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MAKRO

Supply effects in Danish exports?

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Resumé

In macroeconomic models, exports are typically described by demand-based Armington equations. Recent literature, however, has argued that supply effects should be added. In this working paper, we examine the extent to which such supply effects can be found in data for Danish exports.

Supply effects are expressed via an increase in the Danish production capacity which enables the scaling of total exports. Typically, one will think of supply effects as some which materializes on an extensive margin of foreign trade: Exporting new product types and / or to new markets (countries). The intensive margin, on the other hand, expresses changes in exports of existing product types and to existing countries, i.e. movements one would typically associate with demand effects. We use detailed trade data for the period 1995-2016 to first analyze the relative degree of explanation of the intensive and extensive margin in growth rates in total exports over different horizons. We find that growth in exports is primarily driven by the intensive margin in the short run, but that, in the long run, variations in the growth rate in exports is to a larger extent driven by the extensive margin. The full effect has occurred after five year, where the extensive margin explains 70% of the variation in the growth rate of exports.

We subsequently estimate the supply effect for Danish exports, i.e. the percentage change in export for a percentage change in e.g. private GVA, based on a set of Gravity equations. We use both the actual variables, their structural levels and instruments to remove business cycles and address obvious endogeneity problems. Our preferred estimate on the supply effect for private GVA indicates that the elasticity is not significantly different from 1 and that an error correction term of approximately 30% for supply effects seems to be consistent with data. Finally, we find that the extensive margin is highly significantly correlated with the structural levels in the supply variables, which we see as evidence that the supply variables create a scale effect via the extensive margin. We conclude that supply effects are significant in the description of Danish exports, especially in the long run, and should be included in the specification of exports in MAKRO.

1 Introduction

In macroeconomic models of a small open economy such as MAKRO, the specification of exports is important for the short run as well as long run dynamics of the model. For example, accurate predictions of reform effects or good long run projections requires that the specification of the export relation should express the same properties as observed in the data. In this note we examine whether there is empirical evidence to support a specification of the export relationship in MAKRO so that it - in addition to the relative prices and the level of foreign demand - contains supply effects which reflect the total production capacity in the Danish economy.

Several factors may be important for Danish exports. Take as an example the Danish exports off medical and pharmaceutical products to China: In 2007, Denmark exported for 867 million DKK of medical and pharmaceutical products to China. In 2019, 12 years later, exports of these products were 10.7 billion. DKK - more than 12 times the amount! There may be several different potential causes behind this explosive growth:

- a) A general increase in demand in China, or the demand may be higher for specific disease-fighting products such as against diabetes.
- b) Relative price declines in Danish medical products, which make Danish products more attractive.
- c) In industries such as the pharmaceutical industry, there is ongoing product development as a result of the highly skilled workforce or development of new highly productive production equipment. This creates new product types and opens new export markets.

Explanations a and b mean that Danish exports increase via the so-called intensive margin, i.e. an expansion of exports within existing product types to already established markets (countries). Typically, these will be referred to as demand effects, as they are included in a standard demand function. In CGE models, exports have typically been modeled via an Armington equation, i.e. with a focus solely on points a and b [Hilberry and Hummels, 2013]. Explanations such as those in c, on the other hand, will increase exports via the extensive margin, i.e. an expansion of exports through a new product type, to a new country or both. In the more recent theoretical literature, more emphasis has been put on ways to explain how growth in exports via the extensive margin is affected by the total production capacity of the economy. Typically, one will label these as supply effects, and they will for example manifest themselves through an increase in the labor force or structural employment [Krugman, 1980] or from increased productivity [Melitz, 2003]. In [Krugman, 1980] for example, a larger workforce will make it possible to produce more types of differentiated products, some of which will subsequently be exported due to a *love of variety*. These mechanisms are sometimes referred to as scale effects.

Supply effects are included in CGE models less frequently, but can be shown to have a number of desirable properties for the model's long run dynamics, e.g. that real wages follow productivity in the long run [Stephensen and Deng, 2019].[1] In addition, it allows the model to adjust to policy shocks such as labor market reforms via channels other than just the demand-related ones (i.e. via lower wages and prices). Finally, mechanisms associated with the aggregate supply help explain why large economies generally have larger exports ([Hummels and Klenow, 2005]) and that fast

[1] If only the demand effects are included in MAKRO, then real wages will not follow the productivity level in the long run, which is in contrast to what is observed in the data.

growing economies can also have fast growing exports without the need for a depreciation of the real exchange rate ([Gagnon, 2007]).

The main purpose of this paper is to uncover whether there is evidence of such supply effects in Danish exports. The paper first contains a review of previous relevant studies. Subsequently, we conduct an empirical analysis where the primary focus is to investigate long run scale effects as well as the rate of adjustment to these. Regarding the existing empirical literature, we conclude the following regarding the consensus: The intensive margin is the most important in the short run, especially during business cycles such as the financial crisis in 2008 (e.g. [Abreha et al., 2020] on Danish data and [Behrens et al., 2013] on foreign data). On the contrary, the extensive margin has limited effect in the short run, but plays an important role in the long run. A large number of studies conclude that long run, structural fluctuations in exports are largely explained by the extensive margin [Bernard et al., 2009, Kehoe and Ruhl, 2013]. To our knowledge, the rate of adjustment to supply effects in exports has not been previously examined. The export relations in the Danish macroeconomic models (MONA, ADAM, SMEC and DREAM) can generally be described as Armington equations, i.e. reflecting solely demand effects (resp. Danmarks Nationalbank, 2003; Statistics Denmark, 2012; Grinderslev and Smidt, 2007; Andersen, 2008). More recently, the export relation in ADAM has been extended to allow for supply effects ([Temere and Kristensen, 2016, Temere and Kristensen, 2017]), where the rate of adjustment to supply shocks is assumed to be identical to the rate of adjustment by demand shocks.

In our empirical analysis, we first decompose exports into an intensive and an extensive margin. The purpose of this is to illustrate whether there are indications of supply effects in Danish exports. We apply data from the international trade database BACI, which contains bilateral trade data for the period 1995-2016, containing more than 4,200 product types and over 200 importing countries. We find that long run variations in the growth rate of exports are best described by the extensive margin. In the short run, the intensive margin explains 70% of the variation in growth rates in exports, but in the long run (i.e. after five years) the extensive margin is the most important factor for explaining fluctuations in the growth rate of exports. This indicates that the intensive margin primarily drives short run fluctuations in exports and the extensive the long run. We then try to identify whether this scale effect on the extensive margin may be driven by changes in supply variables (private GVA, private employment, as well as private labor productivity). We find that the intensive margin is primarily correlated with the cyclical component in the variables, but to a very small extent the structural part. Vice versa, the extensive margin is uncorrelated with the cyclical component but strongly correlated with the structural part, especially in the long run. These results indicate that the supply side of the economy is likely to affect exports through changes in the extensive margin.

We then estimate the size of these potential supply effects in bilateral Danish exports via a panel data estimation. We use data for Denmark's 64 largest trading partners, which accounts for 97% of Danish manufacturing exports. This is done via a set of so-called Gravity equations that are frequently used for estimating export relations (see e.g. [Temere and Kristensen, 2016] and [Anderson and Wincoop, 2003] for a Danish and foreign example). In the estimation, we include the following variables: Foreign GDP, the real (effective) exchange rate and Danish private GVA. Danish GVA is included as a measure of the total Danish production capacity. Foreign GDP and the real exchange rates reflect typical demand effects in an Armington equation. Finally, fixed effects are allowed in the estimation, which may reflect specific relationships between Denmark and a given trading partner that is constant over time.[2] In different specications, we use the actual variables, their structural levels, as well as instruments for addressing obvious endogeneity problems in such an estimation and to remove the business cycle. As our main result, we find a long run supply elasticity for private GVA, which is close to and not significantly different from 1. This implies that exports in the long run increase 1-to-1 with Danish GVA, all other things being equal and indicates that such supply effects should be included in MAKRO's export relationship. The results are robust to alternative measures for foreign demand as well as relative prices. In addition, the supply effects are not significantly different, if the export elasticities from [Kronborg et al., 2020] are used as a measure of the price effect.

To test our hypothesis that the supply effect affect the extensive margin in Danish exports, we include the extensive margin as an explanatory variable in the Gravity equations. When controlling for the extensive margin in the regressions, the coefficient for Danish GVA becomes insignificant, which we see as an indication that the supply effect increases Danish exports via the extensive margin, consistent with first part of the analysis. The results are robust to alternative partitions of the intensive and extensive margin as well as the use of foreign imports rather than foreign GDP. We find also significant supply effects on exports when, instead of Danish GVA, private employment or labor productivity is included. We examine the rate of adjustment of exports to supply shock by estimating the Gravity equations in the form of an error correction, but where it is assumed that that only error correction is made for changes in the supply side. Here, we find an annual error correction of approximately 30 percent, which implies that 90 percent of the total effect has happened after approximately 7-8 years. The results indicate that the adjustment of exports to changes in the demand side is happening faster than to changes in the supply side of the economy.

The remaining paper is structured as follows: Section 2 describes the existing theoretical and empirical foundations in the literature for supply effects in exports, including the relative explanatory power of the intensive and extensive margin. Section 3 describes how trading can be decom-

[2]Constant factors are, for example, distance and common border [Anderson and Wincoop, 2003] or common language and bilateral trade agreements [Breinlich et al., 2020].

posed into an intensive and an extensive margin based on product data for the period 1995-2016. In addition to the relative importance of the two effects, the section provides an initial estimate of the rate of adjustment to the extensive margin. In Section 4, Gravity equations are estimated for Danish exports, which include both demand and supply effects. In section 5, we make robustness checks and section 6 concludes.

2 Existing literature on supply effects in exports

This section reviews the existing literature concerning supply effects in export. In section 2.1, we briefly go through some of the theoretical models for international trade. Section 2.2 reviews the empirical literature with a primary focus on recent research and we summarize the main results.

2.1 Theoretical literature

Traditional or classical trade models such as Ricardo and Heckscher-Ohlin focus on the comparative advantage of an economy as decisive for which goods a country exports. Comparative advantages arises via a country's productivity level in production, which is reflected in the relative prices. The Armington model ([Armington, 1969]) also includes relative prices, but international trade arises here as a result of an assumption of »love of variety«, so that imports from different countries are each other's imperfect substitutes. In the Armington model, which forms the basis of many macroeconomic models, a country's exports are thus determined based on export prices, relative to the relevant export-competing prices as well as a general demand component. In the classic trade models as well as in Armington, changes in exports thus reflect the intensive margin: For a given foreign demand, increased exports can only come via lower prices, which increases the demand for product types already exported. In a more recent branch of the theoretical trade literature called »The New Trade Theory« (e.g. [Krugman, 1979], [Krugman, 1980], [Helpman and Krugman, 1985]), the economy's own production capacity is emphasized in addition to consumers' preferences. As an example, [Krugman, 1980] shows that in a relatively simple model with returns to scale, it is the amount of labor available that determines how much a country exports, as a larger workforce enables the production of several different product types.[3] Thus, in this type of model, it is not only the demand side that affects exports via the intensive margin, but the labor force increasing exports via the extensive margin. The latest theoretical literature, called »The New New Trade Theory«.[4] [Melitz, 2003] and [Bernard et al., 2003] focus primarily on heterogeneity within firms that have different levels of productivity. By combining an assumption

[3] Since it is assumed that all firms produce one unique product, it can alternatively be interpreted as an increase in the number of firms.

[4] See [Melitz and Redding, 2015] for a comprehensive review of the literature.

of monopolistic competition and entry costs into the export market, this type of model implies that only firms with a sufficiently high level of productivity end up exporting. Hence, it will also be the case in this type of model, that an increase in the aggregate supply (in this case via higher productivity) will lead to higher exports, expressed via the extensive margin i.e. new businesses that chooses to enter the export markets.

2.2 Empirical literature

The empirical literature has partly dealt with the determination of the relative importance of the intensive and extensive margin in foreign trade at different horizons (section 2.2.1), and partly with estimating the size of supply effects on total exports, typically via so-called Gravity equations (section 2.2.2). A large part of the differences of the results across studies can be explained by the type of data used in the analysis. Roughly speaking, the studies can be divided into three types depending on whether they use aggregated, product or firm data, respectively. Aggregated data does not include a firm or product dimension, but still a country dimension. Product data also has a product dimension, which makes it possible to examine the significance of the development in the number of different exported product types (defined as the same HS6 category). Finally, in firm data there is a country-product-firm dimension, where one can also identify entry / exit of firms. Firm data (which has specified where the export goes to and which products) therefore fully captures the extensive margin of trade.

Based on the studies below, one can make the following general observations or "stylized facts":

- 1) The intensive margin constitutes by far the largest part of total exports and is in addition the primary explanatory factor behind short run growth in exports. Conversely, as longer horizons are considered, the extensive margin is increasingly important in explaining export market growth. Roughly speaking, the intensive margin determines exports at business cycle frequencies, while the extensive margin largely determines the long run or structural development in exports.

- 2) The importance of the extensive margin is higher in firm data than product data. It reflects the extra extensive margin in firm data (entry / exit of firms on markets and within product groups already exported to at the product level). Product data will therefore lead to an underestimation of the size of the actual extensive margin.

- 3) There is evidence for a long run supply effects of exports to changes in GDP in the region of 0.7-1.8. I.e. an 1% increase in GDP leads to a 0.7-1.8% increase in exports in the long run. The effect is rarely significantly different from 1.

2.2.1 The intensive vs. the extensive margin

[Hummels and Klenow, 2005] seek to explain why large countries export more than small ones and they argue that this is due to an extensive margin. The paper is the first to decompose exports into the intensive and the extensive margin on product data. They use data for over 50 countries to over 130 destinations in 1995 and shows that the extensive margin can explain 60% of why large countries export the most. In addition, they find that the number of workers is important to explain the extensive margin in particular, thus supporting the hypothesis that supply effects drive the extensive margin. The intensive margin is primarily driven by changes in the volume of exports and not so much to change in prices.

[Kehoe and Ruhl, 2013] use product data for the period 1995-2005 to examine the impact of trade reforms such as NAFTA. The extensive margin in NAFTA countries accounts for 10% of all export variation over the period 1995-2005 and 26%, if we look at trade between the US and countries such as China and South Korea. They argue that if structural reforms like NAFTA are disregarded, there is a limited correlation between the extensive margin and export growth. They vary the number of time periods and finds that the longer time periods used, the more important the extensive margin becomes. In particular, they argue that the extensive margin is primarily important for the long run and that business cycles fluctuations are less influential on the extensive margin of exports. This is consistent with a fixed entry cost, e.g. as contained in the Melitz model: If firms have already incurred an entry cost, they have to cope with negative profit for a period against being able to export again when the economy is booming.

[Bernard et al., 2009] is one of the first studies to use firm level data for the US and is cited often. They find that the variation in exports in the long run is mainly driven by the extensive margin, which describes 65% of the growth from 1993-2003, while the development in the short run is dominated by the intensive margin, which describes 105% (the extensive margin has a negative contribution of 5%) of growth in short run exports. They justify this by showing that relatively few new firms are established year-to-year. These new firms are growing faster than existing firms in the following years. Entry / exit of new firms accounts for 24% of the growth in exports and addition / drop of product types accounts for 42%. The main channel is thus changes in product types.

[De Lucio et al., 2011] use Spanish firm data from 1997-2007 to determine importance of the intensive and extensive margin. In the short run, the intensive margin accounts for on average 77% of growth in exports. 12% is extensive margin in number of firms and 11% is the combination of new product-countries pairs. When you look at the average over time instead, the case is different: From 1997-2002, the contribution of the extensive margin is 50%, 38% for 2002-2007, and 57% for overall 10-year period. They point out that, conditional on survival, exports are growing faster among new firms and new product-countries relationships compared to existing relationships. In contrast to [Bernard et al., 2009], they find that entry of new firms is the primary driver of the extensive margin and whereas diversification of firms in the product-countries dimension is of secondary importance.

[Fernandes et al., 2018] find that the extensive margin accounts for 50% of variations in exports. This study is the (to our knowledge) most detailed with data for 50 countries' exports at the firm level. They argue that the estimates are consistent with a Melitz model with log-normal technology and also show that the number of firms is proportional to the population. The latter speaks in favor of including labor as a proxy for the number of exporting firms, as is known from e.g. The Krugman model. There is no distinction in the paper between short and long run.

[Abreha et al., 2020] is the most detailed study of Danish data. They use Danish data at the firm level to, among other things, explain how the two margins contribute to growth in exports over the business cycle with a focus on the financial crisis. They find that the sharp fall during the financial crisis occurred on the intensive margin, while there was a limited effect on the extensive margin. The downturn was thus primarily driven by a decline in export value in relation to existing trading partners and within existing product groups. This finding is consistent with the results in [Behrens et al., 2013] which studies exports by Belgian firms.

2.2.2 Gravity equations

Gravity equations are one of the most widely used approaches when studying international trade and have been used since [Tinbergen, 1963]. In its simplest form, the equations describe exports as a function of GDP in the exporting country expressing production capacity, GDP abroad expressing demand from abroad and the distance between them. However, other factors are also frequently included, e.g. the real exchange rate [Gagnon, 2007], whether countries have a common border [Anderson and Wincoop, 2003] or speak the same language and enter into bilateral trade agreements [Breinlich et al., 2020]. This type of equation, despite its simple form, often has a explanatory power in bilateral trade data.

[Bayoumi, 1999] uses aggregated data on bilateral trade between 21 industrialized countries, i.e. 420 different trade relations. In a panel data estimation with data for the time period 1960-1992 he includes exporter GDP in the estimation. He finds a supply effect of 0.8 in the long run and that it is primarily when lags are included in the estimation that there is a positive long run effect. It therefore indicates that supply effects are primarily significant in the long run.

[Gagnon, 2007] uses aggregate data for US import growth from different countries for the period 1972-2000. The long run growth in imports (growth rate from 1972-2000) is highly correlated with the growth rate of GDP in the exporting country, which they conclude as being evidence for the Krugman model. The effect from GDP on exports is estimated to be 1.5-1.8, but not significantly different from 1.

[Temere and Kristensen, 2016] use aggregated data on Danish trade to different countries. They use a Gravity equation and include Danish GDP as a measure of a supply effect, which is estimated to be 0.7 in their preferred estimation with fixed effects, but the estimate is only marginally different from 1, statistically speaking. [Temere and Kristensen, 2017] argue that employment in efficient units - which follows GDP closely - can therefore be included when determining the long run export in a macroeconomic model.

3 Intensive and extensive margin in Danish exports: Some stylized facts

In this section we look at whether the extensive margin has a significant impact on Danish exports. We use the detailed data set from the BACI database, which contains data for Denmark's manufacturing exports divided into over 4,200 products (HS6-digit product category) and to over 200 different trading partners. With this data, it is possible to decompose Danish exports into an intensive and an extensive margin in the country and product dimension. The definitions of these are covered in Section 3.1. In Section 3.2, we examine the properties and the relative importance of the two margins for total exports for the period 1995-2016. Finally, in Section 3.3, we relate the two margins to one series of Danish actual and structural variables - GVA, employment and labor productivity - which may reflect the aggregate supply in the Danish economy. The purpose of this is to provide a first indication of whether the extensive margin is driven by the supply side.

3.1 Decomposing exports to its intensive and extensive margin

Let the variable X_{kjt} denote the value of export of product type k, to import country j, at time t. Total exports to a country can be written as exports aggregated by product types,$X_{jt} = \sum_k X_{kjt}$. Let K_{jt} be the set of all product types that Denmark exports to country j at time t, e.g. all product types in the manufacturing sector exported to Sweden. The total change in exports between year t and a given base year t_0 can thus be expressed as

$$\Delta X_{jt} = \sum_{k \in K_{jt}} X_{kjt} - \sum_{k \in K_{jt_0}} X_{kjt_0}.$$

The total amount of product types exported to country j in the two periods is given by the set $K_j \in K_{jt} \cup K_{jt_0}$. K_j can be divided into three groups: 1) Products that were traded between Denmark and country j in both periods, i.e. $K_{jt}^{IM} \in K_{jt} \cap K_{jt_0}$. 2) New products which have arisen between period t and t_0, i.e. $K_{jt}^{Entry} \in K_{jt} \setminus K_{jt_0}$. 3) Products which were exported in period t_0, but not in period t, i.e. $K_{jt}^{Exit} \in K_{jt_0} \setminus K_{jt}$.. The change in total exports can then be decomposed as follows:

$$\Delta X_{jt} = \sum_{k \in K_{jt}^{IM}} \Delta X_{kjt} + \sum_{k \in K_{jt}^{Entry}} X_{kjt} - \sum_{k \in K_{jt}^{Exit}} X_{kjt_0}. \tag{1}$$

The first part, $\sum_{k \in K_{jt}^{IM}} \Delta X_{kjt}$, is the change in the value of exports on the intensive margin, i.e. a change in the value of Danish exports to an existing trading partner within already existing product types. The extensive margin can, via the above definitions, be divided into product types that have entered a given market in period t as compared to the base year t_0 (»entry«) as well as product types that were exported to a given market in the base year, but not at time t (»exit«). The net effect on Danish exports from the extensive margin is obtained as $\sum_{k \in K_{jt}^{Entry}} X_{kjt} - \sum_{k \in K_{jt}^{Exit}} X_{kjt_0}$. The growth rate of total Danish exports can thus be expressed as

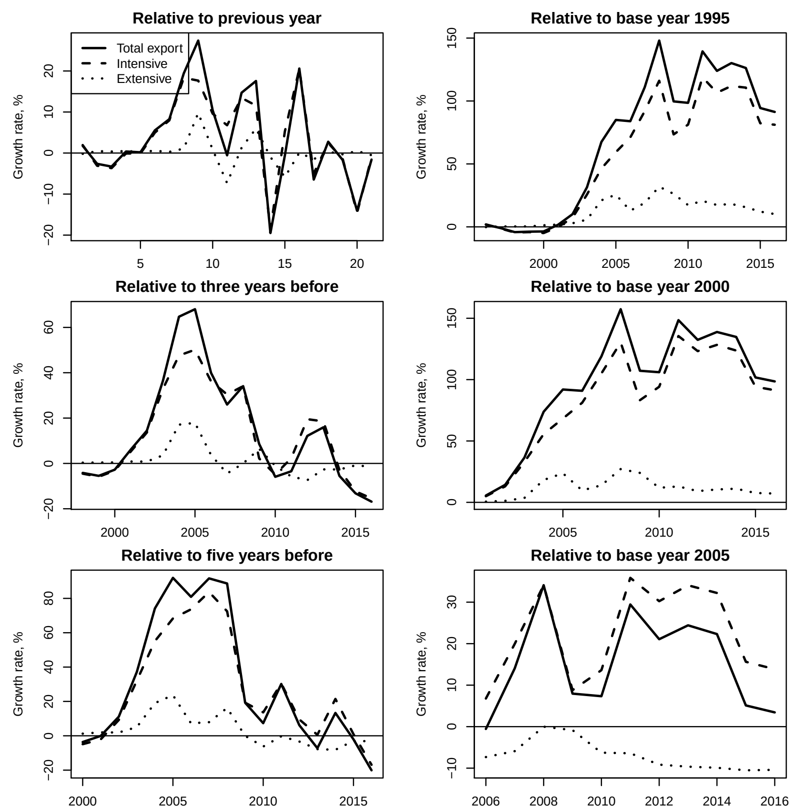
$$x_{jt} \equiv \frac{\Delta X_{jt}}{X_{jt_0}} = IM_{jt} + EM_{jt}, \tag{2}$$

where $IM_{jt} \equiv \sum_{k \in K_{jt}^{IM}} \Delta X_{kjt} / X_{jt_0}$ and $EM_{jt} \equiv \left(\sum_{k \in K_{jt}^{Entry}} X_{kjt} - \sum_{k \in K_{jt}^{Exit}} X_{kjt_0} \right) / X_{jt_0}$ constitute the contribution of the intensive and the extensive margin to export growth, respectively. Although we define the extensive margin for a given country j, the margin may still contain a product and country dimension. An extension of the extensive margin to country j can be expressed through the export of a new product type that is not exported to other countries. In that case, it is an extension along the product dimension. If instead the new exported product type is already exported to other countries, then it is instead an extension along the country dimension.

3.2 The intensive and extensive margin in Danish exports

By summing over j in equation (1) we can form growth in total exports (x_t), an intensive margin (IM_t) and an extensive margin (EM_t), aggregated across all j trading countries. This is analogous to a weighted average of equation (2), where $\frac{X_{jt_0}}{X_{t_0}}$ is used as weights. In this section we apply time series that are aggregated across countries, allowing for a simpler illustration (In the next section, where Gravity equations are estimated, data distributed among the j trading partners are used instead).

With the decomposition of exports in the previous subsection, the importance of the two margins can be determined on the basis of their relative degree of explanatory power on x_t . The left hand side of Figure 1 shows growth rates in total exports and the contribution of the two margins. The top graph shows the growth rates of one year, the middle growth rates of three years and the bottom growth rates of five years. For all horizons, the intensive margin is the primary determinant of growth rates in Danish exports, which is especially evident on one-year horizon.

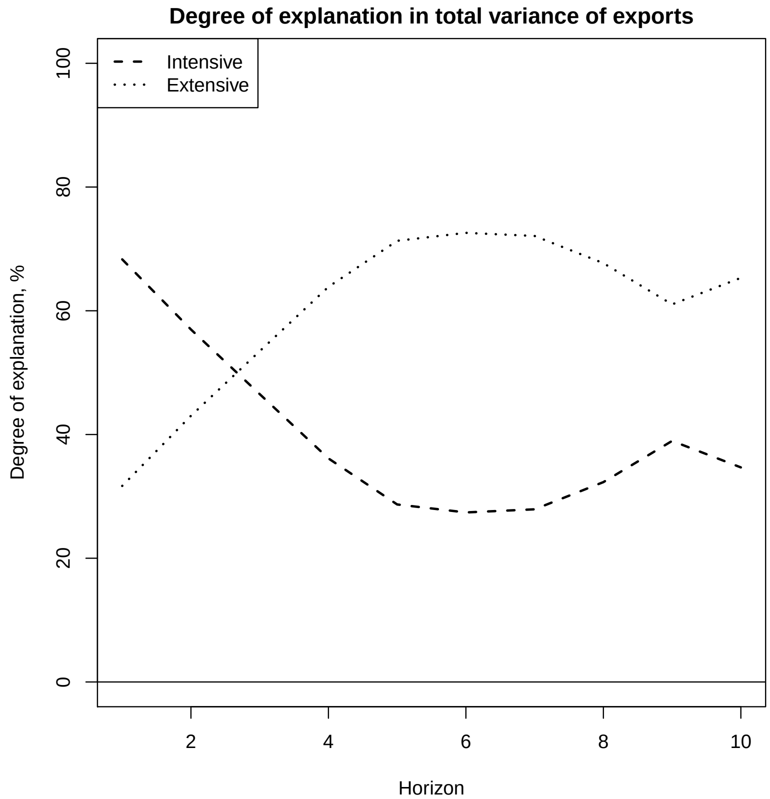


Figur 1: Growth rates in total exports (x_t) as well as the intensive (IM_t) and extensive (EM_t) margins. Growth rates are for a resp. one, three, and five year horizons as well as relative to a fixed base year.

As the horizon increases, so does the significance of the extensive margin. In addition, it can also be noted that most of the volatility in exports, e.g. during the financial crisis, is caught by the intensive margin. This indicates that the intensive margin is particularly important on the business cycle frequency (a result that is also found in, for example, [Abreha et al., 2020]).

The right side of Figure 1 shows growth rates relative to a fixed base year, which may illustrate the long run effects of the various margins. To test the sensitivity to the choice of base years, both 1995, 2000 and 2005 are used as base years in the three graphs. It can be seen in all three that in the short run, virtually all fluctuations in exports are driven by the intensive margin and that it only after a horizon of around five years that the extensive margin has a significant effect on total exports. The extensive margin is typically positive in the long run, i.e. entry into new product types and countries exceed the withdrawal of existing product types and countries. However, this does not apply in the period with 2005 as the base year, which shows that a number of products and countries have been lost during the financial crisis. This is is partly due to higher exit and partly lower entry after the financial crisis (not shown).

The degree of explanation of the two margins for variations in the growth rate of exports



Figur 2: Anova variance decomposition of growth rates in exports for different horizons, i.e. one-year, two-year, etc. growth rates.

can be illustrated by a variance decomposition. This is shown for different horizons, i.e. growth rates for one year, two years, etc. up to 10 years in Figure 2. For example, the figure expresses how much of the variation in the year-to-year growth rates at the one year horizon which can be explained by the intensive and extensive margin, respectively. On a one-year horizon, the intensive margin explains approximately 70% of all variation in the growth rate of exports and the extensive the remaining 30%. As the horizon increases, the importance of the extensive margin grows. At three-year growth rates, it is thus the extensive margin that is the primary explanatory factor of variations in exports. At five-year growth rates, the explanatory power has stabilized at around 70% for the extensive margin and 30% for the intensive margin. Variations in the extensive margin thus explain about 30% of the variation in the growth rate of total exports in the first year and 70% after five years where the effect is fully in place.

To summarize, the decomposition of exports in an intensive and an extensive margin indicates that the intensive margin is the primary determinant behind the growth in Danish exports, especially in the short run and during the business cycle. Variations in the growth rate, however, are primarily driven by the extensive margin in the long run, and the intensive in the short run. The full effect of the extensive margin occurs after five years.

Finally, it should be mentioned that the intensive margin - as defined above - could also contain an extensive margin effect. If e.g. an increased workforce leads to a higher number of firms (as in [Krugman, 1980] and found in [Fernandes et al., 2018], where the number of firms is proportional to the population), it might be that these firms export existing product types and to destinations already traded with by others. In our dataset, these firms' exports will count on the intensive margin, as entry / exit of firms in individual product groups is not taken into account in product data. Measuring the full effect of the extensive margin on exports will therefore require firm data. The consequence of using product data is therefore that the extensive margin is underestimated by definition and the results in this section should therefore be seen as a conservative assessment regarding the importance of the extensive margin.

3.3 The correlation of trade margins with Danish supply variables

The previous subsection gave a first impression of the relative importance of the intensive and extensive margin for growth rates in exports as well as the explanation for variations in growth rates for different horizons. However, models such as MAKRO do not include exports by country, nor exports divided into product types. For this reason, the intensive and extensive margin cannot be incorporated directly in the model. A procedure for including supply effects in MAKRO is therefore to use aggregate variables that are assumed to be the driving factors behind the extensive margin. This could be for example structural private employment, which is proportionate to the number of product types in [Krugman, 1980]. In the same way, an extension in e.g. private GVA could also interpreted as an extension in the number of firms, e.g. entry of new firms gradually as the workforce or productivity increases ([Melitz, 2003]).

The following is a first indication of whether private GVA, employment (measured in number employed) and labor productivity (LP) (hereinafter referred to as supply variables) drive the extensive margin. We exclude the public sector from the total GVA due to its limited export content. Since all three variables are cyclical, a trend-cycle decomposition of the series is done using an HP filter. The growth rate of the three variables as well as the associated decompositions are shown in Figure 3 in Appendix B. All three variables contain a significant cyclical component, especially during the financial crisis. The growth rate of structural employment has been declining over the period and even negative in the years following the financial crisis. GVA and LP develops in similar fashion but are not negative in the years around the financial crisis. Therefore, the strong variation in GVA and LP in the years around the financial crisis is captured of the cyclical component.

The cyclical part of the supply variables are clearly positively correlated with the intensive margin of exports (Figure 3 Appendix B). Conversely, it is difficult to see any correlation between the structural level of the supply variables and the intensive margin, contrary to the extensive margin. Whether this correlation is significant can be tested by calculating the correlation between the growth rates for different horizons, i.e. the series shown in Figure 1, and the corresponding horizons for growth rates in private GVA, employment and LP (Table 1). It can be seen that for one-year growth rates, the extensive margin tends to be correlated with the structural levels and the intensive margin with the cyclic part. This is in line with the discussion earlier that the intensive margin is primarily driven by business cycles. The effect however, is not statistically significant. The first time significant correlations are found is at five-year growth rates. Here, the extensive margin is significantly correlated at a 5% level with the structural level in GVA and employment at 10% significance level. In the very long term, i.e. 10 years, the extensive margin is strongly significantly correlated with both the total growth in GVA, employment and LP, but especially with the structural level of these variables. Here the correlation is significant at a 1% significance level, and even with correlations all the way up to resp. 0.86, 0.84, and 0.82. In summary, the table shows that the intensive margin is partly (but insignificantly) correlated with the cyclical components and insignificantly correlated with the structural levels. Conversely, the extensive margin is uncorrelated with the cyclical part but highly significantly correlated the structural level in the long run (5+ years). The scale effect created by the structural levels in the supply variables therefore appear to be greatest in the long run.

In Table 1 in Appendix A, the coefficients of an OLS regression of the supply variables are reported on the various margins, but now on country-level data, i.e. x_{jt}, IM_{jt} and EM_{jt}. [5] In addition, we also look at the subcomponents of the extensive margin, i.e. entry and exit in the same kind of regressions. To summarize, we therefore run e.g. this year's growth rates 45 different regressions (five different left-hand-side variables, the different margins, and nine different right-hand-side variables, the three supply variables in growth rate, structural and cycle). The parameter estimates must therefore be interpreted as a percentage change in the effect of supply variables on the various margins.[6] If the hypothesis that supply effects create an increase in exports via the extensive margin is consistent with the data, then one would expect that the parameter estimates on the extensive margin will be significantly positive, especially for the structural level. For one-year growth rates, it is confirmed that the intensive margin is primarily driven by the business cycle (and this time significantly, which is likely due to the increase in the number of observations in the disaggregated data). It is also confirmed that no significant effect is seen on the extensive margin of one-year growth rates in supply variables, except for a significant effect of cyclical fluctuations in GVA. This is primarily due to pro-cyclical entry, as the exit appears to be acyclical. This is in

[5] To achieve a balanced panel, we have restricted data to include only those countries that account for more than 0.1% of total Danish imports over the period. Despite the fact that this restriction means that we go from 234 to 64 countries in our data set, this still accounts for 97% of Danish exports.

[6] It should be noted here that where we in the aggregate variable thus had up to 21 variables, we now have up to 1344 variables, which will naturally minimize the standard errors and lead to more significant estimates.

Tabel 1: Correlations between selected supply variables' trend / cycle decomposition and decomposition of exports for different horizons of growth rates.

	Total			Structural			Cyclical		
	L	Y	LP	L	Y	LP	L	Y	LP
				One-year differences					
Export	0.25	0.22	-0.02	0.09	0.04	0.01	0.24	0.23	-0.02
Extensive	0.09	-0.09	-0.21	0.19	0.15	0.12	0.07	-0.15	-0.25
Intensive	0.25	0.28	0.05	0.04	0	-0.03	0.26	0.31	0.06
				Three-year differences					
Export	0.01	0.05	0.05	0.2	0.11	0.04	-0.04	-0.01	0.04
Extensive	-0.06	-0.02	0.05	0.38	0.31	0.24	-0.16	-0.21	-0.04
Intensive	0.03	0.06	0.05	0.12	0.04	-0.03	0	0.06	0.06
				Five-year differences					
Export	0.23	0.16	-0.04	0.31	0.2	0.1	0.15	0.07	-0.12
Extensive	0.35	0.35	0.09	0.56**	0.48*	0.4	0.19	0.11	-0.13
Intensive	0.18	0.1	-0.07	0.22	0.11	0.01	0.13	0.06	-0.11
				Ten-year differences					
Export	0.27	0.39	0.39	0.58**	0.54*	0.5*	-0.05	0.07	0.16
Extensive	0.56*	0.68**	0.59**	0.86***	0.84***	0.82***	0.14	0.26	0.19
Intensive	0.15	0.26	0.29	0.43	0.39	0.35	-0.11	0	0.14

*Note: *,**,*** refers to 10, 5 and 1 percent significance, respectively.*

line with studies of general entry / exit of firms in an economy during the business cycle, which typically finds pro-cyclicality of entry but no cyclicality of exit ([Tian, 2018]).

When we look at three-year growth rates, we see a significant effect of all three supply variables (and especially their structural levels) on the extensive margin, primarily driven by entry rather than exit. As we move to five and ten-year growth rates, the significance of the effect of the variables increases on the intensive margin as well. One possible explanation is that this is due to the entry of new firms in existing product types, which we will not be able to observe in product-level data. It is also conceivable that a larger workforce will enable higher production in the existing firms as well as productivity improvements that expand export opportunities. Alternatively, the significant effect is due to covariation of GDP growths across some of our greatest trading partners, so there is in fact an omitted variable bias. This is addressed in more detail in a Gravity equation in the next section, which includes foreign GDP and uses instruments. The results in this section have shown a clear correlation between the extensive margin and the supply variables, both in aggregate and country level data.

4 Supply effects in Danish exports: Estimates

The previous section has shown that the extensive margin plays a role in Danish exports and is correlated with a range of supply variables. In this section, the effect of the supply variables on exports is estimated. A Gravity equation, described in Section 4.1, is used to estimate the supply effect. In Section 4.2 the estimation results are presented. In Section 4.3, it is tested whether the supply effects will be expressed via the extensive margin.

4.1 Gravity equation

We set up the following Gravity equation, which allows for both demand and supply effects in Denmark's bilateral exports:

$$X_{jt} = \alpha_j + \gamma_1 RER_{jt} + \gamma_2 Y^F_{jt} + \beta_1 Y_t + \varepsilon_{jt}. \tag{3}$$

As above, X_{jt} is the value of Danish exports to land j at time t. Usually, there is also added distance to this equation, e.g. [Temere and Kristensen, 2016, Anderson and Wincoop, 2003][7]. Since the distance between two trading countries is constant over time, we obtain same by including fixed effects, α_j, in the regression. RER_{jt} is the real exchange rate (calculated on the basis of nominal exchange rates and GDP deflators) between Denmark and countries j and Y^F_{jt} is GDP in country

[7]Another obvious factor is trade agreements and common language, e.g. [Breinlich et al., 2020]. However, we are less interested in time-invariant factors and therefore check for these via fixed effects.

j.[8] Y_t is a Danish private GVA, which expresses the production capacity in the Danish economy and is intended to capture any supply effects. As a robustness check, we also examine whether exports show signs of supply effects, if employment, L_t , or labor productivity, LP_t , is included in equation (3). In the above Gravity equation, γ represents demand effects known from the Armington model and β represents possible supply effects.

There are two concrete challenges in estimating the Gravity equation above. Firstly, all supply variables contain a significant cyclical component, for example productivity is well known to be pro-cyclical. We can therefore not be sure that they express an actual effect on supply side, but may indirectly reflect cyclical changes in the aggregate demand. Another issue is reverse causality: Exports are included per construction in GVA, just as a large part of Danish employment is linked to exports. To address this, (3) is estimated either by the structural levels or with population size within the group of 15-64 year-olds as an instrument, analogous to [Gagnon, 2007]. This instrument is suitable as it is highly correlation with GVA but is not affected by exports, and at the same time it is acyclical.

The speed of adjustment can be studied in an error correction model, where the fitted residuals, ε_{jt}, are used in the error correction model to calculate the speed of adjustment. We refer to this rate as "Adjustment" in the tables in the next section. The challenge with this method, however, is that it is implicitly assumed that the speed of adjustment to the demand and supply variables are identical. The speed of adjustments to demand and supply variables respectively can be estimated by only including these in alternating fashion in the long run relationship. This implicitly assumes that exports only error correct to one type of variable. We refer to these rates as "Adjustment D" and "Adjustment S" (for demand and supply) in the next section. The procedure is described in detail in Appendix C.

A prerequisite for being able to identify the speed of adjustments in error correction models is that the time dimension is long enough for identifying variations in its deviation from the long run level or equilibrium. Our time dimension (21 time periods) seems short at first glance when looking at it in a time series context. However, since we use a panel data structure, we assess that we achieve sufficient variation along the country dimension (21 time periods and 64 countries) to be able to identify this moment. Figure 4 in Appendix C contains the time series for ε_{jt} in equation (3) for Denmark's 16 largest trading partners, which account for 73% of Danish manufacturing exports. It is seen that there is considerable variation for each country over time as well as across countries that reflect persistent deviations from the long run level, but that they also return to the long run equilibrium.

[8]Data on foreign variables are from the PWT database and restricted to contain only the 64 countries that make up more than 0.1% of Danish exports. This is 97% of all Danish exports and is therefore assumed to be representative of Danish manufacturing exports.

4.2 Results for Gravity Equations

The results of the Gravity equations with GVA as the supply variable are shown in Table 2. The table contains five different estimations: a pooled OLS regression (first column), a regression with fixed effects (second column), a regression with populations aged 15-64 as an instrument (third column), a regression with the structural levels of the supply variables (fourth column) and a regression in which population is used as an instrument for the structural levels (fifth column). The pooled OLS regression shows large scale effects and significantly different from those where fixed effects are included. This suggests that fixed effects, such as distance, are important factors. For this reason, fixed effects are included in the other types of estimations. We find that the supply (or scale) effect in the fixed effects regression is 0.77 and thus not far from the estimate of 0.7 in [Temere and Kristensen, 2016]. In the IV estimation we find a scale effect of 1.09 and thus greater than when no instruments are used (column 3). In column (4) we instead use the structural level and find a scale effect of 1.40 which drops to 1.05 when we use population as an instrument (column 5). We consider our results to be supportive of the notion that the business cycle pulls the estimate downwards, which is reflected in the difference between the actual and structural level (0.77 compared to 1.4). When further correct for the potential inverse causality by using instruments (which we expect to pull the estimate down) we obtain our preferred estimate of approximately 1, which lies in the middle of the former two. Gravity equations, where foreign imports are used instead of foreign GDP, also support this pattern (Appendix D). The supply effect with this demand variable is otherwise between 0.9-1 and not significantly different from the estimate, where foreign GDP is used as a measure of foreign demand. The degree of explanation is just below 0.7 and indicates that the estimated models have a relatively good fit to the data.

The estimates of the demand variables are in all cases of the expected sign and significant. The estimate of foreign GDP is between 1.2-1.4 across the different estimates. The facts that the coefficients of foreign GDP are estimated to be greater than 1 is likely to reflect that global trade has generally grown faster than total GDP during the estimation period. The estimate of the real exchange rate is negative and between -0.22 and -0.25, consistent with the fact that higher prices of Danish goods reduce exports, all else equal. In Appendix D, where foreign imports are used instead of foreign GDP, the coefficient on foreign demand is now around 1, which we interpret as consistent with an Armington model, where exports increase proportionally to demand from abroad.

The speed of adjustments are also shown in Table 2. Across the estimates, the rate of adjustment is between 0.32-0.41, assuming identical error correction for both types of variables. Seen separately, the speed of adjustment to the demand variables is consistently faster than that of the supply variables. This again indicates that supply effects are more sluggish and shows that different speed of adjustments may be necessary in models such as MAKRO. An speed of adjustment of 0.25-0.31

Tabel 2: Gravity equations.

	(1)	(2)	(3)	(4)	(5)
GDP^F	0.52***	1.42***	1.33***	1.24***	1.34***
RER	-0.66***	-0.22***	-0.23***	-0.25***	-0.23***
GVA^{DK}	2.76***	0.77***	1.09***		
GVA^{DK}_{struc}				1.4***	1.05***
$Adjustment$	-0.02***	-0.32***	-0.41***	-0.34***	-0.4***
$AdjustmentD$	-0.02***	-0.31***	-0.48***	-0.37***	-0.51***
$AdjustmentS$	-0.01**	-0.24***	-0.31***	-0.31***	-0.29***
Fixed effects		X	X	X	X
Instrument			X		X
Observations	1344	1344	1344	1344	1344
R^2	0.52	0.68	0.68	0.69	0.69
$HA :\neq 1$	5.34***	-1.34	0.31	2.01**	0.2

*Note: Adjustment refers to the speed of adjustments and is made in a separate estimation. Instrument is population size aged 15-64. HA:≠1 is the hypothesis of a scale effect different from 1. *, **, *** refers to 10, 5 and 1 percent significance, respectively.*

for shocks to GVA seems realistic (90% adjustment after about 7.5 years), whereas the speed of adjustment for demand shocks is in the range 0.3-0.5 (90 % adjustment after between 4.5 and 7.5 years).

Based on the theoretical literature including [Krugman, 1979] and [Melitz, 2003], one could consider using either employment and productivity as supply variables in addition to GVA, as it may give an indication of whether the supply effects found above are driven primarily by employment or productivity. If, on the other hand, there are significant supply effects for both employment and productivity, this suggests that the supply effect on GVA can be used in MAKRO, but as a scale effect reflecting productivity and employment, just as in [Temere and Kristensen, 2017]. Appendix D contains a table identical to Table 2, but where employment and productivity are used as supply variables, respectively. For the estimation with fixed effects, the supply effect for employment and productivity are 0.85 and 0.83, respectively, and thus not far from the 0.77 to BVT, nor significantly different. If a regression is performed with both supply variables included at the same time, more or less identical elasticities are obtained (results not shown here). At structural levels, however, the case is different: structural employment has a supply effect of around 5, regardless of whether an instrument is used or not. The supply effect for structural labor productivity is 1.8 and not significantly different from the supply effect for structural GVA. In a regression with both

Tabel 3: Gravity equations with an extensive margin

	GVA			Employment			Labor productivity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GDP_F	1.03***	0.9***	0.93***	0.96***	0.91***	0.93***	1.02***	0.88***	0.94***
RER	-0.13***	-0.15***	-0.14***	-0.13***	-0.15***	-0.14***	-0.13***	-0.15***	-0.14***
$Entry$	0.33***	0.31***	0.32***	0.32***	0.31***	0.32***	0.33***	0.31***	0.32***
$Exit$	-0.11***	-0.14***	-0.13***	-0.13***	-0.14***	-0.13***	-0.11***	-0.15***	-0.13***
GVA_{DK}	-0.48***	0.29							
GVA_{DK}^{struc}			0.07						
EMP_{DK}				-0.3	0.67				
EMP_{DK}^{struc}						0.34			
LP_{DK}							-0.57**	0.52	
LP_{DK}^{struc}									0.08
Fixed effects	X	X	X	X	X	X	X	X	X
Instrument		X			X			X	
Observations	1344	1344	1344	1344	1344	1344	1344	1344	1344
R^2	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
$HA :\neq 1$	-9.1***	-2.14**	-4.36***	-5.36***	-0.43	-0.96	-7.52***	-0.83	-3.17***

*Note: Adjustment refers to the speed of adjustments and is made in a separate estimation. Instrument is population size aged 15-64. HA:≠1 is the hypothesis of a scale effect different from 1. *, **, *** refers to 10, 5 and 1 percent significance, respectively.*

structural levels included, roughly the same supply effect is obtained for structural employment, but labor productivity becomes insignificant. When an instrument is used, the supply effect for labor productivity is 1.38 and not significantly different from 1. Based on the estimations, we can draw the following conclusion: When the actual variables are used, more or less identical supply effects are obtained as for GVA. At structural levels, approximately the same supply effects are obtained for productivity, but significantly higher for employment. [9]Overall, it can therefore not be concluded that supply effects in exports should originate from either employment or productivity separately, but rather that they work in conjunction via their effect on GVA.

4.3 Do supply effects lead to an extensive margin?

In Section 4.2, we have shown that Danish supply variables create a significant supply effect for Danish exports and that this rarely deviates significantly from 1. Our interpretation of this has so far been based on a hypothesis that a change in a Danish supply variable, e.g. . employment, scales up exports via an extensive margin, i.e. entry into new markets or via new product types. For this interpretation to be consistent with data, we would expect the estimate of the supply effects to become insignificant if a measure of the extensive margin is directly included as an explanatory variable in the Gravity equation (3). In Table 3, both entry and exit are added to the Gravity equation defined as in (3). The results show that when entry / exit is included in the equation, the positive and significant estimates of the supply effects disappear - they are now either insignificant or even negative. This is especially true for employment. The parameter estimates for entry and exit may seem small at first glance. However, this is by no means the case: Entry accounts for an average of 20% of total exports, but a 1% increase in entry leads to an increase in exports of 0.3% and thus greater than the share of entry. Exit accounts for an average of 10% of exports and an increase in exit is therefore largely proportional to the share in total exports.

We interpret these results as relatively strong evidence that supply variables create a scale effect, i.e. increases exports via an extensive margin, consistent with our interpretation from previous sections. Moreover, the extensive margin has a significant impact on exports, and even more so than what the margin's share of exports attributes.

4.4 Additional methodological considerations: Micro-data and macro estimates

The analysis of supply effects so far gives rise to three methodological considerations. The first two are regarding data and the last one is regarding the estimation. First, it is assumed that foreign GDP (or aggregate imports in the Appendix) is a good measure of the demand for Danish goods. However, this measure does not take into account that Danish exports may specialize in individual product groups where Denmark has a competitive advantage (e.g. exports of pigs to the United Kingdom or medical products to China). To investigate whether this has an impact on the previous conclusions, an alternative demand variable is used in the following. The variable reflects the composition of Danish exports across product groups, so that demand for product groups that

[9] One potential reason behind the high supply effects for employment may be that the HP-filtered series for structural employment is too sluggish as the variance of resp. structural GDP and productivity are 13 and 7 times as high as the variance on structural employment. If the parameter in the HP filter is set to 6.25 instead, the parameter estimate on structural BVT and labor productivity drops to resp. 0.88 and 1.08, which is not a significant drop (results not shown here). The supply effect for structural employment also decreases, but "only" to 3.48 and thus still significantly different from 1. In future work, it may be interesting to investigate in more detail what this high supply effect on structural employment is due to, e.g. by applying a different structural level.

Tabel 4: Gravity equations with alternative demand and price variables.

	Benchmark		Demand		Relative price		Demand and rel. price	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP_F	1.29***	1.31***			1.17***	1.19***		
M_F			0.53***	0.54***			0.36***	0.37***
RER	-0.4***	-0.4***	-0.27***	-0.26***				
P					1	1	1	1
GVA_{DK}	1.25***		0.7**		1.03		1.42*	
GVA_{DK}^{struc}		1.21***		0.66**		1		1.34*
Adjustment	-0.42***	-0.39***	-0.34***	-0.35***	-0.54***	-0.56***	-0.53***	-0.54***
Adjustment D	-0.47***	-0.54***	-0.35***	-0.38***	-0.56***	-0.63***	-0.53***	-0.58***
Adjustment S	-0.29***	-0.25***	-0.2***	-0.2***	-0.44***	-0.37***	-0.32***	-0.34***
Fixed effects	X	X	X	X	X	X	X	X
Instrument	X	X	X	X	X	X	X	X
Observations	987	987	987	987	987	987	987	987
R^2	0.72	0.73	0.77	0.77	0.76	0.76	0.76	0.76
$HA :\neq 1$	0.91	0.81	-1.07	-1.3	0.04	0	0.5	0.43

*Note: Adjustment refers to the speed of adjustments and is made in a separate estimation. Instrument is population size aged 15-64. HA:≠1 is the hypothesis of a scale effect different from 1. *, **, *** refers to 10, 5 and 1 percent significance, respectively.*

Danish exports are concentrated on is also given the highest weight. This alternative measure of demand abroad is given by $M_{jt} \equiv \sum_k x_{kj} log\left(M_{kjt}\right)$, where M_{jt} is a measure of the demand for Danish goods in country j, x_{kj} are Denmark's export weights of product k, and M_{kjt} are total imports in country j of product k across all trading partners.

Table 4 contains new estimates from the Gravity equation, where M_{jt} is included instead of foreign GDP. For reasons regarding data (explained below), however, we have restricted the set of countries to now include 47 countries compared to the 64 previously, which now explain 83% of Danish manufacturing exports rather than 97%. In the first two columns of Table 4, the supply effect is re-estimated for these 47 countries with the preferred specification with fixed effects and instruments (analogous to columns 3 and 5 in Table 2). The supply effect for private GVA and structural private GVA is now resp. 1.25 and 1.21 and not significantly different from 1.09 and 1.05 in Table 2 which shows that the conclusion about a supply effect not significantly different from 1 is robust to change in the number of countries . In columns 3 and 4 of Table 4, M_{jt} is used instead of foreign GDP. The supply effect now drops to 0.7 for GVA and 0.66 for structural GVA, but is still not significantly different from 1 and is significantly different from 0 at a 5% significance level.

We therefore assess that despite the fact that the alternative demand measures results in a lower point estimate for the supply effect, this is still not significantly different from 1 and thus does not alter the previous conclusions.

A similar data consideration applies to the measure for the relative prices, i.e. the real exchange rate. Here it is assumed that the Danish GDP deflator is a good measure of the Danish export price to country j and that the GDP deflator abroad is a good measure of the competing import price in country j. Therein implicitly lies a set of assumptions. First, it is assumed that a so-called "law of one price"[10] applies to Danish exports, implying that pricing-to-market does not take place.[11] Secondly, it is assumed that the composition of Danish exports is identical across trading partners. Third, it is assumed that the GDP deflator, which includes public consumption and "non-tradeables" (e.g. domestic service), has the same price development as exports of goods. To test whether these three assumptions have an impact on the supply effect, an alternative measure of the relative prices is defined, defined as$\sum_k x_{kj} log \left(P_{kjt}/P^F_{kjt} \right)$, where P_{kjt} indicates the price of Danish exports of product k to country j and P^F_{kjt} is the competing price in country j (the import price across all trading partners).

It is a well-known result that estimations of the export elasticity on aggregate data may give rise to an aggregation bias ([Imbs and Mejean, 2015, Imbs and Mejean, 2017] on foreign data). This applies if there is a systematic correlation between P_{kjt} and the associated elasticity at product level, σ_{kj}. In another working paper, we have shown that such an aggregation bias applies in the estimation of the Danish export elasticity in the manufacturing sector ([Kronborg et al., 2020]). The paper shows that the export elasticity at the single-digit SITC level is 3.48 but increases to 5.42 if a three-digit SITC level is used. These elasticities contrast to the parameter we find in the previous section at the real exchange rate of -0.23, corresponding to an export elasticity of 1.23. We think that this difference may be due to 1) choice of estimation method, where the method in [Kronborg et al., 2020] takes into account a potential identification problem that creates a downward bias in the estimate.[12] 2) a potential aggregation bias, which the use of disaggregated data can solve. 3) That the estimates in [Kronborg et al., 2020] are biased because a potential supply effect via GVA is not taken into account.

We find the first two explanations plausible and important to consider in the estimation of the Gravity equation above, although we find the latter point of less concern as the method used (based on [Feenstra, 1994]) control for effects that are constant across different countries, to which Denmark exports, which is precisely the description of e.g. Danish GVA (there is only variation

[10]By »Law of one price«, we in this case refer to the fact that the Danish export price is identical to all countries to which Denmark exports.

[11]Pricing-to-market applies in recent empirics in this field, e.g. [Berman et al., 2012].

[12]Without controllig for the supply side of the economy, the identified parameter is a mix of demand (negative slope) and supply curve (positive slope).

over time periods, but not over trading partners). In the estimation method, such effects are controlled for by estimating relative to an analogue country, e.g. exports to the United States. For this to be an issue regarding supply effects it would have to be the case that the supply effect of private GVA to Danish exports to e.g. Sweden differs from the supply effect of private GVA to Danish exports to the US. We do not find this particularly plausible, and it is at least not an issue that available data can shed light on, as firms' value-added and employment are not distributed across which countries exports go to. We will therefore argue that given the supply effect of private GVA is identical to exports to e.g. Sweden and the US (which we have assumed in the Gravity equation above), then the supply effect is sufficiently controlled for by using the method from [Feenstra, 1994]. We therefore consider estimates of the trade elasticities obtained from this method to be valid even in the presence of supply effects in exports.

In order to address the estimation problems mentioned above as well as the data problem regarding the real exchange rate, we use an alternative measure of the price effect in the following. We define this as $P_{jt} \equiv \sum_k x_{kj} \left(1 - \sigma_{kj}\right) log \left(P_{kjt}/P^F_{kjt}\right)$ and insert it into equation (3) instead of $\gamma_1 RER_{jt}$. As in the above, x_{kj} is the export weight of Danish exports of product k to country j, σ_{kj} is the estimated import elasticity in country j on product k[13], P_{kjt} is the Danish export price of product k to country j, and P^F_{kjt} is the competing price in country j, i.e. import price across all countries exporting product k to country j. In some cases, and primarily countries that are far from Denmark such as Canada, Mexico and countries Denmark trades with to a limited extent, there are large fluctuations in P_{jt} and thus a high variance, which adds a lot of noise to the estimation.[14] For this reason, we reduce the number of countries considered in this particular exercise from 64 to 47. Columns 5 and 6 in Table 4 contain the estimated Gravity equation, where we have included the new price expression, P_{jt}, instead, and used foreign GDP as a measure of foreign demand. Here, we find a supply effects very close to 1, but as P_{jt} is a volatile time series, the supply effect is no longer significantly different from 0. However, the point estimates remain very close to the estimates in Table 2. In the last two columns of Table 4 M_{jt} is now included instead of GDP, and we get supply effects of 1.42 and 1.34, respectively, both of which are significantly different from 0 at a 10% significance level. The speed of adjustment to the supply variable is faster when the new price variable is used compared to the real exchange rate used previously (around 0.3-0.4 instead of around 0.25-0.30 from the estimation with foreign GDP and the real exchange rate).

To summarize, we find that the estimated supply effect in the region of 1 also applies if an alternative expression of demand from abroad as well as the price effect is used. The speed of adjustment to supply effects across the various specifications is in the region of 0.2-0.4 and not

[13] We use the estimates from [Kronborg et al., 2020]. The import elasticities are used instead of export elasticities, see [Kronborg et al., 2020] for further discussion.

[14] By including the countries with a lot of noise we got i.a. an insignificant effect of foreign demand, contrary to all economic theory. However, the estimated supply effect was still positive.

significantly different from those in Table 2. The parameter estimates for foreign GDP are greater than 1 as expected, reflecting that international trade has grown faster than GDP in the time period used. Conversely, they are below 1 when M_{jt} is used as a foreign demand variable. This may be an indication that growth in exports is primarily driven by new countries entering the market.

5 Robustness

5.1 Alternative cutoff between intensive and extensive margin

In the division into an intensive and extensive margin, we have implicitly chosen a cutoff limit of 0 USD: As soon as one dollar of a product type has been traded in the base year, it counts towards the intensive margin. This binary division can be problematic as one dollar exported is almost nothing and an expansion in this product type must therefore be seen as an effect on the extensive margin, as it is practically an export in a new country / product relationship.

An alternative to our division used so far can be found in [Evenett and Venables, 2002], which defines a cutoff limit of 50,000 USD. If the export in a product in the base year is below 50,000 USD, then it is attributed to the extensive margin rather than the intensive margin.[15] In Figure 5 in Appendix E.1, the analogues shown to Figure 1 in Section 3.2, but where this 50,000 USD cutoff has been applied. It is seen that the intensive and extensive margin follow the same course, where the extensive margin is primarily significant in the long run, but now plays a marginally greater role in the short run. In addition, the growth rate relative to the base year in the extensive margin is higher than before, which must also apply per construction.

In Figure 6 in Appendix E.1 we use an anova variance decomposition, analogous to Figure 2 in Section 3.2. The degree of explanation of the extensive margin in one-year growth rates is now approx. 40% with the cutoff limit of 50,000 USD relative to 30% with the cutoff limit of 0 USD. In addition, the degree of explanation of the extensive margin is 80% after five years relative to 70%. However, it is still after five years that the effect has fully occurred and we therefore conclude that the softer cutoff limit does not significantly change our results, especially not in terms of the speed of adjustment.

So far, we have interpreted the extensive margin as an expression of supply effects for supply variables. In Appendix E.1, we analyze whether this also applies when the new cutoff limit is ap-

[15][Gagnon, 2007] instead uses a cutoff limit, where the 10% products with the lowest market share are considered to be on the extensive margin. They argue that this cutoff limit works better in studies comparing exports across countries of vastly different sizes, e.g. the US and Denmark. Since we only analyze Denmark's exports, we find this problem to be of a minor nature as it would be equivalent to setting the cutoff limit to the export value that the 10% percentile has in a given year.

plied. The extensive margin remains highly correlated with the structural levels of supply variables, and is now also significantly correlated with employment at three-year growth rates. We therefore consider the new cutoff limit to support our previous conclusions.

5.2 Lagged GVA variables

One problem with estimating adjustment in error correction models is that the error correction is exponentially decreasing and thus does not express whether the error correction is non-linear in growth rates. To address this, we have estimated the Gravity equations with GVA as supply variable lagged alternately in the interval one to five years in Table 11 in Appendix E.2. This regression can give an indication of which lag has the greatest effect on exports in period t. We find that the supply effect increases from 0.77, where GVA in period t is used as a supply variable, to 2.03 when GVA is used in period $t-3$. GVA in period $t-4$ has roughly the same effect as $t-3$, after which the supply effect in period $t-5$ decreases. In isolation, this indicates that the greatest effects of increased supply occur relatively quickly, after about 3-4 years. However, the regression should only be seen as an indication of the adjustment, as the high supply effects for lagged variables can be an expression of an omitted variable bias, e.g. via lagged variables of foreign GDP, potentially correlated with Danish GVA.

5.3 Different structural variables

Since the HP filter is a minimization problem, it can be difficult to solve this simultaneously with the minimization problem in MAKRO. For this reason, it is preferred due to modelling considerations that the filter used should be included as an equation equally with the other equations in MAKRO. In this section, we look at two of these types of filters. The first is a Hamilton filter and the second is a backward looking moving average. Table 12 i Appendix E.3 contains the estimation results, where the four different variables are used. The supply effect when using the Hamilton filter is 1.27 and 1.07 when instrument is also used. The supply effect for the moving average is 0.97 and 0.94 when an instrument is also used. The supply effects of the backward looking filters are therefore not significantly different from the supply effect of the HP filter and not significantly different from 1. Based on this, we therefore assess that a Hamilton-filtered GVA or moving average can be used in MAKRO to describe the supply effect.

6 Conclusion

In this paper, we analyze whether supply effects should be included in the specification of exports in MAKRO. Supply effects are assumed to scale up exports via. the extensive margin in Danish exports, which expresses exports of new products and / or to new countries. Conversely, the demand effects known from the Armington model lead to shifts in exports along an intensive margin, i.e. change in the export of existing products to existing markets (countries). We find that the intensive margin is the primary explanatory factor behind short run fluctuations in Danish exports, whereas the extensive margin is the primary factor in the long run and thus explains 70% of the variation in exports after five years. Our results are consistent with international empirical data and robust to alternative cutoff boundaries between intensive and extensive margins. We find that the intensive margin has the greatest correlation with the cyclical component of a number of supply variables, while the extensive margin has a significant positive correlation with the long run structural level of these variables.

Subsequently, we estimate the effect of Danish supply variables on Danish exports in a Gravity equation and find that Danish private GVA creates a supply effect of approximately 1. This means that a 1% change in private GVA entails a 1% change in Danish exports in the long run. The results are robust to the application of another measure of foreign demand as well as another measure of the real exchange rate. We also find indications that this scale effect works via the extensive margin, consistent with our assumption about the causality between supply effects and the extensive margin. We use an error correction model and estimate the speed of adjustment for supply shocks at 30% which is slower than the adjustment to demand shocks.

Overall, we see the results in this analysis as a fairly strong indication that supply effects play an important role for Danish exports. As a result, a measure of aggregate supply - for example, structural employment - should be included in the specification of exports in MAKRO.

Litteratur

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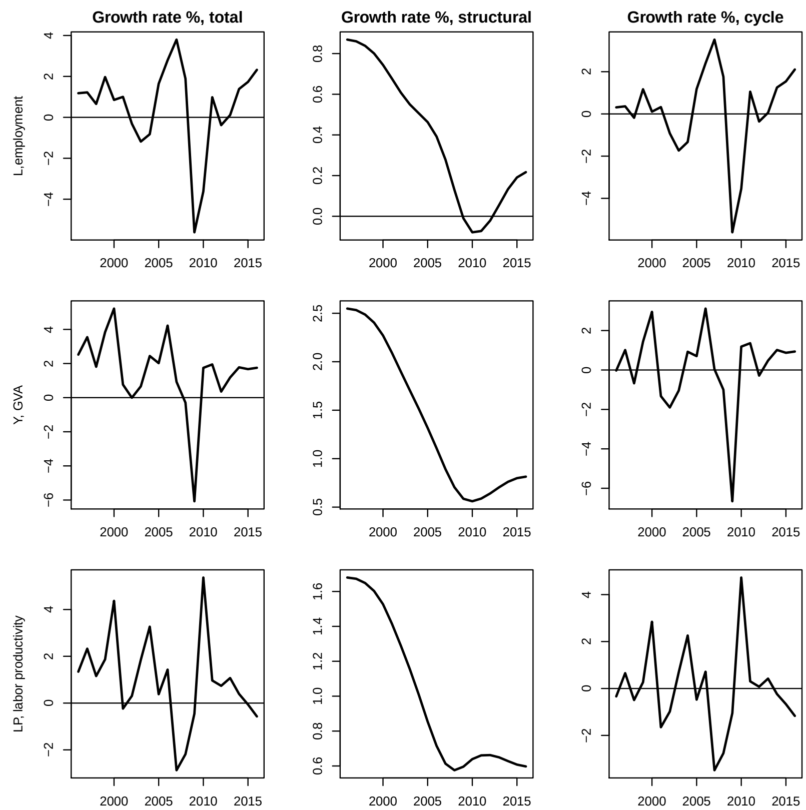
A An intensive and extensive margin at country level

Tabel 5: OLS regressions of the two margins on selected supply variables.

	Total			Structural			Cycle		
	L	Y	TFP	L	Y	TFP	L	Y	TFP
				One-year differences					
Export	1.31***	1.61***	1.63***	2.73	0.68	-0.62	1.34***	1.88***	1.68***
Intensive	1.24***	1.42***	1.44**	2.22	0.51	-2.88	1.27***	1.67***	1.49**
Extensive	0.07	0.19***	0.19	0.51	0.17	2.26	0.07	0.21***	0.19
Entry	0.04	0.12**	0.13	0.58	0.24	1.36	0.02	0.12*	0.13
Exit	-0.04	-0.07	-0.06	0.07	0.07	-0.9	-0.04	-0.1	-0.06
				Three-year differences					
Export	0.35	0.65**	3.26***	4.49***	1.06	-1.68	0.15	0.67	3.53***
Intensive	0.18	0.39	2.84***	3.43**	0.7	-4.61	0.02	0.38	3.12***
Extensive	0.16***	0.26***	0.42**	1.06***	0.36***	2.93**	0.13*	0.29***	0.41**
Entry	0.1	0.15***	0.23	0.82***	0.29**	1.75	0.06	0.13	0.22
Exit	-0.07	-0.12**	-0.2	-0.24	-0.08	-1.18	-0.07	-0.16**	-0.19
				Five-year differences					
Export	1.68***	1.16**	2.91**	7.59***	2.2***	2.57	1.18	1.06	3.3***
Intensive	1.33**	0.76*	2.18**	5.83***	1.51*	-3.38	0.97	0.63	2.63**
Extensive	0.34***	0.4***	0.73***	1.76***	0.69***	5.94***	0.21*	0.43***	0.67**
Entry	0.22**	0.3***	0.66**	1.48***	0.58***	4.74***	0.09	0.26**	0.62**
Exit	-0.12**	-0.1**	-0.07	-0.28*	-0.11	-1.2	-0.13*	-0.16**	-0.05
				Ten-year differences					
Export	3.21**	2.69***	15.8***	12.67***	5.37***	47.64***	-0.58	1.64	16.69***
Intensive	1.99	1.81**	12.21***	9.62***	4***	32.47**	-1.24	0.37	13.49***
Extensive	1.21***	0.88***	3.59***	3.06***	1.37***	15.16***	0.66	1.27***	3.19***
Entry	1.11***	0.79***	3.23***	2.83***	1.26***	13.96***	0.58	1.11***	2.83***
Exit	-0.11	-0.08	-0.36	-0.23	-0.1	-1.2	-0.08	-0.16	-0.36

*Note: Each individual parameter is from a separate OLS regression weighted with the individual countries' average share in total exports. *, **, *** refers to 10, 5 and 1 percent significance, respectively.*

B Supply variables



Figur 3: Growth rates in selected supply variables and trend / cycle decomposition.

C Estimation of speed of adjustment in Gravity equations

Equation (3) constitutes the long run relationship in an Engle-Granger two-step procedure and the long run elasticities are asymptotically identical to those that would typically be estimated in an error correction equation. For this reason, equation (3) is used to determine the long run elasticities of the demand and supply variables. The speed of adjustment, where both the demand and supply variables are included in the long run relationship reflect an assumption where the adjustment to the demand and supply variables is assumed to be identical. We call this adjustment »Adjustment« in the tables above. It is estimated from the equation:

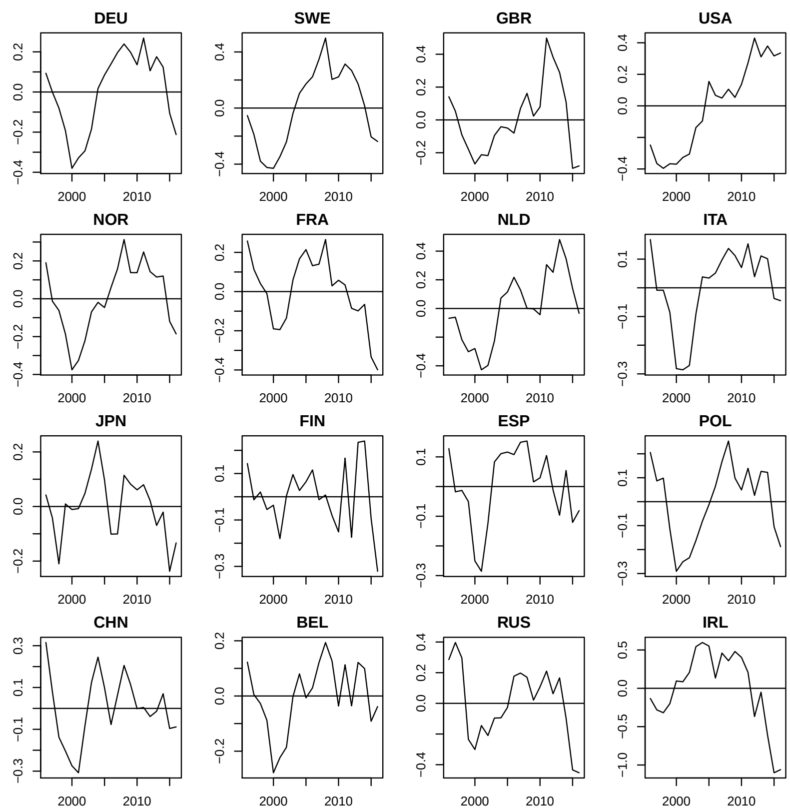
$$\Delta X_{jt} = \alpha\varepsilon_{jt-1} + \kappa_1 \Delta RER_{jt} + \kappa_2 \Delta Y_{jt}^F + \kappa_{:2} \Delta Y_{jt} + \eta_{jt}, \tag{4}$$

$$\varepsilon_{jt-1} \equiv \left(X_{jt-1} - \gamma_1 RER_{jt-1} - \gamma_2 Y_{jt-1}^F - \beta Y_{t-1}\right).$$

ε_{jt-1} indicates the deviation from the long run equilibrium. As above, X_{jt} is the value of

Danish exports to country j, RER_{jt} is the real exchange rate based on the countries' relative GDP deflators, Y_{jt}^F is foreign GDP, Y_t is Danish private GVA. α is the speed of adjustment, the γ coefficients are parameters of the demand variables, β is the supply effect and the κ parameters are short run elasticities.

α in the above equation is the speed of adjustment to the long run equilibrium, where the same speed of adjustment is assumed to apply to the demand and supply variables. To get an indication of whether the speed of adjustment is different for the two types of variables, two new estimations are tried, where $\varepsilon_{jt-1}^D = \left(X_{jt-1} - \gamma_1 RER_{jt-1} - \gamma_2 Y_{jt-1}^F\right)$ and $\varepsilon_{jt-1}^S = (X_{jt-1} - \beta Y_{t-1})$. The corresponding estimates of α are referred to as »Adjustment D« and »Adjustment S« and correspond to an assumption that ε_{jt-1}^D is only adjusting to demand variables and ε_{jt-1}^S only to supply variables.



Figur 4: Residual plot from Gravity equation with GVA as supply variable and fixed effects. 16 largest trading partners.

D Gravity equations

Tabel 6: Gravity equations with employment and productivity.

	Employment					Labor productivity				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GDP^F	0.53***	1.58***	1.41***	1.25***	1.3***	0.52***	1.48***	1.28***	1.27***	1.36***
RER	-0.67***	-0.21***	-0.25***	-0.27***	-0.26***	-0.66***	-0.21***	-0.23***	-0.24***	-0.23***
EMP^{DK}	5.01***	0.85***	2.88***							
EMP^{DK}_{struc}				5.09***	4.49***					
LP^{DK}						3.64***	0.83***	1.74***		
LP^{DK}_{struc}									1.8***	1.38***
$Adjustment$	-0.02***	-0.31***	-0.31***	-0.35***	-0.34***	-0.02***	-0.32***	-0.29***	-0.33***	-1.17**
$AdjustmentD$	-0.02***	-0.3***	-0.31***	-0.35***	-0.39***	-0.02***	-0.31***	-0.28***	-0.36***	0.51
$AdjustmentS$	-0.01**	-0.14***	-0.22***	-0.29***	-0.25***	-0.01**	-0.24***	-0.2***	-0.3***	-0.91**
Fixed effects		X	X	X	X		X	X	X	X
Instrument			X		X			X		X
Observations	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344
R^2	0.51	0.68	0.67	0.69	0.69	0.52	0.68	0.68	0.69	0.69
$HA :\neq 1$	4.84***	-0.53	2.45**	6.3***	3.04***	5.84***	-0.78	1.62	2.87***	1.06

Note: Adjustment refers to the speed of adjustment and is found in a separate estimation. Instrument is population size aged 15-64. HA: neq 1 is the hypothesis of a scale effect different from 1.

Tabel 7: Gravity equations with new demand variable.

	(1)	(2)	(3)	(4)	(5)
M^F	0.62***	0.95***	0.86***	0.85***	0.87***
RER	-0.73***	-0.02	-0.06	-0.06	-0.05
BVT^{DK}	1.51***	0.44**	0.95***		
BVT^{DK}_{struc}				1***	0.9***
$Adjustment$	-0.03***	-0.33***	-0.38***	-0.35***	-0.38***
$AdjustmentD$	-0.03***	-0.33***	-0.42***	-0.37***	-0.49***
$AdjustmentS$	-0.02***	-0.23***	-0.26***	-0.29***	-0.27***
Fixed effects		X	X	X	X
Instrument			X		X
Observations	1344	1344	1344	1344	1344
R^2	0.56	0.71	0.71	0.72	0.72
$HA :\neq 1$	1.58	-3.48***	-0.2	0.02	-0.39

Note: Adjustment refers to the speed of adjustment and is found in a separate estimation. Instrument is population size aged 15-64. HA: neq 1 is the hypothesis of a scale effect different from 1.

Tabel 8: Gravity equations with employment and productivity as well as new demand variable.

	Employment					Labor productivity				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
M^F	0.62***	1.01***	0.89***	0.86***	0.84***	0.62***	0.96***	0.84***	0.86***	0.88***
RER	-0.74***	0	-0.07	-0.08	-0.09	-0.74***	-0.01	-0.05	-0.05	-0.04
EMP^{DK}	2.75***	0.38	2.72***							
EMP^{DK}_{struc}				3.53***	3.97***					
LP^{DK}						1.96***	0.52**	1.46***		
LP^{DK}_{struc}									1.32***	1.17***
$Adjustment$	-0.03***	-0.32***	-0.33***	-0.35***	-0.36***	-0.03***	-0.33***	-0.32***	-0.34***	-0.89**
$AdjustmentD$	-0.02***	-0.32***	-0.34***	-0.36***	-0.39***	-0.03***	-0.32***	-0.32***	-0.36***	0.01
$AdjustmentS$	-0.02***	-0.14***	-0.2***	-0.27***	-0.24***	-0.02***	-0.23***	-0.2***	-0.28***	-0.89*
Fixed effects		X	X	X	X		X	X	X	X
Instrument			X		X			X		X
Observations	1344	1344	1344	1344	1344	1344	1344	1344	1344	1344
R^2	0.56	0.71	0.7	0.72	0.72	0.56	0.71	0.71	0.72	0.72
$HA :\neq 1$	2.2**	-2.25**	2.24**	4.02***	2.76***	2.18**	-2.3**	1.13	1.23	0.54

Note: Adjustment refers to the speed of adjustment and is found in a separate estimation. Instrument is population size aged 15-64. HA: neq 1 is the hypothesis of a scale effect different from 1.

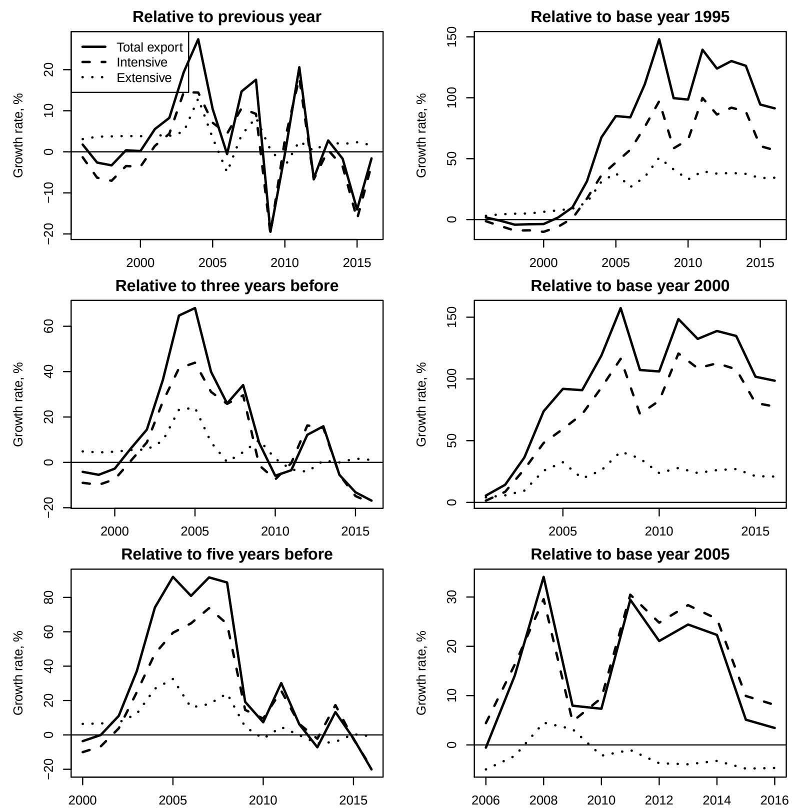
Tabel 9: Gravity equations with extensive margin and foreign imports.

	BVT			Employment			Labor productivity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
M_F	0.7***	0.61***	0.65***	0.66***	0.61***	0.66***	0.69***	0.6***	0.64***
RER	0.02	-0.02	0	0	-0.03	0	0.01	-0.02	-0.01
$Entry$	0.32***	0.29***	0.3***	0.3***	0.29***	0.3***	0.31***	0.29***	0.3***
$Exit$	-0.11***	-0.15***	-0.13***	-0.13***	-0.15***	-0.13***	-0.12***	-0.15***	-0.14***
BVT_{DK}	-0.63***	0.32							
BVT_{DK}^{struc}			-0.08						
EMP_{DK}				-0.53**	0.81				
EMP_{DK}^{struc}						-0.62			
LP_{DK}							-0.64***	0.53	
LP_{DK}^{struc}									-0.05
Fixed effects	X	X	X	X	X	X	X	X	X
Instrument		X			X			X	
Observations	1344	1344	1344	1344	1344	1344	1344	1344	1344
R^2	0.81	0.8	0.81	0.81	0.8	0.81	0.81	0.8	0.81
$HA :\neq 1$	-10.5***	-2.26**	-5.46***	-6.53***	-0.26	-2.42**	-8.29***	-0.94	-3.93***

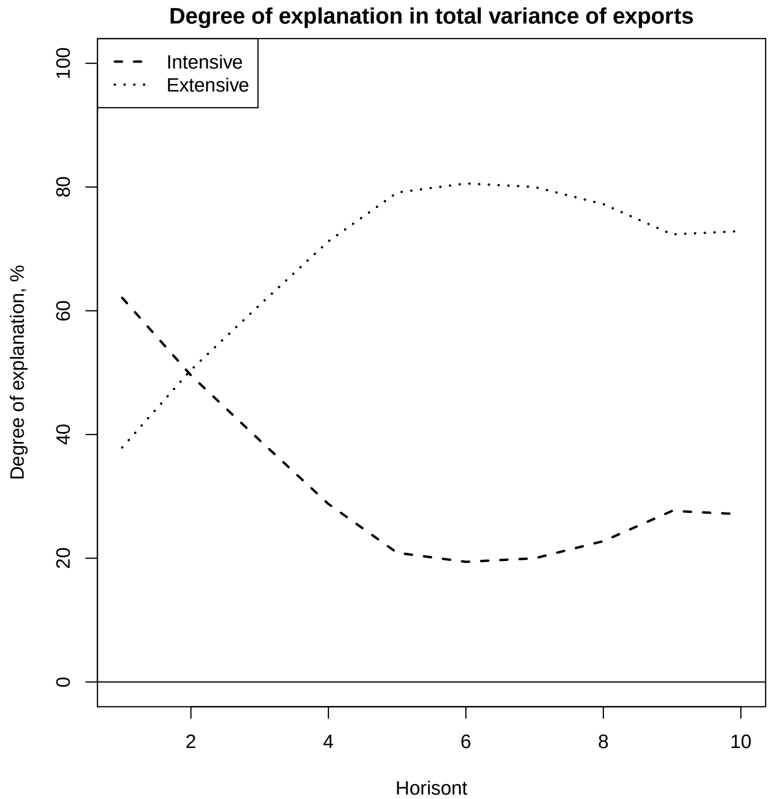
Note: Adjustment refers to the speed of adjustment and is found in a separate estimation. Instrument is population size aged 15-64. HA: neq 1 is the hypothesis of a scale effect different from 1.

E Robustness of results

E.1 Intensive and extensive margin with new cutoff



Figur 5: Intensive and extensive margin with new cutoff, growth rates.



Figur 6: Anova variance decomposition, intensive and extensive margin with new cutoff.

Tabel 10: Correlations with supply variables with new cutoff limit for intensive vs. extensive margin.

	Total			Structural			Cycle		
	L	Y	LP	L	Y	LP	L	Y	LP
				One-year differences					
Export	0.25	0.22	-0.02	0.09	0.04	0.01	0.24	0.23	-0.02
Extensive	0.13	0	-0.14	0.34	0.3	0.27	0.08	-0.11	-0.21
Intensive	0.25	0.26	0.03	-0.02	-0.06	-0.09	0.26	0.31	0.05
				Three-year differences					
Export	0.01	0.05	0.05	0.2	0.11	0.04	-0.04	-0.01	0.04
Extensive	-0.02	0.04	0.08	0.45*	0.37	0.3	-0.13	-0.17	-0.03
Intensive	0.02	0.04	0.03	0.08	0	-0.06	0	0.05	0.07
				Five-year differences					
Export	0.23	0.16	-0.04	0.31	0.2	0.1	0.15	0.07	-0.12
Extensive	0.36	0.37	0.1	0.58**	0.49**	0.4	0.2	0.13	-0.11
Intensive	0.17	0.07	-0.09	0.19	0.08	-0.02	0.12	0.04	-0.11
				Ten-year differences					
Export	0.27	0.39	0.39	0.58**	0.54*	0.5*	-0.05	0.07	0.16
Extensive	0.56*	0.68**	0.59**	0.86***	0.83***	0.81***	0.15	0.27	0.19
Intensive	0.1	0.22	0.26	0.4	0.35	0.31	-0.14	-0.03	0.13

*Note: *, **, *** refers to 10, 5 and 1 percent significance, respectively.*

E.2 Lagged GVA variables

Tabel 11: Gravity equations with lagged GVA.

	(1)	(2)	(3)	(4)	(5)	(6)
GDP^F	1.42***	1.34***	1.25***	1.08***	1.04***	1.02***
RER	-0.22***	-0.22***	-0.24***	-0.33***	-0.27***	-0.23***
BVT_t^{DK}	0.77***					
BVT_{t-1}^{DK}		1.23***				
BVT_{t-2}^{DK}			1.59***			
BVT_{t-3}^{DK}				2.03***		
BVT_{t-4}^{DK}					2.01***	
BVT_{t-5}^{DK}						1.74***
Fixed effects	X	X	X	X	X	X
Instrument						
Observations	1344	1280	1216	1152	1088	1024
R^2	0.68	0.69	0.69	0.69	0.67	0.63

*Note: *, **, *** refers to 10, 5 and 1 percent significance, respectively.*

E.3 Different structural variables

Tabel 12: Gravity equations with different types of filters.

	BVT		Hamilton		HP-filter		Rolling mean	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP_F	1.42***	1.33***	1.29***	1.35***	1.24***	1.34***	1.33***	1.34***
RER	-0.22***	-0.23***	-0.26***	-0.25***	-0.25***	-0.23***	-0.25***	-0.24***
BVT^{DK}	0.77***	1.08***						
$BVT^{DK}_{Hamilton}$			1.27***	1.07***				
BVT^{DK}_{HP}					1.4***	1.05***		
BVT^{DK}_{RMean}							0.97***	0.94***
$Adjustment$	-0.32***	-0.41***	-0.33***	-0.31***	-0.38***	-0.4***	-0.33***	-0.32***
$AdjustmentD$	-0.31***	-0.48***	-0.31***	-0.32***	-0.37***	-0.51***	-0.32***	-0.34***
$AdjustmentS$	-0.24***	-0.31***	-0.26***	-0.23***	-0.31***	-0.29***	-0.26***	-0.23***
Fixed effects	X	X	X	X	X	X	X	X
Instrument		X		X		X		X
Observations	1344	1344	1344	1344	1344	1344	1344	1344
R^2	0.68	0.68	0.69	0.69	0.69	0.69	0.69	0.69
$HA :\neq 1$	-1.34	0.3	1.48	0.26	2.01**	0.19	-0.19	-0.24

Note: Adjustment refers to the speed of adjustment and is found in a separate estimation. Instrument is population size aged 15-64. HA: neq 1 is the hypothesis of a scale effect different from 1.