LUND UNIVERSITY

Exports and Externalities

Arnarson, Björn Thor

2016

Document Version:
Early version, also known as pre-print

[Link to publication](#)

Citation for published version (APA):
Arnarson, B. T. (2016). *Exports and Externalities.* [Doctoral Thesis (compilation), Department of Economics].

Total number of authors:
1

Creative Commons License:
Unspecified

Exports and Externalities

Björn Thor Arnarson

Exports and Externalities

Björn Thor Arnarson

DOCTORAL DISSERTATION
by due permission of the School of Economics and Management,
Lund University, Sweden.
To be defended at Holger Crafoord EC3:210, Lund
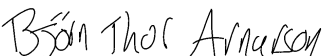on November 11, 2016 at 10:00.

Faculty opponent
Andreas Moxnes, University of Oslo

Organization	Document name
Lund University	Doctoral dissertation
Department of Economics	**Date of issue**
P.O. Box 7082	11 November 2016
S-220 07 Lund, Sweden	
Author	**Sponsoring organization**
Björn Thor Arnarson	

Title and subtitle
Exports and Externalities

Abstract

This thesis, *Exports and Externalities* consists of three papers. The first chapter, *Bridging Trade Barriers: Evaluating Models of Multi-Product Exporters*, evaluates empirically the theoretical predictions of several models of multi-product exporters. For identification I use a *quasi-natural experiment*, the introduction of the Öresund bridge between southern Sweden and Denmark, to analyse the impact on firm behaviour. Using a difference-in-difference methodology, firms in the 'treated' municipality, Malmö, are compared to firms in more geographically distant Gothenburg and Stockholm ('controls'). I find that the results are in line with the predictions in three of four cases. Notably, the only margin that has an ambiguous theoretical prediction, average trade value per product, accounts for 70-80% of the increase in trade value.

In the second chapter, *The Superstar and the Followers: Intra-Firm Product Complementarity in International Trade*, I investigate if exports of different products by the same firm are systematically interconnected. I find evidence that the exports of low-ranked (non-star) products of a firm complement the exports of a superstar(core) products to each destination. The results show that a 1% increase in the exports of the superstar core increases the exports of non-star products by 0.376%. Hence, I find that the exports of non-star products complements the superstar while conversely, the same complementarity is not found using low-ranked products as placebo-superstars.

The third chapter, *Linking Services to Manufacturing Exports*, investigates how services are linked to exporters. We create a Localised Export Exposure (LEE) variable that captures the variation in demand for service inputs based on nearby exporters. Since service firms are much less geographically specialised than manufacturing firms, we observe a high variation in their exposure to demand changes. Our results show that a 1% increase in exports increases the volume of sales of service firms by 0.2% (and employment within the firm by 0.06%). The results show also that the link is *highly* local and the strongest impact is within 20 km of the shock.

Keywords
International Trade, Multi-Product Firms, Spillovers, Services, product complementarity

Classification system and/or index terms (if any)
JEL Classification: F14, F10, F13, F15, F6, L1, L2

Supplementary bibliographical information	Language
	English
ISSN and key title	**ISBN**
0460-0029 Lund Economic Studies no. 197	978-91-7753-022-0 (print)
	978-91-7753-023-7 (pdf)
Recipient's notes	**Number of pages**	**Price**
	143	
	Security classification	

Distributed by Department of Economics, P.O. Box 7082, S-220 07 Lund, Sweden

I, the undersigned, being the copyright owner of the abstract of the above-mentioned dissertation, hereby grant to all reference sources permission to publish and disseminate the abstract of the above-mentioned dissertation.

Signature _Björn Thor Arnarson_   Date _2016-10-06_

Exports and Externalities

Björn Thor Arnarson

Contents

Chapter II: The Superstar and the Followers: Intra-Firm Product Complementarity in International Trade   63

Chapter III: Linking Services to Manufacturing Exports   109

Abstract

This thesis, *Exports and Externalities* consists of three papers. The first chapter, *Bridging Trade Barriers: Evaluating Models of Multi-Product Exporters*, evaluates empirically the theoretical predictions of several models of multi-product exporters. For identification I use a *quasi-natural experiment*, the introduction of the Öresund bridge between southern Sweden and Denmark, to analyse the impact on firm behaviour. Using a difference-in-difference methodology, firms in the 'treated' municipality, Malmö, are compared to firms in more distant Gothenburg and Stockholm ('controls'). I find that the results are in line with the predictions in three of four cases. Notably, the only margin that has an ambiguous theoretical prediction, average trade value per product, accounts for 70-80% of the increase in value.

In the second chapter, *The Superstar and the Followers: Intra-Firm Product Complementarity in International Trade*, I investigate if exports of different products by the same firm are systematically interconnected. I find evidence that the exports of low-ranked (non-star) products of a firm complement the exports of a superstar(core) products to each destination. The results show that a 1% increase in the exports of the superstar core increases the exports of non-star products by 0.376%. Hence, I find that the exports of non-star products complements the superstar while conversely, the same complementarity is not found using low-ranked placebo-superstars.

The third chapter, *Linking Services to Manufacturing Exports*, investigates how services are linked to exporters. We create a Localised Export Exposure (LEE) variable that captures the variation in demand for service inputs based on nearby exporters. Since service firms are much less geographically specialised than manufacturing firms, we observe a high variation in their exposure to demand changes. Our results show that a 1% increase in exports increases the volume of sales of service firms by 0.2% (and employment within the firm by 0.06%). The results show also that the link is *highly* local and the strongest impact is within 20 km of the shock.

Keywords: International Trade, Multi-Product Firms, Spillovers, Services, product complementarity

JEL Classification: F14, F10, F13, F15, F6, L1, L2

Acknowledgments

"…þessi hnífur á að vera þungur"

- Unnamed Viking, *Hrafninn Flýgur*

During recent weeks I have often thought about the above quote, taken from an obscure Icelandic Viking saga movie from the 1980s.[1] There is a scene in the movie where Gestur, the main character, is given a knife, which he notes is heavy. An unnamed Viking then famously responds: "This knife is supposed to be heavy". Why would I think of this quote in these last days of my PhD studies? In many ways it captures my journey as a PhD student. I started the studies with the aim of acquiring a sharp and powerful tool: the ability of being able to approach a question with academic rigour. Just as the knife was supposed to be heavy, acquiring this tool has been hard, as it should be. I do not think this experience would have been nearly as rewarding if it were not for all the bumps I have encountered on the way — as they, especially, have helped me develop, both personally and as a researcher.

I certainly would not have been able to overcome these challenges if there had not been a large group of people who have supported me on the way. First and foremost, I am in debt to my supervisors, Joakim Gullstrand and Fredrik Sjöholm. Without their tremendous support, encouragement and constructive feedback this thesis would not be the same. Joakim, your relentless willingness to answer my questions and endless e-mails has had a profoundly positive effect on this thesis. I am also thankful for you granting me access to the dataset used in all chapters of this thesis. Fredrick, I value your frank and no-nonsense approach to reviewing my papers. Your feedback helped greatly to advance this thesis.

Fredrik Heyman, I thank you for a thorough review of the thesis at my final seminar; your insightful comments truly improved this thesis. I would also like to thank the participants at the international economics seminars, not only for presenting interesting research, but also for attending my presentations. In particular, I would like to thank Maria Person, Anna

---

[1] This film is (oddly) well known in Sweden, as it was compulsory in schools for a number of years.

here more enjoyable, and his willingness to discuss course material, bounce off research ideas or just have a chat was a huge asset in my years as a PhD student. Thank you. Karl McShane, Anna Welander and Margaret Samahita: I appreciate your drive towards making the PhD life more social and entertaining. Discussions in the coffee room or over lunch at the PhD table made this time a pleasant experience. For that I want to thank, among others not previously mentioned: Claes, Valeriia, Usman, Milda, Sanna, Caren, Sara (x2), Veronika, Graeme, Thomas, Johan, Lina, Aron, Hjördís, John, Jim, Jörgen, Dominika, Kristoffer, Simon, Hassan, Pol, Alemu, Dominice, Erik and Elvira. A special thanks to Emma, you are missed.

During my time in Lund I have been fortunate to get to know a large group of Icelanders who have contributed to making my time here even more memorable. Thanks Davíð, Alli and SÓS#9, my team-mates on the legendary, football team *Tungur Knivur*, and the Icelandic community at Kjamminn. Also to Hjalti, for our in-depth conversations during many long lunches.

I am indebted to my parents and sister. Your support during my very first years of school, when I needed it the most, has enabled me to get where I am today. Thank you.

Lastly, I want to thank my family, Margrét and our two daughters, Brynja and Elma, for enriching my life and providing me with a necessary perspective of the truly important things in life. To my wife Margrét, I am forever grateful for your sacrifices, which have enabled me to pursue my dream, as well as your love, support and encouragement, often at times when I needed it the most. Margrét, without you, I would not be here today. Takk, ég elska þig.

October 2016,
Björn Þór Arnarson

Introduction

Introduction

1   Background

Introductory textbooks on international economics often illustrate potential gains from trade by an example of two countries exchanging bananas and cars. The original trade theories provided intuitive explanations for these types of trade flows, either by Ricardo's (1821) comparative advantage or differences in factor endowments, as in the Heckscher–Ohlin model (Heckscher, 1919 and Ohlin, 1924). Both are reasonable when we think of trade of bananas from warmer, to colder climates or countries endowed with a large population of high skilled labour to produce high-skill-intensive products (cars). However, what was less thought about was why would countries producing cars intensively still import them? Why would, for example, Sweden both import and export cars to/from Germany?

This observation sparked a new strand of literature investigating intra-industry trade, starting from contributions by Krugman (1979, 1980) and Krugman and Helpman (1985). The main contributions of this literature, commonly referred to as "New Trade Theory", are economics of scale and imperfect competition, which can explain some of the puzzling intra-industry trade mentioned above. A subtle but important point not emphasised in this early literature is that it is not sectors (or countries) that trade, but rather firms. The seminal work by Marc Melitz (2003) formalised the role of firms in international trade in a theoretical model. The central observations of the model are that the firms are heterogeneous and self-select into exporting. These firms that select to export differ in a systematic manner from non-exporting firms. The exporters have been found to be larger, more profitable, pay higher wages and are more productive than non-exporters within the same sector (Mayer and Ottaviano, 2008). Notably, there is also a large heterogeneity *among* exporters. This point is highlighted, in a descriptive paper, by Mayer and Ottaviano (2008) discussing what they call the "happy few". The name of the paper refers to the handful of firms at the top of the size distribution that account for the bulk of the trade value. Tables 1 and 2 illustrate the same pattern for Sweden.

Table 1: Share (%) of Swedish exporters depending on destination and product scope in 2011. Calculated as the nr. of firms in each cell divided by the total number of exporters.

	Nr. of destinations				
	1	2	3	4-10	11+
Nr. prod exp.					
1	33.8	2.2	0.7	0.9	0.3
2	8.9	4.1	1.0	1.2	0.4
3	4.1	2.4	1.1	1.3	0.6
4-10	5.9	4.0	2.7	5.1	3.1
11+	1.6	1.3	1.1	3.7	8.5

Table 2: Share (%) of Swedish export value depending on destination and product scope in 2011 (calculated as the export value in each cell divided by the total export value).

	Nr. of destinations				
	1	2	3	4-10	11+
Nr. prod exp.					
1	0.4	0.1	0.1	0.3	0.5
2	0.1	0.2	0.1	0.3	0.8
3	0.2	0.1	0.1	1.2	1.7
4-10	0.3	0.2	0.8	1.5	6.4
11+	0.3	0.9	0.4	2.9	80.5

The tables are created by placing each firm in a cell depending on the number of destinations it serves and products exported. In the top left corner of the table 1 we see that in terms of number of firms, around 34% of firms export only a single product to a single destination, and 58% of firms export three or fewer products to three or fewer destinations (blue). Despite accounting for well over half of the exporters in Sweden, these firms account for only 1.4% of the aggregate export value from Sweden (blue, table 2). In terms of the value, we can see from the table 2 that the trade value is at opposite ends to the mass of firms, as over 80% of the trade value is concentrated among multi-product firms exporting 11 or more products to 11 or more destinations (red). These firms account for only 8.5% of the firms (red). A high level of heterogeneity is therefore evident among exporters, and the "happy few" dominate the export value. The frontier in international trade[2] is now taking the natural next step of opening the black box of these multi-product exporters. In Chapter 1 of the thesis I contribute to this growing literature by evaluating the theoretical models available of multi-product exporters and secondly, in Chapter 2, by identifying a new one-way intra-firm complementarity between products.

When products are exported between countries, an intrinsic attribute of the process is that trade is costly, and more so over long distances. Tinbergen's (1962) early "gravity equation" is based on an analogy to Newton's law of gravity, that trade flows between countries depending on their economic mass and is inversely related to the distance between them — the intuition being that countries that are bigger and closer to each other will naturally be drawn towards trading together. The role of proximity and distance *between* countries has therefore been at the core of international trade literature for decades. An important, related theoretical contribution is the seminal work of Paul Krugman (1991) on how firms may geographically agglomerate to minimise transport costs. Hence, intra-country distance may play a role in shaping their competitiveness and export potential. There is, for

---

[2]See for example the following papers (both theoretical and empirical): Bernard, Redding, and Schott (2011), Feenstra and Ma (2008), Arkolakis, Muendler, and Ganapati (2015), Eckel and Neary (2010), Mayer, Melitz, and Ottaviano (2014) Feenstra and Ma (2008), Bernard, Redding, and Schott (2010), Goldberg, Khandelwal, Pavcnik, and Topalova (2010). More empirical Iacovone and Javorcik (2010) and Timoshenko (2015a,b).

example, a literature investigating export spillovers, i.e. how the exporting of nearby firms may influence the *exporting* of neighbouring firms.[3] With increased availability of high-quality datasets at a more disaggregated level, a number of studies have now identified that firms build input-output linkages *within* the country and to a large extend with their geographic neighbours. These local relationships hold both for linkages between manufacturing producers[4] but to an even greater extent for firms providing service inputs.[5]

Another related recent strand has investigated how the construction of road and transport infrastructure can exert a positive impact or externality on nearby areas. There are studies that have found, for example, how transport infrastructure has impacted income or trade (Michaels, 2008) and reallocated economic activity towards areas with improved road infrastructure (Chandra and Thompson, 2000). Better transport and road infrastructure have also been found to have both direct and indirect impact on firms. These effects include increased flexibility and better inventory management (Datta, 2012), lower search cost for suppliers (Bernard, Moxnes, and Saito, 2015), agglomerations effects (Åkerman, 2009) and changes in shipment frequency (Volpe Martincus, Carballo, Garcia, and Graziano, 2014).[6]

In Chapters 1 and 3 of the paper I contribute to the foregoing literature by investigating the potential for externalities associated with neighbours exporting, or that of large-scale transport infrastructure.

2 The Thesis

The thesis consists of three chapters, which share an emphasis on using highly disaggregated microdata from Sweden to advance understanding of firm behaviour. By digging deeper into the detail of the data, I am able

---

[3]See for example Greenaway and Kneller (2008) and Koenig, Mayneris, and Poncet (2010).

[4]See for example, Hillberry and Hummels (2008), Wrona (2015), Bernard, Moxnes, and Saito (2015), and Hummels and Schaur (2013).

[5]See for example a survey by Gullstrand (2016) supporting this line of argument where he shows that over 80% of Swedish manufacturing firms have a major link to service firms from within the region, compared to 30% for product producers. Gervais and Jensen (2015) also finds that services are less tradable over space than manufacturing production, while there is some variation within different service sectors.

[6]It should be noted that this was found as a result of a negative shock on transport infrastructure, closure of a bridge.

to both evaluate current theoretical models and uncover new underlying mechanisms. The thesis explores the two literatures discussed above: multi-product exporters and the role of proximity/geography. In the first two chapters, I focus on the theme of questions relating to intra-firm dynamics of multi-product exporters, while the third (and first) chapter share an emphasis on the role of proximity and geography in firm behaviour. The thesis is named *Exports and Externalities*, as it captures in a broad sense the general theme of the thesis. All chapters have in common that there are externalities or spillovers at their core, whether due to: externalities of bridge construction; how exporters exert a positive influence on their community; or how firms may internalise externalities/spillovers between different products the firm exports.

In the following sections, a more detailed description is provided of each chapter. In each section I discuss how the research questions of that chapter relate to a hypothetical car manufacturer, Malmö Motors, located in the city of Malmö. The examples are provided to give a general intuition behind the mechanism being investigated.

2.1 Bridging Trade Barriers: Evaluating Models of Multi-Product Exporters

In the first chapter, *Bridging Trade Barriers: Evaluating Models of Multi-Product Exporters*, I evaluate theoretical models of multi-product exporters by assessing how the opening of the Öresund Bridge, between Copenhagen in Denmark and Malmö in Sweden, impacted the behaviour of multi-product exporters. The bridge reduced the trade costs for firms trading with Denmark, and to a greater extent for firms in Malmö compared to other cities in Sweden. I use this variation in impact to assess how firms respond to changes in trade costs and how well current theoretical models perform in predicting the effects we observe. The focus is on within-firm adjustments regarding product scope and intensity as well as new firms' export entry decisions.

Intuitively, it seeks to understand how Malmö Motors reacts when trade costs to Denmark fall. More specifically, I try to understand if Malmö Motors: (1) exports more of the cars it had been exporting prior to the

bridge (product intensive margin); (2) has started to export new products to the Danish market, previously not exported — for example motorcycles and/or buses (product extensive margin); (3) has increased their total trade value of all products to Denmark (firm-intensive margin). To address these questions, a difference-in-difference methodology is used, whereby firms in the 'treated' municipality, Malmö, are compared to firms in the more geographically distant Gothenburg and Stockholm ('controls'). Hence, we compare how Malmö Motors reacted compared to other (hypothetical) car producers in locations further away from the Öresund Bridge. Last, we assess if firms in Malmö are more likely to start exporting after the introduction of the Öresund Bridge.

The results show that manufacturing firms in Malmö increased their overall trade with Denmark by over 30%. By decomposing that change, we can see that around 70-80% of the increase in aggregate firm trade value is due to increases in the average trade value per product (product intensive margin) and only 20-30% is due to increases in the number of products exported (product-extensive margin). For Malmö Motors, it means that they have substantially increased their exports of cars that were exported prior to the bridge, while only 20-30% of the increase can be attributed to new products being exported (buses or motorcycles). Firms in Malmö that did not export prior to the bridge are also found to be much more likely to start exporting than firms in the control group.

The main contribution of the paper is to compare the observed impact to the predictions of several models of multi-products exporters.[7] The models predict that multi-product exporters would increase their total trade value of all products and start exporting a greater number of products. The theoretical prediction regarding the impact on the product-intensive margin is ambiguous (number of cars). I find, however, that this is the main margin of adjustment for firms following a decrease in trade costs. Hence, firms increase their total exports though export sales of their pre-existing core export products rather than new, more peripheral products.

---

[7]The predictions of the following models evaluated are: Bernard, Redding, and Schott (2011), Arkolakis, Muendler, and Ganapati (2015), Eckel and Neary (2010) and Mayer, Melitz, and Ottaviano (2014).

2.2 The Superstar and the Followers: Intra-Firm Product Complementarity in International Trade

In the second chapter, *The Superstar and the Followers: Intra-Firm Product Complementarity in International Trade*, I identify a new one-way complementarity between products exported. I first document that within a firm the sales are highly skewed towards a very small set of products.[8] This skewness is apparent when looking at firms exporting over 100 products; for that group of firms, the single best selling product accounts for 40% of the trade value and the top three 'core' products for over 60%. Hence, products are very dissimilar in their importance to the firm aggregate trade value.

For Malmö Motors this means that even if the firm exports 100 products, the export sales of the three best selling (or 'superstar') products (cars, motorcycles and buses) accounts for 60% of their trade value. In this paper I try to explain why firms still export these 97 relatively low value non-star products and how the exports of these products respond to the exports of the superstar products. The intuition behind the mechanism suggested is that even if the core competence of Malmö Motors lies in making vehicles, they may still export other products that complement the sales of their main superstar products. These may be car accessories, for example, specialised navigation systems, bicycle holders, roof boxes or child car seats. In the paper I argue that demand increases for the firm's superstar-products (cars, motorcycles and buses) will lead to increases in the sales of the non-star products (the accessories). Conversely, we should *not* observe that if more people in general want to buy more of a specific accessory, e.g. child car seats, that would be transmitted to the sales of actual vehicles. Hence, the name "The Superstar and the Followers" refers to this mechanism that the superstar products will have followers but a follower will not have a 'star'.

The results of the paper show that there is a one-way complementarity between the superstar products exported by each firm and lower ranked products of the firm. This mechanism is found by using both the single most-exported product as the superstar (car) or the group of superstar-core products (cars, motorcycles and buses) of the firm. The estimated

---

[8]This resembles the stylised facts in figures 1 and 2 except that this skewness is within the firm.

elasticities are 0.13 for the single superstar-product specification and 0.376 for the superstar-core. Hence a 1% increase in the superstar product or the superstar core increases the sales of non-superstar products (the accessories) by 0.13% and 0.376%. This type of intra-firm one-way complementarity of products has, to my knowledge, not been documented before and is missing in current models of multi-product exporters.

2.3   Linking Services to Manufacturing Exports

The third chapter,[9] tries to uncover externalities from exporters to their local business community. The previous chapters have focused on the exporters themselves and how they operate or react to changes in their environment. This chapter reverses the focus, looking not at how exporters are impacted, but rather at how they impact other businesses. The underlying idea is that non-global service firms may be indirectly impacted by global shocks through their neighbours. In this paper, *Linking Services to Manufacturing Exports*, we try to identify such a mechanism.

Services accounted for nearly 70% of world GDP in 2014, and this share has been growing over time. For advanced economies this growth can be attributed to growth in business services (see World bank, 2016 and ECSIP, 2014). Manufacturing firms are also undergoing a process dubbed 'servicification' of the manufacturing production. These firms are increasingly using services as inputs to complement their production of goods. Lodefalk (2013) showed that of all services used in manufacturing production, 75% were external to the firm. Hence there are important input-output linkages between service providers and manufacturing exporters.

For identification we use the fact that the service sector is more evenly distributed over space than manufacturing. The close linkages between the services and manufacturing sectors ensure a high variation in exports across similar types of service firms located in different parts of the country. We use this variation to identify the strength of the linkages between global manufacturing firms and service providers. More specifically, we create a location-specific measure, Localised Export Exposure (LEE), which captures

---

[9]This chapter is written with Joakim Gullstrand.

how service firms are impacted by changes in manufacturing exports in their close proximity. Hence, LEE captures how demand for service inputs in a particular location fluctuates as a result of changes in exporting. To identify this link between services and exporters, we use the facts that the manufacturing sector is spatially specialised and that there are important *local* input-output linkages between manufacturing and services firms. An idiosyncratic industry-specific shock on manufacturing exports will therefore be transmitted to local service firms and impact their volume of sales. As service firms are much more evenly distributed over space, we will observe large variations within the service sector, due to varying exposure to the same shock. A strength of this paper is the highly detailed geographic data[10] used about the location of all firms. This allows us to employ a flexible approach, as we can measure the exposure of service firms to exporting with great detail.

Referring back to Malmö Motors, when producing a car there may be a need for some specialised computer programs. Malmö Motors may want to create customised mobile applications, navigation systems or some specialised software solutions to be installed on the cars computer.[11] In this chapter we investigate how the exporting of, for example, Malmö Motors, impacts the sales of service providers. For identification we exploit the fact that services are less tradable over space and hence an increase in exporting by Malmö Motors will increase the demand for service inputs from mostly the local service provider. Hence if demand for the products of Malmö Motors increases then we expect Malmö Programmers next door to be positively impacted (by providing the service inputs). The shock, however, decays with distance, and programmers in the relatively nearby town of Lund will be less impacted, while firms in more distant Stockholm and Umeå should not be exposed to the shock.

The results of the chapter show that a 1% increase in exporting increases the sales volume of (business) service firms by 0.2%. The results show also

---

[10]The geographic unit used is called SAMS areas, and there are over 9 000 such areas in Sweden compared to less than 300 municipalities.

[11]Audi, BMW, Ford, Mercedes and Volkswagen have all, for example, created mobile applications for their cars. The functionality varies but some focus on special offers while others on maintenance or safety (see Drasnin, 2013).

that the link is *highly* local and the strongest impact is within 20 km from the service firm. A theoretical model is also presented in the chapter to explain this mechanism, which is heavily based on the work of Fujita and Thisse (2002). Our results are broadly in line with the model's expectation that the transmission mechanism should be similar to the export intensity of the manufacturing sector (found to be 0.14).

References

Arkolakis, Costas, Marc-Andreas Muendler, and Sharat Ganapati (2015). *The Extensive Margin of Exporting Products: A Firm-level Analysis.* Working Paper.

Bernard, Andrew B., Stephen J. Redding, and Peter K. Schott (2010). "Multiple-Product Firms and Product Switching". *American Economic Review* 100.1, pp. 70–97. ISSN: 0002-8282. DOI: 10.1257/aer.100.1.70.

— (2011). "Multiproduct Firms and Trade Liberalization". *The Quarterly Journal of Economics* 126.3, pp. 1271–1318. ISSN: 0033-5533. DOI: 10.1093/qje/qjr021.

Bernard, Andrew, Andreas Moxnes, and Yukiko Saito (2015). *Production Networks, Geography and Firm Performance.* Working Paper. Cambridge, MA: National Bureau of Economic Research. DOI: 10.3386/w21082.

Chandra, Amitabh and Eric Thompson (2000). "Does public infrastructure affect economic activity?" *Regional Science and Urban Economics* 30.4, pp. 457–490. ISSN: 01660462. DOI: 10.1016/S0166-0462(00)00040-5.

Datta, Saugato (2012). "The impact of improved highways on Indian firms". *Journal of Development Economics* 99.1, pp. 46–57. ISSN: 03043878. DOI: 10.1016/j.jdeveco.2011.08.005.

Drasnin, David (2013). *How Car Manufacturers Incorporate Mobile Apps in Their Marketing Strategy.* URL: http://www.themail.com/2013/12/18/how-car-manufacturers-incorporate-mobile-apps-in-their-marketing-strategy/ (visited on 09/20/2016).

Eckel, Carsten and J. Peter Neary (2010). "Multi-Product Firms and Flexible Manufacturing in the Global Economy". *Review of Economic Studies* 77.1, pp. 188–217. ISSN: 00346527. DOI: 10.1111/j.1467-937X.2009.00573.x.

ECSIP (2014). *Study on the relation between industry and services in terms of productivity and value creation.* October. European Competitiveness and Sustainable Industrial Policy Consortium.

Feenstra, Robert C. and Hong Ma (2008). "Optimal Choice of Product Scope for Multiproduct Firms under Monopolistic Competition". *The Organization of Firms in a Global Economy.* Ed. by Elhanan Helpman,

Dalia Marin, and Thierry Verdier. Cambridge MA: Harvard University Press. Chap. 6, pp. 173–199.

Fujita, Masahisa and Jacques-Francois Thisse (2002). *Economics of Agglomeration: Cities, Industrial Location, and Regional Growth*. Cambridge: Cambridge University Press. ISBN: 9780511805660. DOI: `10.1017/CBO9780511805660`.

Gervais, Antoine and J. Bradford Jensen (2015). "The Tradability of Services: Geographic Concentration and Trade Costs". DOI: `10.3386/w19759`.

Goldberg, P. K., A. K. Khandelwal, N. Pavcnik, and P. Topalova (2010). "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India". *The Quarterly Journal of Economics* 125.4, pp. 1727–1767. ISSN: 0033-5533. DOI: `10.1162/qjec.2010.125.4.1727`.

Greenaway, David and Richard Kneller (2008). "Exporting, productivity and agglomeration". *European Economic Review* 52.5, pp. 919–939. ISSN: 00142921. DOI: `10.1016/j.euroecorev.2007.07.001`.

Gullstrand, Joakim (2016). "The Export Decision: A Survey of Swedish Firms". *Mimeo.*

Heckscher, Eli F. (1919). "Utrikeshandelns verkan på inkomstfördelningen. Några teoretiska grundlinjer". *Ekonomisk Tidskrift* 21.4, p. 1. ISSN: 02847310. DOI: `10.2307/3437610`.

Hillberry, Russell and David Hummels (2008). "Trade responses to geographic frictions: A decomposition using micro-data". *European Economic Review* 52.3, pp. 527–550. ISSN: 00142921. DOI: `10.1016/j.euroecorev.2007.03.003`.

Hummels, David and Georg Schaur (2013). "Time as a Trade Barrier". *American Economic Review* 103.7, pp. 2935–2959. ISSN: 0002-8282. DOI: `10.1257/aer.103.7.2935`.

Iacovone, Leonardo and Beata S. Javorcik (2010). "Multi-Product Exporters: Product Churning, Uncertainty and Export Discoveries". *Economic Journal* 120.544, pp. 481–499. ISSN: 00130133. DOI: `10.1111/j.1468-0297.2010.02356.x`.

Koenig, Pamina, Florian Mayneris, and Sandra Poncet (2010). "Local export spillovers in France". *European Economic Review* 54.4, pp. 622–641. ISSN: 00142921. DOI: `10.1016/j.euroecorev.2009.12.001`.

Krugman, Paul (1979). "Increasing returns, monopolistic competition, and international trade". *Journal of International Economics* 9.4, pp. 469–479. ISSN: 00221996. DOI: 10.1016/0022-1996(79)90017-5.

— (1980). "Scale Economies, Product Differentiation, and the Pattern of Trade". *The American Economic Review* 70.5, pp. 950–959. ISSN: 00028282. DOI: 10.2307/1805774.

— (1991). "Increasing Returns and Economic Geography". *Journal of Political Economy* 99.3, p. 483. ISSN: 0022-3808. DOI: 10.1086/261763.

Krugman, Paul and Elhanan Helpman (1985). *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy.* Cambridge, MA: MIT Press.

Lodefalk, Magnus (2013). "Servicification of manufacturing - evidence from Sweden". *International Journal of Economics and Business Research* 6.1, p. 87. ISSN: 1756-9850. DOI: 10.1504/IJEBR.2013.054855.

Mayer, Thierry, Marc J Melitz, and Gianmarco I. P. Ottaviano (2014). "Market Size, Competition, and the Product Mix of Exporters". *American Economic Review* 104.2, pp. 495–536. ISSN: 0002-8282. DOI: 10.1257/aer.104.2.495.

Mayer, Thierry and Gianmarco I. P. Ottaviano (2008). "The Happy Few: The Internationalisation of European Firms". *Intereconomics* 43.3, pp. 135–148. ISSN: 0020-5346. DOI: 10.1007/s10272-008-0247-x.

Melitz, Marc J (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity". *Econometrica* 71.6, pp. 1695–1725. ISSN: 0012-9682. DOI: 10.1111/1468-0262.00467.

Michaels, Guy (2008). "The effect of trade on the demand for skill: Evidence from the interstate highway system". *The Review of Economics and Statistics* 90.November, pp. 683–701.

Ohlin, Bertil (1924). *Handelns teori.* Stockholm: Centraltryckeriet.

Ricardo, David (1821). "On the principles of political economy and taxation". 17.

Timoshenko, Olga A (2015a). "Learning versus sunk costs explanations of export persistence". *European Economic Review* 79, pp. 113–128. ISSN: 00142921. DOI: 10.1016/j.euroecorev.2015.02.006.

Timoshenko, Olga A (2015b). "Product switching in a model of learning". *Journal of International Economics* 95.2, pp. 233–249. ISSN: 00221996. DOI: 10.1016/j.jinteco.2014.12.009.

Tinbergen, Jan (1962). "An Analysis of World Trade Flows". *Shaping the World Economy*. Ed. by Jan Tinbergen. New York, NY: Twentieth Century Fund, pp. 262–293.

Volpe Martincus, Christian, Jerónimo Carballo, Pablo M. Garcia, and Alejandro Graziano (2014). "How do transport costs affect firms' exports? Evidence from a vanishing bridge". *Economics Letters* 123.2, pp. 149–153. ISSN: 01651765. DOI: 10.1016/j.econlet.2014.01.030.

World bank (2016). *World Development Indicators*.

Wrona, Jens (2015). *Border Effects without Borders: What Divides Japan's Internal Trade?* Working Paper 185. Düsseldorf Institute for Competition Economics (DICE).

Åkerman, Anders (2009). *Trade, Reallocations and Productivity: A Bridge between Theory and Data in Öresund*. Working Paper.

Chapter I

Bridging Trade Barriers: Evaluating Models of Multi-Product Exporters

Abstract

In this paper I investigate the impact of a decrease in trade costs on firms' decisions to export. The main contribution of this paper is to evaluate empirically the theoretical predictions of several models of multi-product exporters. The focus is on the firm export entry decision and the within firm adjustment regarding product scope and intensity. For identification I use a *quasi-natural experiment*, the introduction of the Öresund bridge between southern Sweden and Denmark, to analyse the impact on firm behaviour.

Using a difference-in-difference methodology, firms in the 'treated' municipality, Malmö, are compared to firms in more geographically distant Gothenburg and Stockholm ('controls'). For the 'treated' manufacturing firms a theoretically consistent positive effect is found for firm entry into exporting, aggregate firm trade flow and the number of products exported. The models of multi-product exporters evaluated do not provide a clear theoretical prediction regarding the impact on average trade value per product. In this paper, however, I find that around 70-80% of the increase in aggregate firm trade value is due to increases in the average trade value per product (the product intensive margin), while only 20-30% is due to increases in the number of products exported (the product extensive margin).

Keywords: International Trade, Multi-Product Firms, Infrastructure, Market Access, Quasi-Natural Experiment, Trade Costs.

JEL Classification: F14, F10, F13, F15.

1   Introduction

In the last decade, firm heterogeneity has been in the foreground of the international trade literature. Exporters are in general rather few, and are more productive, bigger, more profitable, more capital intensive, and pay higher wages than non-exporters in the same industry (Mayer and Ottaviano, 2008). This firm heterogeneity is well-acknowledged in the current trade literature and forms the basis of the standard Melitz (2003) model of trade. Even if we acknowledge that exporters vary from non-exporters, there is great heterogeneity *among* exporters. Mayer and Ottaviano (2008) identify some of these facts and find that the top 1% of exporters account for 40% of aggregate exports, and top the 10% for around 80%. Several recent papers have incorporated this product-level heterogeneity into theoretical models of multi-product multi-destination firms [see e.g., Bernard, Redding, and Schott (2011), Arkolakis, Muendler, and Ganapati (2015), Eckel and Neary (2010) and Mayer, Melitz, and Ottaviano (2014)]. However, the empirical validation of these models is limited. One exception is Berthou and Fontagné (2013), who used the introduction of the Euro as a natural experiment to analyse the behaviour of multi-product firms using the Bernard, Redding, and Schott (2011) model as a benchmark. Other examples include Bernard, Van Beveren, and Vandenbussche (2014), who use Belgian data to verify the empirical predictions of the product switching model of Bernard, Redding, and Schott (2010). This paper also relates to literature using quasi-natural experiments and/or improvements in transport infrastructure to identify their impact on economic activity [see e.g., Bernard, Moxnes, and Saito (2015), Volpe Martincus and Blyde (2013), and Coşar and Demir (2016)].

This paper contributes to the literature by taking several models of multi-product exporters to the data and analysing the impact of a decrease in trade costs. Using the introduction of the Öresund Bridge as a quasi-natural experiment, I compare the theoretical predictions to the observed impact. The introduction of the Öresund bridge has been used before by Åkerman (2009) to test the empirical validity of a simplified version of the Melitz (2003) model. He found how increased trade impacted aggregate productivity by reallocating production from the less productive to the more productive

firms.

This paper's structure is as follows: section 2 reviews the literature and theoretical framework; section 3 discusses the natural experiment; section 4 describes the data; section 5, the empirical specification. They are followed by a discussion of the results and the conclusions in sections 6 and 7.

2 Theoretical Framework and Related Literature

2.1 The Export Decisions of Multi-product Exporters

This paper empirically analyses the theoretical predictions for models of multi-product exporters MPE after a decrease in trade costs. The models evaluated are by Bernard, Redding, and Schott (2011), Arkolakis, Muendler, and Ganapati (2015), Eckel and Neary (2010) and Mayer, Melitz, and Ottaviano (2014) (henceforth referred to jointly as MPE models). The predictions are evaluated on the following margins of trade: the firm-extensive margin (the probability that a firm exports, M), the firm-intensive margin (aggregate export value of the firm, X) which is then decomposed into sub-margins, the product extensive (number of products, P) and the product intensive margin (average export per product, $\bar{x}$). See figure 1.
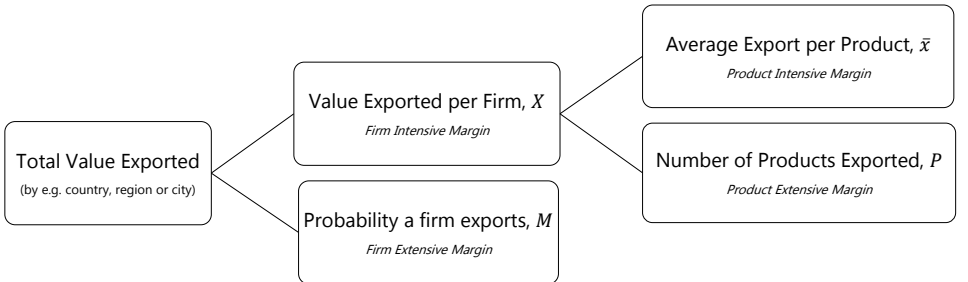
Figure 1: Decomposition of total exports into the margins of trade.

All the MPE models feature a selection mechanism, as in the Melitz model, in which the relatively more productive firms are able to self-select

into exporting and overcome the associated fixed costs. A reduction in trade costs will lower the export threshold ("the productivity cut-off") for new firm entrants. If the cut-off to become an exporter decreases, then the number of exporters (the probability of exporting) increases since more firms are now competitive in the foreign market.[1]

Following a decrease in trade costs all MPE models predict an increase in firm aggregate trade flow (X), but differ in terms of the dynamics and mechanisms within the firm, at the product level. The model by Bernard, Redding, and Schott (2011) incorporates two types of fixed costs: a country specific fixed cost (e.g. to build distribution networks), and a product-specific fixed cost (e.g. due to regulatory standards or to product adjustments). A drop in trade costs would induce firms to *produce* fewer varieties and increase the export volume of products already being exported. Additionally, lower trade costs will make it profitable to *export* more varieties.[2] The model by Eckel and Neary (2010) shows how increased competition may induce firms to focus on products close to their core competency. Mayer, Melitz, and Ottaviano (2014) incorporate competition effects in the destination market and show how increased competition drives firms to skew their export sales to their better performing products and alter their product mix. In both Eckel and Neary (2010) and Mayer, Melitz, and Ottaviano (2014), trade liberalisation would allow firms to export products further away from their core competency. Arkolakis, Muendler, and Ganapati (2015) integrate some of the aspects of Eckel and Neary (2010) and Bernard, Redding, and Schott

---

[1]Increased competition may also cause the least productive firms to exit (shut-down). This relates to Roberts and Tybout (1997), who documented the importance of sunk costs of exporting. They found that previous entry had significant predicting power for future participation, indicating that there are sunk/fixed costs associated with exporting. Using a similar estimation strategy, corresponding results were found by Bernard and Jensen (2004) for US manufacturing firms and Gullstrand (2011) for the Swedish food sector. Other studies have looked at how sunk export costs may be destination-specific. Moxnes (2010) finds that while some costs of exporting are common for all countries (global), the country-specific costs are estimated to be up to three times higher. Gullstrand and Persson (2014) found that firms tended to stay longer in core compared to peripheral markets, indicating differing sunk costs based on the destination market.

[2]The model contains an analogous selection mechanism, as described above, at the firm level, but now at the product level. There is a within-firm selection effect of firms dropping their "worst" products in production (lowest attributes) and shifting resources towards their "better" products that they are now able to export. Hence it has become profitable to export a larger range of products due to a lower "product cut-off".

(2011) in a single framework. Their model emphasises the importance of economics of scope and differences in market access across destinations. All four models predict that a decrease in trade costs will lead to an increase in the number of products exported.[3]

To summarise, all four of the MPE models[4] predict that following a decrease in trade costs, there will be an increase in the following margins of trade: the propensity of firms to export (firm-extensive margin, M), aggregate firm exports (firm-intensive margin, X), and the number of products exported (product extensive margins, P). The MPE models offer an ambiguous prediction for the impact on average export per product (product intensive margin, $\bar{x}$), as new products are exported less intensively.

2.2 Market Access, Transportation, Spatial Decay and Experiments

This paper relates broadly to literatures looking at the impact of market access, geography, transportation and distance on firm behaviour. Of particular relevance are cases where a natural experiment or similar exogenous variation is used for identification. First, the paper relates to literature using large policy shifts or policy-contingent events as source of exogenous variation. Berthou and Fontagné (2013) used the introduction of the Euro as a *natural experiment* to investigate the impact on firm behaviour. They compared their results to the predictions of the Bernard, Redding, and Schott (2011) model. They found a weakly positive effect on the firm intensive margin for all firms, mainly driven by the relatively larger firms in their

---

[3]Mayer, Melitz, and Ottaviano (2014) note that this result is somewhat dependent on assumptions on the type of trade costs.

[4]Several other models have been constructed to explain the behaviour of multi-product firms. Feenstra and Ma (2008) build a model wherein firms exercise their market power over multiple products and optimise their product scope. Bernard, Redding, and Schott (2010) looks at the product switching behaviour of exporters in a simple model, suggesting that product switching contributes to a reallocation of resources within firms to their core. Goldberg, Khandelwal, Pavcnik, and Topalova (2010) look at the impact of tariff reductions on the number of produced varieties. The mechanism in that paper is through how new imported input varieties can enable domestic firms to produce new varieties. Iacovone and Javorcik (2010) analysed the behaviour of Mexican firms following Mexico's entry into NAFTA. They looked at how multi-product firms adjusted their product scope and related the adjustments to theoretical predictions. They found intense product churning (adding and dropping products) following trade liberalisation.

sample. Blonigen and Cristea (2014) investigated the impact of airline traffic on local population, income and employment growth. For identification, they used the US deregulation of the aviation industry in 1978 as a *quasi-natural policy experiment*. They find that increased air travel improved regional economic growth.

Secondly, this paper relates to literature using natural experiments or historical events as exogenous shocks to transport infrastructure. Volpe Martincus and Blyde (2013) look at the importance of domestic transport infrastructure on international trade flows. For their identification, they looked at the impact of a large earthquake in Chile as a *natural experiment*. Using the variation in exposure to closed routes, they find that exports decreased due to less frequent shipments by exporters who had to alter their transportation routes due to damaged road infrastructure. Volpe Martincus, Carballo, Garcia, and Graziano (2014) assessed the impact of trade costs on bilateral trade flows by exploiting a *natural experiment* when the San Martín International Bridge, connecting Uruguay and Argentina, was closed first due to demonstrations, and later as a consequence of bilateral negotiations. Their results suggest that a 1% increase in transport costs reduced firm exports by 6.5%, with the effect stemming from a reduction in the number and size of shipments. Feyrer (2009) uses the temporary closure of the Suez Canal from 1967 to 1975 to examine the effect of distance on trade flows and income. His identification is through the impact of increased sea distance and the associated increase in transportation costs. Additionally, Bernhofen and Brown (2005) uses Japan's nineteenth-century opening up to world commerce as a *natural experiment*. They found a positive effect of trade openness on purchasing power compared to the counter-factual of continued autarky.

Third, this paper relates to studies evaluating the impact of transport infrastructure and market access on economic outcomes. Several papers have used large scale road or highway construction projects as a policy experiment (natural experiment). For the US: Michaels (2008) investigated the impact on income and trade in rural counties; Chandra and Thompson (2000) looked at the distribution of economic activity towards counties with highways and away from others. A couple of papers use the Indian Golden Quadrilateral

highway program to identify the impact of better market access on firm behaviour: Datta (2012) showed how firms with better access to highways reduced their stock of input inventories; Ghani, Goswami, and Kerr (2016) found that manufacturing activity grew disproportionally along the new road network for incumbent firms. For Brazil, Bird and Straub (2014) used the exogenous impulse to construct a radical new highway network following the decision to create a new capital city, Brasília. They found evidence that the road network reduced regional inequality. Coşar and Demir (2016) used large scale infrastructure investments in Turkey to identify the impact of internal transportation on regional market access. They showed that transport-intensive industries in regions with above average improvement in connectivity grew relative to the same industries in regions less affected. Åkerman (2009) used the introduction of the Öresund bridge to identify the impact on aggregate productivity in Malmö. He found a reallocation effect from the less productive firms exiting and the more productive expanding. Bernard, Moxnes, and Saito (2015) looked at buyer-seller relationships in Japan. They use the extension of the Shinkansen high speed railroad as a *quasi-natural experiment* to look at how firm networks are impacted by a drop in travel time. Bernard, Moxnes, and Saito (2015) argued that the new rail link reduced the search costs of finding input suppliers (for example; materials, accounting, and distributional services). They found that sales and productivity of input-intensive firms increased relative to labour intensive firms close to new rail stations.

Finally, this paper relates to the literature looking at the spatial dispersion of economic activity. In their paper, Bernard, Moxnes, and Saito (2015) showed the strong tendency for firms to form business relationships locally, with the median (mean) supplier-customer distance being 30 (172) km. The difference in median and mean distance shows that even if most firms do not trade outside their local environment, some are able to overcome the distance barrier and trade over very long distances domestically. They find that larger firms are able to overcome this domestic distance hurdle and build partnerships outside their local environment. This result resembles the stylised facts from the literature on international trade stating that exporters are rare and only the most productive firms export. Hillberry and Hummels

(2008) also found this local behaviour for firms, and showed that the value of shipments within a zip-code were three times larger compared to outside the zip-code (roughly a 4-mile radius or $\approx$ 6.5 km). Redding and Sturm (2008) explored the impact of the division and reunification of East and West Germany as a *natural-experiment* to asses the importance of market access for economic development. They find that the *division* of Germany had led to a reallocation of population away from the border to other West-German cities and the loss was the most pronounced for relatively smaller cities. Brülhart, Carrère, and Trionfetti (2012) investigated the response of wages and employment to the fall of the Iron curtain in 1990. They argued that the opening up of the eastern block was a *natural-experiment*, exogenous to events in Austria, that impacted regions differently based on distance from the border. Using a band of 50 km around the border, they found a statistically significant and positive effect on wages and employment. Cristea (2011) looked at the importance of face-to-face[5] meetings for international trade and found that an increase in exports raised the local demand for business air travel, suggesting that face-to-face communication plays an important role in business relationship. Niebuhr (2006, 2008) analysed the impact on border regions from accession into the European union. She found that border regions realised higher integration benefits than did non-border regions.

The preceding discussion has established that first, distance and location impacts firms and their behaviour, and second, that transportation infrastructure has a disproportionally positive impact on the industrial growth of firms located nearby.

---

[5]Storper and Venables (2004) discussed the costs and benefits of face-to-face communication. First, it is an efficient communication technology; second, it solves many issues related to misaligned incentives and trust; third, it facilitates socialization and learning; fourth, it creates psychological motivation by encouraging competition. They noted however, that these benefits come at a cost, both pecuniary and in terms of other informational costs (e.g. travel time, monitoring and miscommunication).

3 The Öresund Bridge: A Quasi-Natural Experiment

3.1 Historical Background

This papers uses the establishment of a physical connection between Denmark and Sweden, the Öresund bridge, for identifying the impact on firm export decisions (see figure 2). The idea of creating a fixed land connection between Denmark and Sweden dates back to the 19th century. The first ideas for connecting the two countries were suggested in 1865 by the Swedish rail engineer Claes Adelsköld. In 1872, the English engineer Edwards and the Danish businessman Pedersen presented the first formal proposal. Their plan was to build a tunnel connection between Helsingborg in Sweden and Helsingør in Denmark. Several additional ideas were suggested over the years. In 1973 an agreement was signed between the two nations about a bridge between Malmö and Copenhagen that was expected to be completed in 1985. As a part of the agreement, Kastrup airport was to be relocated to the Island of Saltholm, but in 1978, the Danish authorities rejected that move, and plans for the bridge were suspended. In 1991, the governments signed a new agreement for a bridge (fixed link) over the Öresund. Uncertainty[6] continued due to political opposition in Sweden and concerns over possible environmental effects. It was not until June 1994 the final permission was granted by the Swedish government and contracts were signed with contractors in November 1995. The Öresund bridge was opened on July 1st 2000. It connects the Swedish city of Malmö to the Danish capital, Copenhagen. The bridge is around 8 km long. The total fixed connection ($\approx$16 km) also consists of an artificial island, Pepperholm, and a tunnel. Before the bridge opened, there was a ferry that connected Malmö with

---

[6]The uncertainty continued since a couple of months after the agreement had been ratified in parliament, a new government took charge in Sweden. Within the government, the Centre Party was concerned about the potential environmental effects, which delayed the final approval. Additionally, public opinion was split towards building a connection between Denmark and Sweden in those years. Falkemark and Gilljam (1994) discussed this issue and referred to an SOM institute public opinion poll in Sweden that found that opposition to the bridge increased from 1991 to 1993, from 36% to 44% while the supporting group shrunk, from 38% to 26%. They also note that the opposition was large in Denmark, showing 61% against while 21% supporting a fixed connection in 1994.

Copenhagen, the Limhamn-Dragör (LD) line. The most common way to cross the strait was, however, the Helsingborg-Helsingør (HH) ferry, located 65 km north of Malmö's city centre. According to figures collected by Knowles (2006), around 95% of trucks crossing the strait in 1999 used the HH ferry and only a small minority (5%) the LD line.[7]

3.2 Impact on Trade Costs

This paper exploits the opening of the Öresund Bridge as a *quasi-natural experiment*[8] that provides an exogenous variation in trade costs based on geographical proximity to the bridge. The responses of firms are compared across the three largest cities in Sweden, Malmö (population in 2015: 322 000), Gothenburg (pop. in 2015: 548 000) and the capital Stockholm (pop in 2015: 923 000). These cities are used in the analysis since they share many similar characteristics, are the three largest in Sweden, and serve therefore as natural comparisons. The city of Malmö is located on the southern tip of Sweden, while Gothenburg and Stockholm are on the west and east coasts respectively. See figure 2 for a graphical representation.

The introduction of the bridge impacted trade costs in several ways. In the literature, both distance and travel time are common proxies for trade costs [see, for example: Coşar and Demir (2016), Volpe Martincus

---

[7]The HH line transported 73% of passengers across the Öresund strait in 1999, with other crossing points in Malmö and nearby area accounting for the rest. All such ferries were discontinued after the opening of the bridge except for the HH ferry.

[8]Events that are truly exogenous are often dubbed in economics as natural experiments. The name may be puzzling since there is little natural nor experimental about most "natural" experiments. To add to the confusion, no single definition exists, and several variations of the term are used in the literature. Shadish, Cook, and Campbell (2002) defined a natural experiment as "not really an experiment because the cause usually cannot be manipulated" or "a study that contrasts a naturally occurring event such as an earthquake with a comparison condition." Shadish, Cook, and Campbell (2002) define a *quasi-experiment* as an experiment lacking random allocation into groups. The *quasi-natural experiment* terminology is not used universally in the literature but is growing in popularity. This can be seen from recent handbook chapters in which five papers are referred to as using a quasi-natural experiment despite none of them employing that terminology originally. The Handbook of Regional and Urban Economics (2004) referred to Davis and Weinstein (2002) and Brakman, Garretsen, and Schramm (2004); the Handbook of International Economics (2014) to Bernhofen and Brown (2005); and the Handbook of Economic Growth (2014) to Hanson (1996) and Hanson (1997). Examples of papers discussed using the quasi-natural experiment terminology are Bernard, Moxnes, and Saito (2015) and Blonigen and Cristea (2014).
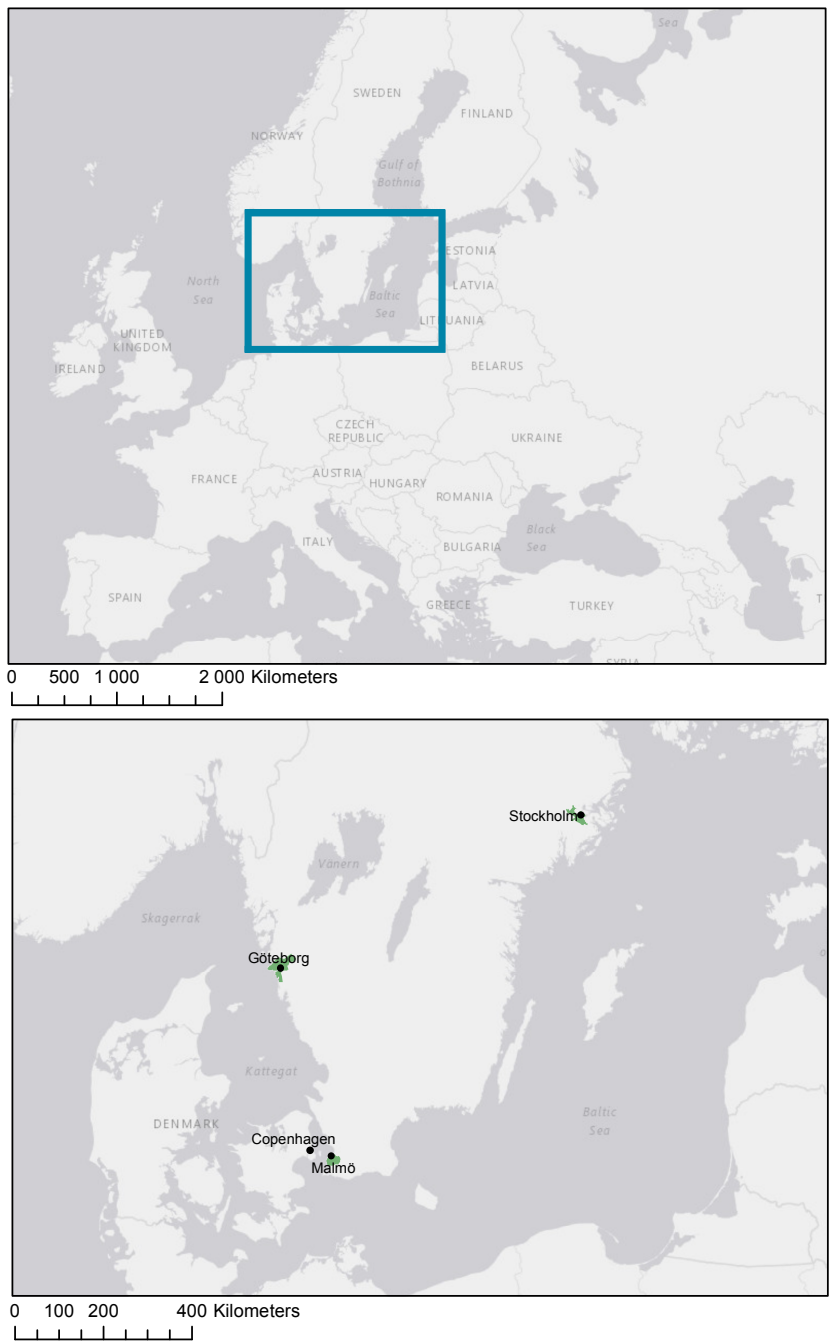
Figure 2: Geographic representation of the areas. The Öresund bridge connects Malmö and Copenhagen.

and Blyde (2013) Volpe Martincus, Carballo, Garcia, and Graziano (2014), Bernard, Moxnes, and Saito (2015), Feyrer (2009)]. To assess the impact of the Öresund bridge on trade costs, the optimal transport/travel routes are calculated in terms of time and road kilometres between Copenhagen and Malmö, Gothenburg and Stockholm. Table 1 shows the optimal route for trucks travelling from all three cities to Copenhagen both before and after the construction of the bridge. The transit time from Malmö decreased by around 67%, while for Gothenburg and Stockholm, the changes were 16% and 9%.

Table 1: Transport route comparison to Copenhagen, minutes (km).

	Malmö	Gothenburg	Stockholm
via Helsingborg ferry	135 (111)	**214 (268)**	**398 (607)**
via Dragör-Limhamn ferry	**122 (36)**	279 (312)	469 (648)
via Öresund bridge	40 (42)	180 (313)	363 (655)
Difference (%)	-67.2 (16.7)	-15.9 (16.8)	-8.8 (7.9)

Note: Travel times are calculated with Google Maps between city centres. Total travel time with the Helsingborg-Helsingør ferry is assumed to be 50 minutes (underestimated by around 20 minutes by Google maps). The crossing time is 20 minutes, minimum check-in is 15 minutes before departure plus loading/unloading time. The same time structure is assumed for the old Dragör-Limhamn Ferry. Note: Difference is calculated for optimal route before (marked in bold).

Despite the decrease in travel time, the HH link may still be the most economical route for truck drivers from Stockholm or Gothenburg, since it is 40-50 km shorter and offers other benefits, reinforcing that the benefits of the bridge disproportionally favour Malmö. Knowles (2006) discussed possible reasons behind why the HH link may have other benefits: first, the route is shorter to all destinations in Denmark by at least 40 to 50 km compared to the bridge; secondly, the ferry can be used to fulfil meal break requirements for drivers (45 minutes every 4.5 hours); finally, favourable multi-journey fares were offered to a small number of long-journey truck operators. Taking this into consideration, it is not clear that the Öresund bridge is more economical for firms located north of the HH link connection. Knowles (2006) found, for example, that the fixed link truck traffic was well below forecasts due to the HH ferry unexpectedly transporting a similar amount of traffic. He found that in 2001, the bridge diverted 16.9% of truck traffic from the HH ferry and created an additional 16%. Figures

from Öresundsbro Konsortiet (2013) showed, however, that the share of trucks crossing the Öresund strait using the bridge has risen steadily from its opening, from around 30% in the first full year to just over 50% in 2012.

The change from having a strait to cross compared to a fixed link offers other benefits, such as efficiency gains to firms in terms of increased reliability and flexibility with 24/7 access to Denmark[9] and avoiding possible bottlenecks in the transportation process. Suggestive evidence of such benefits of the bridge comes from a transport survey from the Swedish Road Administration (Vägverket, 2006). They found that trucks using the Öresund bridge, compared to the harbours, were less often fully loaded and more often empty. They argued that this is due to shorter distances between Denmark and Sweden, as many trucks drive over the bridge with goods only in one direction, without the need to fill the truck for the reverse trip, as is the case for longer journeys.[10] Better connections and increased market access lower search costs for business partners through reduced travel time (e.g. for face-to-face business meetings). As discussed above, firms tend to build business relationships locally, and a distance barrier of several hundred kilometres is likely to discourage distant firms.[11] The value of prompt delivery is highlighted by Hummels and Schaur (2013), who found that an extra day in transit time was equivalent to a tariff of between 0.6-2.1 per cent. While the geographic distance is the same between Malmö and Copenhagen, the fixed connection reduces travel time and substantially improves flexibility in travelling over the strait. I argue therefore, that the Öresund bridge alters the perception of distance inducing firms in Malmö to enter and/or increase their trade in the Danish market. Since firms tend to build business relationships locally, the export decisions of firms in Gothenburg and Stockholm, should not be altered to the same extent.

To summarise, firms in the city of Malmö (the 'treated' city, where the bridge was built) experienced a larger decrease in trade costs following the

---

[9]The HH link ferry does offer 24/7 trips while the number of trips from Limhamn was more limited.

[10]Volpe Martincus, Carballo, Garcia, and Graziano (2014) show similar suggestive evidence, as the number and size of shipments was affected following the closure of the San Martín International Bridge connecting Uruguay and Argentina.

[11]The road distance from Malmö to Copenhagen is now only 42 km, compared to 313 and 655 km from Gothenburg and Stockholm.

introduction of the Öresund bridge compared to the more geographically distant cities of Gothenburg and Stockholm (the 'controls'). The bridge disproportionally lowers both variable trade costs (proxied by transit time) and fixed/sunk costs (search costs, market access costs) of exporting for firms in Malmö compared to the control cities.

4   Dataset

The dataset used for this paper is a firm level census provided by Statistics Sweden (SCB). It includes information on all firms within the municipalities of Malmö, Gothenburg and Stockholm from 1997 to 2011. Firms with less than 4.5 mkr. in yearly trade to all destinations were dropped.[12] The dataset includes information about trade flows at the firm-product-destination level with time-consistent 8-digit CN level product classification. All products with positive trade value are included. The final sample includes 1746 firms, of which 282 are in Malmö, 585 in Gothenburg, and 879 in Stockholm. A comparison of basic firm characteristics across the three cities can be found in table 2. The table shows a simple comparison of means for firms in Malmö compared to Stockholm and Gotheburg and the associated t-statistics. No significant differences are found between firms in Gothenburg and Malmö, while the firms in Stockholm are larger.[13] Information on the sectoral composition of the sample can be found in appendix A, table A1.[14]

In this paper we are interested in investigating the impact of the Öresund bridge on trade flows to Denmark. A natural first step is therefore to analyse how firm level trade has evolved in the three municipalities both before and after the introduction of the bridge in 2000. Figure 3 shows that the average firm trade to Denmark was stable prior to the introduction of the bridge, while after its opening, the average firm trade value increased faster in Malmö relative to the control municipalities. The figure shows the average

---

[12]This is due to firms with less in yearly trade not being obligated to report the trade values to SCB. The threshold value has been 4.5 mkr. from 2005, but had previously been 2.2 mkr. To keep the sample of firms consistent the same threshold (4.5 mkr.) is used for the entire period. The results are robust for the inclusion of these firms.

[13]This is not surprising, since we expect the capital city to attract firms' headquarters.

[14]Around 68% to 82% of firms exported to Denmark during the period. See the sample of firms that exported to Denmark in table A2 in appendix A.

Table 2: Comparison of firms exporting to Denmark in Malmö versus firms in Gothenburg (GB) and Stockholm (STH) in 1999.

	Malmö	vs. Gothenburg		vs. Stockholm	
		GB	t	STH	t
Log total export value					
to all destinations	17.0	17.1	-0.74	17.2	-1.46
Log export to DK	14.5	14.4	0.22	14.3	0.75
Log firm sales	18.3	18.3	0.060	18.8	-2.77[a]
Log nr. of employees	3.65	3.56	0.51	3.98	-1.91[c]
Log firm assets	17.8	17.7	0.60	18.2	-2.24[b]
P to all dest.	30.2	41.4	-1.79[c]	39.3	-1.65[c]
P to DK	14.2	13.3	0.19	11.9	0.54
P_{10} to DK.	8.99	7.98	0.37	7.37	0.63
Firm start year	1983.3	1983.8	-0.48	1983.0	0.33
Log TFP	1.39	1.16	1.66[c]	1.13	2.02[b]
Nr. of exporters	116	194	.	280	.
N	310			396	

P=nr. of products, P_{10}=nr. of products with more than 10 000 SEK in early export value.

The graph shows for each municipality the average percentage change in total firm trade value to Denmark of manufacturing firms. The Öresund bridge opened in mid-2000 and for the graph the trade value by each firm in that year is used as a base. This is calculated as the average for each municipality of ln(trade value to Denmark)$_{it}$ - ln(trade value to Denmark)$_{i,2000}$.

Figure 3: Average change in firm trade value to Denmark by municipality relative to the base year(2000).

growth rate of firm trade value relative to the year 2000. From figure 3 one can see that the average increase in exporting by firms in Malmö has been around 40% relative to 2000, the year the bridge was opened. For the other municipalities the increase has been around 20% (values of 0.2 and 0.4, respectively).

4.1   Empirical Challenge

An important issue for identification of causal effects in this paper is the non-random allocation of firms into 'treatment' groups which gives rise to concerns of endogeneity and selection. Addressing these concerns, the sample under observation is limited to firms located in the same municipality during the entire period, from 1997 to 2011. Firms founded after 1997 are dropped to limit the possible impact of firms being founded or moved to Malmö with the intent to trade over the bridge to Denmark. Additionally, firms that were founded in 1997 or before with the intention to trade to Denmark may reduce the significance of the results since they contribute to a pre-bridge trend.[15]

The location of a fixed connection in Malmö between Sweden and Denmark may not have been the most obvious choice. Helsingborg, a city 65 km north of Malmö, was often suggested as a preferred/alternate location for a bridge/tunnel in earlier plans.[16] This was due to the fact that the shortest distance across the Öresund strait was between Helsingborg in Sweden, and Helsingør (HH) in Denmark (only 3.5 km compared to the 15.9 km from Malmö). Additionally, crossing the strait with the HH ferry was, and still is, the shortest route in terms of road distance to all destinations in Denmark, if the origin is north of Helsingborg. Hence, if there were some historical selection of firms to municipalities due to a possible fixed connection over the strait, it is uncertain that firms would have chosen Malmö rather than Helsingborg before the final decision was made in 1994. Therefore, even if the allocation of firms to groups (i.e. to treated vs. non-treated cities) is non-random, the introduction of the bridge still provides an exogenous

---

[15]Firms intending to export to Denmark were unlikely to wait for the bridge to open before building a presence in that foreign market.

[16]There are still ongoing discussions regarding building a connection there in the near future.

shock to trade costs benefiting firms in Malmö to a greater extent than firms located in Gothenburg and Stockholm.[17]

Finally, as the Öresund bridge opened shortly after the introduction of the Euro common currency, in mid-2000, there may be concerns of trade diversion from Sweden to Euro member states, as Sweden did not adopt the Euro. This concern is reduced because Denmark has been pegged to the Euro since its inception in 1999, and to its predecessor, the ECU, from 1996. Hence, I argue that if there exists a trade-diversion effect, it will impact both trade to the treated destination (Denmark) and other destinations (later used as control destinations). This is also in line with the results of Gullstrand and Olofsdotter (2014), who found that the potential bystander effect of the Euro had minimal or no impact on Swedish firms.

5   Empirical Specification

5.1   Preliminary Specification

The main objective of this paper is to assess empirically the theoretical predictions of MPE models following a reduction in trade costs. We break down the exports of firms into the four margins of trade illustrated in figure 1 before. For the preliminary specification I decompose the trade flows of firms to *Denmark only*. First, the aggregate exports of firm i to Denmark in year t, X_{it}, is decomposed into the number of exported products (P_{it}) and the average export value per product ($\bar{x}_{it}$) within a firm.

$$X_{it} = P_{it} * \bar{x}_{it}, \qquad \bar{x}_{it} = \frac{X_{it}}{P_{it}} \tag{1}$$

To identify the effects of interest we first use the following preliminary empirical difference-in-difference specification:

$$y_{it} = \alpha_i + \lambda_{st} + \beta_1 bridge + \epsilon_t \tag{2}$$

---

[17]Note that in the empirical specification all results are relative to firms in the control municipalities. Hence, if firms in Gothenburg and Stockholm are positively affected by the Öresund Bridge, it will reduce the estimated effects.

where y_{it} can take three different variables, X, P and $\bar{x}$, all variables are in logs. Additionally, α_i is a firm fixed effect, λ_{st} is a 2-digit sector-year fixed effect and ϵ_t an error term. For identification, a standard difference-in-difference approach is used to identify the effect on the margins. A dummy variable, *bridge* (the treatment), is defined as equal to 1 if a firm is located in Malmö, the destination is Denmark, and the year is 2001 or later. As the Öresund bridge opened in mid-year 2000 it is unclear whether that year should be included in the pre- or post-bridge period and is therefore dropped. The standard errors are clustered on municipality.[18]

5.2   Baseline Specification

A potential concern[19] with the preliminary specification is that some firms may be expanding to *all* destinations and not just to Denmark and the treatment effect we estimate could therefore partly capture this trend. For the *baseline specification*, trade flows to alternative destinations are added to control for this concern. The argument for using additional destinations is therefore that the bridge reduces the bilateral trade costs between Sweden and Denmark while other bilateral costs are unaffected.[20] The destinations used are adjacent countries and all EU-15 member states.[21] The relative importance of each destination is similar across the municipalities in 1999 as can be seen from table A3 in appendix A.

---

[18]Bertrand, Duflo, and Mullainathan (2004) and Cameron and Miller (2015) suggest that in a difference-in-difference setting over states (or regions, towns, cities) then errors should be clustered at the state level. Both advise against clustering at the state-year level. This stems from that the fact that observations are likely to be serially correlated within a city between years. Note that if one clusters on city-year, then errors are assumed to be independent across states.

[19]An additional concern is that the number of clusters in the preliminary specification is limited, which makes the inclusion of multiple control variables, lags or leads problematic.

[20]One could argue that the trade costs to e.g. Germany would decrease, as the bridge opens up a pathway on land to western Europe. Even if that is the case, the relative decrease in bilateral trade costs should be larger for Denmark than for other destinations. Note also that if trade costs are reduced to other destinations it will reduce the estimated impact.

[21]The destination control countries are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and the United Kingdom. Norway is added as an adjacent country. Note that only Sweden, Denmark, Norway and the UK of the sample countries did not adopt the Euro in 1999. Greece was pegged to the Euro until 2001, and Denmark has been pegged to the Euro/ECU since 1996.

In the baseline specification, we therefore decompose the trade flows within a destination. Total bilateral exports (X_{ijt}) of firm, i to destination j in year t, is which is then decomposed into the number of products (P_{ijt}) and average trade per product ($\bar{x}_{ijt}$) within a firm.

$$X_{ijt} = P_{ijt} * \bar{x}_{ijt}, \qquad \bar{x}_{ijt} = \frac{X_{ijt}}{P_{ijt}} \tag{3}$$

$$y_{ijt} = \alpha_{ij} + \lambda_{st} + \beta_1 bridge + GDP_{jt} + R_{jt} + \kappa_{it} + \epsilon_{jt} \tag{4}$$

The specification is similar to before, and y_{ijt} can take three different variables, X, P, and $\bar{x}$. Observations in the panel are at the firm-destination level. α_{ij} is a firm-destination fixed effect, λ_{st} a 2-digit sector-year fixed effect, and ϵ_{jt} is an error term. Errors are clustered at the municipality-destination level.[22] The treatment effect, $bridge$ is defined the same way as before, equals 1 if the firm is located in Malmö, the destination is Denmark and the year is 2001 or later (zero otherwise). Now firm level controls (κ_{it}) and country level macroeconomic controls (R_{jt}) are added to control for firm and destination specific effects. See appendix C for a discussion about the destination and firm specific control variables. As before, the year 2000 is dropped.

Lastly, the effect on the propensity to export (firm-extensive margin, M) is estimated with a linear model specification.

$$M_{it} = \alpha_i + \lambda_t + \beta_1 bridge + \epsilon_t \tag{5}$$

Here the dependent variable M is binary. It takes the value 1 if a firm exports to Denmark and 0 otherwise. The treatment, $bridge$, is defined the same way as before. The sample includes all firms that are in the three municipalities and founded in 1997 or earlier. For the identification,

---

[22]Moulton (1990) highlighted the importance of considering the grouping structure of the data; otherwise, the standard error may be biased downward. Angrist and Pischke (2008) suggest that 42 clusters are needed for a reliable estimate of the standard errors. This is a concern for the preliminary specification (using trade flows to Denmark only) as the standard errors are only clustered at the municipality level (3 clusters). In the baseline specification however the standard errors are clustered on municipality-destination pairs which results in 42 clusters (3 municipalities × 14 destinations). Coincidentally, this is the same number of clusters suggested by Angrist and Pischke (2008).

only firms that switched export status are used.[23] Errors are clustered on municipality.

6   Results

The results from estimating the *preliminary specification* in equation 2 show that there is a sizeable and significant effect on trade flows (see table 3). For the preliminary analysis we use firms located in Malmö, Gothenburg and Stockholm and only use trade flows to Denmark. The results show that aggregate firm exports (X) increased by 23% ($e^{0.208} - 1$), and average trade value per product ($\bar{x}$) within a firm by 18% ($e^{0.166} - 1$). For the change in the number of products (P) by firm, the point estimate is positive but only weakly statistically significant (at the 10% level). Note that all results are relative to the control group of firms in Gothenburg and Stockholm.

Table 3: Preliminary specification for firms in all sectors: Trade flows to Denmark only by firms in Malmö, Gothenburg and Stockholm.

	All sectors				
	X	X_{lead}	X_{lag}	$\bar{x}$	P
Bridge	0.208^a	0.230^a	0.195^b	0.166^a	0.0418^c
	(0.0166)	(0.0156)	(0.0213)	(0.00635)	(0.0122)
Bridge lead		0.0631			
		(0.0267)			
Bridge 1-lag			0.0749		
			(0.0327)		
N	7003	7003	7003	7003	7003
R^2	0.779	0.779	0.779	0.773	0.871
Within R^2	0.0007	0.0007	0.0007	0.0005	0.0001
Firm-FE	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standard errors in parentheses, clustered on municipality. X = Total trade value, $\bar{x}$=average trade value within firm, per product. P =Number of products.

The construction of the Öresund bridge was observed, and therefore there may have been some anticipatory effects. In table 3, a lead for the bridge

---

[23]Note that the export status of all firms with less than 4.5 mkr. in yearly trade to Denmark is changed to 0 to keep the sample consistent over time.

variable is added that equals 1 for the year being 1999 and the firm being located in Malmö (0 otherwise). This lead will pick up anticipatory effects (if any) as firms increased their trade the year before opening of the bridge. I also investigated if there was evidence of a lagged effect by interacting the bridge dummy and a dummy for the year 2001. Neither the lead or the lag is significant in the preliminary analysis.

6.1 Baseline Results

In the baseline specification, equation 4, the control group is extended to include the trade flows to all adjacent and EU-15 countries for all firms in Malmö, Gothenburg and Stockholm. From table 4, we see that the aggregate main effect (X) is somewhat smaller than in the preliminary estimation, and only the impact on the product intensive margin is found significant. As before, we test for anticipatory effects using a lead that equals 1 for trade flows from Malmö to Denmark in 1999 and zero otherwise, and find a weakly significant effect prior to the introduction of the bridge (at 10% level). This suggests that firms in Malmö may have increased their trade intensity with Denmark even a year before the introduction of the Öresund Bridge. Note that this effect will tend to reduce the significance of the estimated effects from above, as part of the "bridge" effect is realised prior to the actual opening of the bridge.

As discussed earlier, there are two main sectors in the data, manufacturing and wholesalers (see table A1 in appendix A for the sectoral composition). By looking separately at the two main sectors, a heterogeneous sectoral effect is found. The positive effect observed is solely driven by firms in manufacturing, see table 5. For manufacturing firms the impact on all three margins is now positive and significant, with larger respective semi-elasticities for aggregate exports X, ($e^{0.261} - 1 = 35\%$), average export per product $\bar{x}$, ($e^{0.187} - 1 = 21\%$), and the product extensive margin P, ($e^{0.074} - 1 = 8\%$). For wholesalers the main effect on aggregate exports is insignificant, and only a redistribution, from the average trade value per product to the number of products exported, is found (see table 6).

Several robustness checks are performed for the baseline specification. First the sample is limited to a short period before and after the introduction

Table 4: Baseline specification for firms in all sectors: Includes firms in Malmö, Gothenburg and Stockholm and trade flows to Denmark, adjacent and EU-15 countries.

	All Sectors				
	X	X_{lead}	X_{lag}	$\bar{x}$	P
Bridge	0.0979^b	0.118^a	0.115^b	0.0223	0.0756^a
	(0.0383)	(0.0373)	(0.0516)	(0.0358)	(0.0203)
Log GDP	0.584	0.584	0.592	0.564	0.0197
	(0.558)	(0.558)	(0.561)	(0.452)	(0.163)
Log Real FX	-0.221	-0.221	-0.222	-0.0148	-0.206^b
	(0.235)	(0.235)	(0.235)	(0.240)	(0.0772)
Bridge lead		0.0412^c			
		(0.0206)			
Bridge 1-lag			-0.00999		
			(0.0467)		
Bridge 2-lag			-0.0974^b		
			(0.0375)		
Bridge 3-lag			-0.00996		
			(0.0336)		
N	55876	55876	55876	55876	55876
R^2	0.797	0.797	0.797	0.780	0.853
Within R^2	0.0102	0.0102	0.0102	0.0053	0.0084
Firm-Dest-FE	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standard errors in parentheses, clustered on municipality and destination pairs. X = Total trade value, $\bar{x}$=average trade value within firm, per product. P =Number of products. Adjacent countries are Norway and Finland. Controls for lagged TFP and lagged firm size are included (see appendix C).

Table 5: Baseline specification for manufacturing firms: Includes firms in Malmö, Gothenburg and Stockholm and trade flows to Denmark, adjacent and EU-15 countries.

	Manufacturing				
	X	X_{lead}	X_{lag}	$\bar{x}$	P
Bridge	0.261^a	0.287^a	0.295^a	0.187^a	0.0740^a
	(0.0493)	(0.0548)	(0.0599)	(0.0420)	(0.0184)
Bridge lead		0.0533			
		(0.0345)			
Log GDP	1.219^c	1.219^c	1.236^c	1.255^b	-0.0362
	(0.720)	(0.720)	(0.724)	(0.589)	(0.187)
Log Real FX	-0.369	-0.369	-0.374	-0.177	-0.192^b
	(0.255)	(0.255)	(0.256)	(0.250)	(0.0933)
Bridge 1-lag			-0.0848^c		
			(0.0447)		
Bridge 2-lag			-0.123^b		
			(0.0457)		
Bridge 3-lag			-0.0385		
			(0.0415)		
N	21518	21518	21518	21518	21518
R^2	0.835	0.835	0.835	0.790	0.877
Within R^2	0.0154	0.0154	0.0155	0.0114	0.0051
Firm-Dest-FE	Yes	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes	Yes

[c] $p < .10$, [b] $p < .05$, [a] $p < .01$. Standard errors in parentheses, clustered on municipality and destination pairs. X = Total trade value, $\bar{x}$=average trade value within firm, per product. P =Number of products. Controls for lagged TFP and lagged firm size are included (see appendix C).

Table 6: Baseline specification for wholesale firms: Includes firms in Malmö, Gothenburg and Stockholm and trade flows to Denmark, adjacent and EU-15 countries.

	Wholesale				
	X	X_{lead}	X_{lag}	$\bar{x}$	P
Bridge	-0.0493	0.0257	-0.0247	-0.185^a	0.136^a
	(0.0615)	(0.0599)	(0.0874)	(0.0562)	(0.0282)
Bridge lead		0.152^a			
		(0.0334)			
Log GDP	0.250	0.252	0.261	0.136	0.114
	(0.781)	(0.781)	(0.788)	(0.637)	(0.253)
Log Real FX	-0.0188	-0.0188	-0.0190	0.191	-0.210^b
	(0.386)	(0.386)	(0.387)	(0.342)	(0.102)
Bridge 1-lag			0.0707		
			(0.0854)		
Bridge 2-lag			-0.206^a		
			(0.0543)		
Bridge 3-lag			-0.0909		
			(0.0543)		
N	27642	27642	27642	27642	27642
R^2	0.764	0.764	0.764	0.751	0.838
Within R^2	0.0101	0.0101	0.0101	0.0039	0.0127
Firm-Dest-FE	Yes	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standard errors in parentheses, clustered on municipality and destination pairs. X = Total trade value, $\bar{x}$=average trade value within firm, per product. P =Number of products. Controls for lagged TFP and lagged firm size are included (see appendix C).

of the bridge to see if the effect is driven by the time horizon of the data. Tables B1 and B2 in appendix B, display the results if we use only two years before and after the opening of the bridge (1998-1999 as a pre-period and 2001-2002 as a post-period). For manufacturing firms, the main effect on aggregate firm exports (X) is slightly lower than before but is highly significant. For the other margins, a similar effect is found on the product extensive margin while, a less significant effect is now found for the average trade per product. A second robustness check is to exclude products that have marginally positive trade values. Table B3 shows the results when the regressions are re-estimated to include only products with more than 1000 SEK and 10000 SEK in yearly export sales (equivalent to roughly €100 and €1000). The point estimates are similar for manufacturing firms and are all significant at the 1% level. In general, the robustness checks on the sample of wholesalers are less consistent, and show either an insignificant or a negative effect. A third robustness check is to limit the group of destinations to adjacent countries only instead of to both adjacent and EU-15 countries. The results are stronger for the firms in the manufacturing sector; see table B4. See table B5 for the results on the wholesale sector and a discussion in the following section.[24]

The extensive margin, i.e. the impact on the propensity (probability) of firms in all sectors to export to Denmark, is sizeable, and we find that firms in Malmö are 35% ($e^{0.301} - 1$) more likely to export to Denmark than the control group using a linear specification. See table 7. For robustness, a logit model is estimated, and I find somewhat stronger effect. The odds ratio equals 4.7 ($e^{1.547}$) which means that the odds of exporting to Denmark increase almost fivefold with treatment. Looking separately at manufacturing and the wholesale firms, the impact is positive and significant in both sectors.

---

[24]Other robustness checks include limiting the sample of firms to single plant firms to avoid the possible redistribution of activities within a firm. The results are similar for the manufacturing sector. The results are also robust when limiting the sample to firms founded before 1991, before a decision to build the bridge was made. I argue that it is highly-unlikely that firms anticipated a bridge between Malmö and Copenhagen in the near future before 1991. At that point, the political decision process regarding a possible connection was informal, and with the history of such negotiations not materialising, the probability of a bridge was low. The results using this sub-sample are similar to the baseline (available on request). Note that for this robustness check, the firms are assumed to be in the same municipality as they were in 1997. Lastly, the results are robust when dropping the control variables lagged TFP and lagged firm sales.

Table 7: Extensive margin - Firms in Malmö, Gothenburg and Stockholm

	All Sectors		Manufacturing		Wholesale	
	M	M_{logit}	M	M_{logit}	M	M_{logit}
Bridge	0.301^a	1.554^a	0.343^a	2.000^a	0.252^a	1.249^a
	(0.00519)	(0.201)	(0.0101)	(0.441)	(0.00349)	(0.243)
Constant	0.338^a		0.361^a		0.321^a	
	(0.00921)		(0.0117)		(0.0118)	
N	12816	12746	2583	2563	7898	7863
R^2	0.0127		0.0262		0.0167	
Year-FE	Yes	Yes	Yes	Yes	Yes	Yes

$^c\ p < .10,\ ^b\ p < .05,\ ^a\ p < .01$. Standard errors in parentheses, clustered on municipality.

The magnitude varies, and is stronger for manufacturing firms when using both the linear and the logit specification. Manufacturers and wholesalers in Malmö are 41% ($e^{0.343} - 1$) and 29% ($e^{0.252} - 1$) more likely to export to Denmark than the control group. From the alternative logit specification, the odds ratio also shows the differing sectoral effects in participation, with the odds of manufacturing and wholesaler exporting around 7.4 (e^2) higher and 3.5 ($e^{1.249}$) times higher compared to the respective control groups. This suggests that the fixed costs barrier of exporting to Denmark decreased with the bridge, with the decrease being greater among manufacturing firms.

6.2 Evaluating Models of Multi-Product Exporters

The main objective of this paper is to evaluate empirically the theoretical validity of the predictions provided by MPE models. The nature of wholesalers differs substantially from that of manufacturing firms, as they do not generally produce the products they export themselves but rather serve as a channel to redistribute goods produced by other firms. Therefore, as the MPE models are mostly constructed to explain the behaviour of manufacturing firms rather than of wholesalers, the discussion below will focus on that sector.[25]

---

[25]The results for the wholesale sector are either insignificant or negative in some cases. A possible reason for this is that wholesalers may be more global in nature and less impacted by changes in distance (such as by the Öresund Bridge). This is important as all results are relative to the control group. Hence, if remote wholesalers benefit equally compared to wholesalers in Malmö from the Öresund bridge, the specification

Theoretically, we expect that following a decrease in trade costs, there will be an increase in the propensity of firms to export (M), and both the trade intensity of firms (X) and the number of products (P) exported will also increase. For manufacturing firms a theoretically consistent and robust effect is found on these three margins. See table 8 for an overview of the predictions and a comparison to the results.

Table 8: Comparison of results and predictions for manufacturing firms

Margin	Definition	Prediction	Result
M, Firm Extensive Margin	Probability of exporting	$+$	$+$
X, Firm Intensive Margin	Amount Exported	$+$	$+$
P, Prod. Extensive Margin	Nr. of products exported	$+$	$+$
$\bar{x}$, Prod. Intensive Margin	Ave. trade value per product	$+/-$	$+$

The MPE models do not provide a prediction for the product intensive margin ($\bar{x}$), since it is assumed that new products are exported less intensively than older products. In this paper, the sizeable impact on aggregate exports (X) for manufacturing firms is driven by an increase in the average value per product ($\bar{x}$) and to a smaller degree by the number of products (P).

The overall impact on aggregate firm exports (X) can be decomposed into sub-margins of average exports per product ($\bar{x}$) and number of products (P). For manufacturing firms, I find that around 70-80% of the increase in aggregate firm exports (X) can be attributed to increases in the average trade value per product ($\bar{x}$), while the rest is due to a greater number of products (P) exported (20-30%). This result suggests that firms respond mostly by increasing the trade value of the existing products rather than increasing their product scope following a drop in trade costs. This relates to the findings of Arnarson (2016) discussed in Chapter 2, who showed that firms mainly focus on a limited number of "superstar" (core) products that have a very large weight in terms of export value to a destination. He argues that other, more peripheral products may be exported to support the "superstars" of the firm. Firms may therefore respond to a decrease in trade costs by increasing the intensity of already exported products rather than on the product extensive margin.

---

of treatment and control groups becomes less applicable in that specific case.

This paper relates most closely to Berthou and Fontagné (2013), who evaluated the theoretical predictions of the multi-product exporter model by Bernard, Redding, and Schott (2011) using the introduction of the Euro for identification. Looking only at manufacturing firms, they found a 5% weakly significant (at the 10% significance level) effect on aggregate firm exports (X), with the main effect coming from increased average value per product ($\bar{x}$). After controlling for general equilibrium effects,[26] the main result strengthened and they found that aggregate exports increased by 7%, driven by an increase in average exports per product ($\bar{x}$). Comparing the results for manufacturing firms, we see that both papers find a significant increase in aggregate trade per firm, average value exported per product, and a relatively small increase in the number of products exported. Unlike Berthou and Fontagné (2013), I find a large and significant effect on the firm's decision to export.

7   Conclusion

The main contribution of this paper is to evaluate empirically the theoretical predictions of several models of multi-product exporters when faced with a decrease in trade costs. Using the introduction of the Öresund bridge as a *quasi-natural experiment*, I identify how the export decisions of firms in Malmö ('treated') changed compared to firms in the more distant control municipalities of Gothenburg and Stockholm. The focus of this paper is on how the decision to export to Denmark was impacted as well as on the within-firm decisions regarding product scope and the intensity of trade. Looking at all sectors jointly I find a significant effect on aggregate exports (X) compared to Gothenburg and Stockholm. This result hides vast sectoral heterogeneity since firms in the manufacturing sector are driving the main results while I find mostly insignificant results for wholesalers.

For manufacturing firms the baseline results of the paper are consistent with the MPE models on three of the margins tested. As predicted, a reduction in trade costs induces more firms to export (M) and increases

---

[26]They call this "phi-ness". It is not needed in our setting since the Öresund bridge only benefited Swedish firms.

their aggregate exports (X). Decomposing the impact on aggregate exports, we see that around 70-80% of the increase in aggregate firm trade can be attributed to increased average sales per product ($\bar{x}$), with the other 20-30% attributed to an increase in the number of products exported. This result is important, as the MPE models have an ambiguous prediction regarding how average sales per product ($\bar{x}$) should change following a change in trade costs. The results of this paper show, however, that increases in average sales per product ($\bar{x}$) is driving the increase in aggregate exports rather than increases in product scope (the number of products exported). To our knowledge, only Berthou and Fontagné (2013) have similarly evaluated a model of multi-product exporters when faced with a change in trade costs. This paper differs from theirs in the estimated size of the effects and, unlike their paper, I find a large and highly significant response in terms of the decision to export.

More broadly, the results of this paper highlight the value of infrastructure on market access. The large effect on the probability of exporting indicates that the Öresund was a barrier to trade, and even if the "great circle distance" was unchanged, the improved market access altered both the effective and the perceived distance, leading to a reduction in both variable and fixed costs of exporting.

References

Angrist, JD and JS Pischke (2008). *Mostly harmless econometrics: An empiricist's companion.*

Arkolakis, Costas, Marc-Andreas Muendler, and Sharat Ganapati (2015). *The Extensive Margin of Exporting Products: A Firm-level Analysis.* Working Paper.

Arnarson, Björn Thor (2016). *The Superstar and the Followers: Intra-Firm Product Complementarity in International Trade.* Working Paper.

Bernard, Andrew B. and J. Bradford Jensen (2004). "Why Some Firms Export". *Review of Economics and Statistics* 86.2, pp. 561–569. ISSN: 0034-6535. DOI: 10.1162/003465304323031111.

Bernard, Andrew B., Stephen J. Redding, and Peter K. Schott (2010). "Multiple-Product Firms and Product Switching". *American Economic Review* 100.1, pp. 70–97. ISSN: 0002-8282. DOI: 10.1257/aer.100.1.70.

— (2011). "Multiproduct Firms and Trade Liberalization". *The Quarterly Journal of Economics* 126.3, pp. 1271–1318. ISSN: 0033-5533. DOI: 10.1093/qje/qjr021.

Bernard, Andrew B., Ilke Van Beveren, and Hylke Vandenbussche (2014). "Multi-Product Exporters and the Margins of Trade". *Japanese Economic Review* 65.2, pp. 142–157. ISSN: 13524739. DOI: 10.1111/jere.12030.

Bernard, Andrew, Andreas Moxnes, and Yukiko Saito (2015). *Production Networks, Geography and Firm Performance.* Working Paper. Cambridge, MA: National Bureau of Economic Research. DOI: 10.3386/w21082.

Bernhofen, Daniel M and John C Brown (2005). "An Empirical Assessment of the Comparative Advantage Gains from Trade: Evidence from Japan". *American Economic Review* 95.1, pp. 208–225. ISSN: 0002-8282. DOI: 10.1257/0002828053828491.

Berthou, Antoine and Lionel Fontagné (2013). "How do Multiproduct Exporters React to a Change in Trade Costs?" *Scandinavian Journal of Economics* 115.2, pp. 326–353. ISSN: 03470520. DOI: 10.1111/sjoe.12006.

Bertrand, M., Esther Duflo, and S. Mullainathan (2004). "How Much Should We Trust Differences-In-Differences Estimates?" *The Quarterly Jour-*

nal of Economics 119.1, pp. 249–275. ISSN: 0033-5533. DOI: `10.1162/003355304772839588`.

Bird, Julia and Stephane Straub (2014). *The Brasília Experiment: Road Access and the Spatial Pattern of Long-term Local Development in Brazil.* Working Paper July. World Bank.

Blonigen, Bruce A and Anca D Cristea (2014). "Air Service and Urban Growth : Evidence from a Quasi-Natural Policy Experiment". September.

Brakman, Steven, H. Garretsen, and M. Schramm (2004). "The strategic bombing of German cities during World War II and its impact on city growth". *Journal of Economic Geography* 4.2, pp. 201–218. ISSN: 1468-2702. DOI: `10.1093/jeg/4.2.201`.

Brülhart, Marius, Céline Carrère, and Federico Trionfetti (2012). "How wages and employment adjust to trade liberalization: Quasi-experimental evidence from Austria". *Journal of International Economics* 86.1, pp. 68–81. ISSN: 00221996. DOI: `10.1016/j.jinteco.2011.08.010`.

Cameron, A. C. and Douglas L. Miller (2015). "A Practitioner's Guide to Cluster-Robust Inference". *Journal of Human Resources* 50.2, pp. 317–372. ISSN: 0022-166X. DOI: `10.3368/jhr.50.2.317`.

Chandra, Amitabh and Eric Thompson (2000). "Does public infrastructure affect economic activity?" *Regional Science and Urban Economics* 30.4, pp. 457–490. ISSN: 01660462. DOI: `10.1016/S0166-0462(00)00040-5`.

Coşar, A. Kerem and Banu Demir (2016). "Domestic road infrastructure and international trade: Evidence from Turkey". *Journal of Development Economics* 118, pp. 232–244. ISSN: 0304-3878. DOI: `http://dx.doi.org/10.1016/j.jdeveco.2015.10.001`.

Cristea, Anca D (2011). "Buyer-seller relationships in international trade : Evidence from U . S . States ' exports and business-class travel". *Journal of International Economics* 84.2, pp. 207–220. ISSN: 0022-1996. DOI: `10.1016/j.jinteco.2011.02.003`.

Datta, Saugato (2012). "The impact of improved highways on Indian firms". *Journal of Development Economics* 99.1, pp. 46–57. ISSN: 03043878. DOI: `10.1016/j.jdeveco.2011.08.005`.

Davis, Donald R. and David E. Weinstein (2002). "Bones, Bombs, and Break Points: The Geography of Economic Activity". *American Eco-*

nomic Review 92.5, pp. 1269–1289. ISSN: 0002-8282. DOI: `10.1257/000282802762024502`.

Eckel, Carsten and J. Peter Neary (2010). "Multi-Product Firms and Flexible Manufacturing in the Global Economy". *Review of Economic Studies* 77.1, pp. 188–217. ISSN: 00346527. DOI: `10.1111/j.1467-937X.2009.00573.x`.

Falkemark, Gunnar and Mikael Gilljam (1994). "Opinionen i Öresunds-brofrågan". *Vägval : SOM-undersökningen 1993*. Ed. by Sören Holmberg and Lennart Weibull. Samhälle, opinion, massmedia: 11. Göteborg : SOM-institutet [distributör], 1994 ; (Kungälv : Grafikerna), pp. 27–37.

Feenstra, Robert C. and Hong Ma (2008). "Optimal Choice of Product Scope for Multiproduct Firms under Monopolistic Competition". *The Organization of Firms in a Global Economy*. Ed. by Elhanan Helpman, Dalia Marin, and Thierry Verdier. Cambridge MA: Harvard University Press. Chap. 6, pp. 173–199.

Feyrer, James (2009). *Distance, Trade, and Income - The 1967 to 1975 Closing of the Suez Canal as a Natural Experiment*. Working Paper 15557. National Bureau of Economic Research. DOI: `10.3386/w15557`.

Ghani, Ejaz, Arti Grover Goswami, and William R. Kerr (2016). "Highway to Success: The Impact of the Golden Quadrilateral Project for the Location and Performance of Indian Manufacturing". *The Economic Journal* 126.591, pp. 317–357. ISSN: 1468-0297. DOI: `10.1111/ecoj.12207`.

Goldberg, P. K., A. K. Khandelwal, N. Pavcnik, and P. Topalova (2010). "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India". *The Quarterly Journal of Economics* 125.4, pp. 1727–1767. ISSN: 0033-5533. DOI: `10.1162/qjec.2010.125.4.1727`.

Gullstrand, Joakim (2011). "Firm and destination-specific export costs: The case of the Swedish food sector". *Food Policy* 36.2, pp. 204–213. ISSN: 0306-9192. DOI: `10.1016/j.foodpol.2010.11.017`.

Gullstrand, Joakim and Karin Olofsdotter (2014). *The Euro Effect on Bystanders*. S-WOPEC Working Paper no. 33. Lund University.

Gullstrand, Joakim and Maria Persson (2014). "How to combine high sunk costs of exporting and low export survival". *Review of World Economics.* ISSN: 1610-2878. DOI: 10.1007/s10290-014-0204-7.

Hanson, GH (1996). "Localization economies, vertical organization and trade". *The American Economic Review* 86.5, pp. 1266–1278. ISSN: 0036-8075.

— (1997). "Increasing returns, trade and the regional structure of wages". *The Economic Journal* 107.440, pp. 113–133.

Hillberry, Russell and David Hummels (2008). "Trade responses to geographic frictions: A decomposition using micro-data". *European Economic Review* 52.3, pp. 527–550. ISSN: 00142921. DOI: 10.1016/j.euroecorev.2007.03.003.

Hummels, David and Georg Schaur (2013). "Time as a Trade Barrier". *American Economic Review* 103.7, pp. 2935–2959. ISSN: 0002-8282. DOI: 10.1257/aer.103.7.2935.

Iacovone, Leonardo and Beata S. Javorcik (2010). "Multi-Product Exporters: Product Churning, Uncertainty and Export Discoveries". *Economic Journal* 120.544, pp. 481–499. ISSN: 00130133. DOI: 10.1111/j.1468-0297.2010.02356.x.

Knowles, Richard D. (2006). "Transport impacts of the Øresund (Copenhagen to Malmö) fixed link". *Geography* 91, pp. 227–240.

Mayer, Thierry, Marc J Melitz, and Gianmarco I. P. Ottaviano (2014). "Market Size, Competition, and the Product Mix of Exporters". *American Economic Review* 104.2, pp. 495–536. ISSN: 0002-8282. DOI: 10.1257/aer.104.2.495.

Mayer, Thierry and Gianmarco I. P. Ottaviano (2008). "The Happy Few: The Internationalisation of European Firms". *Intereconomics* 43.3, pp. 135–148. ISSN: 0020-5346. DOI: 10.1007/s10272-008-0247-x.

Melitz, Marc J (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity". *Econometrica* 71.6, pp. 1695–1725. ISSN: 0012-9682. DOI: 10.1111/1468-0262.00467.

Michaels, Guy (2008). "The effect of trade on the demand for skill: Evidence from the interstate highway system". *The Review of Economics and Statistics* 90.November, pp. 683–701.

Moulton, BR (1990). "An illustration of a pitfall in estimating the effects of aggregate variables on micro units". *The Review of Economics and Statistics* 72.2, pp. 334–338.

Moxnes, Andreas (2010). "Are sunk costs in exporting country specific?" *Canadian Journal of Economics/Revue canadienne d'économique* 43.2, pp. 467–493. ISSN: 00084085. DOI: `10.1111/j.1540-5982.2010.01580.x`.

Niebuhr, Annekatrin (2006). "Spatial Effects of European Integration: Do Border Regions Benefit Above Average? (Symposium Article)". *Review of Regional Studies* 36.3, pp. 254–278.

— (2008). "The impact of EU enlargement on European border regions". *International Journal of Public Policy* 3.3/4, p. 163. ISSN: 1740-0600. DOI: `10.1504/IJPP.2008.019065`.

Redding, Stephen J. and Daniel M Sturm (2008). "The Costs of Remoteness: Evidence from German Division and Reunification". *American Economic Review* 98.5, pp. 1766–1797. ISSN: 0002-8282. DOI: `10.1257/aer.98.5.1766`.

Roberts, Mark J and James R. Tybout (1997). "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs". *The American Economic Review* 87.4, pp. 545–564. ISSN: 00028282. DOI: `10.2307/2951363`.

Shadish, William R, Thomas D Cook, and Donald T Campbell (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton Mifflin. ISBN: 0395615569.

Storper, Michael and Anthony J Venables (2004). "Buzz: face-to-face contact and the urban economy". *Journal of Economic Geography* 4.4, pp. 351–370. ISSN: 1468-2702. DOI: `10.1093/jnlecg/lbh027`.

Volpe Martincus, Christian and Juan Blyde (2013). "Shaky roads and trembling exports: Assessing the trade effects of domestic infrastructure using a natural experiment". *Journal of International Economics* 90.1, pp. 148–161. ISSN: 00221996. DOI: `10.1016/j.jinteco.2012.11.001`.

Volpe Martincus, Christian, Jerónimo Carballo, Pablo M. Garcia, and Alejandro Graziano (2014). "How do transport costs affect firms' exports?

Evidence from a vanishing bridge". *Economics Letters* 123.2, pp. 149–153. ISSN: 01651765. DOI: 10.1016/j.econlet.2014.01.030.

Vägverket (2006). *Godstransporter genom Skåne och Blekinge.*

Öresundsbro Konsortiet (2013). *Öresundsbron och Regionen.*

Åkerman, Anders (2009). *Trade, Reallocations and Productivity: A Bridge between Theory and Data in Öresund.* Working Paper.

Appendices

A   Descriptive Statistics

Table A1: Sectoral decomposition of firms in sample.

Sector	Malmö	Gothenburg	Stockholm	Total
Agriculture	0.0	2.4	0.2	0.9
Mining	0.4	0.2	0.2	0.2
Manufacturing	33.0	25.6	17.7	22.9
Infrastructure	1.8	1.0	0.7	1.0
Construction	0.4	1.9	0.9	1.1
Wholesale	50.4	50.8	58.6	54.6
Transport/storage	2.1	6.0	3.3	4.0
Accomodation/food services	0.4	0.0	0.0	0.1
Information/communication	2.5	1.2	6.8	4.2
Finance/insurance	0.0	0.2	0.5	0.3
Real-estate	4.3	2.2	1.9	2.4
Professional activities	4.3	6.7	6.1	6.0
Other	0.7	1.9	3.0	2.2
Total	100	100	100	100
	(282)	(585)	(879)	(1746)

Table A2: Sectoral decomposition of firms in sample, only firms that trade to Denmark in some year.

Sector	Malmö	Gothenburg	Stockholm	Total
Agriculture	0.0	3.3	0.3	1.2
Mining	0.4	0.3	0.2	0.2
Manufacturing	35.9	26.8	20.5	25.4
Infrastructure	1.7	1.5	0.8	1.2
Construction	0.4	1.0	0.6	0.7
Wholesale	50.0	55.4	61.4	57.4
Transport/storage	1.3	1.5	1.1	1.3
Information/communication	1.3	0.8	5.3	3.1
Finance/insurance	0.0	0.3	0.3	0.2
Real-estate	4.7	2.5	1.6	2.5
Professional activities	3.8	5.3	5.8	5.2
Other	0.4	1.5	2.1	1.6
Total	100	100	100	100
	(234)	(399)	(625)	(1258)

Table A3: Share (%) of firms exporting to each destination, for firms in Malmö, Gothenburg and Stockholm in 1999.

Destinations	Malmö	Gothenburg	Stockholm	Total
AT	5.00	4.28	4.74	4.62
BE	5.89	6.16	5.75	5.92
DE	10.20	9.78	9.52	9.73
DK	11.96	11.17	11.16	11.31
ES	5.67	6.28	6.09	6.08
FI	11.06	10.64	11.94	11.33
FR	7.01	7.18	6.91	7.02
GB	8.47	8.58	8.41	8.48
GR	3.05	3.59	3.22	3.32
IT	6.37	6.55	6.20	6.35
LU	0.95	0.77	0.93	0.88
NL	8.01	7.75	7.24	7.56
NO	13.06	13.66	14.56	13.97
PT	3.30	3.62	3.33	3.43
Total	100	100	100	100

B   Results Appendix

Table B1: Robustness for baseline specification using only years 1998 to 2002 and firms in manufacturing sector. Includes firms in Malmö, Gothenburg and Stockholm and trade flows to Denmark, adjacent and EU-15 countries

	Manufacturing				
	X	X_{lead}	X_{lag}	$\bar{x}$	P
Bridge	0.168^a	0.178^a	0.161^a	0.0750^c	0.0929^a
	(0.0489)	(0.0597)	(0.0555)	(0.0437)	(0.0224)
Bridge lead		0.0204			
		(0.0332)			
Log GDP	0.844	0.847	0.842	0.453	0.390
	(1.585)	(1.587)	(1.586)	(1.590)	(0.369)
Log Real FX	-1.161^b	-1.161^b	-1.160^b	-1.330^a	0.169
	(0.458)	(0.458)	(0.459)	(0.396)	(0.277)
Bridge 1-lag			0.0120		
			(0.0299)		
N	7010	7010	7010	7010	7010
R^2	0.895	0.895	0.895	0.861	0.925
Within R^2	0.0116	0.0116	0.0116	0.0102	0.0026
Firm-Dest-FE	Yes	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes	Yes

[c] $p < .10$, [b] $p < .05$, [a] $p < .01$. Standard errors in parentheses, clustered on municipality and destination pairs. X = Total trade value, $\bar{x}$=average trade value within firm, per product. P =Number of products. Controls for lagged TFP and lagged firm size are included (see appendix C).

Table B2: Robustness for baseline specification using only years 1998 to 2002 and firms in wholesale sector. Includes firms in Malmö, Gothenburg and Stockholm and trade flows to Denmark, adjacent and EU-15 countries

| | Wholesale | | | | |
	X	X_{lead}	X_{lag}	$\bar{x}$	P
Bridge	-0.209[a]	-0.119[c]	-0.412[a]	-0.190[a]	-0.0192
	(0.0536)	(0.0602)	(0.0657)	(0.0465)	(0.0315)
Bridge lead		0.180[a]			
		(0.0340)			
Log GDP	3.237[c]	3.265[c]	3.175[c]	2.270	0.939
	(1.758)	(1.761)	(1.748)	(1.826)	(0.710)
Log Real FX	0.251	0.255	0.301	0.450	-0.165
	(0.526)	(0.526)	(0.530)	(0.564)	(0.258)
Bridge 1-lag			0.365[a]		
			(0.0471)		
N	7830	7830	7830	7922	7830
R^2	0.843	0.843	0.843	0.832	0.902
Within R^2	0.0035	0.0036	0.0039	0.0009	0.0055
Firm-Dest-FE	Yes	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes	Yes

[c] $p < .10$, [b] $p < .05$, [a] $p < .01$. Standard errors in parentheses, clustered on municipality and destination pairs. X = Total trade value, $\bar{x}$=average trade value within firm, per product. P =Number of products. Controls for lagged TFP and lagged firm size are included (see appendix C).

Table B3: Robustness for baseline specification using trade to adjacent and all EU-15 countries from firms in Malmö, Gothenburg and Stockholm.

	Bridge		TFP		N
All Sectors					
$\bar{x}_1$	0.0448	(0.0377)	-0.0502^a	(0.0133)	55876
$\bar{x}_{10}$	0.0861	(0.0598)	-0.0631^a	(0.0240)	55876
P_1	0.0671^a	(0.0151)	-0.0198^a	(0.00363)	55177
P_{10}	0.0705^a	(0.0144)	-0.0152^a	(0.00358)	51580
Manufacturing					
$\bar{x}_1$	0.201^a	(0.0510)	-0.0519^b	(0.0248)	21518
$\bar{x}_{10}$	0.211^a	(0.0796)	-0.0628	(0.0383)	21518
P_1	0.0621^a	(0.0152)	-0.00914	(0.00587)	21364
P_{10}	0.0831^a	(0.0139)	-0.00634	(0.00660)	20407
Wholesale					
$\bar{x}_1$	-0.159^a	(0.0597)	-0.0499^a	(0.0192)	27642
$\bar{x}_{10}$	-0.0688	(0.0957)	-0.0777^b	(0.0316)	27642
P_1	0.136^a	(0.0249)	-0.0337^a	(0.00609)	27194
P_{10}	0.129^a	(0.0218)	-0.0265^a	(0.00509)	25010

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standard errors in parentheses, clustered on munic-ipality and destination pairs. X = Total trade value, $\bar{x}$=average trade value within firm, per product. $\bar{x}$ = average trade value within firm, per product. P=Number of products. Controls for lagged firm size for the destinations we include GDP and the real exchange rate (see appendix C). All regressions include firm-destination-FE and sector-year FE. The subscripts 1 and 10 refer to yearly minimum product value (in '000 SEK).

Table B4: Manufacturing firms, alternative control sample: Includes firms in Malmö, Gothenburg and Stockholm and only trade flows to Denmark and adjacent countries (Finland and Norway).

	Manufacturing				
	X	X_{lead}	X_{lag}	$\bar{x}$	P
Bridge	0.378^a	0.334^a	0.271^a	0.274^a	0.104^a
	(0.0612)	(0.0636)	(0.0659)	(0.0635)	(0.0280)
Bridge lead		0.137^b			
		(0.0424)			
Log GDP	3.186^b			3.133^a	0.0528
	(1.096)			(0.930)	(0.539)
Log Real FX	0.741			1.058^a	-0.316
	(0.483)			(0.271)	(0.290)
Bridge 1-lag			-0.0109		
			(0.0591)		
Bridge 2-lag			-0.0909		
			(0.0564)		
Bridge 3-lag			0.0761		
			(0.0673)		
N	6619	6619	6619	6619	6619
R^2	0.827	0.826	0.826	0.770	0.870
Within R^2	0.0203	0.0177	0.0178	0.0153	0.0066
Firm-Dest-FE	Yes	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes	Yes

[c] $p < .10$, [b] $p < .05$, [a] $p < .01$. Standard errors in parentheses, clustered on municipality and destination pairs. X = Total trade value, $\bar{x}$=average trade value within firm, per product. P =Number of products. Controls for lagged TFP and lagged firm size are included (see appendix C).

Table B5: Wholesale firms, alternative control sample: Includes firms in Malmö, Gothenburg and Stockholm and only trade flows to Denmark and adjacent countries (Finland and Norway).

	Wholesale				
	X	X_{lead}	$\bar{x}$	P	X
Bridge	-0.203^a	-0.117^b	-0.260^a	-0.316^a	0.112^b
	(0.0397)	(0.0486)	(0.0561)	(0.0481)	(0.0455)
Bridge lead		0.174^b			
		(0.0523)			
Log GDP	-0.772	-0.764	-0.866	-0.488	-0.284
	(0.685)	(0.687)	(0.692)	(0.499)	(0.444)
Log Real FX	0.646^b	0.650^b	0.658^b	0.958^a	-0.313
	(0.236)	(0.237)	(0.237)	(0.233)	(0.201)
Bridge 1-lag			0.281^a		
			(0.0820)		
Bridge 2-lag			-0.0916		
			(0.0563)		
Bridge 3-lag			0.0966^b		
			(0.0416)		
N	11411	11411	11411	11411	11411
R^2	0.754	0.754	0.754	0.748	0.838
Within R^2	0.0154	0.0155	0.0157	0.0072	0.0167
Firm-Dest-FE	Yes	Yes	Yes	Yes	Yes
Year-FE	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standard errors in parentheses, clustered on municipality and destination pairs. X = Total trade value, $\bar{x}$=average trade value within firm, per product. P =Number of products. Controls for lagged TFP and lagged firm size are included (see appendix C).

C   Control Variables

The data used for GDP comes from the World Development Indicators of the World Bank and is measured in constant US dollars (2005) (in logs). The bilateral real exchange rate is calculated as follows:

$$R_{jt} = E_j * \frac{PPI_{jt}}{PPI_{se,t}} \qquad (6)$$

Here R_{jt} is the bilateral real exchange rate between country j and Sweden. E_j is the yearly nominal exchange rate between Sweden and the destination j, (SEK per unit foreign currency). The data is from the Riksbanken website. PPI_{jt} is the producer price index for country j and $PPI_{se,t}$ is the PPI for Sweden in year t. The PPI is a country level series (B-E36) from Eurostat, measured in national currency.[27]

The firm level control variables used are lagged firm sales and lagged total factor productivity (*TFP*), both in logs. *TFP* is calculated using the Olley-Pakes methodology at the 2-digit sectoral level and lagged by one year to avoid reverse causality. Note that *TFP* is calculated by using the whole dataset for Sweden. This is done so *TFP* can be calculated for as large a proportion of the sample as possible. There are restrictions on the minimum number of firms in a sector, which may make the calculations problematic for smaller samples.

---

[27]See   http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sts_inppd_a&lang=en.

Chapter II

The Superstar and the Followers: Intra-Firm Product Complementarity in International Trade

Abstract

This paper investigates whether the exports of different products by the same firm are systematically interconnected. Using Swedish firm-registry data from 1997-2011, I first document that the distribution of firm export sales is skewed towards their best performing products ('superstars'). I then use a novel instrumental variable approach to identify if the 'superstar' products induce more trade of non-superstar products. I find evidence that the exports of low-ranked (non-star) products of a firm complement the exports of a *single* superstar product to each destination. Extending the 'superstar' concept to a 'superstar core' of products strengthens this result (this includes the top decile of products in terms of export value).

The results show that a 1% increase in the exports of the superstar product and the superstar core increases the exports of non-star products by 0.13% and 0.376%. Hence, I find that the exports of non-star products complements the superstar while conversely, the same complementarity is not found using low-ranked products as placebo-superstars. The main contribution of this paper is identifying a new, sizeable and systematic intra-firm-destination *one-way* complementarity between products that is missing in the current models of multi-product exporters.

Keywords: Multi-product firms, product complementarity, spillovers, intra-firm spillover, international trade, inter-product spillover

JEL Classification: F10, F14, F13, L1, L2

1   Introduction

In the last decades the focus in international trade has shifted from a broad country level view towards less aggregate firm-level data. While the heterogeneity between firms is well acknowledged,[1] an emerging body of literature is looking within the firm. Several theoretical models on multi-product firms have been developed in the past decade to explain the product dimension and the wide scope of multi-product exporters.[2] What these models only partly acknowledge is the 'granular' nature[3] of firm product exports.

While several researchers have demonstrated that the distribution of exports is heavily skewed towards a small set of firms, researchers are now taking the next step by looking at the distribution of product sales *within* a firm. Amador and Opromolla (2012) and Görg, Kneller, and Muraközy (2012) documented that product exports are skewed towards the most exported 'core-products' of the firm.[4] What has not been considered is the possibility that the trade flows of the same firm within a destination may be systematically interconnected. The importance of investigating exports to a specific destination is highlighted by the fact that the traditional measures of firm efficiency/productivity perform much better in predicting firm entry than the distribution of sales within a destination (see Eaton, Kortum, and Kramarz (2011) and Munch and Nguyen (2014)). A gap therefore remains

---

[1] Seminal theoretical contribution from Melitz (2003). Additionally, Mayer and Ottaviano (2008) summarised stylised facts on firms engaging in international trade and found that they are, in general, compared to non-exporters, bigger, more productive, sell to a larger number of destinations and account for the largest share of trade value.

[2] See, for example, Bernard, Redding, and Schott (2011), Feenstra and Ma (2008), Arkolakis, Muendler, and Ganapati (2015), Eckel and Neary (2010), and Mayer, Melitz, and Ottaviano (2014). Berthou and Fontagné (2013) and Arnarson (2015) have evaluated the validity of the models of multi-product exporters.

[3] Gabaix (2011) refers to the large firms as the "incompressible grains of economic activity". Because of this granularity shocks to these large grains(firms) will generate aggregate fluctuations in the economy. He finds that shocks to the 100 largest firms in the US accounted for a third of the aggregate output growth. Di Giovanni, Levchenko, and Mejean (2014) investigate this granularity and find evidence that firm-specific components contribute to aggregate sales volatility and that strong firm-to-firm linkages magnify this effect.

[4] A corresponding granular pattern is found for Swedish exporters, as documented in section 2. Goldberg, Khandelwal, Pavcnik, and Topalova (2010) found similar patterns in the production of multi-product firms.

in the literature in terms of explaining the within-destination distribution of firm exports.

In this paper, I suggest a new within firm-destination mechanism which relates the export value of a 'superstar product'[5] to each destination to the exports of more peripheral non-superstar products. The general intuition for this mechanism is that, since the trade value of firms to any particular destination is generally dominated by a single product, this superstar product may have a positive effect on the sales of other products. Hence, the existence of a trade relationship may induce other products to follow, either due to demand-side scope complementarity or supply-side (cost) advantages. I will not distinguish between alternative explanations in this paper, rather I will provide a discussion of how the proposed mechanism relates to current theoretical and empirical work on multi-product exporters. In this paper, I will focus solely on the intensive margin, (i.e. the intensity of exports of non-star products) in response to a shock to the superstar product.

As the export sales of the superstar and non-superstar products to a destination may be jointly determined, I suggest a novel instrumental variable approach to overcome the potential simultaneity bias, building on the work of Hummels, Jørgensen, Munch, and Xiang (2014). The aim is to find an instrument which is correlated with the trade flow of the superstar product but is uncorrelated with other non-superstar products. I propose using superstar product-destination specific demand variation as an instrument for the trade value of the superstar product. As the demand shock is specific to the superstar product-destination pair it should be uncorrelated with other product flows of the firm within the destination.

For the empirical analysis, I will use a detailed Swedish firm-registry dataset (from 1997 to 2011) which is linked to export flows at the firm-HS6 product-destination level. The empirical results show strong evidence of non-superstar products being complementary to the superstar product, with an elasticity of 0.13. Hence, an increase in the trade value of the superstar

---

[5]The superstar product is defined as the highest exported product, in a pre-sample year, within each firm-destination pair. The superstar product is kept constant over the time period for each firm-destination pair, but the superstar product may differ across destinations for a firm. See section 2 for further discussion. Note that the terms 'superstar' and 'star' are used interchangeably.

product increases the trade value of non-superstar products by 0.13%. A natural continuation is to investigate if this effect is limited to a single superstar product or if an analogous effect is found for other high-ranked products in the pre-sample. A similar, but weaker result is found for the product ranked second and third in the pre-sample, while other placebo tests are generally insignificant. This suggests that the effect found is not limited to a single product but rather related to a 'core' of superstar products. In the paper I alter the definition of the superstar product to a 'superstar core', which includes the products in the first decile of the pre-sample rank. The superstar core definition therefore takes the varying, and often wide product scope of firms into consideration. The results of the superstar core specification are stronger than before, with an estimated elasticity of 0.376. In order to ensure the robustness of the result I use lower-ranked product deciles as placebo-superstar core deciles and find a weaker but significant effect for the second decile, while no significant effects are found for the other eight deciles. Hence, the complementarity is one-way, as *only* the peripheral products are dependent on the superstar product.

This paper relates broadly to a literature on complementaries at the firm level, were early contributions include Milgrom and Roberts (1990) and Vives (1990). A recent paper by Bernard, Blanchard, Van Beveren, and Vandenbussche (2014) documented the existence of "Carry-Along-Trade" (CAT), which is the export of a product by a firm which does not produce that specific good. They suggested that CAT may be a result of demand-scope (or supply side) complementaries. Another example is Gentzkow (2007) who found complementarity in the newspaper industry through the bundling of different platforms (online versus paper).

This paper is also related to several literatures, both theoretical and empirical, investigating the behaviour of exporters, specifically multi-product firms (MPFs). First, in terms of the literature on the sunk/fixed costs of exporting and the duration of trade flows. Several studies have found that a large proportion of trade flows is temporary and that such products are generally among the least traded.[6] Second, it relates research which

---

[6]This has been found both for importing and exporting. See, for example, Besedeš and Prusa (2006a), Besedeš and Prusa (2006b), Görg, Kneller, and Muraközy (2012), Gullstrand and Persson (2014), Békés and Muraközy (2012), Hess and Persson (2011).

has found that MPFs engage in intra-firm product churning (switching) or cannibalisation which can be a source of expansion or adjustment.[7] Thirdly, it has been shown that product quality, mark-ups, and shipment frequency can be important considerations when examining trade patterns of MPFs.[8] Fourthly, it relates to research on the role of demand for exporters, especially in terms of explaining within-destination sales patterns.[9] Lastly, there are studies that have examined *between* firm geographical product level spillovers.[10]

The remainder of the paper is organized as follows. Section 2 discusses the data and documents some empirical regularities of product exports. Section 2 presents theoretical motivation for the suggested within-firm-destination mechanism, section 4, discusses the empirical strategy and section 4 the results. Section 5 concludes the paper.

2   Data and Descriptive Statistics

In this paper, I use Swedish firm-registry data provided by Statistics Sweden from 1997 to 2011. The dataset links firm-level registry data, covering the entire population of Swedish firms, with information about trade flows at the firm-product-destination level. Around 18% of the firms are exporters and the final dataset includes an unbalanced panel of 14303 manufacturing firms, 4662 HS-6 products, and over 2.5 million firm-product-destination observations. The data is provided at the CN 8-digit level but aggregated and converted to time-consistent HS-6-digit level codes. See appendix A for

---

The level of analysis here varies and is either at the product, firm-destination or firm-product destination level.

[7]See, for example, Iacovone and Javorcik (2010) who considered product churning and Bernard, Redding, and Schott (2010) for a theoretical model of product switching. Additionally, Timoshenko (2015b) suggested that MPFs may learn from the demand conditions they face in the export market and adjust their product portfolio accordingly.

[8]For quality and mark-ups, see, for example, Crozet, Head, and Mayer (2012), Kugler and Verhoogen (2012), Baldwin and Harrigan (2011), Antoniades (2015), Hummels and Klenow (2005) and Traiberman, Warzynski, and Smeets (2014). For shipments, see Eaton, Eslava, Kugler, and Tybout (2008) and Kropf and Sauré (2014).

[9]See Eaton, Kortum, and Kramarz (2011), Munch and Nguyen (2014), Foster, Haltiwanger, and Syverson (2016), and Timoshenko (2015a,b).

[10]See Mayneris and Poncet (2013) and Koenig, Mayneris, and Poncet (2010), who found evidence of product level spillovers from neighbouring firms.

information on the sample construction, summary statistics (table A1), and definitions of variables (table A2).

2.1   Why the Lonely 'Star'?

Before proceeding to the empirical analysis it is helpful to document the within-firm and within-firm-destination patterns of export flows. Firms export many products, but a considerable proportion of them are only peripheral to the firms' aggregate export value. By only counting a single product within each firm, the top-ranked export product to all destinations, we account for 44% of the aggregate firm trade value. The value decreases sharply as one descends the product value ladder. The second product accounts for 18.3% and the third for 11.1%. Hence, the first three products constitute over 73% of the aggregate trade value. See table 1.

Noting that a single product has such a high weight within a firm also means that there are many products which only have peripheral trade value. This can be seen from table 2, where over 65% of the products of a firm are only exported to a single destination and over 81% to three or less. The total trade value of these observations is only around 9%. Looking more closely at tables 1 and 2 it is clear that products which are exported to three or less destinations and are ranked 2nd or lower, within the firm, account for 71.4% of the firm-product observations but only for 5% of the export value (marked in red). In contrast, the trade value is highly concentrated among the top-ranked products that are exported to multiple destinations. Products that are exported to four or more destinations and are among the three highest ranked within the firm make up 66.9% of the trade value, but only 5.2% of the firm-product observations (marked in blue).

Looking *within* firm-destination pairs, a similar pattern emerges independent of the product scope at the destination. Figure 1 shows how large of a share of the total trade value, each of the five most exported products, have to the destination. As the firm product scope at a destination increases, the contribution of the largest products declines, but slowly. For firms exporting over 20 products to a destination, still over 40% of the firm export revenue comes from a single product. The top five products account for around or over 70% of the export value, regardless of the number of products exported.

Table 1: Rank of products and percentage of trade value in each cell (2005).

Product Rank	Nr. of destinations					Total
	1	2	3	4-10	11+	
1	1.9	1.1	1.1	6.2	33.7	44.0
2	0.8	0.4	0.5	3.0	13.6	18.3
3	0.4	0.1	0.2	1.6	8.8	11.1
4-10	0.7	0.4	0.7	1.7	16.0	19.5
11+	0.4	0.2	0.2	0.6	5.6	7.0
Total	4.2	2.2	2.7	13.1	77.7	100

Number of firm-product observations: 54324.

Table 2: Percentage of firm-product observations in each cell (2005).

Product Rank	Nr. of destinations					Total
	1	2	3	4-10	11+	
1	8.3	1.1	0.5	1.3	1.0	12.2
2	6.2	0.8	0.4	1.0	0.7	9.1
3	4.9	0.6	0.3	0.7	0.5	7.0
4-10	16.7	2.4	1.1	2.4	1.7	24.3
11+	29.1	6.0	2.9	5.1	4.4	47.5
Total	65.2	10.9	5.2	10.5	8.3	100

Number of firm-product observations: 54324.
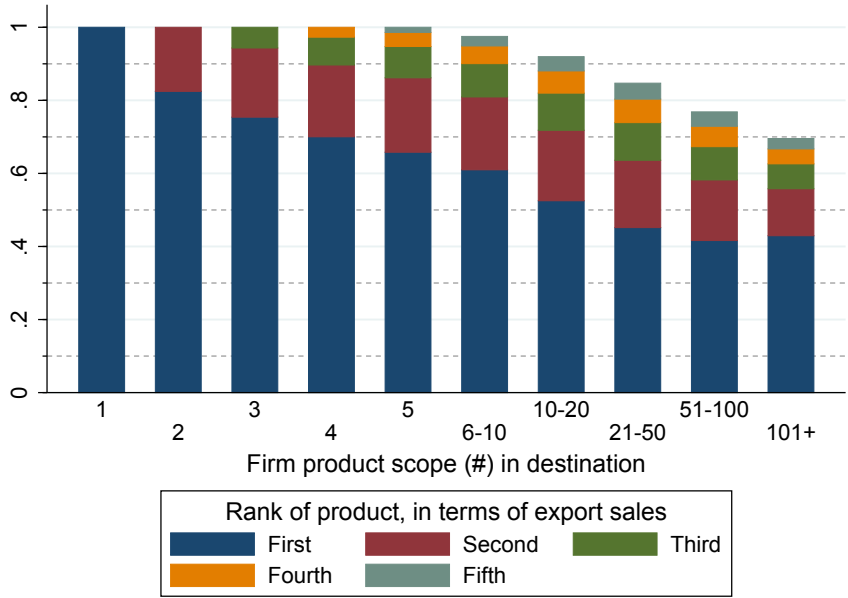
Figure 1: Share of export value of 'star' products ranked first to fifth within a firm-destination pair (2005). Calculated as the export value of the product divided by the total export value to the destination.

This shows that firm exports are granular in nature and that the trade of the first product(s) could explain much of the variation to a destination.

Another aspect of investigating multi-product exporters is the stability of the product rankings across destinations. See table 3. If we look at destinations that a specific firm trades with, then in 38.5% of the cases the product with the highest export value at the firm level is also ranked first to a destination. Conditional on the product being exported to a particular destination, then in 74% of the destinations the most exported product at the firm level is also the most exported product to a destination. Rarely is the product most exported at the firm level ranked lower than second in a destination (less than 11% of the cases). It is also rare for a low ranked product within the firm to be the highest ranked to a destination: in 70.9% of the firm-product observations the highest ranked product in a destination is among the three highest ranked products within the firm.

Table 3: Comparison of product rankings at the firm and destination level in 2005 (row/col percentages).

Rank within-firm		Rank of product within-destination							
		1	2	3	4	5	6	7+	Tot.
1	Row %	74.0	15.4	4.9	2.4	1.3	0.6	1.4	100
	Col %	38.5	12.3	5.4	3.3	2.3	1.2	0.2	7.9
2	Row %	48.2	31.2	9.7	4.9	2.3	1.3	2.5	100
	Col %	20.6	20.4	8.8	5.7	3.3	2.2	0.3	6.5
3	Row %	34.3	30.5	19.2	6.4	3.2	1.9	4.7	100
	Col %	11.8	16.1	13.9	6.0	3.7	2.6	0.5	5.2
4	Row %	23.6	24.4	21.9	14.7	5.7	2.9	6.7	100
	Col %	7.1	11.2	13.9	12.1	5.8	3.6	0.6	4.6
5	Row %	17.9	18.5	19.3	15.5	13.0	4.9	10.8	100
	Col %	4.6	7.3	10.5	10.9	11.3	5.1	0.8	3.9
6	Row %	14.2	17.2	17.2	15.7	12.2	10.7	12.7	100
	Col %	3.3	6.1	8.5	10.0	9.6	10.1	0.8	3.5
7+	Row %	3.1	3.9	4.1	4.2	4.2	4.1	76.3	100
	Col %	14.1	26.6	39.0	52.1	64.1	75.2	96.8	68.4
Total	Row %	15.2	9.9	7.2	5.6	4.5	3.8	53.9	100
	Col %	100	100	100	100	100	100	100	100

Note: Only firms exporting more than 6 products are used when computing this table. Interpretation of table: 38.5% of the products ranked first at the firm-level are also ranked first within a destination and in 20.6% of cases the product ranked 2 at the firm-level is ranked first in a destination. If the highest ranked product of a firm is exported to a destination, then in 74% of the destinations it is ranked first, and 15.4% of cases ranked second in a destination.

Relying on the preceding discussion,[11] the pattern of firm export sales can be formalised in two stylised facts:

- **Fact 1:** Both firm and firm-destination exports are granular in nature with the economic value concentrated in a few 'star' products.
- **Fact 2:** A limited number of 'star' products are consistently among the highest ranked products across destinations, but need not be exported to all. Many products are exported with a peripheral trade value relative to the aggregate exports of the firm.

Based on these stylised facts I introduce the concept of superstar and non-superstar products. The superstar product of firm i in destination d is defined as the product with the highest export sales in destination d in a pre-sample year. Figure 2 illustrates the definition of the superstar and non-superstar products.

	Products exported	Nr. of
Destinations	(ordered by value)	products
d_1 - - - - - (**A**,R,F,...,C,B)	(#22)
d_2 - - - - - (**B**,A,C,...,G,M,Q)	(#35)
Firm i — d_3 - - - - - (**A**,R,...,K,B)	(#12)
d_4 - - - - - (**C**,R,K,A,X,F,L,P,W,....,D)	(#98)

Figure 2: Defining the superstar product (bold).
Note: Products are ranked within destination by export value in a pre-sample year. Note that the figure displays *only* the pre-sample year rankings that are used to define the superstar product. Product A is the highest ranked product at destination d_1 in the pre-sample year and is therefore the superstar product for firm i in destination d_1 in all time periods. All products which are not exported in this pre-sample year are, by definition, non-star products. The superstar product for each destination is marked in bold.

I use a pre-sample year to ensure that the superstar is not endogenously determined. The identity of the superstar product is kept constant within each firm-destination pair in consequent time periods.[12] A non-superstar

---

[11]This paper is not unique in documenting similar within-firm descriptive statistics and the skewness towards the best performing products. See, for example, Görg, Kneller, and Muraközy (2012), Arkolakis and Muendler (2013), Amador and Opromolla (2012) and Bernard, Redding, and Schott (2010).

[12]The superstar products need not be exported or the highest exported product to a

product is defined as any product exported by a firm which is not ranked first in the pre-sample, regardless of the number of products the firm exports. Note that these non-superstar products need not be exported in the pre-sample year.

3 Theoretical Motivation and Mechanism

The aim of this paper is to investigate whether there is a systematic pattern of dependence between the products that a firm exports. To motivate the empirical analysis I suggest a mechanism in conjecture 1 which I will link to current theoretical and empirical studies on multi-product exporters. The suggested mechanism is the following:

Conjecture 1 *Each firm has a superstar product exported to a destination. I propose that an increase in the export value of the superstar product leads to increased exports of non-star products exported to that destination. The reverse mechanism, from non-superstar products to other non-star products or the superstar product, should not be found.*

Note that conjecture 1 describes one-way complementarity or an asymmetric relationship between the products, as only the non-star is dependent on the superstar product trade flows. The mechanism in conjecture 1 could be either demand- or supply-driven and a few examples of both are discussed below.

First, as the export revenue is highly skewed towards the best performing products, I argue that one explanation for this mechanism could be that firms will only overcome the entry costs if the superstar product is successful. This is in line with the theoretical model of flexible manufacturing of Eckel and Neary (2010), where products close to the firms' core-competency (high ranked) are produced at a low cost and should, therefore, be more

---

destination in any of the consequent periods. To investigate the stability of the superstar within a firm-destination pair I examine the last year in the data and compare the rankings. From figure A2 in appendix A, it can be seen, that in just under 35% of the cases, is the superstar product (as defined by the pre-sample) the highest exported product in the last period. The product ranked second in the pre-sample, is in only 5% of the cases the most exported product in the last period. The share decreases sharply for lower ranked products.

competitive and have higher mark-ups than non-core products. In line
with this argument, De Loecker, Goldberg, Khandelwal, and Pavcnik (2016)
demonstrated that products closer to the firms' core have higher mark-ups
relative to those further away. I argue that, since the superstar product is
a core-product with high mark-ups and is exported in large volume, it will
generate the majority of the firm's profit. Firms will therefore base their
export decisions on the superstar product while other non-star products
may be exported to complement/supplement the 'main' product for that
destination. This could be a result of customers demanding a bundle of
superstar and complementary, non-superstar products. This relates to the
findings of Bernard, Blanchard, Van Beveren, and Vandenbussche (2014)
who showed that 75% of the products a firm exports, and 30% of the
export value is in Carry-Along-Trade (CAT) products, which is the export
of a product that the firms themselves do not produce. To explain this
phenomenon, they created a model emphasising sourcing of products and
suggested that the demand-scope complementarity[13] of produced and non-
produced products may explain the existence of CAT products. This type of
demand-side product bundling may provide one explanation of conjecture 1.
Hence, if superstar and non-superstar products are demanded in conjunction
and are bundled, a positive demand shock to the core product will induce
trade in non-star products.[14] Conversely, a positive demand shock to non-
superstar products should not induce trade of star products (or other non-star
products), as these products are of minimal importance for the exporter.[15]

A second explanation of the mechanism in conjecture 1, is related to
demand learning, product churning, and duration. Békés and Muraközy

---

[13]Bernard, Blanchard, Van Beveren, and Vandenbussche (2014) provides some anecdotal
evidence of the demand-scope complementaries. They interviewed Belgian and US firms
on their sales strategies and reported that firms often export non-produced products
with produced products as the customer demands a bundle of goods. An example they
use is a coffee exporter who will bundle his produced good (coffee) with non-produced
goods (coffee cups and/or cookies) which are then sold to the foreign market.

[14]Theoretically, one could perhaps model this as a mechanism whereby the entry costs of
complementary non-superstar products are subsumed (absorbed) in the entry cost of
the product to which they are complementary, i.e. the superstar product. This may
explain the wide scope of many firms as the entry cost of complementary products may
have already been incurred.

[15]In terms of the example above, a demand shock to cups (the non-superstar product)
will not induce trade of coffee (the superstar product) or cookies (other non-star).

(2012) showed that over half of firm-product-destination flows last only a single year. Similarly, Timoshenko (2015b) found that, after firms enter a market, they engage in product switching (churning) as they learn about the appeal of their products. She found that continuing exporters derive around 16% of the aggregate revenue from new products and the value of products that are dropped in the next period was found to be the same. As the bulk of the trade value is in continuously exported products the learning mechanism suggested is mostly active in the lower realm of the product sales. This is consistent with an explanation that the duration of superstar and other high-selling products is longer compared to other products and firms may, as time passes, learn about the market-specific demand conditions for the non-superstar products. This could be in the form of how to bundle products together or learn about destination-specific demands.

A third explanation for this superstar to non-superstar relationship may be related to the number of buyers in the destination and the shipment frequency.[16] As firm sales are skewed towards a limited number of products, potential buyers are more likely to have information and knowledge of the superstar product (due to, for example, marketing) rather than non-superstar products. A new buyer is, therefore, more likely to demand the superstar product than other products. This would result in the mechanism in conjecture 1 if the new buyer also demands some of the non-superstar products. A related explanation may be the ability of firms to spread costs across products by 'co-shipping' goods. Kropf and Sauré (2014) found evidence of substantial fixed costs per shipment which ranged between 0.8-5.4% of the export value. As fixed costs per shipment are independent of shipment size/value, they will have a large deterrent effect on the trade of low value peripheral products, since they make up a large share of their trade value. This could explain the response of the non-superstar products as the trade value of the superstar product increased, as an additional shipment reduces (or removes) the entry cost for co-shipped non-superstar products.

Lastly, one could explain conjecture 1 by considering product quality and mark-ups. Eckel, Iacovone, Javorcik, and Neary (2015) found that in

---

[16]See Carballo, Ottaviano, and Volpe Martincus (2013), Bernard, Moxnes, and Ulltveit-Moe (2014) and Eaton, Eslava, Kugler, and Tybout (2008).

the flexible manufacturing framework of Eckel and Neary (2010), products close to the core-competence of the firm can be produced at a low cost and sold with a high margin. They argued that firms producing differentiated goods are competing in terms of quality rather than cost. There is, therefore, an incentive for firms to invest in the (perceived) quality of their core-products which have the highest mark-ups and sales. One way to achieve higher perceived quality would be to bundle the high-quality superstar product with complementary non-superstars. Alternatively, the firm may use marketing to increase the (perceived) quality of the firm/product which could have a positive spillover on other products exported.

4   Empirical Strategy and Specification

The aim of this paper is to identify whether there is a within-firm-destination complementarity between the 'superstar' and non-superstar products of a firm. The identification challenge, using traditional OLS, stems from the suggested within-firm dependence of export flows of the superstar and non-superstar products. Demand for different products of a firm may be correlated, causing a simultaneity bias in our estimates. An additional problem with using traditional OLS is the potential for measurement error due to misclassification of the superstar product. If a non-star product is (falsely) defined as the actual superstar product the results would be biased towards zero. To overcome these issues I suggest a novel instrumental variable approach. I argue that firms mainly focus on exporting *a* superstar product to a destination and that the trade flows of non-superstars products are partly dependent on the superstar product. By using an instrument for the export of the superstar product, I identify whether changes in the trade of the superstar product explains trade flows of non-superstars in a specific destination. The instrument, therefore, needs to be superstar product-destination specific, correlated with the trade value of the superstar and uncorrelated with other product trade flows.

The instrument used in this paper relates most closely to the instrument used by Hummels, Jørgensen, Munch, and Xiang (2014) and Autor, Dorn, and Hanson (2013). The instrument, Country-Product Import Demand (CPID),

is defined based on the product-specific import demand to a destination.[17]
Formally, the CPID instrument (in logs), z_{i1dt}, is defined as:

$$z_{i1dt} = M_{1dt} \tag{1}$$

where M_{1dt} is the import of the superstar product ($p=1$) for firm i from
the world market (except Sweden) to destination d in year t. For each
superstar product, CPID is used as an instrument for the trade value of
the superstar to a destination. The CPID instrument will, therefore, be
firm-product-destination-specific.[18] Since a single instrument is used for
each firm-destination pair, a firm may have a different 'star' product in
different destinations. Data from UN Comtrade has been used to construct
the instrument. See appendix A for additional information on the dataset,
summary statistics (table A1) and definitions (table A2).

I argue that the instrument for the superstar product is exogenous to
both the firm and export flows of non-superstar products. First, as Sweden
is a relatively small country it is reasonable that changes in demand for a
specific product at a destination are not influenced by Swedish firms. Second,
it is plausible to assume that a demand shock to the superstar product at a
destination (the instrument) is exogenous to the export of other products
of the firm. Hence, the instrument, z_{i1dt}, should explain the trade in the
superstar product, Y_{1idt}, with destination d. However, the instrument should
be uncorrelated with the export of other products, Y_{pidt}, by the firm to
that destination.[19] This assumption is reasonable when considering how
dissimilar the superstar product to the non-superstar products of the firm.
For example, one can see from the data that 90% of the non-star products
exported are *not* within the same 4-digit product category as the superstar.

---

[17]The instrument in Hummels, Jørgensen, Munch, and Xiang (2014), World Import
Demand (WID), is constructed as a weighted average of the product-destination-specific
shocks which are aggregated over all destinations; the WID instrument is, therefore,
firm-year-specific. The CPID however, is not aggregated over destinations or products
and the instrument is therefore product-destination-year specific.

[18]The instrument, z_{i1dt}, for firm i in destination d is constructed based *only* on the import
flows of the superstar to that destination. The instrument need not be firm-product-
destination-specific as multiple firms can have the same superstar in a destination.
There are cases of this in the data, but they are very uncommon.

[19]Note that p ranges from rank *2* to the last product, P, exported by the firm. Products
not exported in the pre-sample year are included in the analysis.

Even at the 2 or 1 digit product level, 67% and 45% of products are not within the same categories.

4.1   Empirical Specification

The idea behind the empirical strategy is that the export value of the superstar product to a destination should explain the trade of other non-superstar products there, which leads naturally to the following baseline specification:

$$ln(Y_{pidt}) = \beta ln(Y_{1idt}) + I_{pdt} + \eta_{dt} + \lambda_{ipd} + \gamma_{st} + \epsilon_{pidt} \qquad (2)$$

Y_{pidt} is the export trade value of product p by firm i to destination d, where p ranges from $p = 2$ to the last (P) within a firm-destination pair, $2 \leq p \leq P$. In equation 2, the trade in non-superstar products, Y_{pidt}, is explained with the export of the superstar product, Y_{1idt}, by the same firm. To overcome the simultaneity bias discussed above, I use an instrumental variable approach, where I instrument for the export of the superstar product. Hence I perform a first stage regression (including the same fixed effects as 2), where the actual exports of the superstar product, $ln(Y_{1idt})$, are regressed on $ln(z_{i1dt})$, then the fitted values, $ln(\hat{Y}_{1idt})$, are used in the second stage equation (instead of $ln(Y_{1idt})$). I include[20] a destination-year fixed effect, η_{dt}, to control for country-time specific effects, such as GDP, exchange rate fluctuations, or other country specific effects; a sector-year fixed effect, γ_{st}, which accounts for unobserved industry variation; a firm-product-destination fixed effect, λ_{ipd}, which accounts for time invariant effects related to the triad. This could be, for example, product-market information, product characteristics, or quality. By using firm-product-destination fixed effects, λ_{ipd}, I identify the impact of the superstar product on non-superstars only in the time dimension. The works of Eaton, Kortum, and Kramarz (2011) and Munch and Nguyen (2014) underlined the importance of accounting for destination specific effects. Both studies found that firm-level indicators perform poorly in accounting for the distribution of sales variation within a

---

[20]Note that no firm controls are included in the main specification; however, the inclusion of firm sales or employment does not change the results.

destination. By including the firm-product-destination fixed effect, I address
this issue as it accounts for all unobserved heterogeneity related to a specific
firm-product-destination combination.

As there may have been some contemporaneous changes in the demand for
the non-superstar product, p, I add a non-superstar product-specific demand
control, I_{pdt}. The demand control is non-superstar product-destination-
time-specific and captures the non-superstar product-specific element of the
change in the export flow. The demand control is defined analogously as the
instrument for the superstar product, $I_{pdt} = z_{ipdt}$ if $2 \leq p \leq P$.

5   Results - The Superstar and the Followers

The objective of this paper is to investigate whether there is intra-firm
dependence between the products that a firm exports to a destination. As
there may be simultaneity and measurement error problems, thereby, biasing
our OLS estimates, I use an instrumental variables approach to estimate
equation 2 to create an exogenous variation.[21] In table 4 the results of the
first stage regression are shown, where the log export value of the superstar
product is regressed on the (logged) instrument, z_{i1dt}. The first stage results
show a strong positive correlation between the superstar product's trade
value and the instrument, with an F-statistic above 19 in all regressions.

Table 5 shows the results of the second stage regression where I find
that a 1% increase in the superstar product's trade value leads to an 0.13%
increase in the non-superstar export value.[22] The results are robust to

---

[21] As there are multiple fixed effects included, I employ the Stata module, `reghdfe`. The
module was developed by Correia (2015) and is able to estimate models efficiently that
include high-dimensional fixed effects.

[22] The reason for using an IV estimator instead of OLS is due to simultaneity and the
potential for measurement error when defining the superstar product. If (by chance) a
non-star product is the most exported product in the pre-sample and is hence defined
as the actual superstar there will be measurement error in the independent variable
(the export value of the actual superstar) thereby, biasing our results to zero. After
superstar product trade, Y_{1idt}, is substituted for instrumented superstar trade, $\hat{Y}_{1idt}$, in
equation 2, the equation can estimate with traditional OLS. The results in column 5 of
table 5 show, as expected, a minimal impact (elasticity of 0.024). Since it is suspected
that the source of the measurement error is a misclassification of the superstar product,
it is possible to check if this is the case. If a non-star product (by chance) is defined
as the superstar, it is likely to have considerably shorter duration than the actual
superstar, and is not traded in consequent periods (this argument is in line with the

Table 4: First stage of IV regressions for single superstar-product specification. Dependent variable is superstar product trade flows.

	(1)	(2)	(3)	(4)
Superstar-product instrument	0.215^a	0.214^a	0.340^a	0.225^a
	(0.0428)	(0.0429)	(0.0496)	(0.0508)
Product demand control		0.00825		
		(0.00839)		
Nr. obs.	2096323	2096323	1638445	1638362
R^2	0.843	0.843	0.874	0.881
# clusters	63658	63658	55323	55315
First stage F stat.	25.09	24.99	46.93	19.58
Firm-prod.-dest. FE	Yes	Yes	Yes	Yes
Dest.-year FE	Yes	Yes	No	Yes
Sector-year FE	Yes	Yes	No	Yes
Prod-dest-year FE	No	No	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. Observations are at the firm-product destination level.

using alternative combinations of fixed effects (see table 5) and defining the superstar based on production data (see appendix E). One potential concern is that the products that a firm exports may be very similar to the superstar product. In that case, the IV strategy may be less applicable as the instrument for the superstar product may be correlated with shocks to other products. I check for this by dropping products which are within the same 2- or 1-digit product categories and the result is similar (see table C5 in appendix C). This result is not surprising, considering that non-star products are generally not in the same product category as the superstar product (see the discussion in section 4).

As a further robustness check I experiment using different 'placebo-superstar' products. If the mechanism in conjecture 1 is correct, then the same type of spillover from low-ranked products within a firm-destination pair in the pre-sample will not be found with other products. I therefore re-estimate the regressions using low-ranked products in the pre-sample as placebo-superstars. The calculations and definitions are, otherwise, un-

results of the studies of Békés and Muraközy (2012) and Timoshenko (2015b)). In column 6 of table 5, I test for this by dropping observations where the export value of the superstar product is zero. In these cases it is suspected that the superstar may have been incorrectly defined. After having dropped these observations (23% of the total) the elasticities from the OLS and IV estimation are very similar.

Table 5: Main results for single superstar-product specification. Dependent variable is non-superstar product trade flows.

	IV				OLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Superstar-product trade value	0.139^a	0.130^a	0.158^a	0.111^c	0.0242^a	0.143^a
	(0.0486)	(0.0479)	(0.0450)	(0.0674)	(0.0016)	(0.0056)
Product demand control		0.0698^a			0.0713^a	0.0717^a
		(0.0038)			(0.0037)	(0.0041)
Nr. obs.	2096323	2096323	1638445	1638362	2096323	1621143
R^2	0.803	0.805	0.838	0.848	0.814	0.827
# clusters	63658	63658	55323	55315	63658	39429
First stage F stat.	25.09	24.99	46.93	19.58	n.a.	n.a.
Firm-prod-dest FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest.-year FE	Yes	Yes	No	No	Yes	Yes
Sector-year FE	Yes	Yes	No	Yes	Yes	Yes
Prod-dest-year FE	No	No	Yes	Yes	No	No

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. Observations are at the firm-product destination level.

changed. I define a placebo-superstar product for each decile of the pre-sample. The best product in each decile is the placebo-superstar product for that decile. Consistent with conjecture 1, I do not find the same spillover for the placebo superstars. See discussion and results in appendix C (see tables C1 and C2).

5.1 Multiple Stars: The Superstar Core

One potential concern with using a single superstar per firm-destination pair is that the inter-product complementarity observed is present due to a group of products. Hence, instead of a single superstar per firm-destination pair, there may be multiple products which belong to a core and the complementarity (spillover) is from that group of products. To assess this, I re-estimate equation 2 using near-superstar products as the actual superstar products. The results show that there is a positive spillover from the products ranked second and third in the pre-sample, to the other products exported (see tables C3 and C4 in appendix C). Thereafter, the

spillover disappears, underlining that the mechanism is concentrated among a small set of high-ranked products of the firm. This result suggests that the initial scope of the exporter may be important.

To address this concern I re-define the superstar as a set of one or more products that belong to a 'superstar core'. A product belongs to the superstar core, c, if it is among the top 10% of the most exported products in the pre-sample year. Formally, the superstar core is defined as, $p \in c$ if $\frac{p}{P} \leq 0.1$, where p is the product identifier (which equals the pre-sample rank of the product) and P is the total number of products exported. Both are calculated within a firm-destination pair in the pre-sample year. All products not exported in the pre-sample are non-superstar core products. For this specification only firms exporting 10 or more products in the pre-sample period to a particular destination are included. See table D1 in Appendix D for descriptive statistics about the superstar core sample. A hypothetical example of the superstar core definition is shown in figure 3. Note that both the set and number of products can differ across destinations.

	Destinations	Products exported (ordered by value)	Nr. of products
	d_1 - - - - -	(**A**,**R**,F,...,C,B)	(#22)
Firm i	d_2 - - - - -	(**B**,**A**,**C**,...,G,M,Q)	(#35)
	d_3 - - - - -	(**A**,R,...,K,B)	(#12)
	d_4 - - - - -	(**C**,**R**,**K**,**A**,**X**,**F**,**L**,**P**,**W**,....,D)	(#98)

Figure 3: The definition of the superstar core (bold).
Note: The products ranked in the top decile in the pre-sample year of firm i in a destination are in the superstar core (marked in bold). At destination d_1, products A and R are in the superstar core for firm i in *all* consequent time periods. In the superstar product definition, only product A was a star at the destination.

The data shows that around 66% of the superstar cores include only a single product, and in 89% of cases there are three or less products in the superstar core. The highest number of products in the core is 35 (see figure D1 in appendix D). The idea behind this definition is to take into account the wide and varying scope of firms. Firms may, for example, export different bundles of products to different buyers. Hence, a firm may bundle

a product from the superstar core with some of the lower ranked products, while other stars in the core are bundled differently.

To construct the instrument for the superstar core, each product is weighted by a pre-sample share. The share of each product, s_{ipd}, equals the trade value of product p to destination d divided by the total trade value of firm i to that destination in the pre-sample year. Both the shares, s_{ipd}, and set of products included in the superstar core are kept constant over the sample period. Formally, the superstar core instrument (in logs), z_{icdt}, is defined in equation 3:

$$z_{icdt} = \sum_{p \in c} s_{ipd} M_{pjdt} \tag{3}$$

The empirical specification is the same as in equation 2 after having replaced the superstar product with the superstar core. The pre-sample observations are dropped as before but now the entire core of superstars is dropped, not just a single superstar product. The instrument is calculated using the same data that was used for the superstar product instrument.

5.2 Superstar Core Results

Before proceeding to the results from this superstar core specification I investigate the first stage results. From table 6, one can see that the coefficients have the expected sign, with the F-statistic above 10. The second-stage results for the superstar core specification are strong and robust, with an estimated elasticity of 0.376 for the top superstar core decile. Hence, an increase of 1% in the trade value of the superstar core (decile) results in a 0.376% increase in the non-core products to a destination. The results underline that the within-firm complementarity of the few products from the top decile to the low-ranked products. See table 7.[23]

---

[23]As discussed in relation to the superstar product results, it is suspected that there may be cases of measurement error due to false definitions of a non-star product as the star. This type of measurement error will bias the OLS results towards zero. Again the OLS elasticities are low when all observations are included (see table 7 column 5). If cases in which measurement error is suspected (i.e. when the export value of the superstar core equals zero) the elasticities increase but are still lower than the IV estimates. As only cases in which the entire superstar core export value equals zero (within 5% of the observations) are dropped, there may still be some measurement error in the superstar

Table 6: First-stage results for superstar-core specification. Dependent variable is superstar-core trade flows.

	(1)	(2)	(3)	(4)
Superstar-core instrument	0.173^a	0.173^a	0.227^a	0.157^a
	(0.0544)	(0.0545)	(0.0527)	(0.0549)
Product demand control		-0.00701		
		(0.00648)		
Nr. obs.	987058	987058	677750	677645
R^2	0.874	0.874	0.897	0.911
# clusters	4131	4131	3981	3978
First stage F stat.	10.08	10.10	18.49	8.180
Firm-prod.-dest. FE	Yes	Yes	Yes	Yes
Dest.-year FE	Yes	Yes	Yes	No
Sector-year FE	Yes	Yes	No	Yes
Prod-dest-year FE	No	No	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. Observations are at the firm-product destination level. The order of models is the same as in main results table.

Table 7: Main results for the superstar-core specification. Dependent variable is non-superstar product trade flows.

	IV				OLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Superstar-core trade value	0.387^a	0.376^a	0.549^a	0.402^b	0.0454^a	0.204^a
	(0.136)	(0.134)	(0.153)	(0.198)	(0.0038)	(0.0107)
Product demand control		0.0712^a			0.0698^a	0.0680^a
		(0.005)			(0.005)	(0.005)
Nr. obs.	987058	987058	677750	677645	987058	938123
R^2	0.778	0.780	0.796	0.834	0.811	0.815
# clusters	4131	4131	3981	3978	4131	3778
First stage F stat.	10.08	10.10	18.49	8.180	n.a.	n.a.
Firm-prod.-dest. FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest.-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	No	Yes	Yes	Yes
Prod-dest-year FE	No	No	Yes	Yes	No	No

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. Observations are at the firm-product destination level.

In the baseline specification, I include a product-demand control which captures the contemporaneous changes for that specific non-star product. An alternative, is to use a product-destination-year fixed effect. This inclusion is very demanding on the data as it requires variation across firm exports of the same six-digit product-destination-year combination. The point estimates are similar (see column 4 in table 7); however, as expected, the significance is slightly lower.

As a robustness check, I use the other nine-deciles of the pre-sample rank as 'placebo-cores'. The instrument is then based on the placebo-cores. Otherwise, the calculation method is unaltered. I find a significant effect for the near-superstar core products in the second decile, which is quantitatively around half of the size of the top decile, indicative of a certain decay of the suggested mechanism. For the other eight deciles, the point estimates are close to zero and are not significant. See coefficient plot in figure 4.
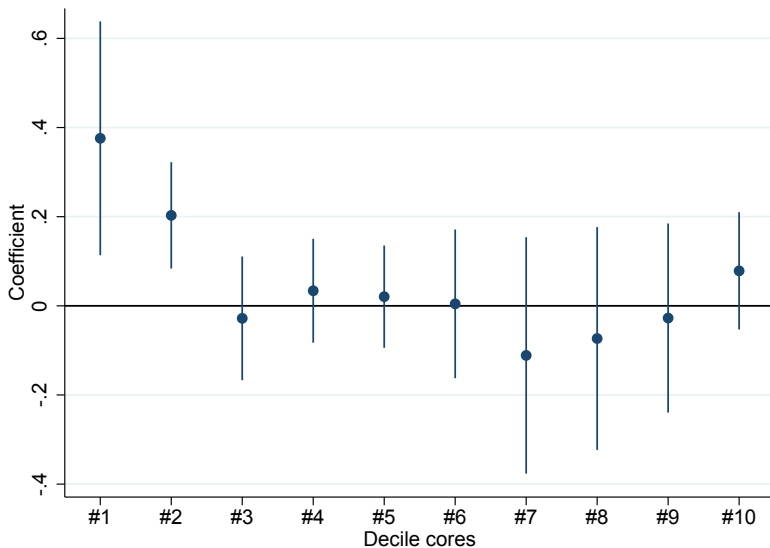

Figure 4: Coefficient plot of all pre-sample cores (deciles). The plot shows the point estimate and 95% confidence interval when using each of the deciles (of the pre-sample) as superstar or placebo cores.
Note: The regression includes the baseline fixed effects. The full results underlying this figure are available in appendix D (tables D2 and D3).

core definition, thereby, biasing the OLS results downward.

This decay is clear from the coefficient plot in figure 4, where each of the 10 coefficients from the 10 regressions is shown along with 95% confidence intervals. For more detailed results, see tables D2 and D3 in appendix D. These results demonstrate that there is a strong mechanism from a set of core products in each destination towards the low-ranked more peripheral products. I find that the superstar core in each destination has 'followers' which complement the trade of the superstar. This mechanism is asymmetric in the sense that it is a one-way complementarity of non-star products to the superstar.

Lastly, I investigate if the mechanism is driven by Carry-Along-Trade (CAT) as discussed by Bernard, Blanchard, Van Beveren, and Vandenbussche (2014). I compare if the investigated mechanism has the same impact on products produced by the firm, compared to those not produced, but only exported (CAT product). I find that the mechanism is found for both produced and CAT products, while the elasticity is (slightly) lower for CAT products. See appendix E for a discussion and the results.

6   Conclusion

In this paper, I identify a new within-firm-destination mechanism which has not previously been documented in international economics. As the distribution of export sales to each destination is highly skewed towards a single product ('superstar product') or a small set of products (the 'superstar core'), I propose that demand variation specific to these superstar products can explain variation in other more peripheral non-star products. To investigate this mechanism, I employed detailed Swedish firm registry data which is matched with export flows at the firm-HS6 product-destination level. Using a novel instrumental variable approach, I identify that the superstar product explains the trade value of non-star products to each destination. Extending the definition of the superstar to include a 'superstar core' of products (which may include more than a single product) strengthens the results. More specifically, I find that a 1% increase in the superstar product and superstar core leads to a 0.13% and 0.376% increases in non-superstar product trade flows respectively.

In the estimations, I control for unobserved heterogeneity by including firm-product-destination, sector-year and destination-year fixed effects. Furthermore, to ensure that the non-star product variation is not driven by foreign demand shocks specific to the non-superstar product, I control for the import demand of non-star products. The result can therefore be interpreted as non-star products being complementary to the superstar core (or product). As a robustness check, I use non-superstar products as placebo-superstars products (or placebo-cores) to verify if they are able to explain the trade value of other products to each destination. In line with the suggested mechanism, I do not find the same type of complementarity/spillover mechanism for these placebo-superstars. The results therefore show evidence of a *one-way* complementarity from the non-superstar to the superstar products, as I only observe that the superstar has followers while the follower does not have 'star'.

The implications of these results are twofold. First, the superstar to non-superstar products mechanism established in this paper, is to my knowledge, not directly incorporated in current theoretical models of multi-product exporters. The models often incorporate the concept of core competency/products of a firm but the superstar core is an addition thereto, as it has followers. Hence, future theoretical research on multi-product exporters should incorporate this within-destination one-way dependence of product sales. Second, as product exports should not be viewed in isolation, there are some direct policy implications. If a policy measure impacts products which are in the superstar core of firms, the actual impact would be underestimated as the interconnected non-superstar products are not assumed to be affected. Conversely, if the policy measure is aimed towards the periphery, the impact is overestimated. The composition of firm-sales may, therefore, be important for policy evaluation.

References

Amador, João and Luca David Opromolla (2012). "Product and destination mix in export markets". *Review of World Economics* 149.1, pp. 23–53. ISSN: 1610-2878. DOI: 10.1007/s10290-012-0136-z.

Antoniades, Alexis (2015). "Heterogeneous Firms, Quality, and Trade". *Journal of International Economics* 95.2, pp. 263–273. ISSN: 00221996. DOI: 10.1016/j.jinteco.2014.10.002.

Arkolakis, Costas and Marc-andreas Muendler (2013). "Exporters and Their Products: A Collection of Empirical Regularities". *CESifo Economic Studies* 59.2, pp. 223–248. ISSN: 1610-241X. DOI: 10.1093/cesifo/ifs028.

Arkolakis, Costas, Marc-Andreas Muendler, and Sharat Ganapati (2015). *The Extensive Margin of Exporting Products: A Firm-level Analysis.* Working Paper.

Arnarson, Björn Thor (2015). *Bridging Trade Barriers: Evaluating Models of Multi-Product Exporters.* S-WOPEC Working Paper no. 6. Lund University.

Autor, David H, David Dorn, and Gordon H Hanson (2013). "The China Syndrome: Local Labor Market Effects of Import Competition in the United States". *American Economic Review* 103.6, pp. 2121–2168. ISSN: 0002-8282. DOI: 10.1257/aer.103.6.2121.

Baldwin, Richard and James Harrigan (2011). "Zeros, Quality, and Space: Trade Theory and Trade Evidence". *American Economic Journal: Microeconomics* 3.2, pp. 60–88. ISSN: 1945-7669. DOI: 10.1257/mic.3.2.60.

Békés, Gábor and Balázs Muraközy (2012). "Temporary trade and heterogeneous firms". *Journal of International Economics* 87.2, pp. 232–246. ISSN: 00221996. DOI: 10.1016/j.jinteco.2011.12.007.

Bernard, Andrew B., Emily J. Blanchard, Ilke Van Beveren, and Hylke Vandenbussche (2014). *Carry-Along Trade.* Working Paper.

Bernard, Andrew B., Stephen J. Redding, and Peter K. Schott (2010). "Multiple-Product Firms and Product Switching". *American Economic Review* 100.1, pp. 70–97. ISSN: 0002-8282. DOI: 10.1257/aer.100.1.70.

— (2011). "Multiproduct Firms and Trade Liberalization". *The Quarterly
Journal of Economics* 126.3, pp. 1271–1318. ISSN: 0033-5533. DOI: 10.
1093/qje/qjr021.

Bernard, Andrew, Andreas Moxnes, and Karen Helene Ulltveit-Moe (2014).
Two-Sided Heterogeneity and Trade. Working Paper. Cambridge, MA:
National Bureau of Economic Research. DOI: 10.3386/w20136.

Berthou, Antoine and Lionel Fontagné (2013). "How do Multiproduct Ex-
porters React to a Change in Trade Costs?" *Scandinavian Journal of Eco-
nomics* 115.2, pp. 326–353. ISSN: 03470520. DOI: 10.1111/sjoe.12006.

Besedeš, Tibor and Thomas J. Prusa (2006a). "Ins, outs, and the duration of
trade". *Canadian Journal of Economics/Revue canadienne d'économique*
39.1, pp. 266–295. ISSN: 0008-4085. DOI: 10.1111/j.0008-4085.2006.
00347.x.

— (2006b). "Product differentiation and duration of US import trade".
Journal of International Economics 70.2, pp. 339–358. ISSN: 00221996.
DOI: 10.1016/j.jinteco.2005.12.005.

Carballo, Jerónimo, Gianmarco I. P. Ottaviano, and Christian Volpe Mart-
incus (2013). "The Buyer Margins of Firms' Exports". London, UK.

Correia, Sergeia (2015). "REGHDFE: Stata module to perform linear or
instrumental-variable regression absorbing any number of high-dimensional
fixed effects".

Crozet, Matthieu, Keith Head, and Thierry Mayer (2012). "Quality sorting
and trade: Firm-level evidence for French wine". *Review of Economic
Studies* 79.2, pp. 609–644. ISSN: 00346527. DOI: 10.1093/restud/rdr030.

De Loecker, Jan, Pinelopi K. Goldberg, Amit K. Khandelwal, and Nina
Pavcnik (2016). "Prices, Markups, and Trade Reform". *Econometrica*
84.2, pp. 445–510. ISSN: 0012-9682. DOI: 10.3982/ECTA11042.

Di Giovanni, Julian, Andrei A. Levchenko, and Isabelle Mejean (2014).
"Firms, Destinations, and Aggregate Fluctuations". *Econometrica* 82.4,
pp. 1303–1340. ISSN: 0012-9682. DOI: 10.3982/ECTA11041.

Eaton, Jonathan, Marcela Eslava, Maurice Kugler, and James R. Tybout
(2008). "Export Dynamics in Colombia: Firm-Level Evidence". *The
Organization of Firms in a Global Economy*. Ed. by Elhanan Helpman.

Cambridge, MA and London, England: Harvard University Press. Chap. 8, pp. 231–272. ISBN: 9780674030817. DOI: `10.4159/9780674038547-008`.

Eaton, Jonathan, Samuel Kortum, and Francis Kramarz (2011). "An Anatomy of International Trade: Evidence From French Firms". *Econometrica* 79.5, pp. 1453–1498. ISSN: 0012-9682. DOI: `10.3982/ECTA8318`.

Eckel, Carsten, Leonardo Iacovone, Beata Javorcik, and J. Peter Neary (2015). "Multi-product firms at home and away: Cost- versus quality-based competence". *Journal of International Economics* 95.2, pp. 216–232. ISSN: 00221996. DOI: `10.1016/j.jinteco.2014.12.012`.

Eckel, Carsten and J. Peter Neary (2010). "Multi-Product Firms and Flexible Manufacturing in the Global Economy". *Review of Economic Studies* 77.1, pp. 188–217. ISSN: 00346527. DOI: `10.1111/j.1467-937X.2009.00573.x`.

Feenstra, Robert C. and Hong Ma (2008). "Optimal Choice of Product Scope for Multiproduct Firms under Monopolistic Competition". *The Organization of Firms in a Global Economy*. Ed. by Elhanan Helpman, Dalia Marin, and Thierry Verdier. Cambridge MA: Harvard University Press. Chap. 6, pp. 173–199.

Foster, Lucia, John Haltiwanger, and Chad Syverson (2016). "The Slow Growth of New Plants: Learning about Demand?" *Economica* 83.329, pp. 91–129. ISSN: 1468-0335. DOI: `10.1111/ecca.12172`.

Gabaix, Xavier (2011). "The Granular Origins of Aggregate Fluctuations". *Econometrica* 79.3, pp. 733–772. ISSN: 0012-9682. DOI: `10.3982/ECTA8769`.

Gentzkow, Matthew (2007). "Valuing New Goods in a Model with Complementarity: Online Newspapers". *American Economic Review* 97.3, pp. 713–744. ISSN: 0002-8282. DOI: `10.1257/aer.97.3.713`.

Goldberg, Pinelopi K, Amit K Khandelwal, Nina Pavcnik, and Petia Topalova (2010). "Multiproduct Firms and Product Turnover in the Developing World: Evidence from India". *Review of Economics and Statistics* 92.4, pp. 1042–1049. ISSN: 0034-6535. DOI: `10.1162/REST_a_00047`.

Gullstrand, Joakim and Maria Persson (2014). "How to combine high sunk costs of exporting and low export survival". *Review of World Economics*. ISSN: 1610-2878. DOI: `10.1007/s10290-014-0204-7`.

Görg, Holger, Richard Kneller, and Balázs Muraközy (2012). "What makes a successful export? Evidence from firm-product- level data". *Canadian Journal of Economics/Revue canadienne d'économique* 45.4, pp. 1332–1368. ISSN: 00084085. DOI: 10.1111/j.1540-5982.2012.01734.x.

Hess, Wolfgang and Maria Persson (2011). "Exploring the duration of EU imports". *Review of World Economics* 147.4, pp. 665–692. ISSN: 1610-2878. DOI: 10.1007/s10290-011-0106-x.

Hummels, David, Rasmus Jørgensen, Jakob Munch, and Chong Xiang (2014). "The wage effects of offshoring: Evidence from danish matched worker-firm data". *American Economic Review* 104.6, pp. 1597–1629. ISSN: 00028282. DOI: 10.1257/aer.104.6.1597.

Hummels, David and Peter J Klenow (2005). "The Variety and Quality of a Nation's Exports". *American Economic Review* 95, pp. 704–723. ISSN: 0002-8282. DOI: 10.1257/0002828054201396.

Iacovone, Leonardo and Beata S. Javorcik (2010). "Multi-Product Exporters: Product Churning, Uncertainty and Export Discoveries". *Economic Journal* 120.544, pp. 481–499. ISSN: 00130133. DOI: 10.1111/j.1468-0297.2010.02356.x.

Koenig, Pamina, Florian Mayneris, and Sandra Poncet (2010). "Local export spillovers in France". *European Economic Review* 54.4, pp. 622–641. ISSN: 00142921. DOI: 10.1016/j.euroecorev.2009.12.001.

Kropf, Andreas and Philip Sauré (2014). "Fixed costs per shipment". *Journal of International Economics* 92.1, pp. 166–184. ISSN: 00221996. DOI: 10.1016/j.jinteco.2013.10.003.

Kugler, M. and E. Verhoogen (2012). "Prices, Plant Size, and Product Quality". *The Review of Economic Studies* 79.1, pp. 307–339. ISSN: 0034-6527. DOI: 10.1093/restud/rdr021.

Mayer, Thierry, Marc J Melitz, and Gianmarco I. P. Ottaviano (2014). "Market Size, Competition, and the Product Mix of Exporters". *American Economic Review* 104.2, pp. 495–536. ISSN: 0002-8282. DOI: 10.1257/aer.104.2.495.

Mayer, Thierry and Gianmarco I. P. Ottaviano (2008). "The Happy Few: The Internationalisation of European Firms". *Intereconomics* 43.3, pp. 135–148. ISSN: 0020-5346. DOI: 10.1007/s10272-008-0247-x.

Mayneris, Florian and Sandra Poncet (2013). "Chinese Firms' Entry to Export Markets: The Role of Foreign Export Spillovers". en. *The World Bank Economic Review*, lht009. ISSN: 0258-6770. DOI: `10.1093/wber/lht009`.

Melitz, Marc J (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity". *Econometrica* 71.6, pp. 1695–1725. ISSN: 0012-9682. DOI: `10.1111/1468-0262.00467`.

Milgrom, Paul and John Roberts (1990). "Rationalizability, Learning, and Equilibrium in Games with Strategic Complementarities". *Econometrica* 58.6, p. 1255. ISSN: 00129682. DOI: `10.2307/2938316`.

Munch, Jakob R and Daniel X Nguyen (2014). "Decomposing firm-level sales variation". *Journal of Economic Behavior & Organization* 106, pp. 317–334. ISSN: 01672681. DOI: `10.1016/j.jebo.2014.06.012`.

Timoshenko, Olga A (2015a). "Learning versus sunk costs explanations of export persistence". *European Economic Review* 79, pp. 113–128. ISSN: 00142921. DOI: `10.1016/j.euroecorev.2015.02.006`.

— (2015b). "Product switching in a model of learning". *Journal of International Economics* 95.2, pp. 233–249. ISSN: 00221996. DOI: `10.1016/j.jinteco.2014.12.009`.

Traiberman, Sharon, Frederic Warzynski, and Valérie Smeets (2014). *Offshoring and the Shortening of the Quality Ladder: Evidence from Danish Apparel*. Working Paper.

Vives, Xavier (1990). "Nash equilibrium with strategic complementarities". *Journal of Mathematical Economics* 19.3, pp. 305–321. ISSN: 03044068. DOI: `10.1016/0304-4068(90)90005-T`.

APPENDICES

A   About the Dataset

The datasets used in this paper are provided by Statistics Sweden (SCB) and include firm registry and trade data. The combined dataset is at the firm-(origin)-product-destination level using HS eight-digit level product codes. The data is first aggregated to the six-digit HS level and then converted to time-consistent product codes using a conversion table from UN Comtrade. All observations with zero trade values and/or missing values are dropped (e.g. missing product codes, trade partners, trade values, product demand control, or instrument values). Only firms which have an aggregate trade value above a threshold are required to report their intra-EU trade to SCB. The firm-level threshold ranges from 2.5 to 4.5 million krona depending on the year. All firms are included in the regression dataset regardless of this threshold. Deleting all firms with a minimum trade value below 4.5 million krona in any year does not change the results of the paper.[24] As noted in table A2, the superstar product is defined as the highest selling product to a destination in a pre-sample. Therefore, the superstar product need not be exported to the destination in all years. To avoid dropping all years when the superstar is not exported all non-superstar firm-product-destination observations are merged with the data on the superstar product instrument regardless of whether the superstar product is exported that year or not. Note that the pre-sample and the superstar product observations are dropped. The same applies to the specification using the superstar core definition. A few negligible countries are dropped from the dataset, as they are either very small or their names were altered during the sample period (examples: Virgin Islands, Serbia/Montenegro, Myanmar/Burma).

   Some descriptive statistics and variable definitions can be found in tables A1 and A2.

---

[24]The point estimates are similar (slightly higher) and the significance the same. The results are available on request.

Table A1: Summary statistics for superstar-product dataset (logs, except #
products).

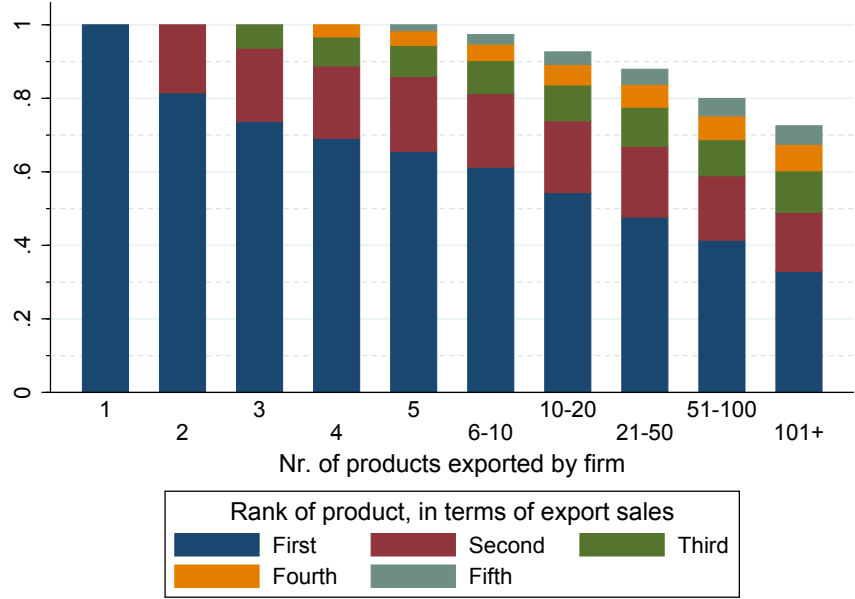|	Mean	St. dev.	Min	Max	Obs.
Non-superstar trade value	9.99	2.92	0.69	22.98	2555465
Instrument	17.30	2.57	0.69	25.11	2555465
Product demand control	16.68	2.47	0.69	25.30	2555465
Superstar trade value	7.79	6.82	0.00	23.55	500259
# non-star products					
exported to dest.	5.11	15.39	1.00	486.00	500259
# firms	14303				
# products	4662				
# superstar-products	37560				

Figure A1: The export value of the top ranked products at firm level
relative to the aggregate export value of firm (2005).
Note: not by destination as in figure 1.

Table A2: Variable definitions and data sources

|	Source	Definition
Firm and trade data	SCB	All firm registry and trade data is provided by Statistics Sweden.
Trade codes	UN comtrade	The trade values are reported as HS 6 digit codes. The codes are then transformed to time consistent codes (HS 1988 classification) using a conversion table from UN Comtrade.
Superstar-product	Own def.	The product of a firm with the highest export value to a particular destination in the pre-sample period. The superstar is consistent across time for each a firm-destination pair.
Superstar-core	Own def.	A product ranked in the first decile of in terms of export value for each destination in a pre-sample year. See figure 3 for a more detailed definition.
Non-superstar product	Own def.	Any product *not* ranked first (or in the superstar-core) for a firm-destination pair in the pre-sample. Includes also products not exported in pre-sample.
Pre-sample	Own def.	The first year a firm enters a particular destination. This pre-sample is then dropped in the empirical analysis.
Superstar-product trade value	SCB	Log of the export value of the product $+$ 1, ln(export value $+$ 1).
Superstar-core trade value	SCB	Log of the sum of the export value of all the products $+$ 1, ln(sum export value $+$ 1).
Non-superstar trade value	SCB	Log of the export value of the product $+$ 1, ln(export value $+$ 1).
Instrument data	UN Comtrade	Import of HS 6 digit (HS 1988) product from all destinations aggregated to importing country-product-year level. Use logs after aggregation of the import value, ln(import value $+$ 1).
Product demand control (I_{pdt}) data	UN Comtrade	Same as for instrument.
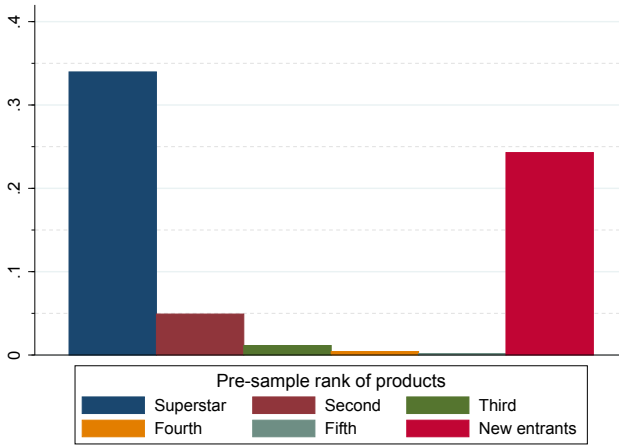
Figure A2: Stability of the superstar product. The figure shows the share of products ranked first in the last period for each firm depending on the initial (pre-sample) rank.

B   Instrument Validity

A possible concern for the validity of the instrument is that the superstar product constitutes a large share of the overall import of that product to a destination. Hence, a firm may be able to influence the inflow of a product from other countries if it has a large share of the product's imports. Tables B1 and B2 demonstrate the ratio[25] of the superstar product trade value of a firm in a year relative to the destination-product-year level import of that product from all origin countries (except Sweden). In most cases, the share is small (below 0.1) which means that the trade value of the superstar product of a firm is less than 10% of the import of that same product from all other countries (excluding Sweden). A ratio above 1 will indicate that the superstar trade value of a particular firm is larger than the import trade value of that specific product from all other destinations. Excluding observations for firm-destination pairs which have a maximum ratio for any year above 0.2 strengthens my results but somewhat reduces the sample size.

---

[25]The difference between the tables is that, in the first one, I use all observations; hence, each share is often counted on multiple occasions. This is because the share for each firm-destination is constant and many products may be exported to each destination. Meanwhile, in the second table each share is counted only once.

Table B1: Trade of superstar relative to instrument

Share	Nr. obs.	%	Cumul. %
0 - 0.1	1653991	63.28	63.28
0.1 - 0.2	196659	7.52	70.80
0.2 - 0.3	161759	6.19	76.99
0.4 - 0.5	47153	1.80	78.79
0.5 - 1	141003	5.39	84.19
1 - 2	129776	4.96	89.15
2 - 5	132567	5.07	94.23
5 - 10	62072	2.37	96.60
10 - 100	75984	2.91	99.51
100 - 1000	10286	0.39	99.90
1000+	2606	0.10	100

Example: a share above 1 means that the trade value of the superstar is larger than the trade value of the instrument.

Table B2: Trade of superstar-product relative to instrument, single

Share	Nr. obs.	%	Cumul. %
0 - 0.1	407217	79.94	79.94
0.1 - 0.2	24000	4.71	84.65
0.2 - 0.3	21311	4.18	88.83
0.4 - 0.5	5859	1.15	89.98
0.5 - 1	16305	3.20	93.18
1 - 2	12645	2.48	95.66
2 - 5	10980	2.16	97.82
5 - 10	4743	0.93	98.75
10 - 100	5225	1.03	99.78
100 - 1000	873	0.17	99.95
1000+	263	0.05	100

Example: a share above 1 means that the trade value of the superstar is larger than the trade value of the instrument.

C Alternative Placebo Superstar Products

The products used as placebo superstar products are found using the relative rank of products in a *pre-sample* year to a destination. The specific product used is the first product that has a rank ratio strictly above each rank ratio threshold decile. The rank ratio is defined as the rank of product(p) divided by the lowest ranked product (P), $p \in c$ if $\frac{p}{P}$. Example: A firm exports 25 products in the pre-sample year. The product ranked third will then be used as the 10% threshold placebo product as it is the first product to have a ratio higher than 0.1 (since 3/25=0.12). The product ranked sixth is used as the 20% (6/24=0.24) placebo product. This method of choosing the placebo products is used to ensure that the placebo products have a similar relative ranking within the firm regardless of product scope to the destination. Note that, as one goes down the product ladder and looks at the lower deciles in the product rank distribution, there is a substantial increase in the number of observations that have a zero trade value for the placebo-superstar. This is expected as their is more randomness in the export of placebo-superstars and they are not expected to be consistently exported to the same destination. Note that the sample is restricted to firms exporting 10 or more products in the pre-sample.

Table C1: Robustness results using comparing the actual superstar product to placebo-superstars from lower deciles of the pre-sample rank. Dependent variable is non-superstar product trade flows.

	Rank	Rank ratio thresholds			
	#1	10%	20%	30%	40%
Placebo-superstar trade value	0.255^b	0.0853	-0.00955	0.0765	0.106^b
	(0.108)	(0.0547)	(0.0495)	(0.0607)	(0.0512)
Product demand control	0.0753^a	0.0748^a	0.0771^a	0.0772^a	0.0740^a
	(0.0057)	(0.0052)	(0.0051)	(0.0051)	(0.0053)
Nr. obs.	1034910	1036717	1040300	1047549	1047929
R^2	0.794	0.835	0.837	0.840	0.837
# clusters	4128	4144	4145	4149	4151
First stage F stat.	9.341	15.74	9.903	11.94	15.68
Firm-prod.-dest. FE	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes
Dest.-year FE	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. Observations are at the firm-product destination level. Limit sample to firms with at least 10 products to a destination in pre-sample. See discussion in appendix C about the how the placebo products are determined by the rank ratio thresholds.

Table C2: Robustness results using placebo-superstar products from lower
deciles of the pre-sample rank. Dependent variable is non-superstar product
trade flows.

	Rank ratio thresholds					
	50%	60%	70%	80%	90%	Last
Placebo-superstar trade value	-0.0698	-0.0616	-0.0878	-0.0670	0.123^c	-0.100^b
	(0.0706)	(0.0759)	(0.139)	(0.122)	(0.0671)	(0.0478)
Product demand control	0.0777^a	0.0761^a	0.0796^a	0.0750^a	0.0737^a	0.0731^a
	(0.0053)	(0.0053)	(0.0061)	(0.0053)	(0.0053)	(0.0054)
Nr. obs.	1051945	1049873	1047340	1048090	1043391	1042265
R^2	0.833	0.834	0.831	0.834	0.835	0.831
# clusters	4153	4146	4156	4145	4148	4143
First stage F stat.	5.073	5.574	2.462	3.680	10.66	22.77
Firm-prod-dest FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dest.-year FE	Yes	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level.
Observations are at the firm-product destination level. Limit sample to firms with at least
10 products to a destination in pre-sample. See discussion in appendix C about the how the
placebo products are determined by the rank ratio thresholds.

Table C3: Robustness results using near-superstar products, ranked #2 to #6
in pre-sample, as the superstar-product. Dependent variable is non-superstar
product trade flows.

	Rank of product within destination				
	#2	#3	#4	#5	#6
Placebo-superstar trade value	0.104^b	0.133^a	0.0389	0.0487	0.0235
	(0.0443)	(0.0440)	(0.0402)	(0.0512)	(0.0431)
Product demand control	0.0733^a	0.0721^a	0.0708^a	0.0733^a	0.0741^a
	(0.00510)	(0.00509)	(0.00515)	(0.00508)	(0.00511)
Nr. obs. used	1059286	1050974	1045163	1049358	1054838
Total nr. of obs.	1187165	1187165	1187165	1187165	1187165
R^2	0.827	0.830	0.837	0.839	0.839
# clusters	4426	4430	4439	4434	4436
First stage F stat.	28.35	11.63	29.22	17.10	17.71
Firm-prod.-dest. FE	Yes	Yes	Yes	Yes	Yes
Year-sector FE	Yes	Yes	Yes	Yes	Yes
Year-dest. FE	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level.
Limit sample to firms with at least 10 products to a destination in pre-sample.

Table C4: Robustness results using near-superstar products, ranked #7 to #10 in pre-sample, as the superstar-product. Dependent variable is non-superstar product trade flows.

	Rank of product within destination			
	#7	#8	#9	#10
Placebo-superstar trade value	-0.0202	0.0900	0.551	0.0670
	(0.0469)	(0.0548)	(5.165)	(0.0469)
Product demand control	0.0745^a	0.0737^a	0.0749^a	0.0747^a
	(0.00504)	(0.00515)	(0.0136)	(0.00499)
Nr. obs. used	1062489	1068004	1066131	1072643
Total nr. of obs.	1187165	1187165	1187165	1187165
R^2	0.837	0.837	0.666	0.839
# clusters	4432	4435	4435	4437
First stage F stat.	10.75	13.31	0.0119	25.52
Firm-prod.-dest. FE	Yes	Yes	Yes	Yes
Year-sector FE	Yes	Yes	Yes	Yes
Year-dest. FE	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. Limit sample to firms with at least 10 products to a destination in pre-sample.

Table C5: Robustness checks for the superstar-product specification when excluding products from within the same 1- or 2-digit product categories. Dependent variable is non-superstar product trade flows.

	2-dig	1-dig
Superstar-product trade value	0.124^b	0.191^a
	(0.0617)	(0.0431)
Product demand control	0.0638^a	0.0634^a
	(0.00441)	(0.00589)
Nr. obs.	1388734	906094
R^2	0.798	0.775
# clusters	42710	35001
First stage F stat.	16.77	47.22
Firm-prod.-dest. FE	Yes	Yes
Dest.-year FE	Yes	Yes
Sector-year FE	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. In the 2-dig and 1-dig columns products within the same 2 or 1 digit product branch are excluded.

D   The Superstar Core dataset and Robustness

Table D1: Summary statistics for superstar-core dataset (logs, except #
products).

	Mean	St. dev.	Min	Max	Obs.
Non-superstar trade value	9.58	2.94	0.69	22.98	1096022
Instrument	17.56	2.60	0.54	24.72	1096022
Product demand control	16.49	2.47	0.69	25.30	1096022
Superstar-core trade value	12.82	6.02	0.00	23.62	43963
# non-star products to dest.	24.93	40.99	1.00	447.00	43963
# firms	1133				
# products	4324				
# firm - dest. combinations	4481				
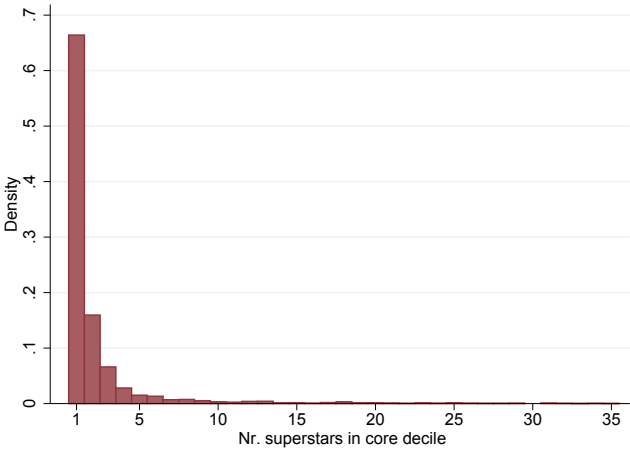
Figure D1: Density plot showing the number of products included in
the superstar core (the top decile).

Table D2: Robustness results for superstar-core. Comparison of the superstar-core (#1) and placebo-superstar cores (based on products in the 2-5 deciles). Dependent variable is non-superstar product trade flows.

	Deciles				
	#1	#2	#3	#4	#5
(Placebo)superstar core trade value	0.376^a	0.203^a	-0.0281	0.0338	0.0205
	(0.134)	(0.0608)	(0.0708)	(0.0594)	(0.0585)
Product demand control	0.0712^a	0.0724^a	0.0748^a	0.0729^a	0.0746^a
	(0.00544)	(0.00512)	(0.00506)	(0.00504)	(0.00514)
Nr. obs.	987058	989685	1001023	1006538	1010737
R^2	0.780	0.828	0.837	0.842	0.842
# clusters	4131	4152	4155	4158	4161
First stage F stat.	10.10	27.56	16.95	24.21	16.94
Firm-prod.-dest. FE	Yes	Yes	Yes	Yes	Yes
Dest.-year FE	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. Deciles are created using pre-sample rank of products. Only firms with 10 or more products in the pre-sample are included.

Table D3: Robustness results for superstar-core. Results using placebo-superstar cores (based on products in the 6-10 deciles). Dependent variable is non-superstar product trade flows.

	Deciles				
	#6	#7	#8	#9	#10
Placebo-superstar core trade value	0.00442	-0.111	-0.0733	-0.0274	0.0784
	(0.0851)	(0.135)	(0.127)	(0.108)	(0.0671)
Product demand control	0.0752^a	0.0759^a	0.0783^a	0.0747^a	0.0760^a
	(0.00512)	(0.00561)	(0.00560)	(0.00513)	(0.00505)
Nr. obs.	1022346	1025450	1030793	1035973	1040495
R^2	0.841	0.830	0.833	0.836	0.837
# clusters	4162	4158	4164	4156	4163
First stage F stat.	8.479	7.246	1.746	6.112	17.79
Firm-prod.-dest. FE	Yes	Yes	Yes	Yes	Yes
Dest.-year FE	Yes	Yes	Yes	Yes	Yes
Sector-year FE	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level. Deciles are created using pre-sample rank of products. Only firms with 10 or more products in the pre-sample are included.

E   The IVP Database and Other Robustness Checks

Not all exported products need to be produced by the firm exporting them.
Considering this point, I use data from the Industrins varuproduktion (IVP)
database which includes information on the production of products by
manufacturing firms with more than 20 employees (10 in some cases). The
production data is based on the same eight-digit[26] product nomenclature as
the trade data.

As a robustness check, for the superstar product specification, the defini-
tion of the superstar product is altered to be based on production. Now, I
define a 'production superstar' as the product with the highest production
value. In this robustness check there is only a single production-superstar
product per firm for the entire period (not per firm-destination as before).
By applying the same methodology as in the regular superstar product case
the results are presented in column 2 (production-star) in table E1. Now
the elasticity is 0.104 compared to 0.13 (see table 5). The difference may be
due to the fact that the same superstar product is used for all destinations
regardless of whether the product is ever exported to that destination. As
there may be market-specific demand conditions (taste), this specification
may be less appropriate.

An alternative robustness check is to compare if the investigated mecha-
nism differs for products which are produced by the firm and those that are
only exported. Following Bernard, Blanchard, Van Beveren, and Vandenbuss-
che (2014), a product which is exported by the firm but produced by another
is called a Cary-Along-Trade (CAT) product. In this study's dataset, there
is a high share of CAT products. Around 88% of the 6-digit observations
(firm-product-destination) are products not produced by the firm exporting
them. Notably, these observations account for only 25% of the trade value
of firms.[27] To investigate if the superstar core has a different effect on CAT

---

[26]There is one difference between the two. The IVP data uses, when applicable, an
  additional letter as a ninth digit in the code. As the data is aggregated to the six-digit
  level this has no impact.

[27]It should be stressed that firms may aggregate(group) the production of similar products
  to a single product code when reporting their production values in the IVP survey. This
  may be a result of different collection methods; the trade statistics are collected on a
  monthly basis while the IVP is based on a yearly survey. Additionally, the nature of
  international trade may limit the scope for such aggregation of exported products. The

products compared to produced products, I include a interaction of CAT dummy and the superstar core instrument. The results show that the impact on the CAT products is statistically weaker, see column 1 (CAT) in table E1. Quantitatively, I argue that the difference is rather small compared to the size of the original effect. The mechanism is weaker for CAT products, but still sizeable and significantly different from zero.

Table E1: Robustness results (IV) using information about product production from the IVP database. Dependent variable is non-superstar product trade flows.

	IVP	
	CAT	Production-Star
Superstar-core trade value	0.406^a	
	(0.135)	
Produced-Superstar product trade value		0.104^b
		(0.0428)
CAT × Superstar-core trade value	-0.0394^a	
	(0.00310)	
Product demand control	0.0704^a	0.0702^a
	(0.00547)	(0.00508)
Nr. obs.	987058	1293030
R^2	0.781	0.818
# clusters	4131	25723
First stage F stat.	5.051	30.34
Firm-prod.-dest. FE	Yes	Yes
Year-sector FE	Yes	Yes
Year-dest. FE	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on firm-destination level.

---

aggregation from the 8- to 6-digit level will offset this problem, at least partially. Note however that even if the data is aggregated to the 4-digit level the results are similar.

Chapter III

Linking Services to Manufacturing Exports

With Joakim Gullstrand

Abstract

In this paper we analyse the interplay between services and manufacturing. This is done through identifying and quantifying a direct link between manufacturing exports and the sales by service providers. For identification of this transmittance mechanism, with the help of highly detailed geographic data, we create a Localised Export Exposure (LEE) variable that captures the variation in demand for service inputs based on nearby exporters. Since service firms are much less geographically specialised than manufacturing firms, we observe a high variation in their exposure to demand changes. This spatial variation in the demand for service inputs results from a variation in local export volumes (LEE); which is used to assess the interplay between manufacturing exports and services. Our results show that a 1% increase in exports increases the volume of sales of service firms by 0.2% (and employment within the firm by 0.06%). The results show also that the link is *highly* local and the strongest impact is within 20 km of the shock.

Keywords: Spillovers, Services, Manufacturing Exports, Input-output linkages

JEL Classification: F10, F14, F6

1   Introduction

Services contribute to over a half of world GDP and its share has grown over time, from 58% in 1995 to 68% in 2014 (World bank, 2016). In high-income countries this trend is explained by an expansion of business services (see ECSIP, 2014).[1] Figures for the EU show, for example, that business services grew on average 2.4% per year between 1999 to 2009, while the overall growth of the EU economy was more modest, at around 1.1% (European Union, 2014). In addition to the increased importance of services themselves, they are also becoming a more integral part in the production process of goods; a phenomenon that has been dubbed the "servicification" of manufacturing production. Lodefalk (2013, 2014) showed, in a Swedish context, that firms' share of external services (i.e. bought-in services) in total manufacturing output more than doubled from 1975 to 2005 (from around 12 to 25%).[2] In terms of export value, Lanz and Maurer (2015) find that external services are also a significant part of manufacturing trade flows, since they form around 30% of the export value of goods for high-income countries. The servicification of manufacturing may therefore explain why trade in services has been quite stable over the last two decades (around 20% of total trade), at the same time as its share in the overall economy grew. That is, services are increasingly embedded into the production of the export of goods.[3]

In this paper we evaluate linkages between manufacturing and services by assessing the effect of manufacturing exports on service sales. We identify this interplay by relying on three features[4]: Firstly, service firms are much less specialised than manufacturing firms across space. Secondly, services are less tradable over space and are therefore, to a much larger extent, influenced

---

[1]Business services is a broad concept related to a variety of services provided by one firm to another in order to support its business without producing any tangible commodities. Business services include: management consultancy, legal services, auditing, engineering and marketing.

[2]This trend is also visible in other countries, see for example Crozet and Koenig Soubeyran (2004) and Keller and Yeaple (2013). Baldwin, Forslid, and Ito (2015) brings up three possible explanations of the servicification of manufacturing: reclassification (internal services moving out of the firm), task-composition-shifts (more services in order to cope with a more complex production process or new attributes in produced goods), and task-relative-price-shifts (service tasks become relatively more expensive).

[3]An example of this is a manufactured product that requires a software application to be operated.

[4]See section 3.2 for more detailed discussion regarding our identification strategy.

by local supplier-buyer networks. Thirdly, manufacturing exporters consist of large firms that are highly integrated in the global market.[5] The implication of these stylised facts is that an idiosyncratic shock in manufacturing exports will be location specific. An evenly distributed service sector and close linkages with manufacturing ensures a high variation in exports across similar types of service firms located in different parts of the country. We use this variation to identify the strength of the linkages between global manufacturing firms and service providers.

In order to answer this question we employ Swedish firm-register data from 2003 and 2011. A unique aspect of this dataset is that we make use of very detailed geographical information about firms' location. We do not rely on broad administrative borders (e.g. municipalities or commuting areas) that may have little to do with the business distance between manufacturing and services. This allows a more flexible approach to be used, and enables us to investigate how an export expansion in a fine geographical unit spreads over space, like ripples on water. We create a location specific measure, Localised Export Exposure (LEE), that captures how service firms are exposed or impacted by changes in manufacturing exports in their close proximity. Hence, LEE captures how demand for service inputs in a particular location fluctuates as a result of changes in exporting. As there may be an endogeneity problem between manufacturing exports and local service providers we make use of global market fluctuations as an instrument for exporting.[6]

The main contribution of this paper seeks to make is to, for the first time to our knowledge, assess the significance of the interplay between service providers and manufacturing exporters. We also expand upon the knowledge of how export fluctuations influence local markets within nations; that is through ripple effects that contribute to regional performance differences. Our results suggest that the link between manufacturing exports and sales by service firms is substantial and highly local. We find that a 1% increase in manufacturing exports increases service sales by 0.2%. This result is in

---

[5]See for example the survey of Bems, Johnson, and Yi (2013) on the global interdependence of manufacturing firms during 2008-2009.

[6]The instrument builds on work by Hummels, Jørgensen, Munch, and Xiang (2014) about using global demand variation as an instrument for firm level exporting. See section 3.2.

line with our theoretical prior, that the transmission should be of similar size to the export intensity of manufacturing firms. We also find that these linkages are highly local and only significant within 20 km of the service providers. Finally, we find a substantial effect on service employment since a similar change in exporting (LEE) increases the employment within services firms by 0.06%.

In addition to the literature on the servicification of manufacturing, our paper is related to a growing literature on how an idiosyncratic shock on the micro-level builds up to aggregate fluctuations. One strand of this literature is represented by Gabaix (2011); he, concentrates on the granularity of the economy and shows how "firm-level shocks can explain an important part of aggregate movements". Another strand focuses on how linkages between firms act as a "propagation mechanism" when individual firms are faced with a shock that is transmitted to other parts of the economy, influencing aggregate fluctuations (see Acemoglu, Carvalho, Ozdaglar, and Tahbaz-Salehi, 2012). Our paper is related to both strands, as we focus on how export fluctuations in generally *large* exporters, are transmitted, or propagated, to their service providers.

This paper is also related to a literature focused on local input output-linkages (or local labour markets) that use, for identification, variation over space in exposure to global shocks. Autor, Dorn, Hanson, and Song (2014), Autor, Dorn, and Hanson (2013), and Caliendo, Dvorkin, and Parro (2015) all focus on how local labour markets, within a single nation, react differently to one another after the same trade shock to manufacturing exporters. The variation stems from the fact that the manufacturing sector is highly specialised within a nation. One finding is that local labour markets tend to contain shocks created by trade variations locally. This is because workers' geographical mobility is, at least in the short and medium-long perspective, quite limited, while mobility across sectors is more pronounced. Hence the structure of the local economy is formed by the location decision of firms, which, together with price changes, influences the demand for local inputs. The results in Autor, Dorn, and Hanson (2013) suggest, for example, that a "negative shock to local manufacturing reduces the demand for local non-traded services".

To motivate our empirical analysis, we discuss in section 2 a simple theoretical model explaining the mechanism between exporters and service firms, that draws heavily from the work of Fujita and Thisse (2002, pp. 321–326). We then relate the predictions of this model to the empirical specification used in the paper. Section 3 discusses the data and our identification strategy. Section 4 discusses the results followed by the conclusion in section 5.

2 Theoretical Motivation and Empirical Specification

In order to capture the interdependence between manufacturing and services we build on a model by Fujita and Thisse (2002) that contains vertical links. This in turn, builds on a framework originally developed by Krugman and Venables (1995) and Venables (1996).[7] The points these types of models emphasise is twofold: in order to maximize real income the pattern of agglomeration is shaped by consumers' demand for final goods and workers' choice of location; and labour is assumed to be geographically immobile and agglomeration arises from manufactures' demand for a broad range of differentiated intermediates. The simplified assumptions of a labour force that is geographically immobile but perfectly mobile across sectors is also used, among others, by Autor, Dorn, and Hanson (2013) in their theoretical motivation for how workers' respond to import competition. Their empirical results also suggest that import competition affects the local labour market in many ways, but not through migration. In the case of Sweden, we found that 83% of all individuals working in both 2001 and 2011 (which consists of over 3 million individuals), worked in the same labour market area, while only 59 and 40% of these individuals stayed in the same sector (using 2-digit sector codes) and plants respectively. These stylised facts of much higher mobility across sectors and plants, when compared to spatial mobility, are in line with the model's presumption that the local economic structure is formed by a firm's location decision.[8]

---

[7]See also Combes, Mayer, and Thisse (2008).

[8]Puga (1999) compares models with and without labour mobility, concluding that the relative lower mobility in the EU compared to the United States may explain the more

The specific model we use to explain the input-output linkages of service providers and manufacturing exporters draws heavily from Fujita and Thisse (2002, pp. 321–326). We take the point of departure in a stylised model with two regions, three industries (agriculture, manufactures and services) and one compound factor of production (labour). Both agriculture and manufactures are, in this setting, producing homogeneous goods and operate under constant returns to scale. However, these sectors differ when it comes to trade costs since agricultural goods are assumed to be traded without frictions, while manufacturing goods face an iceberg trade cost. The assumption of homogeneous goods and perfect competition in manufactures implies that this sector will be located in the least-cost region, and that we paralyse the possibility of an agglomeration force driven by consumers' love for final good varieties. We also ignore other possible agglomeration forces by assuming identical consumers and firms in both regions. Instead, agglomeration stems from how manufacturing firms use, in a Cobb-Douglas fashion, both labour and services in order to produce their final good, and how their demand for services, which is costly to import, is characterized by a love for variety (modeled by a CES function). Hence there is an incentive for manufacturing firms and services to share a location. Manufacturing firms gain from cheaper inputs, since a co-location makes them more competitive as the unit cost of production falls when they avoid trade costs associated with imported services. Service firms, in turn, gain from a co-location since their customers are reached without trade costs.[9]

If we assume, as in Fujita and Thisse (2002), an asymmetric equilibrium where all manufacturing and service firms are located in the home region. In that case the equilibrium will be stable as long as the trade cost of services is large enough so that manufacturing firms have a cost advantage when they are located in the same region as services. A high trade-cost in services ensures that manufacturing firms have no incentive to move to the foreign region without local services, even though it faces a trade cost in

dispersed economic activity observed in the EU.

[9]The similarity with the more common link between consumers and final good producers in a Dixit-Stiglitz model is discussed in Combes, Mayer, and Thisse (2008). In this context, however, manufacturing firms act as consumers and the total cost of production corresponds to consumer income, while the different varieties of business services takes the role of final good varieties.

order to supply consumers in that region. How high trade costs in services has to be in order to support this equilibrium correlates positively with the trade cost of manufacturing goods. This is in addition to its share in consumer expenditure and the unimportance of services in the production of manufacturing goods. A fall in the trade cost of services decreases the advantage of manufacturing firms located in the home region together with services; eventually manufacturing firms may find it profitable to move to the foreign region and start producing by importing services from the home market. The location of choice for services will, however, still be the home region as long as its share of total manufacturing output is larger than in the foreign region.

In this setting, the link between sales made by services and manufacturing is highlighted by a gravity-type equation when it comes to the total sales of a firm i located in region j:

$$sales_{j(i)} = p_{j(i)}q_{j(i)} = (\alpha w_j \sigma / (\sigma - 1))^{1-\sigma} D_j \qquad (1)$$

where $D_j = c_j X_j P_j^{\sigma-1} + c_m X_m \tau_{jm}^{1-\sigma} P_m^{\sigma-1}$ is the total demand of services in j from manufacturing firms located in both j and m, σ is the elasticity of substitution between service varieties, α is the cost share of services in manufacturing, w is the labour cost in j, P is the ideal price index for the CES function, c is the unit cost of producing manufacturing goods, τ is the trade cost of services (equal to 1 if $j = m$), and X is the quantity of manufacturing goods produced for the different markets ($X_j = x_{jj} + x_{jm}, X_m = x_{mm} + x_{mj}$). The sales volume of services firms is therefore influenced by the production of goods (both for the local and the foreign market) as well as other factors such as the cost of producing goods (c_j) and the general price level of services ($P_{j/m}$). Hence, if we use equation 1 in order to assess the importance of the interplay between manufacturing and services, then, without relying on a structural model, we face several endogeneity issues.

In order to overcome these issues our identification strategy (as discussed in more detail below) focuses on the variation of local demand caused by exogenous export fluctuations in the manufacturing sector. Equation 1 highlights the relationship between manufacturing exports and local service

sales, from which we can derive the following elasticity of sales made by service firms with respect to manufacturing exports $(x_{jm,j\neq m})$:

$$\frac{\partial sales_{j(i)}}{\partial x_{jm}} \frac{x_{jm}}{sales_{j(i)}} = c_j P_j^{\sigma-1} x_{jm} \tau_{jm}^{1-\sigma}/D_j, \tag{2}$$

which underlines two important expectations that will be investigated in the empirical section.

The first expectation is that the responsiveness of sales made by service firms to exporting will depend on the export intensity in manufacturing. In an extreme case where the services firm only supplies the manufacturing firms located in the same region, we expect a 1% increase of manufacturing exports leading to a $x_{jm}/(x_{jj} + x_{jm})$ % increase of service sales. Hence, our prior for the empirical analysis is that we expect the elasticity of sales made by services, with respect to manufacturing exports, to be approximately equal to the export intensity of the manufacturing sector (0.14 in our dataset, see appendix A, table A2). The second expectation is that the export variation of manufacturing exporters located further away will be deflated by the trade cost of services. Hence we expect export shocks to be mainly transmitted to service providers locally, while export fluctuations in manufacturing firms located at a distance have no impact.

2.1   The Empirical Specification

Using the expectations from the forgoing model on vertical linkages, we proceed to empirically assess the relationship between sales made by service firms and manufacturing exports by using the following reduced form specification:

$$ln(sales_{j(i)t}) = \beta ln(D_{jt}) + f_i + \theta_{ts} + \eta_{tl} + \epsilon_{it}. \tag{3}$$

This specification captures the ideas presented in the previous section with the dependent variable, $ln(sales_{j(i)t})$, being the log of sales made by service firm i located in region j at time t, while D_{jt} is firm i's exposure to exports.[10] Sales made by service firms are, however, also influenced by

---

[10]See section 3.3 for a more detailed discussion and definition of the Localised Export

other factors such as general equilibrium effects (e.g. prices changes in goods, services or factors) and local effects (e.g. changes in the demand). So in order to mitigate identification problems due to unobserved factors, we include firm-fixed effects (f_i) plus either year-sector (θ_{ts}, using 3-digit sector codes) and year-labour market area fixed effects (η_{tl}) or, in the most stringent specification, year-sector-labour market area fixed effects (ζ_{tsl}). Hence, we identify the link between manufacturing exports and sales made by service sales by zooming in on within-firm variation over time. By using the labour market fixed effects and sector fixed effect we also control for shocks that are common to a specific area or sector (such as prices or demand).

3   Data and Empirical Strategy

3.1   Data

To investigate empirically the relationship between manufacturing and service firms we use firm-register data from Statistics Sweden covering all Swedish firms during the 2003-2011 period. We focus however on two sets of firms. The first set consists of all exporters and their export flows at the firm-product-destination level. This set includes 37 825 exporters, with on average 50 employees which is used in order to generate the variation in exporting. Firms in the manufacturing sector account for the lion's share of the export value in the dataset (around 83%). See appendix A for descriptive statistics about the set of exporters (table A1).

The second set of firms, and the one of primary interest to this study, consists of all private services firms (around 332 000 firms); these cover everything and include: printing, accommodation, transportation, computer programming, R&D and building services. Although all types of services may be important inputs to the manufacturing sector, we start off our analysis by focusing on business services, and thereafter we investigate whether the interplay between manufacturing and services differs between different types of services. The reason for this is that business services are highly integrated in manufacturing and are an important part of the servicification process.

Exposure, D_{jt}.

To define business services we use, as a baseline, the EU definition (from 2008). The four largest 2-digit sectors within business services in the data are; management and consulting, architecture and engineering, computer programming and related, and legal and accounting services. See table 1 for information about the sectors included (2-digit level) and summary statistics, both for the baseline sample of business service firms and the alternative broad definition of service firms. Note that in both cases multi-plant service firms are excluded since we only have information about sales at the firm-level, we have no way of identifying the location of sales changes in firms with two or more locations. In addition, our baseline sample uses only firms with at least one employee. Firms with zero-employees are excluded since these tend to be 'hobby' or micro-firms with very small and erratic sales volumes.

One important advantage of our data is that we have very detailed information about the location of firms'. That is, we know in which SAMS area (Small Areas for Market Statistics) each firm is located, and these SAMS areas divide Sweden's 290 municipalities (or 105 labour market areas) into over 9 000 small spatial areas. Around 67% of the SAMS areas have an area of less than 10 km^2 while 89% have less than 100 km^2. The smallest areas are less than 0.1 km^2 and the largest over 12 000 km^2. The difference in the mean size of 50 km^2 and the median size of 2.2 km^2 is explained by some large remote and sparsely populated areas along the north-western border. We also make use of broader administrative regions in order to control for trends specific to local labour market areas (LMA), while the fine geographical detail of the SAMS areas ensures a high variability within each LMA (see table A2 in appendix A). Figure A1 in appendix A shows for each SAMS area, the number of business services firms (left) and the number of firms when using the broad definition of services (right).[11]

---

[11] The figure also provides an overview of the size and detail of the SAMS areas used. Note that the SAMS areas may appear larger than they actually are, since we do not observe a border between areas that are in the same group in terms of number of firms in each area.

Table 1: Summary statistics for service firms using the broad-definition of services and the baseline-definition of business service firms only.

	Broad-definition			Baseline-definition		
	Sales	Empl.	# firms	Sales	Empl.	# firms
Support to agriculture	834	0.4	4732			
Support to forestry	1547	1.7	1164			
Printing and related	4184	3.0	3007			
Remediation waste man.	3216	1.9	144			
Maintenance parts vehic.	4037	1.7	14243			
Transport removal serv.	4143	3.0	16726			
Warehousing	41917	13.3	3059			
Postal, courier activ.	15368	20.2	559			
Accommodation	5878	5.4	4536			
Food and beverage	2626	2.8	32611			
Publishing activities	7322	3.6	6608	16017	9.2	1146
TV, film, sound recording	2048	0.7	10388			
Computer progr., consult.	5280	2.7	34589	14432	7.8	11598
Information services	5077	3.0	2212	14872	9.4	602
Legal and accounting	1237	1.0	25395	2678	2.6	10185
Management consulting	1560	1.0	51575	3603	2.7	18287
Architecture, engineering	2227	1.6	36792	4902	4.0	14470
Scientific R&D	4899	2.6	2955			
Advertising, research	3571	1.6	16066	8901	4.2	5874
Other professional activ.	1063	0.6	31292			
Rental and leasing activ.	5649	2.0	5660			
Temp. employment activ.	8700	15.7	3642	13591	24.7	2398
Security and investigation	6893	10.2	1597			
Building services, landsc.	2958	4.4	16917			
Office, business support	4906	10.9	5533			

The broad definition of services includes all service firms, even those that report no employment. There are 332 002 service firms in the data, when we apply the broad definition. The baseline definition business service firms only, defined according to the EU definition of business services. There are 64 560 business services firms in the data, when we apply the baseline definition. Note: The numbers for average firm sales are in thousands.

3.2   Empirical Strategy

An important part of our empirical strategy is that distribution across space
is very different within the manufacturing and services sectors. One way
to illustrate this is to make use of the Krugman-specialisation index (see
Krugman, 1991), which measures how similar the distribution of economic
activity across industries are between regions using the average of the
distribution as a benchmark. A value close to zero implies that a region's
distribution of economic activity (often measured with the help of the work
force) is similar to the benchmark while as the value approaches 2 the
industrial composition has nothing in common with the benchmark.[12] We
calculate the Krugman-specialization index for Swedish municipalities using
the distribution of the work force across industries (4-digit SNI codes) within
manufacturing and business services. We find that almost 80% of the labour
force in manufacturing in an average municipality has to change industry,
within the manufacturing sector, in order to get in line with the average
Swedish distribution. If we focus instead on the business services sector,
we find that it is much more evenly distributed. Only about 45% of the
workforce in the average municipality has to switch to another industry,
within the services sector, in order to be in line with the average distribution
of services in Sweden. In other words, the heterogeneity of regions in Sweden
is high when it comes to the distribution of manufacturing firms, while
services are much less specialised regionally. Figure 1 clearly shows how the
distribution of services is less concentrated (i.e. biased towards the left side
of the figure) than the distribution of manufacturing firms.

   The diffusion of services suggests that the local economy demands a
broad set of service inputs in close proximity, while manufacturing outputs
could more easily be supplied at an arm's-length. We find support for
this in a survey, by Gullstrand (2016), of small and medium sized Swedish
manufacturing firms, when they were asked about the location of the major
source[13] for different inputs. One result that is particularly striking is that
more than 80% of the firms answered that their major source of business

---

[12]A value of 1 implies that at least 50% of the economic activity has to switch industry
   in order to have the same distribution as the benchmark region.
[13]A major source is defined as a source where 50% or more of that input originates from.
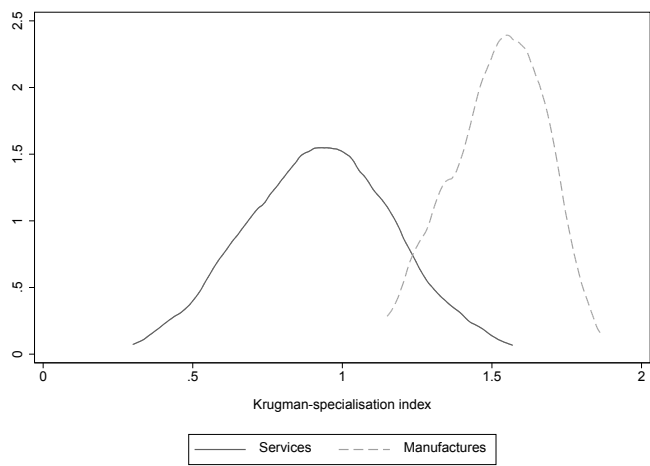
Figure 1: Krugman Specialization index (2011). A higher value of the index means that a larger fraction of the labour force needs to change sector in order to be in line with the average municipality in Sweden (i.e. more specialised).
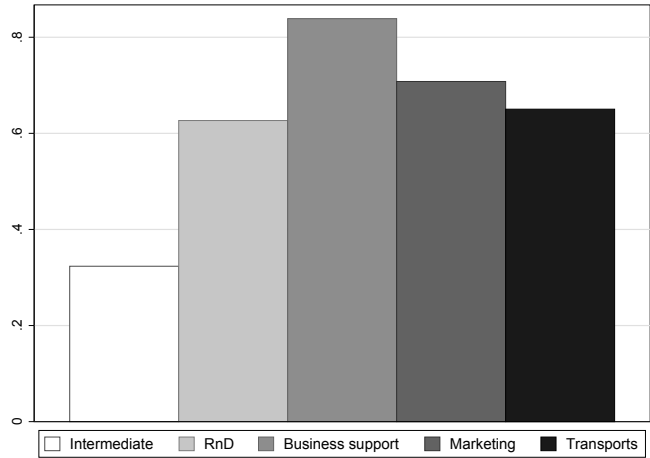

Figure 2: Survey results showing the major regional links of manufacturing firms (2014). The figure shows the percentage of firms that indicate that their local region was the major source region for that specific type of input. A major source is defined as being more than 50% of that input category. See Gullstrand (2016) for more information.

support (e.g. legal advice, accounting and technical support) was from the local region (see figure 2). If we compare this with intermediate goods, then our results show that only around 30% of the firms indicated that the local market was their major source. This finding matches the results in Gervais and Jensen (2015), which found that services in general, but not for all, are less tradable than manufacturing (see also Jensen (2011)). Hence, services are harder to trade over distance — that may be especially important for non-standardised services that require a high degree of knowledge and direct communication. A body of literature has also found that local business linkages matter for (complex) inputs in a globalised world.[14] One specific example of this local nature is found in Bennett, Bratton, and Robson (2000), who showed that firms hire business advisors in over 60% and 80% of cases within 10 and 25 kilometres of their location, respectively.

Services are not only less tradable, Lodefalk (2013) shows that services are also a highly integrated but external part of manufacturing production. If one breaks down manufacturing firms' expenditure on services into internal and external services, then external services account for 75% of total service costs during the 2001-2006 period.[15] Additionally, using Swedish input-output tables, he finds that 83% of service inputs are sourced from domestic suppliers.[16] The servicification of manufacturing and the significance of short distances to service input suppliers suggests that we should find important local input-output linkages. We also found tentative evidence for this by calculating coagglomeration indexes between sectors.[17] The results show that the average pairwise coagglomeration between service and manufacturing sectors was the most pronounced; it was even stronger than between sectors

---

[14] See Bernard, Moxnes, and Saito (2015), Hillberry and Hummels (2008), Hummels and Schaur (2013), Iammarino and McCann (2013), Keller and Yeaple (2013), and Wrona (2015) See also Ellison, Glaeser, and Kerr (2010) who find that, of the three Marshall theories of agglomeration, input-output linkages are found to be particularly important. See also Meliciani and Savona (2015) and Dinteren (1987) for an early descriptive analysis of the role of business services in the local economy.

[15] He finds that expenditure on services in general increased while the share of external services was stable, suggesting that external and internal services grew in tandem.

[16] We replicate the aggregate figure of Lodefalk (2013) and found additionally large differences across sectors. If we focus on business services, then the domestic share of external service inputs increases to 89%, while it falls to 73% for other services.

[17] We used the Ellison, Glaeser, and Kerr (2010) metric in order to measure coagglomeration (EG-index), and we used the 2-digit level of the Swedish Industry Classification system.

within manufacturing, and much stronger than between manufacturing and other types of economic activity (e.g. mining, agriculture, wholesale and retail or public services).

For our identification, we make use of the foregoing discussion that the manufacturing sector is spatially specialised and that there are important *local* input-output linkages between manufacturing and services firms. An idiosyncratic industry specific shock on manufacturing exports will therefore be transmitted to local service firms and impact their volume of sales. As service firms are much more evenly distributed over space, we will observe large variations within the service sector; due to varying exposure to the same shock.

3.3   Localised Export Exposure

To identify the link between manufacturing and service firms we therefore *localise* manufacturing exports; this helps to capture the fact that manufacturing demand for services inputs is influenced by their distance to the service firm. In other words, we make use of the highly detailed SAMS areas (see discussion in section 3.1) and construct a variable called Localised Export Exposure (LEE) by spatially weighing manufacturing exports so that they become location specific.[18] The Localised Export Exposure (D_{jt}) is constructed by first calculating the total manufacturing export of each SAMS area j, $X_{jt} = \sum_i X_{i(j)t}$. Then, in order to account for the impact of distance on the demand for services in SAMS area j, we use a spatial weight so that SAMS level exports (X_{jt}) are deflated by distance between the pair of SAMS areas j and m. Hence, the localized export exposure to services (specific for each SAMS area), D_{jt}[19], equals the distance weighted sum of

---

[18]The use of the SAMS areas is a great strength of the analysis, as even very short distances have been found to have a large deterring effect on business relationships. See, for example, Hillberry and Hummels (2008) who stressed the advantage of highly detailed geographic data as distance is found to have a pronounced effect on a firm's trade, even over very short distances within a municipality or other administrative areas.

[19]Alternative formulation of this shock is the following: $WD_t = [D_{jt}]$. Here W is a spatial weight matrix with the dimension JxJ (J is the number of SAMS areas in Sweden) and D_t is a $J \times 1$ matrix with SAMS-specific exports for year t.

all SAMS level exports:

$$D_{jt} = \sum_m \frac{X_{mt}}{d_{jm}} \tag{4}$$

where d_{jm} is the distance (in km) between the centroids of SAMS areas j and m. Note that the distance within a SAMS area, d_{jj}, is estimated to be the circle-radius of the SAMS area to account for their varying size. The specialisation pattern of manufacturing and product-specific idiosyncratic shocks on the world market imply that the demand for services varies considerably across SAMS areas. The heterogeneity of the Localised Export Exposure (D_{jt}) is visible in the top row of the figure 3, which shows the annual percentage change of D_{jt} for each SAMS area during the 2004-2011 period.

3.4   Instrumenting for the Localised Export Exposure

A potential concern of using actual export flows of nearby manufacturing firms as a source of variation, is that input-output linkages between manufacturing and service firms imply that the characteristics of the service sector in the proximity of manufacturing firms may influence their export performance. A potential endogeneity problem therefore arises. Evangelista, Lucchese, and Meliciani (2015) found for example, by using European input-output data, that business services "exert a positive impact on the international competitiveness of manufacturing industries". In order to address this concern of simultaneity, we build our identification strategy on an instrument for the Localized Export Exposure in equation 4.
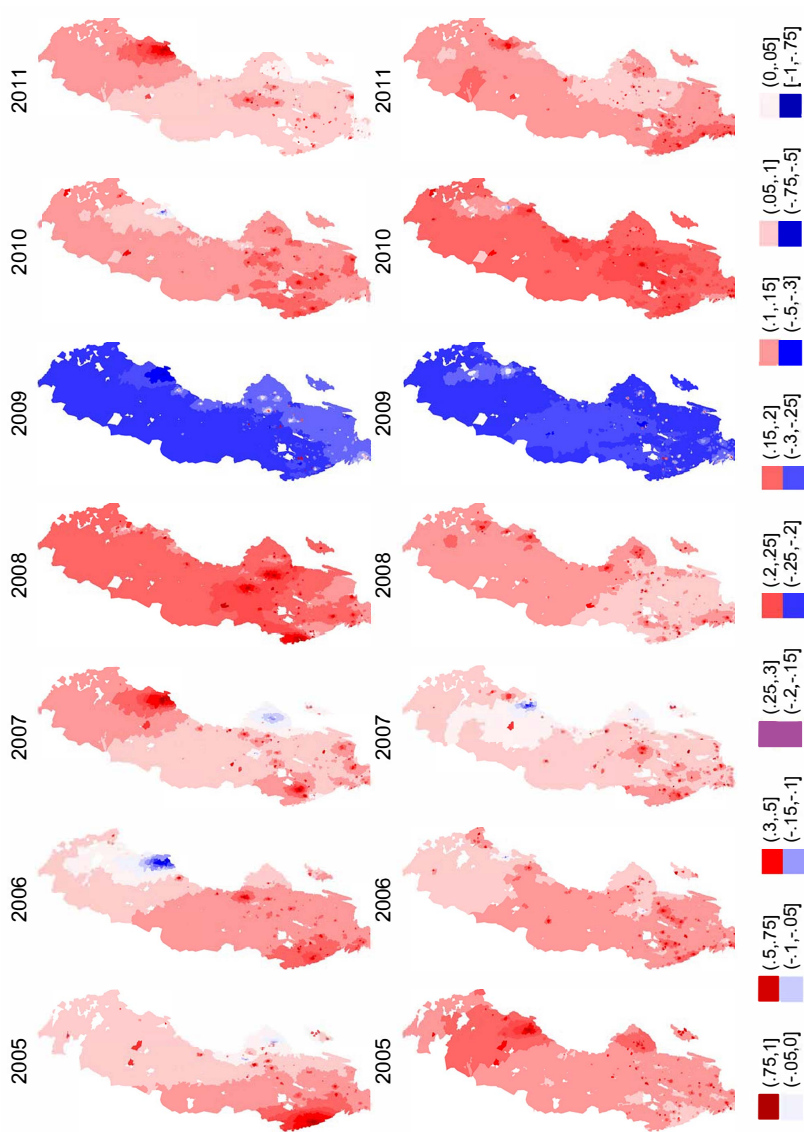
Figure 3: Yearly percentage growth in the SAMS level Localised Export Exposure, D_{jt} (top row) and the instrument for Localised Export Exposure, $D^{\star}_{jt}$ (bottom row), between 2005 and 2011. The yearly percentage growth is calculated as: $\triangle D_{jt} = ln(D_{jt}) - ln(D_{jt-1})$ and $\triangle D^{\star}_{jt} = ln(D^{\star}_{jt}) - ln(D^{\star}_{jt-1})$.

To construct the instrument we first create a firm-specific instrument, using a similar methodology as Hummels, Jørgensen, Munch, and Xiang (2014), which we aggregate to the SAMS level. To create the firm-level instrument we begin by calculating pre-sample shares (s_{ick}) of the export flow of product k to destination c in total export of firm i.[20] The next step is to use data from the UN Comtrade database, about bilateral trade flows at the HS 6-digit product-destination level, in order to create a product-destination level demand shocks (I_{ckt}) by using the total imports (except from Sweden) of each country at the product level. The time varying firm-specific instrument is then calculated by multiplying the firm-product-destination specific shares with the product-destination country specific import demand (I_{ckt}) and then aggregate over all products and destinations. The firm specific instrument therefore equals:

$$I_{it} = \sum_{kc} s_{ick} \times I_{ckt}. \tag{5}$$

The next step is to aggregate the firm-specific instrument, I_{it}, to the SAMS level:

$$X^{\star}_{mt} = \sum_{i} I_{it} \tag{6}$$

Similarly to equation 4, we finally create a time varying instrument for each SAMS area j by weighing shocks by the inverse distance between SAMS areas:

$$D^{\star}_{jt} = \sum_{m} \frac{X^{\star}_{mt}}{d_{jm}}. \tag{7}$$

This variable, $D^{\star}_{jt}$, is thereafter used as an instrument for the Localised Export Exposure, D_{jt} in equation 4.[21] Figure 3 compares the yearly percentage change for the localized export exposure (top row) and the instrument of the Localised Export Exposure (bottom row). From simple eye-balling of the figures, we can see a very similar pattern over the period. Importantly for our identification we see that there is large variation across space and

---

[20]This is either 2003 or the first year a firm exists in the dataset.

[21]For robustness we consider using inverse distance squared as a alternative distance weight. The alternative instrument is defined as, $D^{\star\star}_{gt} = \sum_{m} X^{\star}_{jt} \times \frac{1}{(d_{gm})^2}$. The LEE, D_{jt}, is adjusted in the same manner.

time in the exposure measure. The growth of the Localised Export Exposure was, for example, very high in the western part of Sweden in 2010 while the northeastern part stagnated. In 2011 one could see a reversed pattern with high growth in the northeastern part of Sweden. One could even identify differences in the downturn and also some regional pockets of positive changes during the big freeze (i.e. during the financial crisis 2008-09). This detailed and heterogeneous pattern of Localised Export Exposures across Sweden is the central component in our identification strategy. If there is an important channel or a feedback effect from manufacturing firms to nearby service firms, then we would expect a positive change in the Localised Export Exposure to increase sales of service firms. Table A2 in appendix A shows summary statistics for both the Localised Export Exposure, D_{jt}, and the Localised Export Exposure instrument, $D_{jt}^{\star}$.

4 The Effect of Manufacturing Exports on Services

The objective of this paper is to analyse the linkages between manufacturing and services firms. For our empirical identification we use an instrumental variable approach were we instrument for the exposure of service firms to changes in exporting. If we consider the validity of the instrument, then the first stage regression shows a strong positive correlation between the Localised Export Exposure and our Localised Export Exposure instrument, see table 2. The first stage F-statistic is above 400 in our estimates.

The main result on how business services firms's sales respond to changes in manufacturing exporting are shown in table 3. From the theoretical motivation in section 2 our theoretical prior regarding the responsiveness of services firms' sales to exporting, was an elasticity on par with the export intensity of the manufacturing sector. In other words, if we use the export intensity of the manufacturing sector in Sweden as a benchmark, then a 1% increase of manufacturing exports should increase services' sales by around 0.14%. If we consider the results from our IV-regressions in table 3, then we find that a 1% increase in exporting (Localised Export Exposure) increases

Table 2: First-stage for baseline results (in table 3) and alternative instrument (in table B3, ID sq.). Dependent variable is the Localized Export Exposure of the SAMS area (D_{jt}) regressed on the instrument for the Localized Export Exposure ($D_{jt}^{\star}$) or the alternative instrument ($D_{jt}^{\star\star}$).

	Baseline			ID sq.
	D_{jt}	D_{jt}	D_{jt}	D_{jt}
LEE Instrument, ($D_{jt}^{\star}$)	0.537^a	0.537^a	0.537^a	
	(0.0255)	(0.0256)	(0.0254)	
LEE Alt. instrument, ($D_{jt}^{\star\star}$)				0.155^a
				(0.0216)
Nr. obs.	237653	237653	236244	236244
R^2	0.98	0.98	0.98	0.97
Within R^2	0.4850	0.4850	0.4830	0.3537
First stage F stat.	443.4	441.2	446.7	51.5
# clusters	105	105	103	103
Firm-FE	Yes	Yes	Yes	Yes
Sector-Year FE	No	Yes	No	No
LMA-year FE	No	Yes	No	No
LMA-Sector-year FE	Yes	No	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on labour market areas (LMA) level. For the alternative instrument, $D_{jt}^{\star\star}$, inverse distance squared is used as a weight, $1/(d_{gm})^2$ instead of inverse distance. Note that for the alternative instrument the D_{jt} is also adjusted by the different distance weight. LEE stands for Localized Export Exposure.

Table 3: Baseline sample: Main results using both IV and OLS specification. Dependent variable is domestic sales (log) for firms supplying business services (EU definition).

	IV			OLS		
	Sales	Sales	Sales	Sales	Sales	Sales
LEE	0.201^a	0.197^a	0.196^a	0.0569^a	0.0888^a	0.0837^a
	(0.0164)	(0.0159)	(0.0167)	(0.0111)	(0.0117)	(0.0113)
Nr. obs.	237653	237653	236244	237661	237653	236244
R^2	0.81	0.81	0.82	0.81	0.81	0.82
Within R^2	-0.0002	-0.0002	-0.0003	0.0003	0.0005	0.0004
First stage F stat.	443.4	441.2	446.7	n.a	n.a	n.a
# clusters	105	105	103	105	105	103
Firm-FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	No	Yes	No	No	Yes	No
LMA-year FE	Yes	Yes	No	Yes	Yes	No
LMA-sec-year FE	No	No	Yes	No	No	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on labour market areas (LMA) level. LEE stands for Localized Export Exposure

sales made by services around 0.2%. Hence our results suggests that an idiosyncratic shock on the world market will not only have a significant impact on those exporters facing this shock, but also on services (and other parts of the economy) through input-output linkages. This result is also robust to different types of fixed effects, even with our most stringent specification when we include LMA-sector-year fixed effects and firm fixed effects.

We find the results from the IV-regression very plausible, compared to the OLS found in table 3, since one reason for using an IV approach was that the structure of the local service sector may in itself influence manufacturing exports. If firm fixed effects corrrelates with location specific externalities bewteen manufactring and services, then we would expect a low OLS estimate; this we find in our sample. The instrument, on the other hand, is based on the variation in demand of arm's-length trading partners, and hence the variation becomes cleaner.

4.1   Are Linkages Local?

A natural extension of the results presented above is to investigate the reach of this transmission mechanism. Since our data includes highly detailed information about firm location, we can explore if there is a distance decay in how a fluctuation in manufacturing exports is transmitted to the local economy. We split the Localised Export Exposure faced by service firms into several smaller shocks depending on their distance away from the firm. We use the following distance ranges; 0-20km, 20-100 km, 100-200 km, 200-300 km, 300-400 km and 400 km+. This allows us to investigate whether shocks closer to the service firm are more significant in comparison to those further away; as we expect due to significant trade costs in services.

We run a regression similar to before, except now we include an instrument for multiple measures of export exposures based on distance.[22] The same fixed effects are included as in the baseline. The result is presented in a coefficient plot in figure 4, and more detailed results can be found in table B1

---

[22]Effectively we create Localised Export Exposure and Localised Export Exposure instruments for each interval. For the first interval it becomes, $D_{jt,0-20km}$ and $D^{\star}_{jt,0-20km}$ etc. In a single regression we use the $D^{\star}_{jt}$'s as an instrument for each D_{jt} separately.
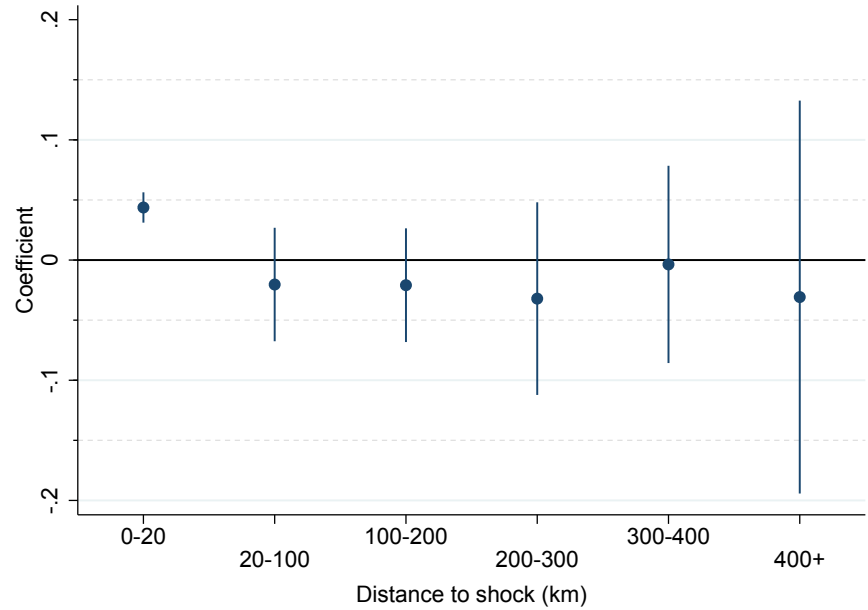
Figure 4: Coefficient plot: IV-regression results when log firm service sales are regressed on the Localised Export Exposure for each distance range (six separate exposures in a single regression). The figure shows the coefficient estimate and 95% confidence interval. More detailed information on this regression can be found in table B1 column 1 in appendix B.

in appendix B. The figure shows the coefficient for each interval (included in a single regression) and the 95% confidence intervals. A clear distance decay is present and the results suggest that the links are highly local. The link between service firms and manufacturing exporters is driven by changes in the exporting of firms located within 20 kilometres of the services firm. Thereafter, the relationship disappears. These results are also robust for the inclusion of an alternative instrument when inverse distance squared (ID sq., see section 3.4) is used instead of inverse distance, see table B1 in appendix B. In other words, services firms are highly influenced by manufacturing firms in their proximity while arm's-length manufacturing firms have little influence.

4.2   Robustness

For the baseline specification we perform a number of robustness checks. First we include business services firms that report zero employment (excluded in the baseline) and find a lower elasticity than before (0.156 compared to 0.2 baseline, see table 4). This change is not surprising, since micro-firms without employment may be dormant firms, or they may consist of entrepreneurs with multiple employments. Alternatively, we alter the definition of services to embrace a much broader scope, and include both business services and other types of services.[23] The results for this broad definition show a highly significant, but slightly smaller elasticity, than for business services. This is also expected since these other types of services firms may have a broader customer base outside manufacturing, when compared to business services. See table 4.

In order to test for differences between business services firms and other services firms, we used the total sample consisting of service firms with positive employment and then interacted the Localised Export Exposure instrument with an indicator for business services. The result did not, however, support any significant differences between businesses and other services, see table B2 in appendix B. A possible explanation may be, as discussed by Gervais and Jensen (2015), that there is a considerable variation

---

[23]For more information on the sectors included in the broad definition see table 1. Firms that report zero employment are also included.

Table 4: Alternative definitions of services: IV results using a broad definition of service firms and compared to business service firms only. Note that in both cases firms reporting zero labour are included (unlike the baseline sample). Dependent variable is domestic sales (log).

	Broad Definition			BS (incl. zero empl.)		
	Sales	Sales	Sales	Sales	Sales	Sales
LEE	0.141^a	0.141^a	0.141^a	0.156^a	0.155^a	0.156^a
	(0.0167)	(0.0152)	(0.0155)	(0.0149)	(0.0145)	(0.0145)
Nr. obs.	1243958	1243950	1237579	629299	629299	628036
R^2	0.84	0.84	0.85	0.81	0.81	0.81
Within R^2	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
First stage F stat.	589.0	594.8	609.9	689.2	689.4	685.9
# clusters	105	105	105	105	105	105
Firm-FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	No	Yes	No	No	Yes	No
LMA-year FE	Yes	Yes	No	Yes	Yes	No
LMA-sec.-year FE	No	No	Yes	No	No	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on labour market areas (LMA) level. LEE stands for Localized Export Exposure.

within service sectors when it comes to their tradability over space.

A second robustness test was to use an alternative spatial weight when we calculated the Localised Export Exposure and the instrument. We used the inverse distance squared as an alternative (see section 3.4), which implies that the decay function becomes steeper; therefore exports in close proximity have a relatively higher weight. Since the result discussed above suggests that exports in the proximity are more important than those at arm's-length, we expect the elasticity to be higher when shocks in this proximity have a greater weight. This is also what we find, see table B3 in appendix B. We also test if there are some unobserved trends that may be contributing to the results. We replace the fixed effects with sector and LMA trends; the results are unchanged (see table B3 in appendix B).

One concern with the baseline specification may be that services firms set up a contract with manufacturing firms where they specify a bulk purchase of services during the year. If this is the case, then the responsiveness may be lagged, since fluctuations in exports may not influence the sales of services until the year after. In order to control for this, we introduced a lag-structure,

which is presented in table B3 in appendix B. The results suggests that there is both an immediate and a lagged effect; using only lagged shocks suggests that the relationship becomes slightly weaker, although it is still highly significant.

A final robustness test is to investigate whether export fluctuations develop into more lasting effects and influence employment within service firms. Hence we re-estimate equation 3 after we have replaced the dependent variable, ln(firm sales), with average employment, ln(employment). We find the same pattern as before when it comes to the comparison between the IV-regression and the OLS-regression, as well as when we used different lag-structures. The major, and expected, difference is that the magnitude of the elasticity drops. We now find that a 1% increase in exporting (LEE) leads to a 0.06% increase in employment of a nearby business services firm. Hence, not only is there a spillover to firm sales, but there are also labour market effects to services providers. See table B4 in appendix B.

5   Conclusion

The last few decades have been characterised by larger and more global manufacturing firms dominating the export flows of countries and regions. In addition to more global manufacturing firms, manufacturing itself is being transformed by a 'servicification' process. Manufacturing firms are bundling goods and services to a higher degree in the production process, by using predominantly service inputs from external but geographically local services providers. This suggests that the local economy becomes more vulnerable to idiosyncratic global shocks. This is because it will first be faced by exporters and thereafter it will be transmitted to local firms supplying exporters with services.

The aim of this paper is to assess and quantify the linkages between manufacturing exporters and service providers. We make use of three stylised facts in order to identify this link: first, manufacturing firms are spatially specialised while services are more dispersed; second, there are important input-output linkages between manufacturing and services; and third, service firms tend to supply locally — hence we will observe large variations within

the services sector across space, in their exposure to changes in exporting.

Our results show that a 1% increase of manufacturing exports (LEE) translates into increased sales made by service providers by 0.2%. Interestingly we find that this effect is extremely local, since the main effect of exports on a services provider is their exposure within 20 km of its location. Notably, exporting makes a significant impact on employment — it was found that a 1% increase in exporting increases local employment by 0.06%. Our results therefore suggest that a global idiosyncratic shock may deeply penetrate into the local economy through manufacturing exports to local services firms. Hence we have established a sizeable transmission mechanism from manufacturing exporters to services providers; it may help to explain regional differences in growth and employment performance.

References

Acemoglu, Daron, Vasco M. Carvalho, Asuman Ozdaglar, and Alireza Tahbaz-Salehi (2012). "The Network Origins of Aggregate Fluctuations". *Econometrica* 80.5, pp. 1977–2016. ISSN: 0012-9682. DOI: `10.3982/ECTA9623`.

Autor, David H, David Dorn, and Gordon H Hanson (2013). "The China Syndrome: Local Labor Market Effects of Import Competition in the United States". *American Economic Review* 103.6, pp. 2121–2168. ISSN: 0002-8282. DOI: `10.1257/aer.103.6.2121`.

Autor, David H, David Dorn, Gordon H Hanson, and Jae Song (2014). "Trade Adjustment: Worker-Level Evidence". *The Quarterly Journal of Economics* 129.4, pp. 1799–1860. ISSN: 0033-5533. DOI: `10.1093/qje/qju026.Advance`.

Baldwin, Richard, Rikard Forslid, and Tadashi Ito (2015). *Unveiling the evolving sources of value added in exports*. Working Paper Joint Research Program Series No.161.

Bems, Rudolfs, Robert C. Johnson, and Kei-Mu Yi (2013). "The Great Trade Collapse". *Annual Review of Economics* 5.1, pp. 375–400. ISSN: 1941-1383. DOI: `10.1146/annurev-economics-082912-110201`.

Bennett, Robert, William Bratton, and Paul Robson (2000). "Business Advice: The Influence of Distance". *Regional Studies* 34.9, pp. 813–828. ISSN: 0034-3404. DOI: `10.1080/00343400020002958`.

Bernard, Andrew, Andreas Moxnes, and Yukiko Saito (2015). *Production Networks, Geography and Firm Performance*. Working Paper. Cambridge, MA: National Bureau of Economic Research. DOI: `10.3386/w21082`.

Caliendo, Lorenzo, Maximiliano Dvorkin, and Fernando Parro (2015). *The Impact of Trade on Labor Market Dynamics*. Working Paper. Cambridge, MA: National Bureau of Economic Research. DOI: `10.3386/w21149`.

Combes, PP, Thierry Mayer, and Jacques-françois Thisse (2008). *Economic geography: The integration of regions and nations*. Princeton University Press. ISBN: 9780691124599.

Crozet, Matthieu and Pamina Koenig Soubeyran (2004). "EU enlargement and the internal geography of countries". *Journal of Comparative Eco-*

nomics 32.2, pp. 265–279. ISSN: 0147-5967. DOI: `http://dx.doi.org/10.1016/j.jce.2004.02.009`.

Dinteren, J H J Van (1987). "The role of business-service offices in the economy of medium-sized cities". *Environment and Planning A* 19.5, pp. 669–686. ISSN: 0308-518X. DOI: `10.1068/a190669`.

ECSIP (2014). *Study on the relation between industry and services in terms of productivity and value creation.* October. European Competitiveness and Sustainable Industrial Policy Consortium.

Ellison, Glenn, Edward L. Glaeser, and William R. Kerr (2010). "What causes industry agglomeration? Evidence from coagglomeration patterns". *American Economic Review* 100.3, pp. 1195–1213. ISSN: 00028282. DOI: `10.1257/aer.100.3.1195`.

European Union (2014). *High level report in Business services.*

Evangelista, Rinaldo, Matteo Lucchese, and Valentina Meliciani (2015). "Business services and the export performances of manufacturing industries". *Journal of Evolutionary Economics*, pp. 959–981. ISSN: 09369937. DOI: `10.1007/s00191-015-0400-1`.

Fujita, Masahisa and Jacques-Francois Thisse (2002). *Economics of Agglomeration: Cities, Industrial Location, and Regional Growth.* Cambridge: Cambridge University Press. ISBN: 9780511805660. DOI: `10.1017/CBO9780511805660`.

Gabaix, Xavier (2011). "The Granular Origins of Aggregate Fluctuations". *Econometrica* 79.3, pp. 733–772. ISSN: 0012-9682. DOI: `10.3982/ECTA8769`.

Gervais, Antoine and J. Bradford Jensen (2015). "The Tradability of Services: Geographic Concentration and Trade Costs". DOI: `10.3386/w19759`.

Gullstrand, Joakim (2016). "The Export Decision: A Survey of Swedish Firms". *Mimeo.*

Hillberry, Russell and David Hummels (2008). "Trade responses to geographic frictions: A decomposition using micro-data". *European Economic Review* 52.3, pp. 527–550. ISSN: 00142921. DOI: `10.1016/j.euroecorev.2007.03.003`.

Hummels, David, Rasmus Jørgensen, Jakob Munch, and Chong Xiang (2014). "The wage effects of offshoring: Evidence from danish matched worker-firm

data". *American Economic Review* 104.6, pp. 1597–1629. ISSN: 00028282. DOI: 10.1257/aer.104.6.1597.

Hummels, David and Georg Schaur (2013). "Time as a Trade Barrier". *American Economic Review* 103.7, pp. 2935–2959. ISSN: 0002-8282. DOI: 10.1257/aer.103.7.2935.

Iammarino, Simona and Philip McCann (2013). *Multinationals and Economic Geography.* Edward Elgar Publishing. ISBN: 9781781954799. DOI: 10.4337/9781781954799.

Jensen, J. Bradford (2011). *Global trade in services: fear, facts, and offshoring.* Washington, DC: Peterson Institute for International Economics.

Keller, Wolfgang and Stephen Ross Yeaple (2013). "The Gravity of Knowledge". *American Economic Review* 103.4, pp. 1414–1444. ISSN: 0002-8282. DOI: 10.1257/aer.103.4.1414.

Krugman, Paul (1991). "Increasing Returns and Economic Geography". *Journal of Political Economy* 99.3, p. 483. ISSN: 0022-3808. DOI: 10.1086/261763.

Krugman, Paul and Anthony J Venables (1995). "Globalization and the Inequality of Nations". *The Quarterly Journal of Economics* 110.4, pp. 857–880. ISSN: 0033-5533. DOI: 10.2307/2946642.

Lanz, Rainer and Andreas Maurer (2015). "Services and Global Value Chains: Servicification of Manufacturing and Services Networks". *J. Intl Econ. Comm. Policy.* 06.03. DOI: 10.1142/s1793993315500143.

Lodefalk, Magnus (2013). "Servicification of manufacturing - evidence from Sweden". *International Journal of Economics and Business Research* 6.1, p. 87. ISSN: 1756-9850. DOI: 10.1504/IJEBR.2013.054855.

— (2014). "The role of services for manufacturing firm exports". *Review of World Economics* 150.1, pp. 59–82. ISSN: 1610-2878. DOI: 10.1007/s10290-013-0171-4.

Meliciani, Valentina and Maria Savona (2015). "The determinants of regional specialisation in business services: agglomeration economies, vertical linkages and innovation". *Journal of Economic Geography* 15.2, pp. 387–416. ISSN: 1468-2702. DOI: 10.1093/jeg/lbt038.

Puga, Diego (1999). "The rise and fall of regional inequalities". *European Economic Review* 43.2, pp. 303–334. ISSN: 00142921. DOI: 10.1016/S0014-2921(98)00061-0.

Venables, Anthony J. (1996). "Equilibrium Locations of Vertically Linked Industries". *International Economic Review* 37.2, p. 341. ISSN: 00206598. DOI: 10.2307/2527327.

World bank (2016). *World Development Indicators.*

Wrona, Jens (2015). *Border Effects without Borders: What Divides Japan's Internal Trade?* Working Paper 185. Düsseldorf Institute for Competition Economics (DICE).

Appendices

A Descriptive Statistics

Table A1: Summary statistics for the exporting firms.

	Mean	St. dev.	Min	Max	Obs.
Log Firm Sales	16.6	2.0	6.49	25.5	165296
Firm Labour	51.3	367.1	0	21842	165296
Log Total Exports	12.7	3.2	0	25.0	165296
Exports/Sales	0.14	0.2	1.3e-10	1	165296
# firms	37825				
# SAMS areas	6419				
Man. sect. share	0.830				

Note that a small number of observations are dropped for the descriptive statistics as firm sales are reported to be higher than firm exports. These observations only impact the descriptive statistics on export intensity. If we assume that all sales of these firms are exported (export intensity of 1) then the export intensity of all firms changes to 0.15. Man. sect. share shows that 83% of the value of exports are from firms in the manufacturing sector, 17% from firms in other sectors.

Table A2: Summary statistics for the logs of Localized Export Exposure, $ln(D_{jt})$, the Localized Export Exposure instrument, $ln(D_{jt}^{\star})$, and the alternative Localized Export Exposure instrument, $ln(D_{jt}^{\star\star})$.

	Mean	St. dev.	Min	Max	Obs.
$ln(D_{jt})$	22.2	0.70	20.0	25.7	69122
$ln(D_{jt}^{\star})$	24.7	0.80	22.4	27.6	69122
$ln(D_{jt}^{\star\star})$	21.4	2.18	15.5	30.4	69122
# SAMS areas	8939				
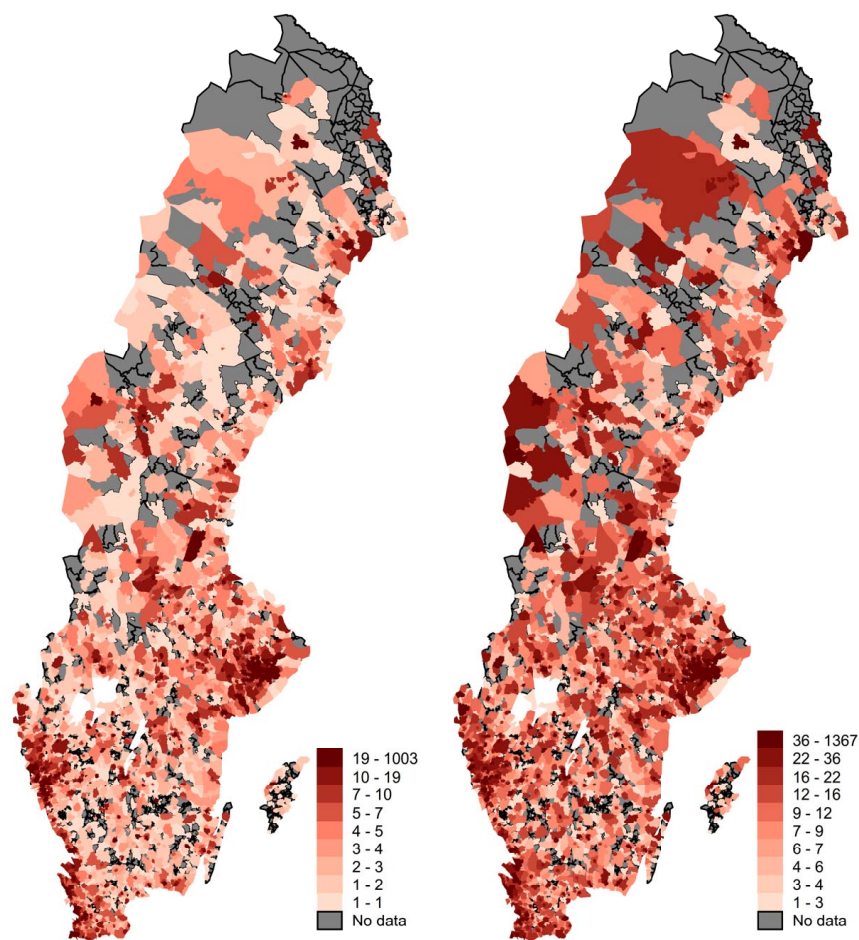
Figure A1: The number of business service firms (baseline definition, left side) and the number of service firms (broad definition on right side, excluding firms reporting zero employment) located in each SAMS area.

B   Results Appendix

Table B1: Business Service firms (baseline-definition): IV and OLS results using different distance bands. Dependent variable is domestic sales (log) for firms supplying business services.

	IV		OLS	
	ID	ID sq.	ID	ID sq.
LEE, 0-20 km	0.0437^a	0.0419^a	0.0263^a	0.00913^a
	(0.00636)	(0.00411)	(0.00419)	(0.00114)
LEE, 20-100 km	-0.0204	-0.0194	0.00768	-0.00536^a
	(0.0238)	(0.0159)	(0.0120)	(0.00193)
LEE, 100-200 km	-0.0209	-0.0215	-0.0244	-0.00459
	(0.0239)	(0.0224)	(0.0162)	(0.00519)
LEE, 200-300 km	-0.0321	-0.0318	-0.0500	-0.0201^a
	(0.0404)	(0.0385)	(0.0481)	(0.00739)
LEE, 300-400 km	-0.00363	-0.00543	0.0334	0.00193
	(0.0414)	(0.0359)	(0.0400)	(0.00521)
LEE, 400 km +	-0.0308	-0.0399	0.0236	-0.00991
	(0.0824)	(0.0619)	(0.0579)	(0.0112)
Nr. obs.	236699	236699	236699	236699
R^2	0.81	0.81	0.81	0.92
Within R^2	0.0004	0.0010	0.0008	0.0017
First stage F stat.	6.9	7.8	n.a.	n.a.
# clusters	104	104	104	104
Firm-FE	Yes	Yes	Yes	Yes
Sector-Year FE	Yes	Yes	Yes	Yes
LMA-year FE	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on labour market areas (LMA) level. ID,: inverse distance, as in original specification. ID sq.: equals $1/(d_{gm})^2$. LEE stands for Localized Export Exposure.

Table B2: All service firms (broad-definition, only firms with positive labour). Comparison of impact on business services compared to other services. Dependent variable is domestic sales(logs).

	IV	OLS
	Sales	Sales
Localized Export Exposure	0.146^a	0.0697^a
	(0.0523)	(0.0161)
LEE × EUBS	0.0529	0.0143
	(0.0485)	(0.0138)
Nr. obs.	483617	483617
R^2	0.85	0.85
Within R^2	-0.0003	0.0004
First stage F stat.	53.4	n.a.
# clusters	105	105
Firm-FE	Yes	Yes
Sector-Year FE	Yes	Yes
LMA-year FE	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on labour market areas (LMA). The interaction, LEE × EUBS interacts the Localized Export Exposure instrument and a dummy equalling 1 the firm is providing business services (EU definition).

Table B3: Business Service firms (baseline-definition): IV results using lagged effects, alternative instruments and trends. Dependent variable is domestic sales(log).

	Lags		ID sq.	Trend
	Sales	Sales	Sales	Sales
Localized Export Exposure	0.124^a		0.262^a	0.186^a
	(0.0156)		(0.0334)	(0.0167)
Localized Export Exposure 1-lag	0.131^a	0.179^a		
	(0.0201)	(0.0229)		
Nr. obs.	208631	208631	236244	237661
R^2	0.83	0.83	0.82	0.81
Within R^2	-0.0003	-0.0002	-0.0015	-0.0012
First stage F stat.	188.6	479.8	51.5	120.4
# clusters	103	103	103	105
Firm-FE	Yes	Yes	Yes	Yes
LMA-Sector-year FE	Yes	Yes	Yes	No
Sector time-trend	No	No	No	Yes
LMA time-trend	No	No	No	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on labour market areas (LMA) level. ID sq.: inverse distance squared, equals $1/(d_{gm})^2$.

Table B4: Business Service firms (baseline-definition): Employment effects results using both IV and OLS specification. Dependent variable is firm average employment (log).

	IV			OLS		
	Empl.	Empl.	Empl.	Empl.	Empl.	Empl.
LEE	0.0629^a	0.0395^a		0.0278^a	0.0191^a	
	(0.00442)	(0.00557)		(0.00370)	(0.00330)	
LEE 1-lag		0.0360^a	0.0513^a		0.0150^a	0.0224^a
		(0.0055)	(0.0054)		(0.0027)	(0.0035)
Nr. obs.	236244	208631	208631	236244	208631	208631
R^2	0.92	0.93	0.93	0.92	0.93	0.93
Within R^2	-0.0003	-0.0003	-0.0003	0.0005	0.0006	0.0004
First stage F stat.	446.7	188.6	479.8	n.a.	n.a.	n.a.
# clusters	103	103	103	103	103	103
Firm-FE	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year FE	No	No	No	No	No	No
LMA-year FE	No	No	No	No	No	No
LMA-Sec.-year FE	Yes	Yes	Yes	Yes	Yes	Yes

^{c} $p < .10$, ^{b} $p < .05$, ^{a} $p < .01$. Standards errors are clustered on labour market areas (LMA).
LEE stands for Localized Export Exposure.

Lund Economic Studies

1. Guy Arvidsson   Bidrag till teorin för verkningarna av räntevariationer, 1962

2. Björn Thalberg   A Trade Cycle Analysis. Extensions of the Goodwin Model, 1966

3. Bengt Höglund   Modell och observationer. En studie av empirisk anknytning och aggregation för en linjär produktionsmodell, 1968

4. Alf Carling   Industrins struktur och konkurrensförhållanden, 1968

5. Tony Hagström   Kreditmarknadens struktur och funktionssätt, 1968

6. Göran Skogh   Straffrätt och samhällsekonomi, 1973

7. Ulf Jakobsson och Göran Norman   Inkomstbeskattningen i den ekonomiska politiken. En kvantitativ analys av systemet för personlig inkomstbeskattning 1952-71, 1974

8. Eskil Wadensjö   Immigration och samhällsekonomi. Immigrationens ekonomiska orsaker och effekter, 1973

9. Rögnvaldur Hannesson   Economics of Fisheries. Some Problems of Efficiency, 1974

10. Charles Stuart   Search and the Organization of Marketplaces, 1975

11. S Enone Metuge   An Input-Output Study of the Structure and Resource Use in the Cameroon Economy, 1976

12. Bengt Jönsson   Cost-Benefit Analysis in Public Health and Medical Care, 1976

13. Agneta Kruse och Ann-Charlotte Ståhlberg   Effekter av ATP - en samhällsekonomisk studie, 1977

14. Krister Hjalte   Sjörestaureringens ekonomi, 1977

15. Lars-Gunnar Svensson   Social Justice and Fair Distributions, 1977

16. Curt Wells   Optimal Fiscal and Monetary Policy - Experiments with an Econometric Model of Sweden, 1978

17. Karl Lidgren   Dryckesförpackningar och miljöpolitik - En studie av styrmedel, 1978

18. Mats Lundahl   Peasants and Poverty. A Study of Haiti, London, 1979

19. Inga Persson-Tanimura   Studier kring arbetsmarknad och information, 1980

20. Bengt Turner   Hyressättning på bostadsmarknaden - Från hyresreglering till bruksvärdesprövning, Stockholm 1979

21. Ingemar Hansson   Market Adjustment and Investment Determination. A Theoretical Analysis of the Firm and the Industry, Stockholm 1981

22. Daniel Boda Ndlela   Dualism in the Rhodesian Colonial Economy, 1981

23. Tom Alberts — Agrarian Reform and Rural Poverty: A Case Study of Peru, 1981

24. Björn Lindgren — Costs of Illness in Sweden 1964-75, 1981

25. Göte Hansson — Social Clauses and International Trade. An Economic Analysis of Labour Standards in Trade Policy, 1981

26. Noman Kanafani — Oil and Development. A Case Study of Iraq, 1982

27. Jan Ekberg — Inkomsteffekter av invandring, 1983

28. Stefan Hedlund — Crisis in Soviet Agriculture?, 1983

29. Ann-Marie Pålsson — Hushållen och kreditpolitiken. En studie av kreditrestriktioners effekt på hushållens konsumtion, sparande och konsumtionsmönster, 1983

30. Lennart Petersson — Svensk utrikeshandel, 1871-1980. En studie i den intraindustriella handelns framväxt, 1984

31. Bengt Assarsson — Inflation and Relative Prices in an Open Economy, 1984

32. Claudio Vedovato — Politics, Foreign Trade and Economic Development in the Dominican Republic, 1985

33. Knut Ödegaard — Cash Crop versus Food Crop Production in Tanzania: An Assessment of the Major Post-Colonial Trends, 1985

34. Vassilios Vlachos — Temporära lönesubventioner. En studie av ett arbetsmarknadspolitiskt medel, 1985

35. Stig Tegle — Part-Time Employment. An Economic Analysis of Weekly Working Hours in Sweden 1963-1982, 1985

36. Peter Stenkula — Tre studier över resursanvändningen i högskolan, 1985

37. Carl Hampus Lyttkens — Swedish Work Environment Policy. An Economic Analysis, 1985

38. Per-Olof Bjuggren — A Transaction Cost Approach to Vertical Integration: The Case of Swedish Pulp and Paper Industry, 1985

39. Jan Petersson — Erik Lindahl och Stockholmsskolans dynamiska metod, 1987

40. Yves Bourdet — International Integration, Market Structure and Prices. A Case Study of the West-European Passenger Car Industry, 1987

41. Krister Andersson and Erik Norrman — Capital Taxation and Neutrality. A study of tax wedges with special reference to Sweden, 1987

42. Tohmas Karlsson — A Macroeconomic Disequilibrium Model. An Econometric Study of the Swedish Business Sector 1970-84, 1987

43. Rosemary Vargas-Lundius — Peasants in Distress. Poverty and Unemployment in the Dominican Republic, 1989

44.	Lena Ekelund Axelson	Structural Changes in the Swedish Marketing of Vegetables, 1991
45.	Elias Kazarian	Finance and Economic Development: Islamic Banking in Egypt, 1991
46.	Anders Danielson	Public Sector Expansion and Economic Development. The Sources and Consequences of Development Finance in Jamaica 1962-84, 1991
47.	Johan Torstensson	Factor Endowments, Product Differentiation, and International Trade, 1992
48.	Tarmo Haavisto	Money and Economic Activity in Finland, 1866-1985, 1992
49.	Ulf Grönkvist	Economic Methodology. Patterns of Reasoning and the Structure of Theories, 1992
50.	Evelyne Hangali Maje	Monetization, Financial Development and the Demand for Money, 1992
51.	Michael Bergman	Essays on Economic Fluctuations, 1992
52.	Flora Mndeme Musonda	Development Strategy and Manufactured Exports in Tanzania, 1992
53.	Håkan J. Holm	Complexity in Economic Theory. An Automata Theoretical Approach, 1993
54.	Klas Fregert	Wage Contracts, Policy Regimes and Business Cycles. A Contractual History of Sweden 1908-90, 1994
55.	Per Frennberg	Essays on Stock Price Behaviour in Sweden, 1994
56.	Lisbeth Hellvin	Trade and Specialization in Asia, 1994
57.	Sören Höjgård	Long-term Unemployment in a Full Employment Economy, 1994
58.	Karolina Ekholm	Multinational Production and Trade in Technological Knowledge, 1995
59.	Fredrik Andersson	Essays in the Economics of Asymmetric Information, 1995
60.	Rikard Althin	Essays on the Measurement of Producer Performance, 1995
61.	Lars Nordén	Empirical Studies of the Market Microstructure on the Swedish Stock Exchange, 1996
62.	Kristian Bolin	An Economic Analysis of Marriage and Divorce, 1996
63.	Fredrik Sjöholm	R&D, International Spillovers and Productivity Growth, 1997
64.	Hossein Asgharian	Essays on Capital Structure, 1997
65.	Hans Falck	Aid and Economic Performance - The Case of Tanzania, 1997
66.	Bengt Liljas	The Demand for Health and the Contingent Valuation

Method, 1997

67. Lars Pålsson Syll   Utility Theory and Structural Analysis, 1997

68. Richard Henricsson   Time Varying Parameters in Exchange Rate Models, 1997

69. Peter Hördahl   Financial Volatility and Time-Varying Risk Premia, 1997

70. Lars Nilsson   Essays on North-South Trade, 1997

71. Fredrik Berggren   Essays on the Demand for Alcohol in Sweden - Review and Applied Demand Studies, 1998

72. Henrik Braconier   Essays on R&D, Technology and Growth, 1998

73. Jerker Lundbäck   Essays on Trade, Growth and Exchange Rates, 1998

74. Dan Anderberg   Essays on Pensions and Information, 1998

75. P. Göran T. Hägg   An Institutional Analysis of Insurance Regulation – The Case of Sweden, 1998

76. Hans-Peter Bermin   Essays on Lookback and Barrier Options - A Malliavin Calculus Approach, 1998

77. Kristian Nilsson   Essays on Exchange Rates, Exports and Growth in Developing Countries, 1998

78. Peter Jochumzen   Essays on Econometric Theory, 1998

79. Lars Behrenz   Essays on the Employment Service and Employers' Recruitment Behaviour, 1998

80. Paul Nystedt   Economic Aspects of Ageing, 1998

81. Rasha M. Torstensson   Empirical Studies in Trade, Integration and Growth, 1999

82. Mattias Ganslandt   Games and Markets – Essays on Communication, Coordination and Multi-Market Competition, 1999

83. Carl-Johan Belfrage   Essays on Interest Groups and Trade Policy, 1999

84. Dan-Olof Rooth   Refugee Immigrants in Sweden - Educational Investments and Labour Market Integration, 1999

85. Karin Olofsdotter   Market Structure and Integration: Essays on Trade, Specialisation and Foreign Direct Investment, 1999

86. Katarina Steen Carlsson   Equality of Access in Health Care, 1999

87. Peter Martinsson   Stated preference methods and empirical analyses of equity in health, 2000

88. Klas Bergenheim   Essays on Pharmaceutical R&D, 2000

89. Hanna Norberg   Empirical Essays on Regional Specialization and Trade in Sweden, 2000

90. Åsa Hansson   Limits of Tax Policy, 2000

91. Hans Byström   Essays on Financial Markets, 2000

92. Henrik Amilon	Essays on Financial Models, 2000	
93. Mattias Lundbäck	Asymmetric Information and The Production of Health, 2000	
94. Jesper Hansson	Macroeconometric Studies of Private Consumption, Government Debt and Real Exchange Rates, 2001	
95. Jonas Månsson	Essays on: Application of Cross Sectional Efficiency Analysis, 2001	
96. Mattias Persson	Portfolio Selection and the Analysis of Risk and Time Diversification, 2001	
97. Pontus Hansson	Economic Growth and Fiscal Policy, 2002	
98. Joakim Gullstrand	Splitting and Measuring Intra-Industry Trade, 2002	
99. Birger Nilsson	International Asset Pricing, Diversification and Links between National Stock Markets, 2002	
100. Andreas Graflund	Financial Applications of Markov Chain Monte Carlo Methods, 2002	
101. Therése Hindman Persson	Economic Analyses of Drinking Water and Sanitation in Developing Countries, 2002	
102. Göran Hjelm	Macroeconomic Studies on Fiscal Policy and Real Exchange Rates, 2002	
103. Klas Rikner	Sickness Insurance: Design and Behavior, 2002	
104. Thomas Ericson	Essays on the Acquisition of Skills in Teams, 2002	
105. Thomas Elger	Empirical Studies on the Demand for Monetary Services in the UK, 2002	
106. Helena Johansson	International Competition, Productivity and Regional Spillovers, 2003	
107. Fredrik Gallo	Explorations in the New Economic Geography, 2003	
108. Susanna Thede	Essays on Endogenous Trade Policies, 2003	
109. Fredrik CA Andersson	Interest Groups and Government Policy, A Political Economy Analysis, 2003	
110. Petter Lundborg	Risky Health Behaviour among Adolescents, 2003	
111. Martin W Johansson	Essays on Empirical Macroeconomics, 2003	
112. Joakim Ekstrand	Currency Markets - Equilibrium and Expectations, 2003	
113. Ingemar Bengtsson	Central bank power: a matter of coordination rather than money supply, 2003	
114. Lars Pira	Staples, Institutions and Growth: Competitiveness of Guatemalan Exports 1524-1945, 2003	
115. Andreas Bergh	Distributive Justice and the Welfare State, 2003	

116. Staffan Waldo	Efficiency in Education - A Multilevel Analysis, 2003
117. Mikael Stenkula	Essays on Network Effects and Money, 2004
118. Catharina Hjortsberg	Health care utilisation in a developing country -The case of Zambia, 2004
119. Henrik Degrér	Empirical Essays on Financial Economics, 2004
120. Mårten Wallette	Temporary Jobs in Sweden: Incidence, Exit, and On-the-Job Training, 2004
121. Tommy Andersson	Essays on Nonlinear Pricing and Welfare, 2004
122. Kristian Sundström	Moral Hazard and Insurance: Optimality, Risk and Preferences, 2004
123. Pär Torstensson	Essays on Bargaining and Social Choice, 2004
124. Frederik Lundtofte	Essays on Incomplete Information in Financial Markets, 2005
125. Kristian Jönsson	Essays on Fiscal Policy, Private Consumption and Non-Stationary Panel Data, 2005
126. Henrik Andersson	Willingness to Pay for a Reduction in Road Mortality Risk: Evidence from Sweden, 2005
127. Björn Ekman	Essays on International Health Economics: The Role of Health Insurance in Health Care Financing in Low- and Middle-Income Countries, 2005
128. Ulf G Erlandsson	Markov Regime Switching in Economic Time Series, 2005
129. Joakim Westerlund	Essays on Panel Cointegration, 2005
130. Lena Hiselius	External costs of transports imposed on neighbours and fellow road users, 2005
131. Ludvig Söderling	Essays on African Growth, Productivity, and Trade, 2005
132. Åsa Eriksson	Testing and Applying Cointegration Analysis in Macroeconomics, 2005
133. Fredrik Hansen	Explorations in Behavioral Economics: Realism, Ontology and Experiments, 2006
134. Fadi Zaher	Evaluating Asset-Pricing Models in International Financial Markets, 2006
135. Christoffer Bengtsson	Applications of Bayesian Econometrics to Financial Economics, 2006
136. Alfredo Schclarek Curutchet	Essays on Fiscal Policy, Public Debt and Financial Development, 2006
137. Fredrik Wilhelmsson	Trade, Competition and Productivity, 2006
138. Ola Jönsson	Option Pricing and Bayesian Learning, 2007

LUND UNIVERSITY