl (2005) distinguish between entrepreneurs with experience from foreign firms in the same sector, or from unrelated sectors. They find significant spillover effects only in the case of entrepreneurs from the same sector. Masso and Vahter (2019) also find that workers and managers from multinationals in the same sector lead to larger productivity spillovers than those from unrelated sectors. They explain these findings by relying on the argument that technological proximity between firms from the same sector signifies a higher level of absorptive capacity (a concept first introduced by Cohen and Levin, 1989) and therefore enhances the level of spillovers. However, neither study distinguishes between the other sectors, and therefore cannot control for the degree of linkages between the firm's sector and the other sectors. Thus, the existing empirical literature has established that conditional on moving to domestic firms, employees from foreign firms in the same sector have positive spillover effects for the productivity of domestic firms but is silent on vertical spillovers through labour mobility.

We believe that this is an important distinction to make, especially for developing countries. In developing countries, the assumption that employees would leave foreign firms to establish their own firms or to move to competitor domestic firms in the same industry may be quite unrealistic. By providing higher wages, superior technology, and other non-pecuniary benefits, foreign firms may simply be more attractive employers. Many studies show that workers (especially skilled ones) in foreign firms enjoy wage premiums. Wages can increase for incumbent workers after a foreign acquisition (Huttunen, 2007; Girma and Görg, 2007).[44] Martins (2011) uses a 10-year panel of matched employer-employee data in Poland to show that while there is a selection effect, differences in wage-setting characteristics between foreign and domestic firms account for a larger part of the foreign wage premium. In fact, Barry et al. (2005) develop a theoretical model showing that in less competitive

[44] Malchow-Møller (2013) describes three possible explanation for the wage premium in foreign firms: a selection effect where foreign firms hire more productive employees; a learning effect where workers become more productive through training provided at the foreign firm; and a firm heterogeneity effect, which captures differences between foreign and domestic firms' characteristics that affect their wage setting decisions in a non-competitive labour market.

markets characterised by production functions with higher elasticities of input substitution, the foreign wage premium may even lead to workers moving from domestic firms to foreign ones, resulting in productivity losses for domestic firms. Furthermore, in developing countries, working in foreign firms confers not only higher wages, but also better working conditions, social and health benefits, bonus payment schemes and opportunities for additional trainings and personal career development. Hence, while there is substantial evidence to support the argument that intra-industry labour mobility from foreign to domestic firms leads to domestic spillovers, there is less evidence to show that these movements within the industry are a frequent phenomenon in the first place. Therefore, the potential of horizontal spillovers through this channel may also be smaller.

On the other hand, there may be more potential for vertical productivity spillovers. Firstly, foreign firms may be less worried about workers moving and bringing along accumulated knowledge to domestic firms in sectors that they do not compete with. On the contrary, having workers with knowledge of their production process move to firms that may act as potential suppliers or establish new firms acting as suppliers may be in the foreign firms' interest. It may also be easier for workers to move from foreign firms to domestic firms along the value chain, if there are already inter-firm linkages in place between the two. The argument of absorptive capacity on which previous literature has based the expectation of larger spillover effects from labour mobility within the same sector may also be less relevant in developing economies. In countries like Moldova, where employment and entrepreneurship are need-based, we would expect workers to be more flexible about switching between jobs in different industries. Moreover, if the type of knowledge premium that they accumulate from foreign firms is of the managerial type and not industry-specific, transferring these knowledge and skills across industries will not be difficult. Thus, by distinguishing between horizontal, backward and forward FDI spillovers and their interaction with the labour mobility channel, we incorporate the different kinds of inter-firm relationships in our analysis of spillovers through labour mobility.

To estimate the effect of labour mobility on productivity spillovers without relying on employer-employee data, we employ an identification strategy that exploits sectoral and regional variation in institutional labour market conditions instead. The main assumption behind this strategy is that institutional differences affecting the degree of flexibility of labour markets will have moderating effects on FDI spillovers. Xiao and Park (2018) argue that FDI spillovers are affected by subnational differences in the development of institutional environments, especially in emerging markets, where there is more regional heterogeneity in the level of institutional development. Their argument is based on a growing volume of empirical evidence that institutions and business environment characteristics affect the entry decisions, types, and performance of multinational firms, which in turn will have

consequences for potential spillovers to domestic firms.[45] They test their hypothesis on data from the Chinese manufacturing sector, and find that there is a significant effect of subnational institutional development levels on FDI spillovers. Another empirical contribution in this vein is Gorodnichenko et al. (2014), who focus on the mitigating effects of corruption, red tape and regulatory burden, but do not find any direct or indirect effect (through FDI spillovers) on firm efficiency. They attribute these results in part to difficulties in measuring institutional differences. By focusing on labour market restrictions, which affect the labour mobility channel directly, we expect it will be easier to capture its effect on spillovers.

We focus on regional and sectoral labour market restrictions as perceived and reported by Moldovan firms in the annual Cost of Doing Business surveys. More specifically, we analyse the moderating effect of difficulties with formal contracts, minimum salary and complex layoff procedures on FDI spillovers. These indicators measure firms' flexibility to adjust to shocks by hiring and firing, and therefore are a good proxy for labour mobility. In a similar vein, Aghion et al. (2008) study the effect of market liberalization through delicensing on industry growth. They find that there is variation in labour market institutions across Indian states and that states with more pro-employer labour market institutions grow more after the dismantling of the License Raj. Their finding helps to validate our expectation that differences in labour market conditions will affect the degree of labour mobility within and across sectors and regions, and consequently FDI spillovers through the labour mobility channel.

5.4 Methodology and Data

5.4.1 Empirical strategy

We construct the FDI spillover variables by sector, region and year following Javorcik (2004) and Blalock and Gertler (2008). Horizontal FDI is measured as the sum of foreign firms' output in each sector-region-year over the total output in that sector, region and year:

$$HorizontalFDI_{jrt} = \frac{\sum_i FDI_{ijrt} \times Y_{ijrt}}{\sum_{ijrt} Y_{ijrt}} \quad \textbf{(5.1)}$$

FDI_{jrt} is an indicator for whether firm *i* is a foreign firm, in sector *j* located in region *r* in year *t*. In different specifications of the model, a foreign firm is defined to include fully foreign-owned firms, joint ventures, or both. Y_{ijrt} is the output of firm *i* and $\sum_{ijrt} Y_{ijrt}$ is the total output of all firms in sector *j* of region *r* and year *t*. The backward and forward FDI variables are defined as the foreign firms in the downstream and upstream sectors of sector *j*. Backward FDI is the weighted sum of foreign firms in the

[45] See for example Moran et al. (2005) who argue that better institutional conditions will attract "high quality" FDI, which yields higher potential benefits for domestic firms.

downstream sectors of the domestic firms, where the weights are the input-output coefficients from the Input-Output tables, and is defined as:

$$BackwardFDI_{jrt} = \sum_{k \neq j} \alpha_{j \to k} \, HorizontalFDI_{krt} \quad \textbf{(5.2)}$$

where $\alpha_{j \to k}$ is the input-output coefficient that measures the share of outputs of sector *j* sold to sector *k*. Forward FDI is the weighted sum of foreign firms in the upstream sectors of the domestic firms and is defined as:

$$ForwardFDI_{jrt} = \sum_{k \neq j} \alpha_{k \to j} \, HorizontalFDI_{krt} \quad \textbf{(5.3)}$$

where $\alpha_{k \to j}$ is the input-output coefficient that measures the share of inputs of sector *j* purchased from sector *k*.

We use annual firm panel data for the period 2003 – 2014. To account for any endogeneity issues from unobserved time-invariant, firm-specific heterogeneity, we follow prior literature (Javorcik, 2004) and estimate the regression model in first differences. The specification of the baseline model estimated for the sample of domestic manufacturing firms is:

$$\begin{aligned} \Delta\omega_{ijrt} = {} & \beta_1 \Delta Horizontal\ FDI_{jrt} + \beta_2 \Delta Backward\ FDI_{jrt} + \beta_3 \Delta Forward\ FDI_{jrt} \\ & + \beta_4 \Delta HHI_{jt} + \gamma_t + \gamma_{jt} + \gamma_{rt} + \varepsilon_{ijrt} \end{aligned} \quad \textbf{(5.4)}$$

$\Delta\omega_{ijrt}$ is the first difference of the productivity of firm *i* in sector *j*, region *r*, and year *t*, which is measured as the natural logarithm of total factor productivity (TFP). Horizontal, Backward and Forward FDI are measured at the sector, region, year level and first-differenced. An annual measure of the Herfindahl index is introduced as a control variable at the sector level to account for competition dynamics within each industry. Year, region-year, and sector-year fixed effects are also included to control for any time, region or sector specific unobserved shocks each year. To correct for correlated error terms within sectors, standard errors are clustered at the sector level. Finally, to disentangle the heterogeneous effects of FDI, the sample of domestic firms is divided into subsamples based on the size, age or productivity gap quartile of the domestic firm, and the same baseline model is estimated for each of the subsamples. The sectors are defined according to the Input-Output table and the list of sectors is provided in Appendix B.

We estimate TFP as the residual of a production function expressed in logarithms:

$$ln\, Y_{it} = ln\, K_{it} + ln\, L_{it} + ln\, IC_{it} + \omega_{it} \quad \textbf{(5.5)}$$

where Y_{it} are firm i's sales revenues in year t; K_{it} is the firm's capital in year t, measured by Current Long-term Tangible Assets; L_{it} is number of employees; IC_{it} are input costs, measured by Current Cost

of Sales in year t,[46] and ω_{it} is the idiosyncratic error term, the estimate of which will serve as our TFP estimate for the productivity analysis. We estimate equation (5.5) for each manufacturing industry separately, thus allowing input elasticities to vary by industry.

A main concern in the productivity literature is the endogeneity of input decisions when estimating TFP. To address these endogeneity concerns we estimate the TFP residual by using the two-stage semi-parametric procedure first introduced by Olley and Pakes (1996) with the Ackerberg-Caves-Frazer correction (Ackerberg et al., 2015) for the estimation of the labour elasticity coefficient in the second stage. In the first stage of the procedure, we estimate the productivity shock as the inverse of a third-degree polynomial function of the state variable (capital) and investment. We use the Perpetual Inventory Method and calculate investment as the one-year change in long-term tangible assets plus depreciation. We interpolate these variables by firm and exclude from the analysis firms with negative values for investment. We deflate investment with the same price indices used to deflate capital (see data subsection below) and take the natural logarithm. We use the first stage productivity estimates in the second stage to estimate input elasticities, but do not report the coefficients here. We also estimate bootstrapped standard errors and control for firm attrition in the data. We show some descriptive statistics on the estimated TFP variable in Appendix B.

To estimate the moderating effect of labour market conditions on FDI spillovers, we introduce an interaction term between the labour market variables and our FDI variables similar to the empirical strategy employed by Rajan and Zingales (1998). Thus, our baseline specification is modified to include the interaction term with each labour market variable separately:[47]

$$\begin{aligned}\Delta\omega_{ijrt} = {} & \beta_1 \Delta Horizontal\ FDI_{jrt} + \beta_2 \Delta Backward\ FDI_{jrt} + \beta_3 \Delta Forward\ FDI_{jrt} \\ & + \beta_4 \Delta HHI_{jt} + \beta_4 \Delta LMV_{jrt-1} + \beta_5 \Delta Horizontal\ FDI_{jrt} \Delta LMV_{jrt-1} \\ & + \beta_2 \Delta Backward\ FDI_{jrt} \Delta LMV_{jrt-1} + \beta_3 \Delta Forward\ FDI_{jrt} \Delta LMV_{jrt-1} \\ & + \gamma_t + \gamma_{jt} + \gamma_{rt} + \varepsilon_{ijrt}\end{aligned} \quad \textbf{(5.6)}$$

[46] Since not all firms are required to report the cost of raw materials or wage expenses separately, we use the overall cost of sales as a proxy for cost of intermediate inputs. Although this measure incorporates both labour and intermediate input costs and is therefore highly correlated to the labour variable, we decide to include it as an input in the production function, while still controlling for the number of employees. By doing so, we avoid introducing omitted variable bias from not controlling for intermediate inputs, and correctly estimate production functions for industries where labour and production costs are not (positively) correlated, although for some industries this results in very low and sometimes statistically insignificant labour elasticities. Estimates of productivity from this production function specification are very similar to those yielded by an alternative specification where we control for a proxy of raw materials for the firms that provide this information.

[47] The labour market variables are highly correlated, and as such, including all of them and their interaction terms in the same regression leads to multicollinearity issues. However, as they may have different effects on labour mobility, we decide to run and show the analysis for each of them separately.

LMV_{jrt-1} is the average score of each labour market restriction measure lagged by one year, to account for the fact that changes in labour market conditions usually take time to be fully implemented and to affect firm performance and labour mobility. Thus, in addition to the interaction of the lagged variable, we also include the main effect of the labour market variables on the performance of domestic firms in the manufacturing sector.

We believe that by following this identification strategy, we also address concerns over several sources of potential endogeneity. We control for endogeneity that will arise if foreign firms choose to locate in regions or invest in sectors that contain the more productive domestic firms by taking first differences. If FDI goes to sectors with more productive domestic firms and we fail to control for this, our estimates of FDI spillovers may reflect this existing domestic productivity premium and therefore be upward biased. First-differencing controls for any time-invariant, firm-specific unobserved heterogeneity at the firm level. Additionally, there may be other regional or sectoral characteristics that may explain the decision of foreign firms to locate there and simultaneously affect the productivity of domestic firms (for example, agglomeration effects). If these characteristics also affect labour market conditions (or firms' perception of these conditions), our interaction term may also be biased. We include sector-year and region-year fixed effects to account for these sources of endogeneity. Finally, it could be argued that more productive firms may affect labour market conditions, either because our measures of labour market restrictions reflect firms' perceptions, and more productive firms may experience or perceive fewer restrictions, or because they may have some power to change labour market restrictions in their favour (for example through lobbying). In this case our interaction term would suffer from simultaneity bias. However, we address this issue by using a lagged value of the labour market restriction measures. Also, since our measures of labour market restrictions are averages within sectors, regions and years of firm responses from a representative sample based among other factors, on size, we would expect that many of the responses driving the averages are from small firms that would not typically have the lobbying power to affect policies.

5.4.2 Data

Our empirical analysis combines two unique datasets that describe firm performance and the business environment. First, we use firm-level administrative data from the Moldovan National Statistics Bureau for 2003-2014. The data provides annual information from an unbalanced panel of firms on a number of firm characteristics, including their location, main sector of operation, type of registered ownership, number of employees, sales revenues and cost of sales. Although the raw data covers the entire population of firms in the Moldovan economy, we exclude Agriculture, Mining and Public Services from our analysis and focus on manufacturing and services (NACE Revision 1 categories 15-74) to build our measures of FDI concentration by sector and region. We rely on the regional disaggregation provided in the data, which divides Moldova into six regions: Chisinau (the capital), Center, North, Balti, South and Gagauzia. These regions correspond to the four main territorial units (Chisinau, Center,

North and South) defined by EU's NUTS definition at the highest level of aggregation, with the North and South regions further disaggregated to distinguish the highly developed district of Balti and the Autonomous Territorial Unit of Gagauzia.

To estimate the effect of FDI on firm productivity, we limit our estimation sample further and only include manufacturing firms. We choose not to include firms in the services sectors because we use TFP estimates as the dependent variable, and the production function we employ to estimate TFP is mainly used in the literature to describe production processes in manufacturing. Hence, we would expect TFP estimates for services not to be reliable estimates of the actual revenue based TFP of firms. Sales and cost of sales are deflated by using yearly sector-specific Producer Price Indices, according to the NACE Rev. 1 industry classification. Capital was deflated using yearly price indices for investment in long-term tangible assets. The base year for the indices is 2013. The production function was estimated in logarithms, and the deflated values of sales and capital were interpolated and transformed to account for missing values when taking natural logarithms.[48] Data on Price Indices was taken from the National Accounts publications of the Moldovan National Bureau of Statistics.

To construct backward and forward FDI at the sector level, the 2009 National Input-Output (IO) table in constant prices is used to derive industry weights. Being halfway through the period of analysis, the 2009 IO table data allows for a good representation of inter-industry dynamics in the years prior and following 2009, as changes in these dynamics are usually slow to materialise.[49] The classification of sectors in the IO table is done according to the NACE Rev. 1 classification system, with sectors aggregated to the two-digit level listed in Appendix B. Throughout the FDI spillover analysis, the classification of sectors according to the IO table is used for the construction of sector-level FDI variables and when controlling for sector-year fixed effects.

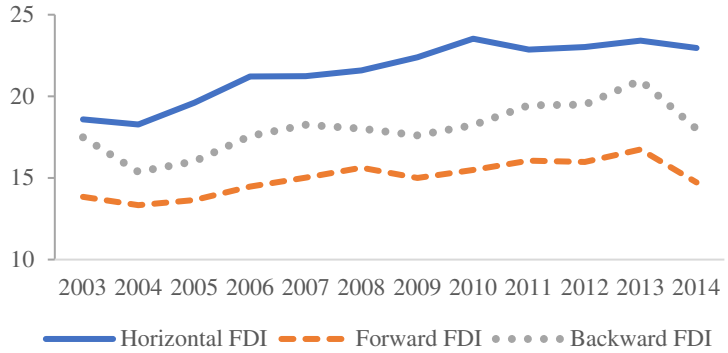
Figure 5.3 shows the development of the FDI variables over time. In line with the description in Section 5.2, we see an increase in the share of FDI presence over time, as measured by the share of foreign output in total output in a sector and region. There is a similar trend for Backward and Forward FDI, although both have consistently lower shares than intra-industry FDI. This indicates that while foreign presence in each sector may be quite high (19 per cent in 2003 and 23 per cent in 2014), a lower share of foreign output is participating in the local value chains. This can also be seen in Table 5.2, which provides summary statistics of the Horizontal, Backward and Forward FDI variables by type of

[48] We interpolate missing values for the variables used in the production function on time and by firm. To avoid excluding observations with zero sales, capital etc., when taking logarithms, we transform each of these variables by adding one.

[49] The 2009 IO table was chosen as the IO tables from prior years combine certain manufacturing sectors and the loss of information will reduce the variation in the spillover variables.

ownership. Table 5.2 also shows that in Moldova a higher share of output is produced by joint ventures than by fully foreign-owned firms.

Figure 5.3: FDI variables over time



Source: Authors' elaboration using data from the National Bureau of Statistics; Note: FDI variables in percentages

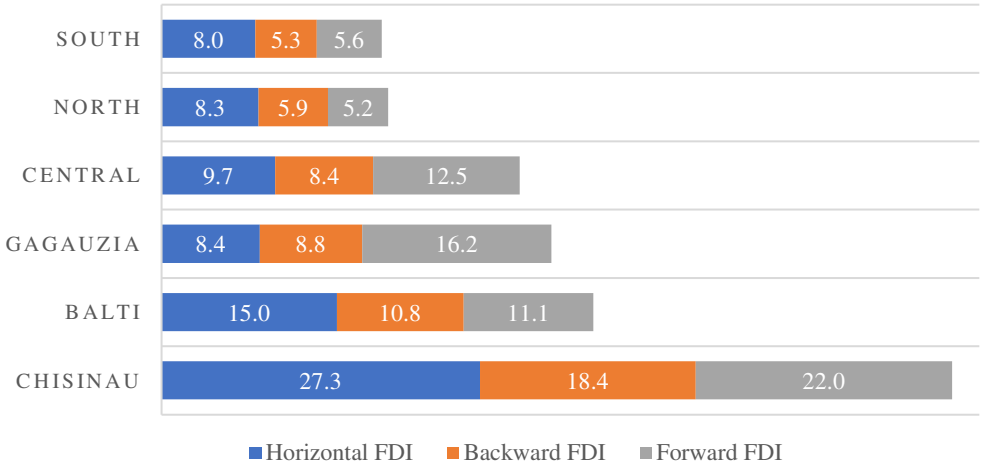
Table 5.2: FDI variables, main summary statistics

Variable	Mean	Std. Dev.	Min	Max
Horizontal FDI (all)	0.219	0.153	0	1
Backward FDI (all)	0.152	0.068	0	0.753
Forward FDI (all)	0.183	0.081	0	0.565
Horizontal FDI (fully foreign-owned)	0.120	0.101	0	1
Backward FDI (fully foreign-owned)	0.064	0.037	0	0.714
Forward FDI (fully foreign-owned)	0.070	0.043	0	0.544
Horizontal FDI (JV)	0.100	0.095	0	0.997
Backward FDI (JV)	0.088	0.044	0	0.613
Forward FDI (JV)	0.113	0.057	0	0.506

Note: Summary statistics based on full sample (sectors 15-74). N=421,071

In Figure 5.4, average FDI presence by region shows that FDI in Moldova is not distributed equally among regions.

Figure 5.4: FDI variables by region



Source: Authors' elaboration using data from the National Bureau of Statistics
Note: FDI variables in percentages.

Foreign presence is highest in the capital Chisinau, where average Horizontal FDI is 27 per cent. Foreign presence is also more concentrated in the business district of Balti, while the rest of the Northern region has only half of the share of Balti's Horizontal, Backward and Forward FDI. We exploit this regional, sectoral and time variation of the FDI variables to investigate their effect on domestic firms' productivity levels.

For our firm heterogeneity analysis, based on the information provided from the administrative firm-level data, we divide the estimation sample into different subsamples according to the following domestic firm characteristics:

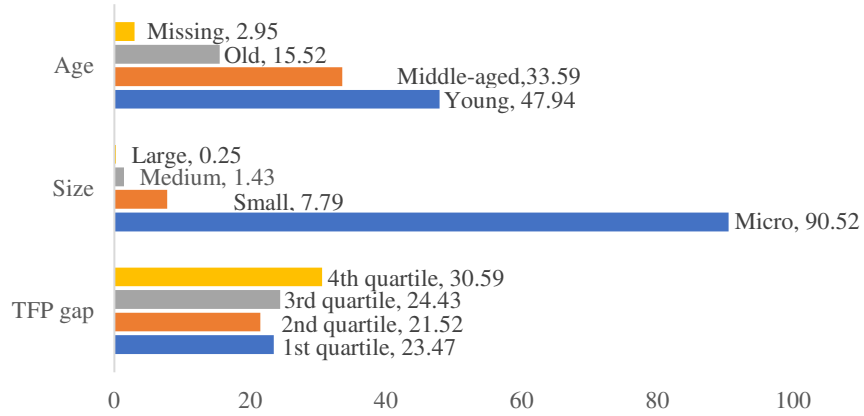
Productivity gap quartile: We build the productivity gap quartile for domestic firms in manufacturing based on the productivity gap of each firm in the first year they appear in the dataset to avoid simultaneity bias as a result of the effect of FDI spillovers on TFP. The gap is defined as the ratio of firm's TFP over the sector's TFP frontier (most productive firm) in that year. Thus, the firms in the first quartile have the largest TFP gap and are the least productive (up to 25 per cent of frontier TFP), while the productivity of the firms in the fourth quartile is 75 per cent or more of frontier TFP. Figure 5.5 shows that the distribution of domestic manufacturing firms among the quartiles is quite equal. Most firms are grouped in the most productive quartile, which is an indication that the frontier firm is not much more productive than the rest.

Firm size: Domestic firms in the sample are divided into four categories, based on the number of employees in the first year they appear in the data: micro (one to nine employees), small (10-49), medium (50-249), and large (250 or more). The majority of domestic firms in the whole sample are micro firms (almost 91 per cent), while firms with 250 employees or more account for only 0.25 per cent.

Firm age: For every domestic firm, we calculate age as its average age during the period it appears in the sample, taking as first year of existence either its year of registration, or the first year it appears in the sample for firms missing registration year information.[50] Based on this variable, we categorise firms into young (less than four years in operation), middle-aged (four to nine years), and old (ten years or older). Almost half of the domestic firms in our sample are young firms, while old firms account for only about 15 per cent (Figure 5.5).

[50] Since this is administrative data and covers the universe of firms in Moldova, setting the first year it appears in the data as the year it starts its activities should be a safe assumption. From anecdotal evidence, there are concerns that many firms leave the market or cease to exist while still appearing as active on the Business Registry, but the reverse (firms operating without being registered) seems to be less of an issue.

Figure 5.5: Share of domestic firms by firm characteristics



Source: Authors' elaboration using data from the National Bureau of Statistics.
Note: Sample shares in percentages next to the categories.

Age of FDI: To build FDI variables by age of FDI, we categorise each foreign firm in each year as either new (up to three years) or old (four years or older), and then calculate two separate sets of FDI variables based on the age categories (namely Old and New Horizontal, Backward and Forward FDI). To be able to compare the effects of both age categories, we include all six constructed variables in the same regression. Alternative definitions of old FDI (above five years and eight years) are considered in the analysis as well.

Our second source of data are indicators of labour market restrictions from the Cost of Doing Business Survey (CODB). Starting from 2005, this survey is conducted annually in Moldova with the support of the Moldovan Ministry of Economy and the World Bank. Each year, it collects evaluations of business environment components from a random sample of about 600 firms, representative at the sector, region, and firm size levels. Information about the respondent firms' main sector of activity and location is only available at a higher level of aggregation than the administrative firm-level data. We can distinguish between four main sectors of activity (food industry, non-food manufacturing, retail and wholesale trade, and other services), and four main regions (Chisinau, North, South and Center). To construct our labour market restriction measures by sector and region, we take averages of firm responses to the CODB questions on the labour market across these dimensions.

We build our measures of labour market restrictions based on evaluative questions from the CODB survey, where firms are asked whether they face any difficulties in the labour market with regards to: (i) the necessity to engage employees only on a formal contract base; (ii) the necessity to pay minimum salary; and (iii) complicated procedures to lay off personnel. These questions are scored between one (no difficulties) and five (significant difficulties). The survey responses allow us to objectively assess the extent of difficulties in the business environment, but they may also incorporate the firms' judgment of the difficulties they face, which will be relative to its peers or expectations. We attenuate this issue by taking averages of the scores at the sector and regional level and estimate aggregate de facto indicators of labour market restrictions.

Table 5.3 provides the summary statistics of the average scores across regions and sectors and over time for the whole sample of firms. On average, the reported level of difficulties at the sector-region level with each of the labour market restrictions is not very high. However, as we confirmed in our qualitative interviews with representatives of business associations, there is variation of labour market conditions over time and across sectors and regions.

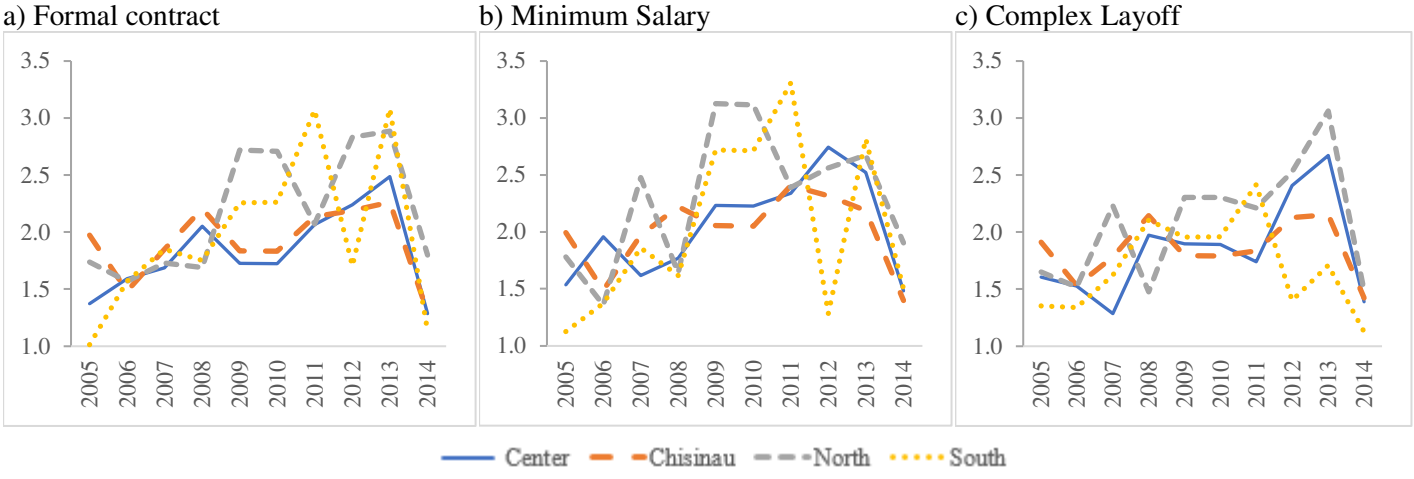
Table 5.3: Summary statistics of labour market restriction variables

Variable	Mean	Std. Dev. (Overall)	Std. Dev. (Across sector-regions)	Std. Dev. (Over time)	Min	Max
Complex layoff procedures	1.916	0.526	0.166	0.501	1.000	3.667
Minimum salary	2.135	0.651	0.174	0.629	1.000	4.000
Formal contracts	2.002	0.616	0.175	0.592	1.000	4.400

Note: Summary statistics based on 16 sector-region combinations, over a 10-year period (2005-2014). N=160.

In Figure 5.6 we present the variation of each labour market restriction over time, by region. In general, labour market conditions show a high degree of fluctuation over time, with formal contracts and minimum salary deteriorating in the post-financial crisis period. Firms seem to have encountered more difficulties with complex layoff procedures in 2013. Overall, Chisinau and Center regions experienced less difficulties, while the less developed North and South regions reported experiencing more difficulties and had sharper fluctuations during this period.

Figure 5.6: Variation of labour market restrictions over time, by region

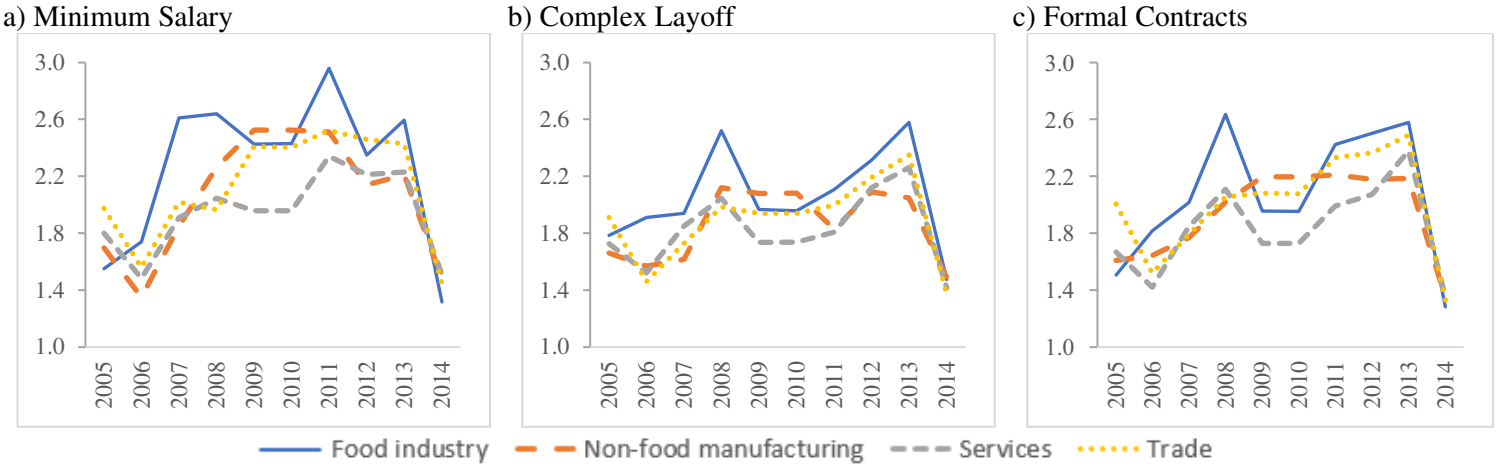


Source: Authors' elaboration using Cost of Doing Business survey data.
Note: Restrictions measured on a scale of 1 (no difficulties) – 5 (severe difficulties).

In Figure 5.7 we disaggregate labour market restrictions by sector. Across all panels we find that the food manufacturing industry appears to be experiencing the most difficulties, followed by other manufacturing and trade, while services seem to experience the least difficulties. Services also seem to have been less affected in the post-crisis period, while manufacturing industries suffered from labour market restrictions, possibly due to lack of flexibility to adjust labour inputs following the shock

introduced by the crisis. Remarkably, the disaggregation of labour market restrictions by sector shows that all sectors experienced more or less the same trends, whereas changes in restrictions over time not only varied more across regions, but seem to have done so with a lag (for example an improvement in labour market conditions is observed across sectors around the same years, while the less developed regions seem to experience improvements with at least a one year lag, compared to the more developed ones). Thus, when estimating the effect of labour market restrictions by using first differences, we expect the main source of variation in the changes in labour market conditions to come from the regional, rather than sectoral differences. Therefore, while we restrict the analysis to manufacturing firms, which leaves us with two sectors for labour market restrictions, the variation over time by region should still capture the effects of the labour mobility channel.

Figure 5.7: Variation of labour market restrictions over time, by sector



Source: Authors' elaboration using Cost of Doing Business survey data.
Note: Restrictions measured on a scale of 1 (no difficulties) – 5 (significant difficulties).

Table 5.4 shows a correlation matrix of FDI, labour market and TFP productivity variables. We see that, as we would expect, all three labour market variables are negatively correlated with productivity levels: firms in regions and sectors that report experiencing more difficulties with labour market restrictions have lower productivity levels. However, a negative correlation could also indicate that less productive firms are clustered in specific regions and sectors and report more difficulties exactly because of their lower productivity levels. To account for this endogeneity issue, we include region-year and sector-year fixed effects in our regression analysis with FDI spillovers and labour market interactions. Another advantage of having information about the labour markets at the region and sector level, instead of at the firm level, is that we do not need to worry about firm-level endogeneity issues typically arising in matched employer-employee data. While more productive workers could choose to work for more productive domestic firms after leaving foreign firms (which, uncontrolled for, could lead to biased estimates of the labour mobility effect), we would not expect the productivity level of any individual firm to affect the average sector-region labour market restriction variable scores. We also find that for the most part, correlations between FDI variables and labour market variables are also

negative: there is more foreign output in sectors and regions that experience more flexible labour market conditions.

Table 5.4: Correlation matrix

	ln(TFP)	Complex layoff procedures	Formal contracts	Minimum salary	Horizontal FDI	Backward FDI	Forward FDI
ln(TFP)	1.000						
Complex layoff procedures	-0.092	1.000					
Formal contracts	-0.057	0.785	1.000				
Minimum salary	-0.078	0.732	0.856	1.000			
Horizontal FDI	-0.211	0.023	0.030	-0.014	1.000		
Backward FDI	0.247	-0.020	-0.038	-0.071	0.398	1.000	
Forward FDI	0.107	-0.051	-0.058	-0.106	0.427	0.716	1.000

Note: Reported FDI variables based on All FDI

5.5 RESULTS

5.5.1 Baseline Results

In Table 5.5 we present the results from our baseline specification in first differences, with the natural logarithm of TFP as dependent variable. We estimate the contemporaneous effect of horizontal, backward and forward FDI, while controlling for year, sector-year and region-year fixed effects. We also control for the degree of competitiveness by sector by including a measure of the Herfindahl index. In column 1 we present the findings for FDI defined as both fully foreign-owned and joint ventures. Column 2 describes the effects of fully foreign-owned FDI, while column 3 focuses on joint ventures. The estimation sample are domestic firms (firms with no foreign equity) in the manufacturing sectors.

The main result of our baseline analysis is that there are significant and positive effects of backward FDI from all types of FDI on the TFP of domestic firms, while horizontal and forward FDI do not have any significant effects. Focusing on the order of magnitude of spillovers from backward FDI in column 1, we find that an increase in the share of FDI in downstream sectors by one standard deviation (0.068), increases the productivity of domestic firms in sectors supplying to foreign firms by 3.4 per cent. Moreover, the effects of an increase in the share of JV output seem to be smaller than those of fully foreign-owned firms (0.443 vs. 0.549), but this difference is not statistically significant.[51] Hence, while domestic firms do not seem to benefit from horizontal and forward FDI in general, they seem to benefit from both fully foreign-owned firms and JVs in downstream sectors. However, these results do not convey the entire story, as there may be heterogenous effects from FDI, depending on both foreign and

[51] We fail to reject the null hypothesis of no significant difference between the estimated coefficients for backward FDI from fully foreign-owned firms and joint ventures (Chi^2 = 0.5; p>Chi^2 =0.4797).

domestic firm characteristics. To investigate this further, we turn to the analysis of FDI spillovers and firm heterogeneity.

Table 5.5: Baseline FDI spillovers regression

	All FDI	Fully Foreign-Owned	Joint Ventures
	(1)	(2)	(3)
VARIABLES	ΔLn(TFP)	ΔLn(TFP)	ΔLn(TFP)
Δ Horizontal FDI	-0.0836	-0.0819	-0.0777
	(0.0505)	(0.0612)	(0.0515)
Δ Backward FDI	0.509***	0.549***	0.443**
	(0.169)	(0.187)	(0.190)
Δ Forward FDI	-0.0362	0.125	-0.155
	(0.0825)	(0.148)	(0.111)
Δ HH index	0.0953	0.0997	0.116
	(0.113)	(0.124)	(0.128)
Observations	21,601	21,601	21,601
R-squared	0.024	0.021	0.022

Note: First differences, year, sector-year, region-year fixed effects. Clustered standard errors at the IO industry level. Sample of manufacturing domestic firms. No constant. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5.5.2 Heterogeneity

Productivity gap: The results from the analysis on FDI spillovers in columns 1-4 of Table 5.6 confirm the findings from the baseline regression and refine them further. There is a positive effect of backward FDI on the productivity of domestic firms, while horizontal and forward FDI do not affect the productivity of domestic firms in any of the productivity quartiles. The firms reaping the most benefits from foreign presence in downstream sectors are the least productive firms (first and second quartiles). The moderating effect of productivity gap seems to be linear for fully foreign-owned FDI – as the productivity gap decreases, so do FDI spillovers; but it has an inverse U-shape for joint ventures – there is a positive and significant effect of backward FDI for firms in the first, second and third quartiles, but the effect is highest for firms within 25 and 50 per cent of frontier TFP, and it disappears in the fourth quartile. Thus, it appears that the most productive domestic firms do not benefit from joint ventures, which suggest that joint ventures may be less productive than fully foreign-owned firms and not significantly more productive than the most productive domestic firms. As such, there may not be much potential for spillovers from them to the most productive domestic firms in upstream sectors.

Firm size: The regression results (columns 5-8 of Table 5.6) show that the firms benefitting the most from overall backward FDI presence are small and medium sized firms. In contrast, the effect is significant but smaller for micro firms, and it disappears altogether (positive, but insignificant) for large ones. This is mainly due to the insignificant effect of joint ventures, as the effect of fully foreign-owned FDI presence in downstream sectors is not only significant for large domestic firms, but it is also higher than for any other firm size categories.

Table 5.6: FDI spillovers by domestic firm characteristics

		Tech. gap				Size				Domestic firm age		
		1st quartile	2nd quartile	3rd quartile	4th quartile	Micro	Small	Medium	Large	Young	Middle-aged	Old
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)
All FDI	Horizontal	-0.117**	-0.150*	-0.0431	-0.0681	-0.125**	-0.0171	-0.0752	-0.0453	-0.148*	-0.114	-0.0463
		(0.0560)	(0.0752)	(0.0704)	(0.0599)	(0.0499)	(0.0749)	(0.0955)	(0.127)	(0.0722)	(0.0685)	(0.0495)
	Backward	0.795***	0.737***	0.377*	0.174	0.424**	0.688***	0.651**	1.028	0.580	0.446**	0.598**
		(0.235)	(0.183)	(0.211)	(0.113)	(0.166)	(0.212)	(0.303)	(0.614)	(0.345)	(0.206)	(0.221)
	Forward	-0.0478	0.0180	0.0623	-0.106	-0.0439	0.118	-0.104	-0.261	-0.124	-0.0150	0.0349
		(0.207)	(0.104)	(0.104)	(0.127)	(0.102)	(0.119)	(0.181)	(0.309)	(0.125)	(0.0988)	(0.117)
Fully Foreign Owned	Horizontal	-0.0922	-0.171	-0.0548	0.0134	-0.0811	0.00492	-0.317***	-0.119	-0.281	-0.0347	-0.118
		(0.0986)	(0.115)	(0.123)	(0.144)	(0.0567)	(0.101)	(0.101)	(0.102)	(0.258)	(0.0828)	(0.108)
	Backward	0.807***	0.739***	0.188	0.467**	0.534**	0.587**	0.323	1.263**	0.784	0.658***	0.412
		(0.289)	(0.239)	(0.330)	(0.170)	(0.220)	(0.260)	(0.246)	(0.535)	(0.538)	(0.196)	(0.293)
	Forward	0.214	0.133	0.274	0.0232	0.0871	0.262	0.353	-0.597	0.0576	0.187	0.277
		(0.314)	(0.179)	(0.182)	(0.295)	(0.219)	(0.159)	(0.227)	(0.697)	(0.377)	(0.131)	(0.277)
Joint Ventures	Horizontal	-0.117*	-0.132	-0.0280	-0.0973*	-0.138**	-0.0174	0.0255	0.0574	-0.110	-0.143**	-0.00199
		(0.0668)	(0.0809)	(0.0678)	(0.0550)	(0.0528)	(0.0695)	(0.117)	(0.136)	(0.0732)	(0.0666)	(0.0477)
	Backward	0.729**	0.928***	0.446**	-0.221	0.314*	0.748**	0.892**	0.350	0.605	0.253	0.657***
		(0.299)	(0.229)	(0.204)	(0.242)	(0.182)	(0.270)	(0.358)	(0.457)	(0.639)	(0.249)	(0.229)
	Forward	-0.199	-0.152	-0.107	-0.182	-0.162	0.0366	-0.462***	-0.0738	-0.337	-0.157	-0.102
		(0.176)	(0.187)	(0.0827)	(0.133)	(0.162)	(0.164)	(0.135)	(0.0710)	(0.263)	(0.161)	(0.0831)
	Observations	4,871	5,512	5,718	5,500	12,754	6,049	2,112	686	1,680	11,130	8,670

Note: Dependent variable: ln(TFP). First differences, year, sector-year, region-year fixed effects. Clustered standard errors at the IO industry level. Sample of manufacturing domestic firms. No constant. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

This could be an indication of different input sourcing strategies of fully foreign-owned firms and joint ventures: establishing backward linkages with the largest suppliers in upstream sectors may be important to fulfill supply needs of fully foreign-owned firms, while joint ventures may need to rely less on the size of suppliers, and therefore establish linkages with small and medium firms. Breaking down the analysis by size also reveals that there are some negative horizontal spillovers, which mainly arise as crowding out effects and lead to lower productivity levels for the affected domestic firms. Higher fully foreign-owned presence in the sector leads to lower domestic productivity levels for medium firms, while higher JV presence affects micro firms negatively. Thus, firm size has a moderating effect on backward and horizontal FDI, but there is no evidence of any forward FDI spillovers.

Domestic firm age: Overall, spillover effects from FDI increase with firm age – there are no significant effects of backward FDI on young firms, middle-aged firms are affected positively, while old firms experience the highest positive and significant backward FDI spillovers. The spillovers to old domestic firms seem to be derived from fully foreign-owned firms in downstream sectors, as spillovers from JVs are insignificant. This result is reversed for middle-aged firms: they are not affected by fully foreign-owned firms in downstream sectors but increases in JV output shares are correlated with higher productivity levels. Thus, the results of FDI spillovers by age reinforce the findings from our previous analysis by size: larger, older and generally more established domestic firms benefit from spillovers from fully foreign-owned buyers, while less established firms create supplier linkages and benefit from spillovers from joint ventures.

Age of FDI: Based on previous literature and on the findings from the heterogeneity analysis so far, foreign firm embeddedness in domestic markets seems to play an important role in determining who benefits from FDI spillovers and to what extent. Besides type of FDI ownership, another foreign firm characteristic that affects how much it is embedded in the local market is the amount of time it has operated in the market. According to our field interviews, not only do foreign firms establish more linkages with domestic firms over time, as they get to know the market better, but they may also start switching to local managers, who know the local market better. Table 5.7 presents the results from the analysis where we disaggregate the spillover variables by the age of foreign firms.

The results for backward FDI are very revealing: whether backward FDI spillovers from old or new FDI materialise at all, and whether there are significant differences between spillovers from fully foreign-owned firms and joint ventures, depends on how we define "old". In columns 1-3, where we define all firms older than one year as "old", we find positive backward FDI spillover effects from all types of old FDI, but the order of magnitude of these effects is not significantly different across different ownership types. This is to be expected, as with a cut-off value at year one, most foreign firms, whether fully foreign-owned or joint ventures, would be categorised as old. Hence, our measure of "old FDI" is

very similar to our general measure of FDI, and consequently, our results are very similar to the baseline results. On the other hand, a cut-off value at year one means that only very new firms would count as new. Among these very new foreign firms, only new joint ventures have positive and significant backward spillovers, while new fully foreign-owned firms do not have any effects on domestic firms upstream.

As the threshold for the definition of "old FDI" increases, fewer firms fall under this category. At the other extreme, we find that when we define FDI as old only after eight or more years of operating in the market, backward spillovers from old fully foreign-owned firms are significant, positive, and at the order of 1.27. At the same time, spillovers from old joint ventures are insignificant. Moreover, the difference between these two effects is statistically significant. However, this cut-off value also means that more foreign firms are categorised as new, thus bringing these results closer to our baseline results: both joint ventures and fully foreign-owned firms lead to positive and significant backward spillovers, and although the coefficient for new joint ventures is higher than for new fully foreign-owned FDI, this difference is not significant. The clearest differences between spillovers from fully foreign-owned firms and joint ventures by age appear when we use five years as a threshold for the definition of "old FDI". Backward spillovers from both old and new FDI are in line with our expectations: spillovers from old fully foreign-owned firms are significantly higher than from old joint ventures and spillovers from new joint ventures are significantly higher than from new fully foreign-owned firms. This is not surprising, as the descriptive statistics show that the average age of foreign firms is 4.98 and the median is four years. Hence, a threshold of five years will divide the sample of foreign firms used for the calculation of the FDI measures roughly in half.[52] By varying the age threshold, we show that both FDI age and type of ownership matter for the size of backward spillovers. As it takes time for fully foreign-owned firms to establish linkages with domestic firms in the local market, the latter only start seeing higher productivity benefits from the presence of fully foreign-owned firms in downstream sectors by foreign firms that have been there longer. Whereas for joint ventures, the necessary time to establish linkages and potentially transfer knowledge to domestic suppliers is shorter, leading to immediate positive backward spillovers from new joint ventures (as early as in their first year of operation), which dissipate as they get older.

[52] A detailed summary of age of foreign firms is provided in Table B3 of Appendix B.

Table 5.7: Old and New FDI spillovers, by type of ownership

	Old FDI: Older than 1 year			Old FDI: Older than 3 years			Old FDI: Older than 5 years			Old FDI: Older than 8 years		
	All FDI	Fully foreign	Joint Ventures	All FDI	Fully foreign	Joint Ventures	All FDI	Fully foreign	Joint Ventures	All FDI	Fully foreign	Joint Ventures
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)	ΔLn (TFP)
Old Horizontal FDI	-0.0834	-0.0851	-0.0832	-0.0926	-0.105	-0.0906	-0.0834	-0.134	-0.0692	-0.0984*	-0.139*	-0.0877
	(0.0524)	(0.0616)	(0.0548)	(0.0558)	(0.0714)	(0.0549)	(0.0627)	(0.0988)	(0.0558)	(0.0570)	(0.0796)	(0.0531)
Old Backward FDI	0.572***	0.721***	0.437**	0.531**	0.608**	0.412**	0.520**	0.910***	0.310*	0.483*	1.270**	0.237
	(0.199)	(0.238)	(0.196)	(0.208)	(0.263)	(0.185)	(0.223)	(0.328)	(0.179)	(0.266)	(0.462)	(0.214)
Old Forward FDI	-0.0477	0.113	-0.194	-0.0724	0.173	-0.260*	-0.0586	0.483	-0.161	-0.00425	0.803	-0.138
	(0.0991)	(0.144)	(0.141)	(0.0980)	(0.165)	(0.141)	(0.120)	(0.371)	(0.127)	(0.152)	(0.497)	(0.175)
New Horizontal FDI	-0.0801	-0.103**	-0.0469	-0.0606	-0.0422	-0.0568	-0.0863**	-0.0547	-0.0890*	-0.0753	-0.0627	-0.0709
	(0.0471)	(0.0470)	(0.0723)	(0.0451)	(0.0533)	(0.0456)	(0.0363)	(0.0400)	(0.0498)	(0.0502)	(0.0604)	(0.0548)
New Backward FDI	0.150	0.136	0.494***	0.432***	0.494**	0.652***	0.505***	0.382**	0.904***	0.517***	0.460**	0.647***
	(0.0889)	(0.0933)	(0.178)	(0.142)	(0.204)	(0.232)	(0.139)	(0.184)	(0.219)	(0.151)	(0.174)	(0.200)
New Forward FDI	0.00215	0.119	-0.0403	0.0113	0.0790	0.0496	-0.0225	0.0609	-0.131	-0.0441	0.0901	-0.163*
	(0.0575)	(0.177)	(0.0756)	(0.0684)	(0.134)	(0.0882)	(0.0688)	(0.148)	(0.0860)	(0.0712)	(0.144)	(0.0913)
R-squared	0.025	0.022	0.022	0.024	0.021	0.022	0.024	0.022	0.022	0.024	0.023	0.022
Observations	21,601	21,601	21,601	21,601	21,601	21,601	21,601	21,601	21,601	21,601	21,601	21,601
	Coefficient estimate comparison test (H0: β_BFDI_Fully Foreign-owned Firms = β_BFDI_Joint Ventures)											
Old FDI	Chi_2 = 2.65 (p=0.1037)			Chi_2 = 1 (p=0.3178)			Chi_2 = 3.76 (p=0.0524)			Chi_2 = 6.72 (p=0.0095)		
New FDI	Chi_2 = 3.11 (p=0.078)			Chi_2 = 0.39 (p=0.534)			Chi_2 = 4.8 (p=0.0284)			Chi_2 = 1.15 (p=0.2839)		

Note: Dependent variable: ln(TFP). First differences, year, sector-year, region-year fixed effects. Clustered standard errors at the IO industry level. Sample of manufacturing domestic firms. No constant. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<01

5.5.3 Labour market restrictions

To investigate how different labour market conditions moderate the effect of FDI on domestic firm productivity, we extend our baseline regression model by including interactions between the FDI variables and labour market restrictions scores, as described in equation (5.6). Since we expect firms to take time to adjust to the labour market, and consequently generate FDI spillovers through the labour mobility channel, we lag each labour market restriction variable by one year. The results from this analysis, for each labour market variable separately and distinguishing among different types of FDI, are shown in Table 5.8. First, the main finding of positive and significant backward FDI spillovers from our previous analysis, holds even after controlling for either of the labour market restriction variables and their interactions. Second, for overall FDI, we find that only the interaction term between backward FDI and complex layoff procedures is negative and significant. Thus, in regions and sectors with fewer labour market restrictions, the positive effect of foreign presence in downstream sectors on domestic firm productivity is higher. This indicates that when firms face fewer difficulties with termination procedures, there is more flexibility in the labour market and higher labour mobility. We find no significant effects of either minimum salary or formal contracts restrictions on overall FDI spillovers. Furthermore, once we control for year, sector-year and region-year fixed effects, there is no direct effect of any of the labour market restrictions on the productivity of domestic firms. Thus, the negative correlation between the restriction variables and productivity in Table 5.4 can be explained away by region and sector characteristics.

Breaking down the analysis by type of FDI ownership provides more insights. The interaction term between fully foreign-owned horizontal FDI and minimum salary is also significant and negative, as is the interaction term between fully foreign-owned forward FDI spillovers and complex layoff procedures. Thus, in labour markets where firms experience less difficulties with minimum salary requirements, workers are free to move across firms in the same industry and facilitate horizontal FDI spillovers. The same holds in sectors that experience less complex layoff procedures for spillovers from fully foreign-owned firms in upstream sectors. In contrast, joint ventures seem to lead to spillovers through the backward channel: in sectors with less complex layoff procedures and less difficulties with formal contracts, spillovers from joint ventures in downstream sectors are significantly higher. This finding is in line with our previous finding that joint ventures in Moldova create linkages with domestic firms more easily, thereby introducing avenues for the movement of workers across sectors based on these supplier linkages. It is also to be expected that domestic firms experiencing more flexibility to hire new workers (due to less difficulties with formal contracts) will benefit more from the movement of workers from foreign firms in downstream sectors.

Given the significant results for the case of complex layoff procedures, a more thorough analysis of the mechanism at work is needed. The negative interaction term indicates that less complex layoff procedures in the firm's own sector can increase backward spillovers as firms can hire workers from

Table 5.8: FDI spillovers with labour market restriction interaction

	Formal contracts			Minimum Salary			Complex Layoff		
	All FDI	Fully Foreign Owned	JV	All FDI	Fully Foreign Owned	JV	All FDI	Fully Foreign Owned	JV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)
Δ Labour Restriction, lagged	0.00779	-0.00171	0.00573	0.00683	0.00271	0.00225	0.00691	0.00292	0.00116
	(0.00618)	(0.00487)	(0.00755)	(0.00861)	(0.00846)	(0.00817)	(0.00501)	(0.00506)	(0.00469)
Δ Horizontal FDI	-0.0691	-0.00688	-0.102	-0.0525	0.0150	-0.102	-0.0684	-0.00538	-0.124
	(0.0633)	(0.0681)	(0.0743)	(0.0654)	(0.0681)	(0.0763)	(0.0704)	(0.0818)	(0.0786)
Δ Backward FDI	0.624***	0.596**	0.521**	0.542**	0.549**	0.451*	0.634**	0.724***	0.509*
	(0.217)	(0.214)	(0.236)	(0.201)	(0.209)	(0.221)	(0.235)	(0.225)	(0.278)
Δ Forward FDI	0.206	0.375*	0.0336	0.138	0.376*	-0.0611	0.221	0.684**	-0.0156
	(0.156)	(0.197)	(0.208)	(0.137)	(0.185)	(0.163)	(0.178)	(0.283)	(0.167)
Δ Horizontal FDI x Δ LR_{t-1}	-0.00198	-0.0113	-0.00197	-0.00911	-0.0204**	-0.00168	-0.00179	-0.0120	0.00888
	(0.00771)	(0.0120)	(0.0122)	(0.00537)	(0.00793)	(0.0121)	(0.00931)	(0.0220)	(0.0116)
Δ Backward FDI x Δ LR_{t-1}	-0.0539	0.0209	-0.0755**	-0.0162	0.0426	-0.0440	-0.0603***	-0.0473	-0.0705**
	(0.0340)	(0.0514)	(0.0349)	(0.0283)	(0.0331)	(0.0366)	(0.0191)	(0.0440)	(0.0296)
Δ Forward FDI x Δ LR_{t-1}	-0.0742	-0.0455	-0.0920	-0.0371	-0.0437	-0.0379	-0.0814*	-0.187**	-0.0687
	(0.0464)	(0.0755)	(0.0635)	(0.0255)	(0.0438)	(0.0363)	(0.0470)	(0.0854)	(0.0515)
Δ HH index	0.0989	0.0925	0.113	0.0988	0.0921	0.110	0.0986	0.0929	0.111
	(0.145)	(0.154)	(0.161)	(0.146)	(0.155)	(0.162)	(0.145)	(0.155)	(0.161)
Observations	14,067	14,067	14,067	14,067	14,067	14,067	14,067	14,067	14,067
R-squared	0.025	0.023	0.022	0.025	0.023	0.022	0.025	0.023	0.022
	-0.069	-0.007	-0.102	-0.053	0.015	-0.102	-0.068	-0.006	-0.124
p-val Horizontal FDI (F test)	0.285	0.918	0.182	0.427	0.832	0.193	0.340	0.946	0.125
	0.623	0.596	0.520	0.542	0.549	0.451	0.633	0.724	0.509
p-val Backward FDI (F test)	0.008	0.010	0.037	0.012	0.014	0.051	0.012	0.003	0.079
	0.205	0.375	0.034	0.138	0.376	-0.061	0.220	0.683	-0.015
p-val Forward FDI (F test)	0.199	0.067	0.872	0.322	0.053	0.711	0.226	0.023	0.927

Note: First differences, year, sector-year, region-year fixed effects. Clustered standard errors at the IO industry level. Sample of manufacturing domestic firms. No constant. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

foreign firms. The ability to hire workers from foreign firms is also influenced by labor market restrictions in the other sectors. Less complex layoff procedures could not only make it easier for foreign firms in these sectors to shed employees, but also for employees to leave foreign firms and establish their own enterprises, perhaps supplying to foreign firms. If we consider improvements in labour market conditions in the own sector to affect labour demand from the firms in the sector, changes in labour market conditions in other sectors, upstream or downstream, would affect labour supply. Hence, backward FDI spillovers may not only be affected by the complex layoff procedures in the firm's own sector, but by those in the other sectors as well.

To test this hypothesis, we need to control for the interaction between FDI spillovers and labour market restrictions in other sectors. For this, we build three separate variables that measure complex layoff procedure scores in other sectors in the same region. Thus, our working assumption, based on the same argument as for the FDI spillover variables, is that in the Moldovan economy, labour is mobile across sectors but immobile across regions. We interact horizontal spillovers in sector *j* with an unweighted average of complex layoff procedure scores of the three other sectors in the region.[53] To capture the supply chain relationships across sectors for backward and forward FDI, we interact each with a separate labour market variable, which represent weighted averages of other sectors' layoff procedure scores. The weights are shares of sector *j's* total output sold to every other sector *k* and shares of sector *j's* total inputs purchased from each sector *k* (where $k \neq j$), respectively. These backward and forward labour market variables ($Complex^{b}_{k,t-1}$ and $Complex^{f}_{k,t-1}$ respectively) are analogous to the backward and forward FDI spillover variables and uses the same IO weights in their construction.

Table 5.9 displays the results from these regressions, where columns 1-3 contain the analysis with interactions with other sectors' indicators only and columns 4-6 expand the analysis to include both own sector and other sectors' complex layoff scores. As with the rest of our analysis, we distinguish between spillovers from fully foreign-owned firms and joint ventures. In addition to the interaction terms, we also control for the direct effect of the newly introduced labour market restriction variables on the productivity of domestic firms. Our main results still hold: backward FDI spillovers are still present for all FDI. Next, the interaction term between backward FDI spillovers and complex layoff procedures in downstream sectors (column 1) is significant and negative: if downstream sectors (where foreign firms buy from domestic firms) experience more difficulties with complex layoff procedures, FDI spillovers to domestic firms in the upstream sectors will be significantly lower. This result validates our argument that workers of foreign firms in these sectors are free to move to upstream sectors and work for existing domestic companies or start their own new ventures.

[53] The reader may recall that the CODB survey covers four broad sectors, as described in Section 5.3.

Move on up(stream)

Table 5.9: FDI spillovers interactions with complex layoff procedures indicators from other sectors

	Only other sectors interactions			Own sector and other sector interactions		
	All FDI	Fully foreign owned	JV	All FDI	Fully foreign owned	JV
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)	Δ ln(TFP)
Δ Horizontal FDI	-0.0529	0.0265	-0.100	-0.0524	0.0143	-0.105
	(0.0733)	(0.0957)	(0.0876)	(0.0737)	(0.101)	(0.0915)
Δ Backward FDI	0.727***	0.921***	0.542*	0.737***	0.944***	0.566*
	(0.256)	(0.295)	(0.301)	(0.257)	(0.295)	(0.303)
Δ Forward FDI	0.0954	0.289*	-0.110	0.251	0.697**	0.0313
	(0.133)	(0.152)	(0.168)	(0.205)	(0.292)	(0.191)
Δ Horizontal FDI x $Complex_{k,t-1}$	-0.0106	-0.0282	-0.00274	0.00368	-0.00457	0.0106
	(0.0143)	(0.0408)	(0.0189)	(0.00880)	(0.0190)	(0.0132)
Δ Backward FDI x $Complex^{b}_{k,t-1}$	-0.130***	-0.182	-0.103*	-0.0226	0.0116	-0.0599
	(0.0415)	(0.118)	(0.0514)	(0.0193)	(0.0292)	(0.0390)
Δ Forward FDI x $Complex^{f}_{k,t-1}$	-0.0697	-0.0173	-0.0548	-0.0814	-0.197**	-0.0802
	(0.0771)	(0.123)	(0.0752)	(0.0482)	(0.0841)	(0.0493)
Δ Horizontal FDI x $Complex_{j,t-1}$				-0.0144	-0.0184	-0.0120
				(0.0153)	(0.0505)	(0.0213)
Δ Backward FDI x $Complex_{j,t-1}$				-0.107**	-0.212*	-0.0444
				(0.0487)	(0.106)	(0.0650)
Δ Forward FDI x $Complex_{j,t-1}$				-0.0688	0.0315	-0.0604
				(0.0806)	(0.132)	(0.0800)
Δ $Complex_{j,t-1}$				0.0302	0.0243	0.0276
				(0.0200)	(0.0174)	(0.0194)
Δ $Complex_{k,t-1}$	0.0408	0.0302	0.0481	0.137	0.122	0.138*
	(0.0323)	(0.0340)	(0.0338)	(0.0839)	(0.0854)	(0.0789)
Δ $Complex^{b}_{k,t-1}$	-0.0492	-0.0356	-0.0782	-0.136	-0.115	-0.164*
	(0.0596)	(0.0678)	(0.0623)	(0.0965)	(0.101)	(0.0936)
Δ $Complex^{f}_{k,t-1}$	0.0159	0.00175	0.0195	0.0299	0.0108	0.0344*
	(0.0142)	(0.0124)	(0.0138)	(0.0195)	(0.0158)	(0.0184)
Δ HH index	0.0949	0.0916	0.111	0.0947	0.0944	0.108
	(0.145)	(0.154)	(0.162)	(0.145)	(0.155)	(0.161)
Marginal effect Horizontal FDI	-0.053	0.026	-0.100	-0.053	0.014	-0.105
p-val Horizontal FDI	0.475	0.787	0.261	0.481	0.891	0.261
Marginal effect Backward FDI	0.725	0.920	0.542	0.735	0.942	0.565
p-val Backward FDI	0.009	0.004	0.083	0.008	0.004	0.074
Marginal effect Forward FDI	0.095	0.289	-0.110	0.250	0.695	0.032
p-val Forward FDI	0.479	0.068	0.518	0.232	0.025	0.870
Observations	14,067	14,067	14,067	14,067	14,067	14,067
R-squared	0.025	0.023	0.022	0.025	0.023	0.023

Note: First differences, year, sector-year, region-year fixed effects. Clustered standard errors at the IO industry level. Sample of manufacturing domestic firms. No constant. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

We do not observe this effect when we distinguish between the type of foreign firms (columns 2-3). This effect also disappears when we introduce the interaction terms with the own sector's indicators. Instead, the interaction of own sector complex layoff procedure with backward FDI is significant. We suspect that this may be a result of collinearity, as labour market variables across sectors are highly correlated, as pointed out in our discussion of Figure 5.7. Importantly, the analysis in Table 5.9 highlights a new finding for spillovers from fully foreign-owned FDI to domestic firms in downstream sectors (column 5). Not only are there positive and significant spillovers from fully foreign-owned forward FDI, but these spillovers are higher from FDI in upstream sectors that experience less complex layoff procedures. Thus, the movement of workers from foreign to domestic firms seems to be occurring in both directions of the value chain and leads to significantly higher spillovers in both cases.

We find no evidence of any effect of complex layoff procedures in other sectors on horizontal spillovers. Based on our discussion in Section 5.3, this result is not surprising. The lack of significant effects for horizontal FDI in general suggests that these spillovers are just less likely to materialise, even in the presence of labour market flexibility. This could be a result of workers not moving from foreign to domestic firms within the same sector. Instead, they may prefer to move to a different foreign firm, or even leave domestic firms for foreign firms since working in foreign firms may be more attractive. Unfortunately, our data allows us to measure changes in the labour market conditions, but not workers' movements as a result of these changes. Alternatively, the lack of labour mobility effect on horizontal spillovers could be a sign of foreign firms retaining workers despite less complex layoff procedures to prevent them from moving to competitor domestic firms. This would also explain why we find effects on backward and forward spillovers, since movement of workers to supplier or buyer sectors would be less of a concern for foreign firms.

Finally, having previously established that firm characteristics are important for the estimation of FDI spillovers, we turn to investigate how different segments of the domestic firm population are affected by the presence of foreign firms under different levels of labour market restrictions. In Table 5.10 we present the results of the analysis where we divide domestic manufacturing firms in subsamples based on the same firm characteristics as in Table 5.6, and include the interaction terms of FDI variables with labour market variables. For brevity, we continue the analysis by focusing on complex layoff procedures and spillover variables for All FDI. The results for minimum salary and formal contracts, and distinctions between fully foreign-owned firms and JVs reinforce our findings that firm heterogeneity matters, and the full set of results is available upon request. After controlling for labour market restrictions, we see that the findings from our heterogeneity analysis still hold. There are significant and positive backward spillovers across different types of domestic firms. Firms that benefit the most from foreign presence in downstream sectors are small, young, and the least productive ones. Results from the interaction of backward FDI with the labour market restriction

Table 5.10: FDI spillovers with complex layoff procedure interactions and firm characteristics

	Technology gap				Size				Age		
	1st quartile	2nd quartile	3rd quartile	4th quartile	Micro	Small	Medium	Large	Young	Middle-aged	Old
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
VARIABLES	Δln(TFP)	Δln(TFP)	Δln(TFP)	Δln(TFP)	Δln(TFP)	Δln(TFP)	Δln(TFP)	Δln(TFP)	Δln(TFP)	Δln(TFP)	Δln(TFP)
Δ $Complex_{j,t-1}$	0.0201	0.00179	0.0122	0.0121	0.0165*	0.00143	-0.0220*	0.0169	0.0244	0.00440	0.00753
	(0.0125)	(0.0176)	(0.0116)	(0.0220)	(0.00838)	(0.0174)	(0.0120)	(0.0246)	(0.0424)	(0.0127)	(0.00813)
Δ Horizontal FDI	-0.106	-0.0938	-0.0723	-0.111	-0.161**	0.114	-0.175	0.139	-0.0775	-0.140	0.0264
	(0.0825)	(0.118)	(0.0964)	(0.128)	(0.0710)	(0.122)	(0.108)	(0.133)	(0.122)	(0.0968)	(0.0768)
Δ Backward FDI	1.130***	1.012***	0.373	0.658***	0.605**	0.842**	0.304	0.721	1.387***	0.732**	0.553*
	(0.406)	(0.210)	(0.318)	(0.182)	(0.243)	(0.331)	(0.454)	(0.754)	(0.452)	(0.266)	(0.316)
Δ Forward FDI	0.280	0.266	0.434**	0.132	0.207	0.435*	0.136	0.146	0.0309	0.0859	0.410*
	(0.371)	(0.372)	(0.169)	(0.270)	(0.252)	(0.230)	(0.228)	(0.174)	(0.274)	(0.226)	(0.203)
Δ Horiz. x $Complex_{j,t-1}$	0.0185	-0.00689	-0.0129	0.00604	0.00877	-0.0245	0.0500	-0.0187	0.000882	0.00782	-0.0158
	(0.0250)	(0.0316)	(0.0133)	(0.0393)	(0.0167)	(0.0254)	(0.0479)	(0.0217)	(0.0418)	(0.0101)	(0.0181)
Δ Back x $Complex_{j,t-1}$	-0.0708	-0.0173	-0.120	-0.205***	-0.121***	0.000359	0.155***	-0.0582	-0.270**	-0.141***	0.0334
	(0.0452)	(0.0367)	(0.0854)	(0.0522)	(0.0285)	(0.0638)	(0.0435)	(0.218)	(0.112)	(0.0289)	(0.0263)
Δ For. x $Complex_{j,t-1}$	-0.156	-0.0345	-0.0730	-0.129	-0.110	-0.101	-0.0139	-0.0383	-0.0892	-0.0230	-0.103*
	(0.0938)	(0.133)	(0.0531)	(0.112)	(0.0855)	(0.0923)	(0.123)	(0.0665)	(0.118)	(0.0666)	(0.0598)
Δ HH index	-0.0383	0.795**	-0.0261	-0.0756	0.126	0.332	0.538	-3.433***	0.527**	0.113	0.0834
	(0.392)	(0.336)	(0.118)	(0.162)	(0.149)	(0.219)	(0.372)	(0.330)	(0.235)	(0.188)	(0.204)
Observations	3,101	3,671	3,760	3,538	8,505	3,773	1,353	439	1,049	7,579	5,342
R-squared	0.101	0.103	0.078	0.093	0.034	0.091	0.251	0.701	0.247	0.040	0.065
p-val Horizontal	.4236	0.3247	.3963	0.488	.089	.6075	.2824	0.5649	.5947	.3615	0.6837
p-val Backward	.033	0.0002	.3805	0.0009	.001	.0193	.002	0.6278	.0139	.0002	0.0471
p-val Forward	.1419	0.2531	.0319	0.2067	.3729	.1443	.7319	0.6006	.1592	.9294	0.1363

Note: First differences, year, sector-year, region-year fixed effects. Clustered standard errors at the IO industry level. Sample of manufacturing domestic firms. No constant. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

variable confirms the general findings from the labour market analysis: in markets with less complex layoff procedures, positive spillovers from downstream FDI presence are higher. However, these results are not the same for all firms in the economy. Backward spillovers through the labour mobility channel are present for the most productive firms, indicating that if workers are moving across sectors from foreign to domestic firms, they may be choosing the most productive ones. These are also present for middle-aged and young firms, which could also be an indication that workers may be moving from foreign firms to establish their own firms that may act as suppliers to foreign firms.

Finally, breaking down the sample by firm characteristics shows that for some segments of the firm population, there are horizontal and forward FDI spillovers present as well. Moreover, these effects also vary by labour market restrictions. We find that the productivity of domestic micro firms is negatively affected by higher FDI presence in the sector. However, labour market flexibility seems to attenuate the negative effect: as layoff procedures become less complex, the negative effects of product market competition are reduced due to labour mobility. The only firms that seem to benefit from FDI in upstream sectors are small firms, and firms in the third productivity quartile. Overall, this analysis helps to show that it is important to account for firm heterogeneity, as effects that are realized through different channels for different types of domestic firms may be cancelling each-other out in a more generalised setting.

5.6 Conclusions

This chapter investigates productivity spillovers from FDI to domestic firms through the labour mobility channel in a developing country setting and how these spillovers vary by domestic and foreign firm characteristics. We merge firm-level administrative data with indicators of labour market conditions from a survey on the Cost of Doing Business in Moldova. By interacting measurements of labour market restrictions with FDI presence at the sector and regional level, we estimate the effect that different degrees of labour market restrictions have on horizontal, backward and forward spillovers. This allows us to circumvent the need for matched employer-employee data usually used to study FDI spillovers through the labour mobility channel, which are often not available for developing countries. Results from an analysis in first differences with panel data from 2005 to 2014 show that overall domestic firms benefit from positive and significant backward FDI spillovers. Moreover, in regions and sectors where firms experience less complex layoff procedures, FDI spillovers are larger. However, these effects are limited to foreign presence in downstream and in some cases, upstream sectors, while we find no significant effects of either horizontal FDI spillovers per se, nor of its interaction with the labour market restrictions. The rationale for our findings is that in a developing country like Moldova, FDI spillovers through the labour mobility channel are more likely to happen across rather than within industries. With less restrictive and thus more mobile labour markets, employees of foreign firms may establish new or move to existing domestic firms in upstream and downstream sectors that serve as suppliers to foreign

firms. For this to happen, foreign firms need to be embedded in local markets and develop linkages with domestic firms. To test this hypothesis further, we also control for the interaction between FDI and labour market restrictions in other sectors and find that these conditions have a moderating effect on inter-industry FDI spillovers.

We also explore firm heterogeneity by estimating FDI spillovers in different subsamples based on domestic firm characteristics. We are able to identify differential spillover effects for different segments of domestic firm populations. We conclude that backward FDI spillovers vary by domestic firm size, age and technology gap. Based on insights from qualitative interviews with business associations in Moldova, we also introduce foreign firm characteristics that may affect linkages with domestic firms, especially along the supply chain. We find that type and age of foreign ownership are important determinants of backward FDI spillovers. With a partner with knowledge of the local market and suppliers, joint ventures need less time to create linkages, thereby leading to positive FDI spillovers by new joint ventures in downstream sectors. Fully foreign-owned firms, on the other hand, need a longer time to establish these linkages, and backward FDI spillovers are larger for older fully foreign-owned firms. Finally, these characteristics are also important to account for when looking at the labour mobility channel, because the mechanisms at work for the transmission of knowledge through labour mobility are different for different domestic firms.

Incorporating firm heterogeneity when estimating FDI spillovers is important, as it can serve to inform more specific and targeted foreign investment policy, especially in developing countries. We provide evidence of the importance of firm characteristics in such a setting for the development of spillover-inducing inter-firm linkages. We also try to bridge the knowledge gap on the mechanisms of spillover transmission in developing countries, by providing insights on the effect of labour market restrictions on FDI spillovers. While our data and estimation strategy do not allow us to measure actual labour mobility from foreign to domestic firms (or vice-versa, which so far has not been really explored) as matched employer-employee data would, it provides a reliable proxy for labour market conditions that can be used to investigate and provide much needed answers on FDI spillover channels in developing countries.

Our results also offer new insights in terms of policy, as they clearly show that, next to the development of linkages with domestic firms, developing flexible and well-functioning labour markets can also affect backward FDI spillovers positively. This is especially relevant for governments of developing countries, where backward FDI spillovers are known to be important for the productivity of domestic firms. Thus, our finding that labour markets can impact these types of spillovers is a novel contribution to the literature on backward FDI spillover channels in developing countries and provides new policy implications for governments.

Chapter 6 CONCLUSIONS

6.1 WHAT WE HAVE LEARNED, HOW TO APPLY IT AND WHAT TO IMPROVE

The main goal of this thesis was to provide a systematic and comprehensive answer to one of the central questions in the literature on FDI spillovers today:

Why is there such a large divergence in findings on the productivity spillovers impact of FDI on local firms?

In the last two decades, this divergence has acted as an instigator, fuelling and pushing research forward, by constantly producing new findings and in the process, raising new questions. Because of this constant process of knowledge upgrading, we now know more about the nature of heterogeneity that determines, moderates and mediates FDI spillovers. Despite the fact that, at first sight, evidence sometimes may seem to point to firm characteristics affecting spillovers in each and every possible direction (including opposite ones), a careful and systematic review of the body of evidence as it stands today is still very informative and shows the incremental progress we have made. It is important to take stock of the fact that in the early days of the development of this literature strand we were using far less optimal data (cross-sectional data at the industry level) and employing at times inconsistent methodologies (that did not address any of the endogeneity issues we now know to be of great relevance for the reliability of empirical findings) to estimate far simpler models (that did not account for heterogeneity, and made many simplifying assumptions that were not always supported by the data). Just as importantly, the state of the research on FDI spillovers should neither serve as a reason to become complacent about the strides that have been made so far, nor to be discouraged by the overwhelming amount of empirical contributions and their sometimes contradictory findings.

In fact, these contradictions serve as the starting point for my thesis. In each of the previous chapters I addressed a different potential reason for the divergence in the literature, pointed out the explicit and implicit assumptions that they relied on, and analysed how they may affect the findings. I summarise each exercise in turn, focusing on the main takeaways, pointing out the limitations, and offering suggestions for future research and policy implications.

Can findings of FDI spillovers be generalised across different time periods, or are they specific to a certain time frame, defined by the country context and characteristics of that period? By adopting the methods of a replication study but applying them to data from a different time period, I find that consistent and robust findings of positive spillovers from foreign firms in downstream sectors in Indonesia for the period 1980-1996 have turned negative in the period 2002-2013. Using the same data sources as the original study by Blalock and Gertler (2008) and the same measures of FDI and

productivity allows me to remove other confounding factors that may affect my findings and therefore isolate the true effect of investigating spillovers for a different time period.

However, while this exercise establishes the existence of a change in impact of FDI, one of its limitations is that remains silent on the causes of this change. While identifying and testing these drivers was outside the scope of this study, the generally robust finding of positive backward spillovers, not only by the specific study we replicate, but by the FDI literature in general, warrants further analysis of the new findings. Hence, based on the qualitative review of the historical conditions of FDI in Indonesia, in a discussion section I offer potential explanations for the findings. On the one hand, the change in impact may be caused by changes in the landscape of firms in Indonesia and the way that they operate, changes that the data is unable to capture. In this case, the main suggestion is to invest in collecting data on linkages that would allow us to capture foreign firms' sourcing strategies explicitly, to identify if foreign firms are acting as competitors or customers to local firms, and to understand the bargaining power dynamics in buyer-supplier relationships between domestic and foreign firms. On the other hand, the change in impact of FDI may be related to changes in the political and business environment that may be more or less conducive to spillovers from FDI. In this case, there are clear policy implications for the Indonesian government: while attracting FDI into the country is important, it is equally important to offer the necessary conditions to make FDI presence lead to benefits for the local economy.

In Chapter 3, I focus on Indonesia again and use the data from the Manufacturing Survey to investigate the issue of estimating FDI spillovers with incomplete datasets. As an example of an incomplete dataset, I use the World Bank's Enterprise Survey data for Indonesia from 2009. Using information from the Enterprise Surveys to estimate FDI spillovers is a good example of using the right tool for the wrong purposes. The surveys are a great source of data that allows us to gain insights on a whole range of issues that businesses face in their everyday operations in different countries. Moreover, they cover many developing countries for which other data sources are simply unavailable, facilitate cross-country comparisons by using the same sampling methodology, and make ongoing efforts to provide longitudinal data. However, in this chapter I show by means of comparison with the Manufacturing Survey data and through simulations that its sampling methodology, which is not aimed at measuring FDI in a representative manner, consistently mis-measures foreign participation at the industry level. As a result, the use of such a dataset produces unreliable estimates of FDI spillovers. Two main takeaways can be drawn from this chapter: the first is a word of caution on drawing conclusions from future research on FDI spillovers with unrepresentative samples. The second is a call to Statistics Offices to provide industry-level statistics on FDI participation that would greatly facilitate future research.

It is also important to briefly focus on the results from chapters two and three and make sense of the different findings regarding backward FDI spillovers. In Chapter 3, using the Manufacturing Survey

dataset, I find positive and significant backward FDI spillovers for the period 2008-2009, which is in strong contrast to the findings of negative and significant backward FDI spillovers I estimate in Chapter 2, using data from the same source for the years 2002-2013. However, several reasons could help to explain these differences. First, variable definition and level of aggregation are different between the two studies. While we focus on sector-region definitions of sectors for the purposes of spillover estimations in Chapter 3, our definition of the industry level in Chapter 2 does not have a spatial dimension. Moreover, due to constraints from the WBES data, the level of industry aggregation in Chapter 3 is much higher than in Chapter 2: as was discussed in Subsection 2.5.2, this could lead to large differences in estimated spillovers, as a more aggregated industry definition classifies many vertical relations as horizontal, and vice-versa.

Second, although the use of two years allows us to estimate total factor productivity and use fixed effects to estimate FDI spillovers, this is still a very short time period. As such, the cross-sectional dimension of the panel is a lot stronger than the time-series dimension. As we discussed in Section 3.1, one of the reasons that the majority of studies in the early years of the development of the empirical literature on this topic finds positive and significant spillovers is the use of cross-sectional data, which tends to bias the results upward. Thus, despite alleviating the issue to some extent by using a two year panel, the results could still be affected by endogeneity. However, as I mention in Chapter 3, although this may put into question the external validity of the findings, it is not a concern for the internal validity of our argument, as we find different results by using the same data *as a result of the sampling methodology*.

Third, as I show in Chapter 2, focusing on non-overlapping time periods results in different estimates of effects on productivity. However, it is not clear whether we should expect to find the same effects for different lengths of time periods within the same main time frame. This question becomes even more relevant for the years I focus on in Chapter 3, as they represent the years of the Financial Crisis, which were an outlier in terms of economic and business environment conditions. Besides a change in conditions, this issue touches upon the bigger question of short- vs. long-term spillovers, which has been mainly investigated by including lags of different length of the industry FDI variables in the estimations, and estimating their marginal, cumulative long-run effect (Javorcik, 2004). Focusing more specifically on different time periods could be a useful exercise that future research could focus on.

More generally, Chapters 2 and 3 lend support to the argument that more replication research is necessary in empirical literature. Empirical evidence on spillovers in different countries is often based on either one study, or several studies making use of the same dataset for the same time period. However, as Chapters 2 and 3 have shown, both the source of data and the time period it is covering are important determinants of the estimated spillovers. Therefore, by replicating studies with various

datasets and time periods, we can either come to robust findings across all of them, or get better at understanding where and why differences arise.

In Chapter 4, I question and test an implicit assumption made by FDI spillover studies that use Input-Output tables to proxy inter-firm linkages between domestic and foreign firms in upstream and downstream sectors: do foreign and domestic firms develop the same quantity and quality of linkages with their domestic suppliers? Using IO tables to weigh the importance of foreign presence (in this case measured as share of foreign output) in a downstream sector implies that they do. However, by using a propensity score matching technique and unique data on firm-level linkages between foreign and domestic manufacturing firms in Vietnam, I find that in fact foreign firms in Vietnam establish fewer linkages with domestic firms than their domestic counterparts do. However, conditional on having foreign buyers in Vietnam, I find that domestic firms with higher shares of foreign buyers in the country experience higher levels of Total Factor Productivity. By using instrumental variables in a 2SLS and 3SLS analysis, I conclude that this is true, even after accounting for the endogeneity of developing linkages in the first place. The effect is also only present among firms that have direct linkages with foreign firms, while the effect of the traditional measure of spillovers capturing the presence of foreign firms in the country is estimated to be insignificant.

The study does have its limitations, which are important to address and justify. The cross-sectional nature of the data limits the study to a static analysis that does not allow me to explore these effects over the long term, or to study its possible dynamics. Moreover, the analysis is based on a non-representative sample. As the findings from Chapter 3 made clear, any industry measures of FDI from a non-representative sample might suffer from measurement error that would bias the FDI spillover estimates. However, in this case, if anything, FDI is overrepresented in the sample. Hence, industry-level FDI measures would overestimate foreign presence. Moreover, regarding domestic firms, instead of an overrepresentation of small firms (which was an issue with samples like WBES), the Vietnam sample contains mostly larger firms, firms that are more likely to have more interactions with foreign firms. Hence, the estimated effect of industry-level backward FDI in this case would be biased upward. Moreover, I instrument industry-level FDI variables with variables built on a representative sample from Indonesia. Thus, the fact that I do not find a significant effect even after taking these steps, serves as an argument that the findings of no vertical spillovers at the industry level still hold.

Based on these findings, policy-makers in Vietnam need to promote policies that ensure that foreign firms are locally embedded in the economy, and more specifically, encourage more and better direct linkages between foreign firms and their local suppliers. Just as importantly, they need to implement supplier development programmes that will help to upgrade and improve the capabilities of domestic suppliers. It is not only essential that foreign firms are made aware of potential suppliers in the local market, but also that they can trust that these potential suppliers have the right capacity to comply with

the standards and requirements of the foreign firms. Increasing the level of capabilities of domestic suppliers would also help them to improve their position in the global market and to be able to survive the competition from producers abroad.

Finally, in Chapter 5 I combine data from two sources in Moldova (administrative firm-level data and survey data on the Cost of Doing Business) to address a number of issues. First, I determine how firm heterogeneity may impact estimated FDI spillovers. Second, I investigate spillovers through the labour mobility channel in the setting of a developing country, by focusing on the distinction between intra- and inter-industry spillovers. Third, I propose a way to study the effect of the spillover channel of labour mobility without having to use employer-employee data. This is important, as such data is normally not available for developing countries. Instead, I use data on labour market characteristics to study spillovers through the labour market channel. The results of the analysis highlight the importance of controlling for firm characteristics when estimating FDI spillovers. They also point to the importance of flexible labour markets and of the embeddedness of foreign firms in the local markets for the occurrence of inter-industry spillovers. Therefore, along with efforts to upgrade capabilities of domestic firms and promote the level of FDI embeddedness with firms in the local market, governments should also pay attention to the development of flexible and well-functioning labour markets. This finding is a new contribution to the literature on the channels of backward FDI spillovers. It is also especially important for governments of developing and emerging economies: while literature has already established the importance of backward FDI spillovers for productivity growth in these countries, the finding that well-functioning labour markets are one of the channels through which these spillovers happen provides new policy implications for labour market development.

6.2 GOING FORWARD

As a final thought, it is important to put the findings and conclusions from this work in a broader context, and link them to perspectives for future work. Going forward, I see two main avenues for future research that the topics dealt with in this thesis lend themselves to. I like to think of my approach to them as zooming inward and looking outward.

Zooming inward: One of the most robust findings that appears repeatedly in the conclusions of different chapters, despite only setting out to study it explicitly in Chapter 4, is the need to look deeper into and understand the linkages between foreign and domestic firms better. As Chapter 4 showed, these linkages are neither a given, nor are they the same for foreign and domestic firms. Further, Chapters 2 and 5 reiterated and reinforced the finding that one of the most important conditions for the occurrence of spillovers is the embeddedness of foreign firms in the local market. Several factors can promote embeddedness of foreign firms. As discussed in Chapter 5, it takes time for foreign firms to embed themselves in the market by hiring local workers and acquiring local suppliers. Also, the type of foreign firm can be important: especially, joint ventures tend to be more inclined to develop linkages with

domestic firms compared to fully foreign-owned firms. A more proactive way to develop the level of embeddedness of foreign firms is to actively promote linkages between foreign and local firms. Doing so ensures that foreign firms become more strongly rooted into their host economy and therefore have an active interest in increasing the productivity of their suppliers and, more generally, their host economy. In this case, "proactiveness" can be understood across two dimensions: a policy dimension, whereby governments promote policies to develop linkages between foreign and domestic firms, and a research dimension, whereby research focuses its efforts on deepening insights on the dynamics and determinants of linkages. Again, firm heterogeneity is important. What characteristics of domestic firms are conducive to more and better linkages with foreign firms? What do foreign firms consider when they decide to source domestically or abroad? Which combinations of domestic and foreign firm characteristics lead to voluntary technology and knowledge transfers and result into knowledge spillovers? In order to answer these questions, new data needs to be collected that captures firm-specific linkages and characteristics. At the time of this writing, I am working on a new project in Moldova, where we plan to implement a survey to a representative sample of foreign and domestic firms to understand the linkages among them. We also plan to merge this survey with administrative data and provide sound empirical support to the qualitative insights from the survey.

Looking outward: Important as firm productivity and performance may be, in the aggregate it is only as important as the effect it has on the rest of the economy, and further, society at large. I started this thesis by highlighting the findings on the relationship between FDI and economic growth at the country level. This is what many International, Development and Macroeconomists see as an appropriate measure and level of aggregation. But as we saw, neither policy makers, nor average Jane or Joe, think of economic growth when they consider FDI and globalisation. Instead, they consider its effects on measures that matter to them – employment, wages, inequality, standard of living – at a scale that truly affects them – the region, city, or even the household. This is why going forward, I plan to focus my research on the effects of FDI on these aspects in the setting of a developing country *through* productivity spillovers to local firms. To do so, I plan to make use of several waves of the Indonesian Household Survey to merge the firm-level Indonesian panel data to the household panel data at the regional level. This will allow me to link and explore a wide range of interrelated topics in the fields of International and Development Economics that have sparked my interest for many years, especially since setting out to work on this thesis. The future is exciting.

APPENDICES

APPENDIX A – CHAPTER 4

Table A1: Variable Description

Log(output)	Log(sales)
Log(capital)	Log(fixed assets)
labour	Total number of full-time employees
Log(materials)	Log(materials)
Log(electricity)	Log(electricity)
TFP	Total factor productivity, by industry
totexp	Total exports (Section A harmonized with export section)
d.age	Age of company categorical variable (1: 0-5 yrs, 2: 6-10 yrs, 3: 11-20 yrs, 4: >20 years)
d.size	Size group in terms of number of full-time employees (S-M-L, I part)
techlevel	Technological classification of the manufacturing sector (Based on OECD definition
foreign10	Ownership Structure D-F (0-10-100, from question 7)
Same province	=1 if At least one main buyer in the same province as the firm
SEZ	Dummy for industrial/export processing zone, computed from q49
Skill ratio	Techical, administrative & managers staff over total workers (%)
d.main buyer	1=main buyer is domestic
Backward FDI	Backward FDI by output share, 10 per cent threshold, province level, including self
Overall buyer support	Sum of different types of support from different types of buyers, ranging from 0 to 18. If a supplier has reported receiving all 6 types of support from all 3 types of buyers (domestic, foreign in Vietnam and foreign abroad), buyersupport=18.
Domestic buyer support	Sum of different types of support from domestic buyers, ranging from 0 to 6. Variables only coded as missing value if supplier did not check any type of support, otherwise coded as 0.
Foreign buyer in Vietnam support	Sum of different types of support from foreign buyers in Vietnam, ranging from 0 to 6. Variables only coded as missing value if supplier did not check any type of support, otherwise coded as 0.
Foreign buyer out Vietnam support	Sum of different types of support from foreign buyers outside Vietnam, ranging from 0 to 6. Variables only coded as missing value if supplier did not check any type of support from any type of buyer, otherwise coded as 0.
Product quality	Assistance with product upgrade from all types of buyers (domestic, foreign in Vietnam, foreign abroad)– if no assistance reported, assistance is coded as 0
Efficiency upgrade	Assistance with upgrade of production efficiency from all types of buyers (domestic, foreign in Vietnam, foreign abroad)– if no assistance reported, assistance is coded as 0
Worker training	Assistance with employee training from all types of buyers (domestic, foreign in Vietnam, foreign abroad)– if no assistance reported, assistance is coded as 0
Financial support	Assistance with financial support from all types of buyers (domestic, foreign in Vietnam, foreign abroad)– if no assistance reported, assistance is coded as 0
Technology transfer	Technology transfer from all types of buyers (domestic, foreign in Vietnam, foreign abroad)– if no assistance reported, assistance is coded as 0
Product design	Assistance with product design/joint product design from all types of buyers (domestic, foreign in Vietnam, foreign abroad)– if no assistance reported, assistance is coded as 0
GVC participation	A dummy variable equal to 1 if the firm is both an importer and an exporter.

Table A2: Heteroskedasticity tests for 2SLS and 3SLS estimations

		3SLS		2SLS	
Equation	E2 functional form	Chi(2)	p-value	Chi(2)	p-value
TFP	Yh	0.0013	0.9712	0.0667	0.7961
TFP	Yh2	3.3839	0.0658	0.5178	0.4718
TFP	LYh2	0.9099	0.3401	0.1382	0.7101
Share of foreign buyers in Vietnam	Yh	9.5214	0.002	16.4027	0.0001
Share of foreign buyers in Vietnam	Yh2	11.397	0.0007	12.5667	0.0004
Share of foreign buyers in Vietnam	LYh2	5.6923	0.017	13.7572	0.0002
Share of buyers abroad	Yh	2.6532	0.1033	1.5089	0.2193
Share of buyers abroad	Yh2	0.752	0.3858	0.1406	0.7077
Share of buyers abroad	LYh2	7.4266	0.0064	5.2141	0.0224
Backward FDI	Yh	0.0327	0.8565	2.5155	0.1127
Backward FDI	Yh2	0.0999	0.752	2.2725	0.1317
Backward FDI	LYh2	0.3628	0.547	0.8592	0.354
Industry export intensity	Yh	18.398	0	16.9501	0
Industry export intensity	Yh2	10.448	0.0012	12.4632	0.0004
Industry export intensity	LYh2	28.232	0	15.3652	0.0001
Overall system heteroskedasticity tests					
Breusch-Pagan LM test		137.1102	0	137.1102	0
Likelihood Ratio LR test		131.8425	0	131.8425	0
Wald Test		2.70E+05	0	2.67E+05	0

Table A3: Results from bootstrapped estimations

	2SLS						3SLS					
	Beta	S.E.	Z	p-val	95% Conf. interval		Beta	S.E.	Z	p-val	95% Conf. interval	
Eq: TFP												
Share of foreign buyers in Vietnam	0.536496	0.287295	1.87	0.062	-0.02659	1.099585	0.865373	0.502884	1.72	0.085	-0.12026	1.851008
Share of buyers abroad	-0.26809	0.141678	-1.89	0.058	-0.54577	0.009595	-0.43711	0.235406	-1.86	0.063	-0.89849	0.024281
_cons	-0.05416	0.036962	-1.47	0.143	-0.12661	0.018281	-0.07035	0.060523	-1.16	0.245	-0.18898	0.048271
Eq: Share of foreign buyers in Vietnam												
Backward FDI	0.618597	0.104352	5.93	0	0.414072	0.823122	0.841149	0.183226	4.59	0	0.482033	1.200265
_cons	-0.10878	0.048904	-2.22	0.026	-0.20463	-0.01293	-0.21565	0.086449	-2.49	0.013	-0.38508	-0.04621
Eq: Share of buyers abroad												
Industry export intensity	0.541121	0.163028	3.32	0.001	0.221592	0.86065	0.704055	0.214941	3.28	0.001	0.282778	1.125332
_cons	0.134036	0.041854	3.2	0.001	0.052002	0.216069	0.092926	0.053553	1.74	0.083	-0.01204	0.197888
Eq: Backward FDI												
Indonesian BFDI	0.383417	0.218418	1.76	0.079	-0.04468	0.811509	0.224378	0.232457	0.97	0.334	-0.23123	0.679985
MFN tariff rate	-0.00621	0.001026	-6.05	0	-0.00822	-0.0042	-0.00504	0.001238	-4.07	0	-0.00747	-0.00262
_cons	0.540549	0.029226	18.5	0	0.483268	0.59783	0.537112	0.025522	21.05	0	0.487091	0.587134
Eq: Industry export intensity												
Indonesian export intensity	0.010165	0.000855	11.88	0	0.008488	0.011841	0.010478	0.000869	12.06	0	0.008774	0.012181
MFN tariff rate	-0.00587	0.001008	-5.82	0	-0.00785	-0.0039	-0.00522	0.001106	-4.72	0	-0.00739	-0.00305
_cons	0.252019	0.019558	12.89	0	0.213686	0.290352	0.239298	0.020859	11.47	0	0.198415	0.280182

APPENDIX B – CHAPTER 5

Table B1: Industry classification according to Moldova's Input-Output Table 2009

NACE Rev.1 Code	Number of observations	IO category description
151	1,475	Production, processing and preserving of meat and meat products
152	219	Processing and preserving of fish and fish products
153	1,580	Processing and preserving of fruit and vegetables
154	1,021	Manufacture of vegetable and animal oils and fats
155	415	Manufacture of dairy products
156	2,342	Manufacture of grain mill products, starches and starch products
157-158	4,371	Manufacture of animal feeds and other food products
159	3,203	Manufacture of beverages
16	281	Manufacture of tobacco products
17	1,513	Manufacture of textiles
18	3,790	Manufacture of wearing apparel; dressing and dyeing of fur
19	894	Manufacture of leather and leather products
20	3,569	Manufacture of wood and wood products
21	825	Manufacture of pulp, paper and paper products
22	6,952	Publishing, printing and reproduction of recorded media
23-24	1,342	Manufacture of coke, refined petroleum products and nuclear fuel & Manufacture of chemicals and chemical products
25	3,537	Manufacture of rubber and plastic products
26	4,502	Manufacture of other non-metallic mineral products
27	152	Manufacture of basic metals
28	5,120	Manufacture of fabricated metal products, except machinery and equipment
29	2,373	Manufacture of machinery and equipment n.e.c.
30	104	Manufacture of office machinery and computers
31	872	Manufacture of electrical machinery and apparatus n.e.c.
32	339	Manufacture of radio, television and communication equipment and apparatus
33	631	Manufacture of medical, precision and optical instruments, watches and clocks
34-35	146	Manufacture of transport equipment
36	4,537	Manufacture of furniture; manufacturing n.e.c.
37	411	Recycling
E	2,401	Electricity, gas and water supply
F	28,104	Construction
G	201,743	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
H	15,346	Hotels and restaurants
60-63	28,641	Transport and storage
64	5,153	Post and telecommunications
J	8,186	Financial intermediation
70	27,682	Real estate activities
71	2,133	Renting of machinery and equipment without operator and of personal and household goods
72	8,009	Computer and related activities
73	1,168	Research and development
74	35,989	Other business activities

Table B2: Summary statistics and distribution of ln(TFP) estimates

IO NACE code	Observations	Mean ln(TFP)	Std. Dev.	Min.	Max.
151	889	0.283785	0.100213	0.033693	1.847144
152	146	0.272575	0.106983	0.10684	0.820182
153	861	0.317015	0.156093	0.070442	1.646829
154	582	0.40693	0.168444	0.062256	1.060831
155	254	0.265094	0.101835	0.109893	1.01102
156	1,452	0.354974	0.129007	0.041189	1.05895
157-158	2,490	0.31158	0.109375	0.013083	1.321905
159	2,368	0.32128	0.13172	-0.15641	1.477479
16	186	0.291205	0.179748	-0.23379	1.023006
17	819	1.228392	0.380258	-1.26576	3.724689
18	2,050	0.699115	0.352532	-0.43542	3.073807
19	498	1.401621	0.257566	0.1124	2.961403
20	1,641	0.85105	0.287915	-0.4288	3.916953
21	465	0.877562	0.289945	-0.2094	4.922923
22	3,269	1.012427	0.261885	-0.26349	2.5703
23-24	820	0.767279	0.956081	-0.77678	7.190934
25	1,971	0.250733	0.160819	-0.19669	1.492206
26	2,371	0.316752	0.189767	-0.20821	1.463394
27	80	0.873166	0.316287	0.103543	2.766346
28	2,750	0.641435	0.224806	-1.5481	3.473035
29	1,475	1.64683	0.325646	-0.61589	3.788107
30	69	1.005069	0.251379	0.045912	1.569128
31	517	1.687738	0.447932	-0.57279	3.87256
32	147	0.871032	0.248838	-0.21319	1.832874
33	385	2.304494	0.456379	0.053114	4.503079
34-35	12	0.487756	0.070227	0.344423	0.579289
36	2,149	1.378192	0.275548	-0.42128	3.063251
37	148	0.834389	0.278543	-0.08384	1.855955

Figure B1: Distribution of ln(TFP) estimates

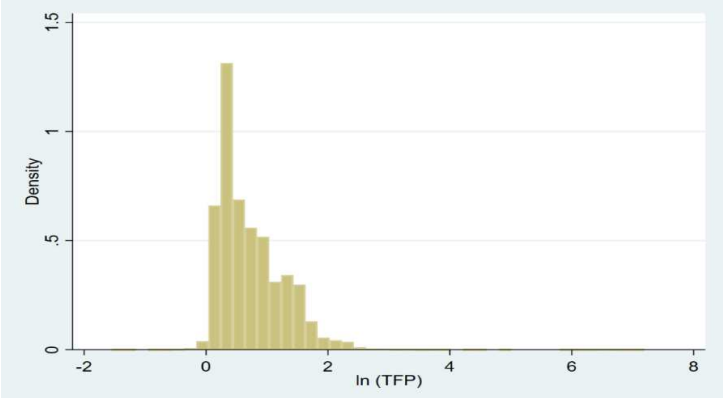


Table B3: Summary statistics for foreign firms' age

	Observations	Mean	Std. Dev.	Median	Min	Max
Foreign Firms Age	36,903	4.978023	4.484792	4	0	22

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NEDERLANDSE SAMENVATTING

Theoretisch en empirisch onderzoek in de internationale en ontwikkelingseconomie literatuur heeft aangetoond dat bedrijven die in het buitenland investeren (vooral multinationale bedrijven met filialen in meer dan één land) gemiddeld productiever zijn dan binnenlandse bedrijven in die landen van bestemming. Ze hebben betere managementmethoden, meer geavanceerde technologieën en ze investeren meer in fysiek en menselijk kapitaal en R&D. Als buitenlandse bedrijven zich in een ontwikkelingsland vestigen, ontstaat zo de mogelijkheid voor binnenlandse bedrijven om van deze buitenlandse bedrijven te leren, en zo productiever te worden. Dit gebeurt meestal door demonstratie- en imitatie-effecten (binnenlandse bedrijven kopiëren simpelweg buitenlandse praktijken), arbeidsomzet (werknemers van buitenlandse bedrijven verhuizen naar binnenlandse bedrijven of worden ondernemers en passen hun verworven kennis toe in hun nieuwe functies), en kennisoverdracht langs de *supply chain* (buitenlandse bedrijven contracteren binnenlandse leveranciers en hebben een strategisch belang om hen te helpen hun productiviteit te verhogen, om input van hogere kwaliteit, meer betrouwbaarheid, etc. te ontvangen). De perceptie dat buitenlandse bedrijven door middel van deze zogenaamde "spillover effects" de productiviteit van binnenlandse bedrijven helpen om te verhogen is zo sterk, dat regeringen van ontwikkelingslanden de instroom van buitenlandse investeringen in hun land door belastingvrijstellingen en subsidies aanmoedigen.

Het bewijs voor het bestaan van deze positieve spillover-effecten is echter verre van eenduidig. Sinds de beschikbaarheid van gegevens is verbeterd en de hoeveelheid onderzoek naar dit onderwerp is toegenomen, hebben verschillende onderzoeken positieve, onbeduidende of zelfs negatieve spillover-effecten gevonden. In dit proefschrift heb ik getracht de structurele redenen voor deze uiteenlopende bevindingen te onderzoeken. Elk hoofdstuk van dit proefschrift is een empirisch onderzoek naar een specifieke dimensie van FDI spillover schattingen in de context van een ontwikkelingsland. De resolutie om op ontwikkelingslanden te focussen is opzettelijk: aan de ene kant, wil ik de unieke uitdagingen benadrukken waarmee deze landen worden geconfronteerd, om eerst FDI aan te trekken en vervolgens om daarvoor te zorgen dat het tot ontwikkeling leidt. Aan de andere kant, wil ik enkele van de unieke uitdagingen die onderzoekers die met gegevens van ontwikkelingslanden werken, in hun onderzoek onder de aandacht te brengen. Dit doe ik in vier afzonderlijke, maar gerelateerde projecten, die gezamenlijk een samenhangend overzicht geven van de uitdagingen, kanalen en voorwaarden voor FDI-spillover-effecten. Ik som deze structurele redenen hieronder op:

Tijd- en contextgedreven divergentie: hoewel de FDI-spillover-literatuur meerdere decennia omvat, en veel recente studies de kwestie van spillovers voor bepaalde landen in verschillende tijdsperioden opnieuw bekijken, is het moeilijk om te beoordelen of de verschillende resultaten die ze vinden te wijten zijn aan feitelijke veranderingen in de politieke en economische context van een specifiek land in de loop van de tijd. Verschillen kunnen ook worden veroorzaakt door verschillen in gebruikte data, verschillen in definities

van variabelen of in de gebruikte methoden. In hoofdstuk twee voer ik een replicatiestudie uit met gegevens van de Indonesische industriesector voor de periode 2002-2013. Door dezelfde gegevensbronnen en methodologieën te gebruiken en dezelfde variabelen te construeren als een ander onderzoek over Indonesië over de periode 1980-1996, kan ik deze verstorende factoren uitsluiten en het effect van en andere tijdsperiode isoleren. Ik constateer dat FDI spillover-effecten in Indonesië in de loop van de tijd zijn veranderd, wat een gevolg kan zijn van een veranderend landschap van bedrijven, een veranderende politieke en zakelijke omgeving, of een combinatie van beide. Ik sluit het hoofdstuk af met beschrijvend bewijs over de ontwikkelingen omtrent beide zaken tijdens de onderzoeksperiode.

Datagedreven divergentie: de beschikbaarheid van gegevens is een kwestie die onderzoek (over ontwikkelingslanden) al lang bemoeilijkt. Met de toenemende beschikbaarheid van meer en betere gegevens, hebben we het effect van het gebruik van verschillende gegevenssoorten en bronnen op schattingen van FDI-spillover-effecten kunnen bestuderen. Om deze data-uitdagingen aan te pakken, voer ik een empirisch onderzoek uit over de "bias" die ontstaat bij het schatten van FDI-productiviteitspillovers met onvolledige datasets. Ik behandel de World Bank Enterprise Survey (WBES) als een voorbeeld van een onvolledige dataset om te laten zien hoe steekproefmethodologie en steekproefgrootte kan leiden tot gebiaste en onbetrouwbare schattingen van FDI spillover-effecten. Om dit te doen, schat ik FDI spillover-effecten voor Indonesië, waarbij bevindingen uit een WBES-dataset worden vergeleken met bevindingen die zijn verkregen met de dataset van hoofdstuk twee (MS dataset), die een telling van alle bedrijven met twintig of meer medewerkers is. Verder voer ik verschillende schattingen uit op grote aantallen willekeurige steekproeven uit de MS, volgens de steekproefmethode van de WBES. De resultaten laten zien dat schattingen van FDI-spillovers op basis van dit steekproefraamwerk onnauwkeurig zijn, veroorzaakt door meetfouten in de variabelen van horizontale en verticale FDI-deelname, sterke steekproefaanwezigheid van kleine bedrijven en kleine steekproefomvang. Het versoepelen van de WBES-steekproefcriteria en het gebruik van FDI-sectorparticipatievariabelen berekend met de MS-dataset levert aanzienlijk betrouwbaardere bevindingen op.

Divergentie gedreven door heterogeniteit van relaties: met behulp van een unieke dataset uit Vietnam waarmee ik de werkelijke relaties tussen buitenlandse en binnenlandse bedrijven in Vietnam kan bestuderen, onderzoek ik of en hoe buitenlandse bedrijven *supply chains* met binnenlandse bedrijven opzetten, kennis aan hun binnenlandse leveranciers overdragen, en of dit de productiviteit van binnenlandse bedrijven verhoogt. Na controle voor een aantal biases, merk ik dat buitenlandse bedrijven in en buiten Vietnam de neiging hebben om meer banden met andere buitenlandse bedrijven in het land dan met binnenlandse bedrijven te ontwikkelen. Wanneer kennisoverdracht plaatsvindt, verhoogt dit echter de productiviteit van binnenlandse bedrijven. Daarom moeten de nodige voorwaarden worden gecreëerd om buitenlandse bedrijven in de lokale economie te verankeren, zodat kennisintensieve koppelingen kunnen ontstaan.

Bedrijfsklimaat en heterogeniteit van bedrijven aangedreven divergentie: met behulp van een nieuwe dataset van het universum van Moldavische bedrijven van 2005-2014, onderzoek ik hoe de bedrijfsomgevingsomstandigheden de kanalen van spillover-effecten beïnvloeden, en daarmee ook het niveau van spillover-effecten. Meer specifiek richt ik mij op arbeidsmobiliteit als kanaal voor spillover-effecten. Om arbeidsmobiliteit in een ontwikkelingsland te meten, zonder op afgestemde gegevens van werkgevers en werknemers te hoeven meten, combineer ik administratieve gegevens van bedrijven met gegevens over arbeidsmarktomstandigheden uit een jaarlijkse enquête over de kosten van zakendoen (CODB). Ik benut variaties in de evaluatie van bedrijven van arbeidsmarktbeperkingen over tijd, sectoren en regio's, om te onderzoeken of arbeidsmarktomstandigheden FDI spillovers beïnvloeden. De resultaten uit dit hoofdstuk laten zien dat er positieve en significante spillover-effecten ontstaan van buitenlandse bedrijven naar Moldavische bedrijven in leverancerende sectoren (backward FDI spillovers), maar niet voor binnenlandse bedrijven in hun eigen sector (horizontale spillovers) of in sectoren die van buitenlandse bedrijven kopen (forward FDI spillovers). Er is echter sprake van heterogeniteit in spillover-effecten als gevolg van de kenmerken van zowel binnenlandse als buitenlandse bedrijven. Verbeteringen in de arbeidsmarktregelgeving, zoals formele contracten en minder ingewikkelde ontslagprocedures, die de arbeidsmobiliteit vergemakkelijken, zijn positief gecorreleerd met backward FDI spillovers.

Tot slot geef ik in hoofdstuk zes enkele implicaties voor het beleid, suggesties voor empirische onderzoekspraktijken en ideeën voor toekomstige onderzoek die uit het onderzoek in deze proefschrift voortkomen.

PËRMBLEDHJE NË SHQIP

Fokusi i këtij dizertacioni janë efektet e prezencës së Investimeve të Huaja Direkte në produktivitetin e kompanive vendase në vendet në zhvillim. Duke përdorur të dhëna mikroekonomike nga Indonezia, Vietnami dhe Moldavia unë hulumtoj arsyet për divergjencat në konkluzionet e arritura nga literatura empirike mbi temën e efektit të Investimeve të Huaja Direkte mbi produktivitetin. Konkluzionet e arritura në këtë studim sugjerojnë që divergjencat e gjetura në efektet e Investimeve të Huaja mund të jenë rezultat i karakteristikave të ndryshme të firmave të huaja dhe vendase, i kushteve të biznesit në vend, si dhe i kontekstit politiko-ekonomik të shtetit nën studim. Në të njëjtën kohë, këto divergjenca mund të jenë pasojë e problemeve me matjet dhe të dhënat e përdorura, si për shembull përdorimi i të dhënave nga burime të ndryshme apo përdorimi i bazave jo të plota të të dhënave. Këto rezultate kanë një sërë implikimesh të rëndësishme për politikat e implementuara nga qeveritë e vendeve në zhvillim, si dhe për kërkimet empirike në të ardhmen. Së pari, ekziston potenciali për përhapjen e efekteve pozitive mbi produktivitetin e kompanive vendase nga kompanitë e huaja, sidomos nëpërmjet lidhjeve me furnizuesit vendas. Megjithatë, që ky potencial të realizohet, kompanitë e huaja duhet të bëhen pjesë e integruar e ekonomisë vendase. Së dyti, këto efekte përhapen në mjedise politike dhe biznesi që inkurajojnë prurjet e Investimeve të Huaja Direkte nëpërmjet kanaleve të ndryshme, siç janë ndërlidhjet mes firmave të huaja dhe lokale përgjatë zinxhirit të furnizimit dhe tregjet fleksibël të punës. Për këtë arsye, zhvillimi i kushteve të duhura të biznesit, që do të siguronte funksionimin dhe mbarëvajtjen e këtyre kanaleve, është mëse i rëndësishëm. Së treti, vlerësimi i efektit të Investimeve të Huaja Direkte në ekonominë vendase bëhet më i vështirë për vendet në zhvillim, ku të dhënat janë shpesh të pamjaftueshme ose të pasakta. Ndaj, është e nevojshme që kërkimet e ardhshme mbi këtë temë të bazohen në matje të sakta të pjesëmarrjes së Investimeve të Huaja në industri. Gjithashtu, përdorimi i një metodologjie universale për matjen e këtyre variablave do të ishte i dobishëm, sepse do të eliminonte disa nga shkaqet për papërputhshmërinë e gjetjeve në vlerësimet empirike.

CURRICULUM VITAE

Dea Tusha was born in Skrapar, Albania in 1992 and grew up in Tirana, Albania. She received her Bachelor of Science degree in Economics and Business Economics (cum laude) from Utrecht University. She went on to complete a Research Master in Multidisciplinary Economics at the Utrecht School of Economics (U.S.E.), for which she received a Master of Science degree (cum laude) in 2015. In September 2015, Dea started working as a PhD candidate at U.S.E. During her PhD, she was an intern at the United Nations Industrial Development Organization in Vienna. As of October 2018, she was dividing her time between completing her thesis and working as a consultant for the World Bank in Washington D.C., where she still works and resides.

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