The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity: An Empirical Investigation*

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Abstract

Three potential consequences of trade liberalisation are often argued to take place: (1) an increase in aggregate productivity, (2) an expansion of the most productive firms and (3) an exit of the least productive firms. In recent years much research within trade has taken place on this phenomenon, mainly due to Melitz (2003). He designed a model in which intraindustry reallocation of production achieves these three results. This paper utilises a natural experiment to test this model as well as alternative models. The experiment in question is the construction of a bridge connecting Malmö in Sweden with Copenhagen in Denmark across the Öresund Strait (previously only connected through a ferry link). The paper finds evidence for an increase in aggregate productivity, an expansion of the most productive firms and an increased likelihood for the most productive firms to become exporters due to the increase in trade that took place after the bridge was opened. It fails to show evidence for an exit of the least productive firms as well as for alternative theories in the literature.

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1 Introduction

The effect of trade on aggregate productivity is central to trade theory. Without exaggeration, the common view among economists would probably be that trade openness has a positive effect on aggregate productivity. However, the empirical evidence on this has not been that clear in its prediction because of the difficulty in finding exogenous reductions in trade costs. Trade agreements and trade liberalisation policy are rarely determined in a way that is isolated from the nature of the industry in the countries in question. Pavcnik (2002) estimates the effect of trade liberalisation in Chile in the 1970s. However, domestic policy in Chile in those years can hardly be argued to have been of the kind that did not affect the nature of Chilean industry. Also, Loecker (2005), Aw, Chen, and Roberts (2001) and Clerides, Lach, and Tybout (1998) find similar results. Trefler (2004) estimates the effect of the Free Trade Agreement between the United States and Canada. However, it is difficult to claim that the decision process in setting sector specific tariffs was isolated from the the nature of these industries in the two countries at the time.

This paper revisits this issue by using a natural experiment in Scandinavia. The natural experiment is the construction of the Öresund bridge linking the Swedish city Malmö with the Danish capital Copenhagen. It is argued to be exogenous mainly due to the fact that its construction was decided six years prior to its construction and the fact that a bridge cannot (intentionally) favour certain sectors more than other, at least this can only be very weakly related to variables affecting productivity.

Theory offers different channels through which a reduction in trade costs can effect productivity levels. Classical theory such as that proposed by Ricardo, Heckscher and Ohlin and Dornbusch, Fischer, and Samuelson (1977) describe situations when comparative advantages or factor endowments differ. Sweden and Denmark, however, are very similar countries in this context so the trade can be assumed to be of an intraindustry kind instead. With great simplification, three effects are then highlighted in the literature: An increase in the productivity due to scale effects from a larger market (and in the case of the Öresund region, these could interact with agglomeration effects, see for example Krugman (1991) or Krugman and Venables (1995)), an increased concentration of production to the most productive firms (see Melitz (2003)) and finally existing firms become more productive due to reorganisation or learning effects (see Lileeva and Trefler (2004) and Bernard and Jensen (1999)).

This paper aims to provide estimates of the effect of a reduction in trade costs on the general productivity levels in two developed countries. It also aims at differentiating between the three different explanations of a productivity increase

described above. Since there is currently much discussion in the literature of Melitz (2003), this will be the main theory that I test. I will define the main predictions of Melitz (2003) as:

Due to an increase in intraindustry trade as a consequence of reduced trade costs

1. *average productivity in each industry affected will increase.*
2. *the correlation between output and productivity on the firm level in each industry affected will increase.*
3. *the number of firms in each industry affected will decrease.*

Section 2 gives a description of the region in which the bridge was built as well as the political process preceding the decision to build the bridge. I will discuss here the suitability of the Öresund bridge as a natural experiment. Section 3 describes the data that I use and section 4 analyses the heterogeneity and comparability of firms. Section 5 describes how the change in productivity can be decomposed. Then I examine the evolution of productivity in the region and compare it to relevant control groups in section 6. Section 7 concludes.

2 The Öresund bridge as a natural experiment

Empirical research on trade liberalisation policy often suffers from an endogeneity problem. The decision to reduce tariffs is likely to coincide with other industrial policy measures that have an effect on production choices and productivity. It is easy to imagine a country that, for example, pushes trade liberalisation while at the same time removing domestic regulatory barriers to productivity growth. Such a case would then estimate an effect that is too high since productivity increases because of other reasons than lower trade costs. This would be a major objection to the results in Pavcnik (2002) where a positive effect is found in Chile in the 1970s. Similar arguments, to a varying extent, could be made regarding Loecker (2005), Aw, Chen, and Roberts (2001) and Clerides, Lach, and Tybout (1998).

Also, tariff reduction policy is frequently effected by industry lobbying. See Grossman and Helpman (1994) for theory and Goldberg and Maggi (1999) for empirics. The size of a tariff cut in a specific sector is therefore very likely to be correlated with other characteristics that affect production and productivity. This would exaggerate the estimates for the effect of trade liberalisation on productivity. For example, a sector with no productive firms may lobby its government to retain tariff protection while a sector with some very productive firms may want the government to sign free trade treaties with countries to which these firms can succesfully export. Both of these problems would bias

the estimates upward. If tariffs are only reduced in the latter case, we would according to Melitz (2003) observe an expansion of these highly productive firms and an increase in the productivity in that sector. This would bias the estimates upwards. This is clearly a risk in Trefler (2004) where the Free Trade Agreement between Canada and the United States is examined.

The natural experiment in focus is the construction of the Öresund bridge. The Öresund bridge connects the Danish capital of Copenhagen with Sweden's third largest city of Malmö. These two cities are separated by the Öresund Strait which was previously only connected by large ferries and somewhat smaller but faster boats that only carried people. The region was, however, already before the bridge constructed well integrated due to free trade, common cultures, similar and mutually comprehensible languages and the fact that passing the border did not require a passport. The metropolitan population of Copenhagen was in 2006 1.1 million and that of Malmö 0.6 million. When counting the surrounding regions (see figure **??**) the total population was 3.6 million[1].

2.1 Possible criticisms

I will here list common criticisms against empirical work on trade liberalisation and relate it to the natural experiment in question.

2.1.1 The timing of the trade liberalisation is endogenous.

This bridge was a controversial subject in both Danish and Swedish politics. To trade theory, however, both the controversy and the final construction is very welcome. One of the main criticisms against much empirical work on trade liberalisation is that the timing of such policies is endogenous. Chile liberalised its trade levels at the same time as many other new industrial policies were implemented. The political decision on the bridge was taken in 1994 but due to public concern regarding environmental effects and the construction time itself, the bridge was only finally completed in 2000. Discussions about the bridge started already in 1991[2]. The reason why this long lag is useful for this paper is that politicians at the time in 1994 could have only a vague idea of what the business cycle would be in 2000, what other industrial policies would be implemented in 2000 and so on. I therefore claim the timing of the construction of the bridge to be exogenous.

2.1.2 Which sectors benefit from the bridge is endogenous.

It is often argued that trade policy is endogenous in the sense that which sectors experience a decrease in trade costs is related to current and future potential

[1] Orestat SCB.
[2] Öresundsbrokonsortiet.

of productivity in these sectors. Weak sectors might, for example, be protected when trade agreements are negotiated. In the case of the Öresund bridge, however, it is difficult to see how this could happen since it is difficult to design a bridge so that sectors are protected in a way that is related to variables affecting productivity. A lorry carrying goods from any industry is able to drive across the bridge. It is probably the case, however, that a bridge of this type favours certain sectors more than others. Some trade, for example, is simply transported through information technology communication and not subject to any change due to a bridge. Sectors whose goods are very costly to transport by sea but not by road might, however, be greatly effected. But since which sectors benefit from a bridge is largely exogenous, the productivity levels in those sectors at the time of construction can not be related to the bridge actually being constructed.

2.1.3 Future looking behaviour of firms

Possible criticisms specifically against the experiment used here could be that rational firms change their behaviour in advance since they are expecting the bridge to open in 2000. This might mean that I do not fully capture the true effect of the bridge by simply looking at levels before and after the experiment happened. This might be true in this case but it would, however, not be that problematic as long as the results are significant. This phenomenon would only make it more difficult to find significant results.

2.1.4 Changes in skill composition of the labour market

Another criticism is that labour markets in the region change. There is strong evidence of this (add reference!) mostly in the shape of skilled Swedish labour working in Copenhagen, somewhat draining firms in Malmö of skilled labour. Since I use Swedish data this factor would only make it more difficult for me to find significant results. If I find productivity to increase in Malmö due to an increased exposure to foreign competition and a larger market, this would happen despite the movement of skilled labour to Copenhagen.

2.2 The effect on traffic

The fact that the bridge was constructed is enough information for this analysis. If there is a sharp effect in Malmö in that specific year it lends support to Melitz (2003). However, I want to demonstrate that there has been an increase in traffic across the bridge. Figure 2 demonstrates the sharp increase since the construction of the bridge from a largely stable level. However, from this we do not know if this is only tourism or commuting (there is strong evidence of an increase in commuting in the region). But figure 3 shows that the proportion in "business", which includes transportation of goods, is relatively stable. Figure 4 shows the number of trucks crossing the bridge. Combined, these last two graphs show that there seems to have been an increase also in trade across the

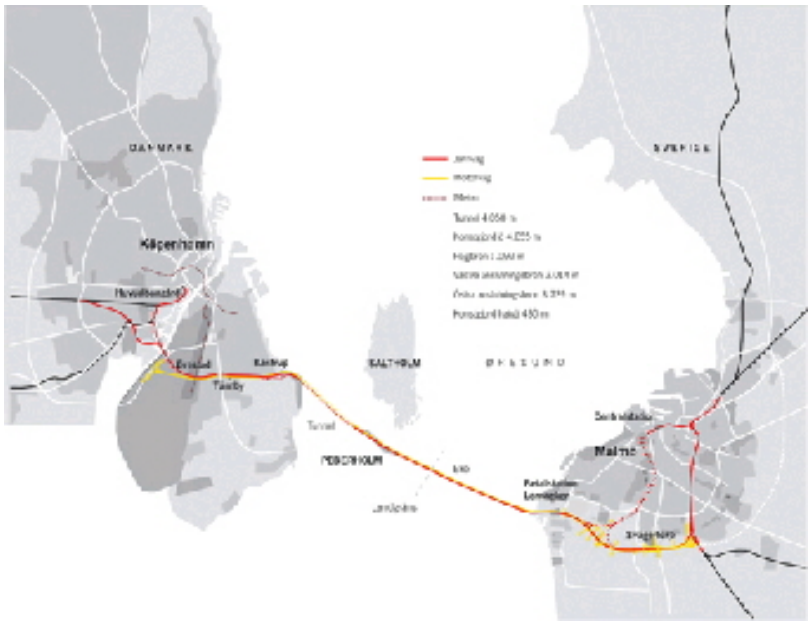

Figure 1: Map of the Öresund bridge. Source: Öresundsbrokonsortiet.

bridge. Since I do not know the destination of the goods being transported, it can of course be argued that the goods are destined further south in Europe or to large ports. But there is at least some indication that the bridge has had an effect on trade patterns.

3 Data

The data I will use is from the Swedish database "Företagsdatabasen" that contains information on all active Swedish firms during the time period 1996 to 2002.

4 Heterogeneity and comparability of firms

Generally, the data show that similar relationships as found in the literature for other countries (regarding the difference between exporters and nonexporters, export intensity and which industries export) hold also in Sweden.

There is clear evidence of heterogeneity among firms which is a key motivation for Melitz (2003). The standard deviation of the log of sales of manufacturing firms in Sweden is 2.24 which is slightly higher than estimated in the US and

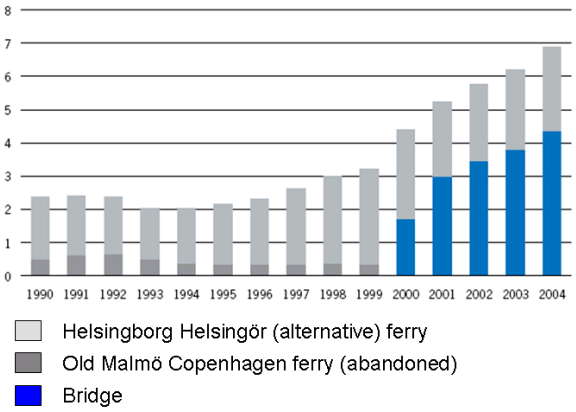

Figure 2: Millions of vehicles crossing the Öresund Strait per year. Source: Öresundsbrokonsortiet.

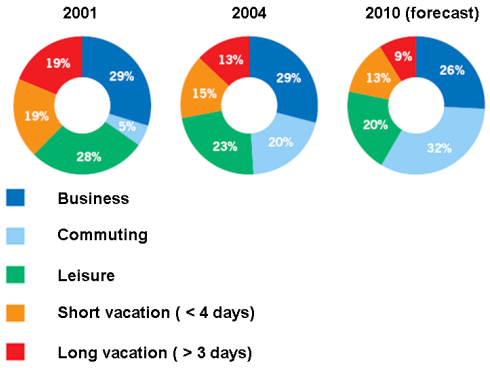

Figure 3: Car traffic across the bridge broken down by purpose. Source: Bridge Authorities.

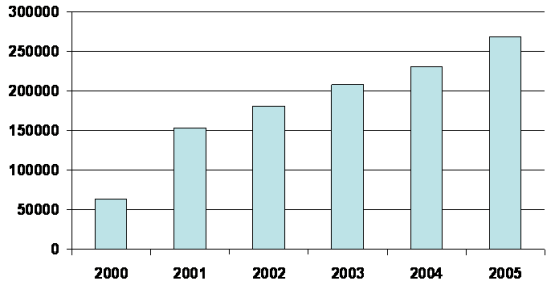

Figure 4: Number of trucks crossing the bridge per year. Source: Öresundsbrokonsortiet.

France. When only including variation within sectors, the variance is still as high as 2.18. In terms of productivity (the definition of productivity will be the total value added of production divided by the number of employees) there is also substantial variance. The variance of productivity among manufacturing firms of the log of productivity is 0.87 and when only using variation within sectors it is 0.86.

In terms of exports, only 10% of Swedish manufacturing firms exported in 2002 which seems slightly below levels found in the US and other European countries. Exporting intensity in sectors is typically very low as can be seen in figure 5[3]. Also, most exporters only export a small share of their output as can be seen in figure 6[4].

This knowledge creates a case for comparing exporters with nonexporters since they tend to operate within the same sectors and exporters tend to compete directly with nonexporters when serving the domestic market. Among manufacturing firms in 2002, I find that exporters are on average 4.2 times bigger than nonexporters. This is a very large difference, especially when compared to the finding by Bernard and Jensen (2001) who found a 40% difference in US data. In terms of productivity, exporters are on average 55% more productive than nonexporters. This can also be seen in more detail in figure 7 where I divide the productivity of each firm by the mean in its sector and compare nonexporters with exporters.

Finally, a common finding which Bernard and Jensen (2005) took as a sign for

[3] This could be due to the fact that some Swedish firms which produce goods for Swedish exporting companies are listed as nonexporters in the data since the buyer is still listed as a Swedish firm even though the goods sold are all exported in the end.

[4] In the case of Sweden, it could be that there are some large exporters that use smaller firms as suppliers. This would then mean that although the sales of these smaller suppliers are recorded as domestic sales, their final output is still exported. Fortunately, this does not affect my analysis.

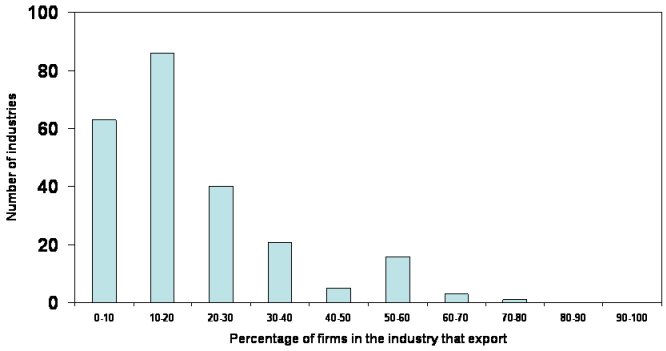

Figure 5: Export intensity in most industries is typically low.

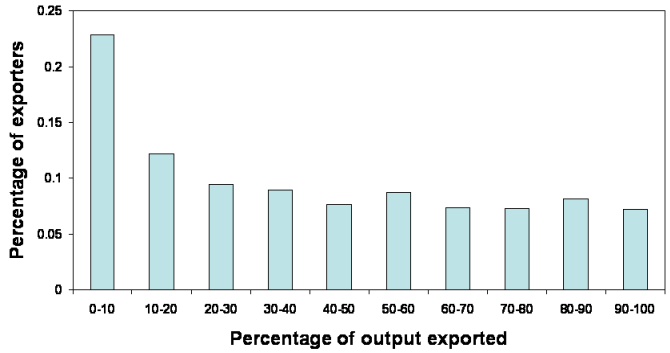

Figure 6: Exporting firms typically only export a smaller share of their output.

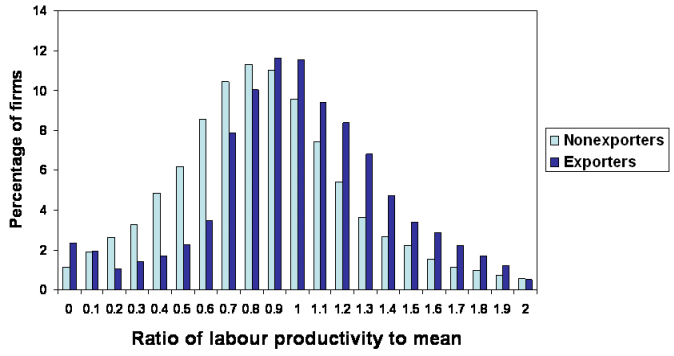

Figure 7: Distribution of relative productivity for exporters and nonexporters.

sunk costs involved in exporting, which is assumed by Melitz (2003), is that exporters have a lower probability of being shut down. Bernard and Jensen (2005) found in US data that after introducing controls that could explain a plant shutdown there is a 5% reduction in the probability of the plant being shut down if the plant is exporting. Although the Swedish data is at the firm and not the plant level, I find the same number of a 5% reduction in shutdown probability for exporters (my controls here are: 4digit sector dummies, geography dummies, log sales and log productivity).

These findings tell us that there are indeed clear signs of heterogeneity among Swedish firms, that exporters and nonexporters operate within the same sectors and that there is an indication of fixed costs involved in exporting.

5 Decomposing the change in productivity

An increase in firm size across the sector or an increase in the number of firms but with similar size would point at a productivity increase due to increasing returns to scale and agglomeration affects. A productivity increase due to the expansion of more productive firms and the contraction or exit of less productive firms would support the theory put forward by Melitz (2003). In order to differentiate between these measures I can decompose the change in productivity and see if it is a result of an increase in the concentration of production to the most productive firms.

The decomposition is done in the following way according to Olley and Pakes (1996). For a given sector and setting p_{st} as sector productivity at time t, p_{sit} as firms level productivity and s_{it} as the firm's share of output,

$$p_{st} = \sum_{i=1}^{N_t} s_{sit} p_{sit}$$

where N_t is the number of firms in the sector. Now I can decompose p_{st} in the following way:

$$\begin{aligned} p_{st} &= \sum_{i=1}^{N_t} \left(\overline{s}_{st} + \Delta s_{sit}\right)\left(\overline{p}_{st} + \Delta p_{sit}\right) = N_{st}\overline{s}_{st}\overline{p}_{st} + \sum_{i=1}^{N_{st}} \Delta s_{sit}\Delta p_{sit} = \\ &= \overline{p}_{st} + \sum_{i=1}^{N_{st}} \Delta s_{sit}\Delta p_{sit} \end{aligned}$$

where

$$\Delta z_{sit} = z_{sit} - \overline{z}_{st}$$

so $\overline{s}_{st}$ and $\overline{p}_{st}$ are the unweighted mean share and productivity, respectively. In this way I can decompose the change in productivity. I will denote

$$x_{slt} = \sum_{i=1}^{N_{slt}} \Delta s_{silt} \Delta p_{silt}$$

so that x_{slt} denotes the covariance between production and productivity in each sector and location and time.

I divide this covariance by the product of the standard deviations of the two variables and calculate the correlation instead. This variable will then be a measure of how concentrated production is to the most productive firms. Since it is one of the main predictions of Melitz (2003) I incorporate it into the analysis in the next section.

6 Results

6.1 Graphical analysis

In terms of which years to use as treatment and control, I choose to take out the year of 2000 from the analysis. This is since the bridge was constructed in the summer of that year and since I only have annual data it is impossible to decide whether it should be counted as treated or not. Since two years then remain (my data ends in 2002) I choose to compare the average of these two years with the averages of the two years preceding the construction of the bridge, 1998 and 1999. Two years ensure that I compare time frames which are short enough to be close around the construction of the bridge but still I use two different datapoints for each observation and therefore lower the risk of capturing annual fluctuations by a factor of two.

I use the Malmö city region as my "treatment" area since it is the closest geographic area to the bridgehead. In proportional terms, the largest decrease in trade costs should be for areas closest to the bridge. I want two kind of control groups, one that faces the same macroeconomic or national shocks as Malmö. For this one, I pick the two largest cities in Sweden: Gothenburg and Stockholm. Any national policy or national economic shock should theoretically affect Malmö, Gothenburg and Stockholm in the same direction. The other control group I want is one which can be expected to be hit by regional shocks similar to those that affect Malmö. However, if the area is too close to Malmö, it will also be affected by the bridge (this seems to be the case with Helsingborg). Instead I choose Halmstad which is the largest city north of Malmö but still not more than 140 kilometers away from it. Finding good micro controls is of course a very difficult task and all candidates can be questioned. So I view the comparison with the macro controls as the most important for the analysis.

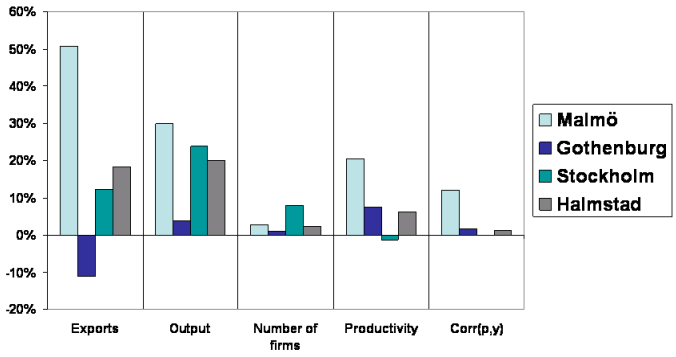

Figure 8: All sectors.

6.1.1 Did the bridge have an effect?

To examine whether there was an effect of the bridge on trading patterns, I examine the change in exports. Figure 8 reports the findings for all sectors in the economy, including the agriculture and service sectors as well as manufacturing (see list of sectors in the appendix). As can clearly be seen, Malmö has experienced a dramatic increase in exports compared to the other regions. It seems as if something has really changed the trading patterns comparing time before 2000 and after.

I also compare output to see if the increase in exports is due to an expansion of production in Malmö but contractions in the other locations. Here the results indicate that although production has expanded in Malmö sharper than other locations, it is not as far away from the levels in the control cities. So the increase in exports is sharper than the increase in output which indicate that the proportion of output that is exported has increased after the bridge was constructed.

6.1.2 The effect of the bridge on the variables of interest

As stated in section 1, there are three main predictions of the model in Melitz (2003) if trade costs have decreased: (1) aggregate productivity in each industry affected will increase, (2) the correlation between output and productivity on the firm level in each industry affected will increase and (3) the number of firms in each industry affected will decrease.

Figure 8 reports also the change in these three variables. First, aggregate productivity increases by a dramatic 21%, far more than in the other cities. Recall

that this is the increase in total value added per employee in the entire private economy. This is a very sharp result although the magnitude seems almost too high to be intuitive. The other cities follow productivity growth levels that are roughly in line with national GDP (add reference!). This strongly supports the hypothesis that increased trade increases aggregate productivity.

The change in the correlation between productivity and output is reported in the same figure. The analysis is done at the 4 digit level. Also this result is very sharp. In the control cities the level of concentration of production to the most productive firms stays about the same across the period but in Malmö there is a sharp jump. This result lends specific support to Melitz (2003) which argues that the productivity increase stems from an increase in the correlation between productivity and output.

Finally, the change in the number of firms indicates that Malmö is not different from the other cities. This is contrary to Melitz (2003) but it could be the case that a large rate of shutdowns of firms take some time to evolve. However, it rejects the "new economic geography" explanation of the productivity increase: namely that there is a high inflow of new firms to the area as a consequence of agglomeration forces and that scale effect and circular causality effects from these concentration of firms raises aggregate productivity.

It might be, however, that there is a simultaneous exit of the least productive firms while at the same time new firms relocate to Malmö or new firms are simply created in Malmö after the bridge wsa constructed. The total effect of these two changes would then be about zero.

However, since the dataset includes more years and data on each firm in Sweden I can also perform a regression analysis to see more clearly which firms start exporting and which firms raise output.

6.2 Regression framework

6.2.1 All sectors

In the regression analysis I will include all firms and all sectors (see list of sectors in the appendix) in Sweden and all years in the sample, 1996 to 2002. This widens the comparison compared to the previous section. First I examine whether there was a uniform increase in productivity across all firms in Malmö due to some unknown reason. I do this by a simple pooled OLS regression where I include two dummy variables: M_{it} which indicates that the firm is registered in Malmö and T_{it} which indicates that $t > 2000$.

$$p_{it} = \beta_0 + \beta_T T_{it} + \beta_M M_{it} + \beta_{int} T_i M_t + \Sigma_{i \in G} \gamma_{di} d_i + \varepsilon_{it} \qquad (1)$$

where p_{it} is the firm specific productivity level at time t. The d_i's are dummies which indicate which province (*län*) the firm operates in. The results are listed in Table 1.

The coefficient on the interaction variable is not significant which means that there is no evidence for a broad increase in productivity across firms. This fails to support the theory put forward by the "New economic geography" field as well as the field that argues that trade induces firms to reorganise and/or learn from trading partners.

However, it could be that productivity increases more in certain firms but not in others. The most likely firms to start exporting are the largest firms. I therefore run a second regression where I specifically test this with an interaction term:

$$\begin{aligned} p_{it} &= \beta_0 + \beta_T T_{it} + \beta_M M_{it} + \beta_{TM} T_{it} M_{it} + \beta_y y_{it} + \\ &+ \beta_{My} M_{it} y_{it} + \beta_{yT} y_{it} T_{it} + \beta_{MyT} M_{it} y_{it} T_{it} + \Sigma_{i \in G} \gamma_{di} d_i + \varepsilon_{it} \end{aligned} \tag{2}$$

where β_{MyT} is the coefficient of interest. If this is positive and significant, it would be the case that larger firms have increased their productivity after the bridge was built and more in the area close to the bridge than further away. Table 1 reports the findings and the regression fails to report a siginificant result. Then also here it seems as if learning by exporting does not take place.

Finally, I test for the main prediction of Melitz (2003), namely that the most productive firms expand following an increase in the exposure to trade. I run the following regression:

$$\begin{aligned} y_{it} &= \beta_0 + \beta_T T_{it} + \beta_M M_{it} + \beta_{TM} T_{it} M_{it} + \beta_p p_{it} + \\ &+ \beta_{Mp} M_{it} p_{it} + \beta_{pT} p_{it} T_{it} + \beta_{MpT} M_{it} p_{it} T_{it} + \Sigma_{i \in G} \gamma_{di} d_i + \varepsilon_{it}. \end{aligned} \tag{3}$$

A significant and positive coefficient on the interaction term, β_{MpT}, would mean that the more a productive a firm is, the more it has expanded in Malmö since the bridge was built compared to elsewhere in Sweden. Table 1 provides the result and the effect is significant and positive. It seems as if a firm is 1% more productive and it was located close to the bridge, it has expanded its production by 4.6% more than elsewhere in Sweden, which is rather large. This correlation between productivity and output causes aggregate productivity to increase. The results in Table 1 therefore support Melitz (2003) but not the other competing theories.

I can also test whether the bridge has prompted firms to become exporters to a larger degree than before. Melitz (2003) argues that more firms should export

than before and the firms that should start exporting are the ones that have the highest productivity. I therefore can run the same regressions as before but now as probit regressions with the probability of being an exporter, $\Pr(X = 1)$, as the explained variable:

$$\begin{aligned}\Pr(X &= 1) = \beta_0 + \beta_T T_{it} + \beta_M M_{it} + \beta_{int} T_i M_t + \\ &+ \Sigma_{i \in G} \gamma_{di} d_i + \varepsilon_{it}\end{aligned} \tag{4}$$

$$\begin{aligned}\Pr(X &= 1) = \beta_0 + \beta_T T_{it} + \beta_M M_{it} + \beta_{TM} T_{it} M_{it} + \beta_y y_{it} + \\ &+ \beta_{My} M_{it} y_{it} + \beta_{yT} y_{it} T_{it} + \beta_{Myt} M_{it} y_{it} T_{it} + \Sigma_{i \in G} \gamma_{di} d_i + \varepsilon_{it}\end{aligned} \tag{5}$$

$$\begin{aligned}\Pr(X &= 1) = \beta_0 + \beta_T T_{it} + \beta_M M_{it} + \beta_{TM} T_{it} M_{it} + \beta_p p_{it} + \\ &+ \beta_{Mp} M_{it} p_{it} + \beta_{pT} p_{it} T_{it} + \beta_{Mpt} M_{it} p_{it} T_{it} + \Sigma_{i \in G} \gamma_{di} d_i + \varepsilon_{it}.\end{aligned} \tag{6}$$

Table 1 reports the results. It seems that on average firms have become more likely to be exporters in Malmö after the bridge was built and in comparison to firms in the rest of the country. However, which firms that become exporters does not depend on size but productivity as can be seen in the table. It therefore seems as if the more productive a firm was the more likely it was to start exporting when trade costs fell. This also lends support to Melitz (2003).

Regression	1	2	3	4	5	6
	OLS	OLS	OLS	Probit	Probit	Probit
Explained variable	p_{it}	p_{it}	y_{it}	$\Pr(X=1)$	$\Pr(X=1)$	$\Pr(X=1)$
Malmö	0.031***	-0.190***		0.023**	0.135***	-0.379***
T	0.094***	0.015**	0.029	0.123***	0.371***	0.496***
Malmö*T	0.004	0.035	-0.296***	0.036**	-0.023	-0.357*
	[0.008]	[0.035]	[0.110]	[0.016]	[0.049]	[0.191]
y		0.211***			-0.348***	
Malmö*y		0.007***			-0.047***	
T*y		0.024***			-0.010**	
Malmö*y*T		-0.003			0.005	
		[0.004]			[0.008]	
p			1.011***			-0.117***
T*p			-0.005			-0.078***
Malmö*p			-0.043***			0.065***
Malmö*p*T			0.046**			0.061*
			[0.019]			[0.033]
Geography dummies	yes	yes	yes	yes	yes	yes
Number of observations	1217507	1217481	1217481	1975173	1974880	1217507
R^2	0.0334	0.2426	0.2192			

Table 1. Regression results for all sectors.

Standard errors in paranthesis. * significant at 10%; ** significant at 5% and *** significant at 1%. Note that the differences in sample size are due to missing or zero values for certain variables.

6.2.2 Manufacturing

The previous section analysed the full sample including all sectors. This section, however, restricts the sample to include only manufacturing sectors (which will in this paper not include energy). The graph depicting the changes is displayed in figure 9.

The results are very similar to those including all firms in the sample. Exports seem to have been sharply affected in Malmö, although manufacturing exports increased by "only" half of those when all sectors where included. Now the change in exports from Malmö is only marginally higher than the absolute value of the change in manufacturing exports from Gothenburg which makes it less clear that Malmö has experienced a shock larger than other more frequent ones. Still, the absolute value of the change in exports from Malmö is the largest in our analysis. Output moves less in Malmö than in Gothenburg or Halmstad.

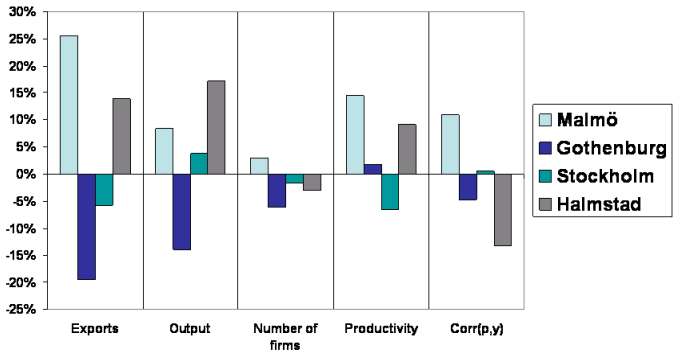

Figure 9: Only manufacturing sectors.

This is neither in conflict nor support for Melitz (2003) but simply tells us that no positive output shock or agglomeration process has started in Malmö.

The results for productivity, however, are again very striking. Compared to the large cities Gothenburg and Stockholm it is much larger. Compared to Halmstad, however, the difference is not as large but Halmstad's manufacturing sector is much smaller and therefore most likely also more volatile.

The most striking result, however, is that for the correlation between productivity and output where Malmö experiences a sharp increase while the other large cities are constant and Halmstad has a decrease.

The regression analysis is displayed in Table 2. The results are much the same in terms of coefficient sizes. However, the results in columns (3) and (6) show insignificant coefficients. The level though of the coefficients show an almost twice as large effect on the expansion in output from higher productivity as well as on the likelihood of being an exporter. However, since the standard errors are larger than in the full sample, the p value in column (3) is only 15% (check!), giving us only a very weak level of evidence.

Regression	1	2	3	4	5	6
	OLS	OLS	OLS	Probit	Probit	Probit
Explained variable	p_{it}	p_{it}	y_{it}	$\Pr(X=1)$	$\Pr(X=1)$	$\Pr(X=1)$
Malmö	-0.011	-0.174***	0.939***	-0.008	0.723***	0.722**
T	0.086***	0.050***	0.227***	0.103***	0.551***	0.596***
Malmö*T	-0.006	-0.062	-0.515	0.071	0.035	-0.49
	[0.020]	[0.083]	[0.398]	[0.045]	[0.118]	[0.569]
y		0.175***			0	
Malmö*y		0.002			-0.060***	
T*y		0.020***			-0.102***	
Malmö*y*T		0.007			-0.005	
		[0.009]			[0.016]	
p			1.409***			0.353***
T*p			-0.038***			-0.103***
Malmö*p			-0.168***			-0.147***
Malmö*p*T			0.088			0.09
			[0.067]			[0.094]
Geography dummies	yes	yes	yes	yes	yes	yes
Number of observations	166843	166842	166842	233287	233273	166843
R^2	0.0392	0.2746	0.2541			

Table 2. Regression results for the manufacturing sector.

Standard errors in paranthesis. * significant at 10%; ** significant at 5% and *** significant at 1%. Note that the differences in sample size are due to missing or zero values for certain variables.

7 Conclusion

The construction of the Öresund bridge connecting Malmö in Sweden and Copenhagen in Denmark has had a strong effect on trade as seen from the increase in exports from firms based in Malmö. Assuming that trade costs have in fact decreased, I also find strong support for two of the predictions by Melitz (2003): the increase in aggregate productivity and the increase in the correlation between productivity and output among firms. I do not find strong evidence for an exit of firms due to increased competition. I can also reject that an agglomeration process has started in the region with an inflow of firms. There is also no evidence that firms have experienced a productivity increase within the firms as a consequence of learning or reorganisation. The same analysis applied only on manufacturing firms generate similar results with higher values of the coefficients but they are insignificant.

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