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Economic Commentaries

How do global value chains impact the krona exchange rate's effect on exports?

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The exchange rate is important for small, trade-dependent economies like Sweden. For example, a weakening of the krona means that export companies' products become cheaper on the export markets. However, over the last thirty years, Swedish business has become increasingly integrated in global production networks. This means that Swedish exports have a large component of imported intermediate goods and consist of products and services that cross several international borders several times before reaching their final destinations. This may imply that changes in the exchange rate have a smaller impact on the volumes of Swedish exports. This economic commentary investigates how Sweden's participation in international production networks influences the effect of the exchange rate on export volumes among Swedish industries. The analysis suggests that widespread participation in global value chains dampens the effects of the exchange rate on exports. But this does not mean that the exchange rate has no significance for export volumes. Rather, it may be that the krona exchange rate would have to change somewhat more today to have the same impact on Swedish export volumes as before.

The Swedish krona has weakened by around 15 per cent in trade-weighted terms (KIX) since the start of 2014. As Sweden is a small, trade-dependent economy, changes in the exchange rate have relatively large effects on economic activity. According to textbook examples, a krona depreciation means that imported goods and services become more expensive than their domestic equivalents.[2] This leads to relatively higher demand for domestic goods and services, with the compound effect that inflationary pressures increase. A weakening of the krona exchange rate also strengthens demand for Swedish goods abroad and can thus be expected to lead to an increase in Swedish export volumes. Higher demand for Swedish products abroad in turn leads to rising incomes, consumption and inflationary pressures in Sweden.[3]

However, in recent years, there has been some discussion of whether exchange rates have been 'disconnected' from trade flows. This discussion took off when major depreciations of the exchange rates in the United Kingdom 2007–2009, Japan 2102–2014 and elsewhere were not followed by export increases.[4] There has also been some discussion in Sweden of the exchange rate impact on exports.[5] This discussion has primarily centred on Swedish export companies' participation in global value chains, as it means that Swedish exports include an increasing portion of imported goods and services. When export companies import a greater proportion of their intermediate goods, their costs will increase if the krona should weaken. This could lead to Swedish export volumes not increasing to the same extent as previously – or not at all.[6] At the same time, there are a number of other factors that also influence which effect the exchange rate has on exports in practice: including which currency exports are priced in (Boz et al. 2018) and how companies adjust their mark-ups to exchange rate changes (Amiti et al. 2014).

As the krona exchange rate and its impact on exports are a part of the monetary policy transmission mechanism, it is important to understand whether this relationship may have changed. This economic commentary therefore

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[2] See, for instance, Blanchard (2015).

[3] The krona exchange rate also effects inflation via several channels. See Hopkins et al. (2009).

[4] See, for example https://www.ft.com/content/b87a0e98-c426-11e4-9019-00144feab7de#axzz3z1gq0sVw. The International Monetary Fund (IMF) also included a chapter in its World Economic Outlook in 2015 that dealt with the issue of whether exchange rates are now disconnected from international trade. This concluded that, on the whole, there had not been any major changes to the exchange rate impact over time. At the same time, there are other studies suggesting that the effects of exchange rates are now smaller than earlier (see Ollivaud et al. 2015, for example).

[5] For example, Almega https://www.almega.se/2012/11/okat-tjanste-och-importinnehall-i-exporten-allt-viktigare-for-sveriges-konkurrenskraft/ argued that krona depreciations do not have the same impact as previously as the import content has increased. On 26 January 2015, Dagens Industri newspaper also had a spread on exporting companies negatively affected by a krona depreciation https://www.di.se/di/artiklar/2015/1/27/exportorer-ocksa-i-knipa/.

[6] See, for example, Powers and Riker 2013; Amiti et al. 2014; Ahmed et al. 2015 and Arbatli and Hong 2016.

investigates how participation in global value chains can influence the krona exchange rate's effect on Swedish industries' export volumes.

What is a global value chain?

A value chain is a corporate network of developers, producers, sub-contractors, investors and distributors who all supply inputs in one step or more in a production process. They may use imported intermediate goods to create goods or services for final consumption or they may supply intermediate goods or services for processing. One company may find itself involved in several different stages of the same network at the same time (for example as developer, investor and distributor). Value chains become international when intermediate goods or services cross one or more international borders.[7]

Examples of Swedish companies involved in global value chains are IKEA and Ericsson, who organise networks of sub-contractors and partners across the entire world to assemble their products. Other major Swedish companies like SKF contribute intermediate goods at an early stage in the production process in long value chains.[8] But even though multinational companies play an important part in global value chains, it is far from just employees of major companies that are engaged in value chains. The fact is that the largest percentage of Swedish jobs in global value chains are with companies with fewer than 20 employees.[9]

Value chains arise when Swedish companies decide to move operations overseas to their own branches, via direct investments, or contract operations to other companies abroad.[10] But they also arise when foreign multinational companies establish operations in Sweden. Both numbers of employees in Swedish branches abroad and Swedish employees in foreign multinational companies have increased heavily since 1990.[11] The driving force behind this expansion is the pursuit of the efficiency that can be achieved by allowing different specialists in different places to manage different parts of the production processes.[12]

Swedish companies have increased their participation in global value chains.

Measuring the proportion of Sweden's foreign trade in global value chains is very difficult.[13] The figures for participation vary slightly depending on which source is used, but usually show the same development over time. The data material that makes the longest comparison possible starts in 1970 and finishes in 2009.[14] Figure 1, panel A uses this source to show an estimate of how the import content of Swedish exports has developed. It increased by

[7] Common examples of products produced in global value chains are iPhones and Boeing aircraft.
[8] Swedish Agency for Growth Policy Analysis (2014).
[9] Ibid.
[10] Swedish Agency for Growth Policy Analysis (2012) points out that Sweden has successfully taken advantage of the possibilities and jobs provided by global value chains and has positioned itself to provide highly specialised activities (such as research and development).
[11] In 2015, Swedish multinational companies employed almost 1.4 million people abroad, while foreign multinational companies in Sweden had 637,000 or 21.4 per cent of employees in the Swedish business sector.
[12] See Grossman and Rossi-Hansberg (2006).
[13] Normal trade data does not show how large the import content in exports is or how Swedish exports are used by our trading partners. Researchers have therefore used various methods to calculate the proportion of a country's exports present in global value chains. In general, so-called global input-output tables are used. There are several different such data sources with different strengths and weaknesses, including the OECD's Trade in Value Added (TiVA), World Input-Output tables, EORA and Johnson and Noguera (2017). The method that is often used to make these estimates has been developed by Koopman et al. (2014) and refined by Wang et al. (2013). According to OECD TiVA, more than half of Swedish exports are present in global value chains. Other global input-output tables such as the World Input-Output Tables suggest that the proportion is instead closer to 40 per cent.
[14] Johnson and Noguera (2017).

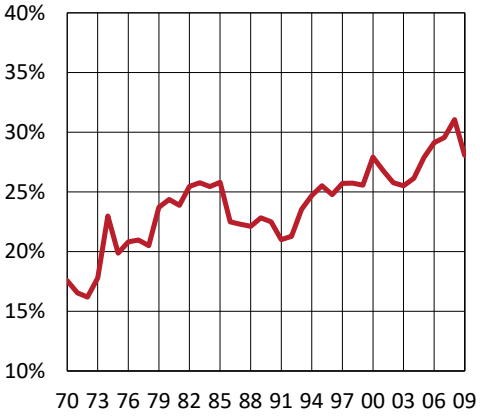
around 10 percentage points between 1970 and 2009, from 18 to 28 per cent. In an international comparison, the Swedish import content is relatively high.[15]

Participation in global value chains can also be studied using traditional trade data. One way of doing this is to calculate the correlation between Swedish exports and imports, and the correlation between Swedish exports and other countries' exports for different periods. If Swedish exports increase, imports should also increase when Swedish companies import intermediate goods and services to produce their exports. Likewise, Swedish exports should rise when our value chain partners' exports increase. This is because we supply intermediate goods and services that are included in their exports. Figure 1, panel B shows that Swedish export growth now correlates to a greater extent with import growth and with other countries' export growth than during earlier periods. The increasing correlation starting in the early 1990s is in line with the increase of global value chains described in the literature and the measures based on global input-output tables.[16]

All in all, it can be noted that an increasing and relatively large proportion of Swedish exports is now part of global value chains. This means that Swedish trade has now become intermeshed with developments abroad.

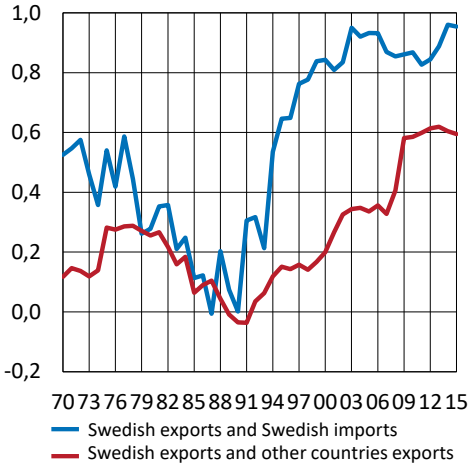
Figure 1. Sweden has increased its participation in global value chains.

Panel A
(imported share of value added, per cent of gross exports)



Source: Johnson and Noguera (2017).

Panel B
(correlation coefficient)



Note. The correlation coefficients have been calculated using a ten-year rolling window. This means that every point in the diagram is a correlation over ten years. The export correlation is an average and has been calculated against 63 countries (both emerging market economies and advanced economies). The correlations are unweighted.
Source: World Bank.

How do value chains affect the impact of the exchange rate?

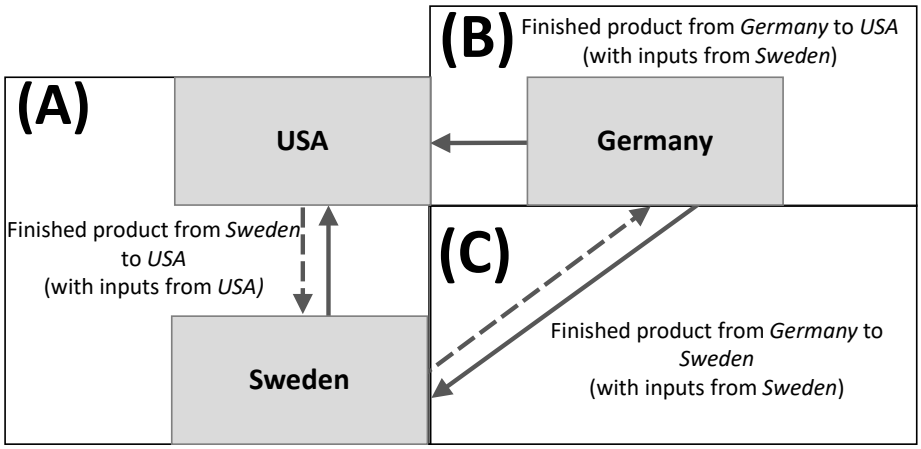
Before global value chains became an important part of Swedish trade, a weakening of the exchange rate was expected to lead to an increase in export volumes. But when Swedish companies participate in international production networks, they import intermediate goods and services to a greater extent to produce their exports, and these imports become more expensive when the krona depreciates. In addition, they export intermediate goods that are reimported to Sweden as finished goods or are sold to other trading partners. Figure 2 shows

[15] See OECD TiVA https://stats.oecd.org/Index.aspx?DataSetCode=TIVA_2016_C1
[16] See Baldwin (2016).

a simplified three-country example to clarify the different relationships.[17] In the figure, the unbroken arrows represent a flow of finished goods or services and the broken arrows represent intermediate goods or services.

In box (A), Swedish companies import intermediate goods and services from the United States to produce finished goods and services that are re-exported there. An example could be the Swedish company Volvo, which imports parts and components from the United States that are used in the production of finished trucks that are exported to customers in the United States. In this kind of value chain, a weakening of the krona against the dollar would affect both the costs (via imports) and make the finished products cheaper for consumers in the United States. The higher the import content and the amount of parts and components from the United States, the high the costs and the lower the price advantage become when the krona weakens against the dollar.[18]

Figure 2. Stylised example of participation in global value chains.



But Sweden also sells intermediate goods and services to other countries. These may be traditional intermediate goods such as iron ore or steel and various types of service, such as research and development, which are used in the foreign production of export goods or services. Figure 2, box B illustrates this as Sweden exporting intermediate goods to Germany, which, in turn, processes and sells these on as finished products to the United States. An example could be the Swedish company SKF, which produces ball bearings for use in the German automotive industry, which exports finished cars to the United States. Here, a depreciation of the krona against the euro makes the Swedish intermediate goods cheaper and should increase exports to Germany. At the same time, demand for the Swedish products is indirectly steered from the United States and is partly determined by the exchange rate between the euro and the dollar. Consequently, Swedish exports can also be sensitive to exchange rate changes among our trading partners.

Swedish intermediate goods are also used by the German automotive industry to export cars back to Sweden (box C). In an initial step, a weakening of the krona against the euro means that the Swedish exports of intermediate goods may increase as these become

[17] The example assumes that exports are priced in Swedish kronor. It is also a fictitious example that uses well-known Swedish companies. It is not at all certain that their participation in value chains in reality resembles the description in the diagram.

[18] However, this reasoning assumes that substitution elasticity, which is to say how Swedish companies choose to switch suppliers of foreign intermediate goods and services when there is a price change, is relatively low. International studies have demonstrated the presence of considerable inertia in changing supplier of intermediate goods, even in cases when the consequences of not changing have been major. See, for example, Boehm et al. (2015). In six case studies of various Swedish companies participating in global value chains, the Swedish Agency for Growth Policy Analysis found that it takes time and demands just as many resources to build up relationships of this type as it does to switch partners in the network. These relationships can involve development and intermediate goods, but also production, marketing and sales. However, it cannot be ruled out that substitution elasticity may be higher for some Swedish industries.

cheaper for Germany. But then the finished goods or services must be imported to Sweden for a higher price in Swedish kronor. This means that Swedish consumers will demand less of these products, reducing exports via Germany. Consequently, a larger proportion of exports being reimported should lead to a lower exchange rate impact.[19]

To summarise, relationships in boxes (A) and (C) above all should make Swedish exports less sensitive to bilateral krona exchange rate changes. Relationships in (B) should not have any effect on the bilateral exchange rate effect. But it could make Swedish exports more sensitive to trading partners' exchange rates.

As there are several factors that affect export volumes, the relationship between exports and exchange rate must be estimated. In a new paper (de Soyres et al. 2018), the authors estimate the effect of different value chains on the exchange rate impact in a data material covering 33 industries in 40 countries between 1995 and 2009.[20] They use simple export equations and find no support for a general disconnection of exports from the exchange rate.[21] On the other hand, they find that participation in value chains can weaken the impact of exchange rates on exports. Furthermore, the results show that exports from a number of industries to certain countries can even be affected negatively if the exchange rate depreciates, if these industries have a high level of participation in international value chains. This may make it easier to understand different opinions in the debate on the exchange rate's effect on exports.

The estimates from the paper show that a weakening of the bilateral exchange rate by one percentage point leads to an average increase of an industry's exports by between 0.15 and 0.26 percentage points over one year.[22] At the same time, the proportion of import content (box A) and exports returning as imports (box C) decreases the exchange rate effect. Exports via other countries (box B) do not seem to have any impact on exchange rate effects. However, such exports may increase the sensitivity to changes in trading partners' exchange rates.

In the next section, we use the results of this paper and detailed data on Swedish participation in value chains for the year 2008 to gain an understanding of how participation affects the effects of the krona exchange rate on exports.[23] As this data reflects the situation almost ten years ago, it could be asked whether it is current enough to help us understand today's situation. This is a good question, and relationships have surely changed over time. What can be said on the basis of more up-to-date but less detailed information is that Swedish participation in value chains overall has increased and is probably higher today than it was ten years ago.[24] The results presented here can therefore be seen as a lower limit for the actual effects of value chains on the impact of the exchange rate.

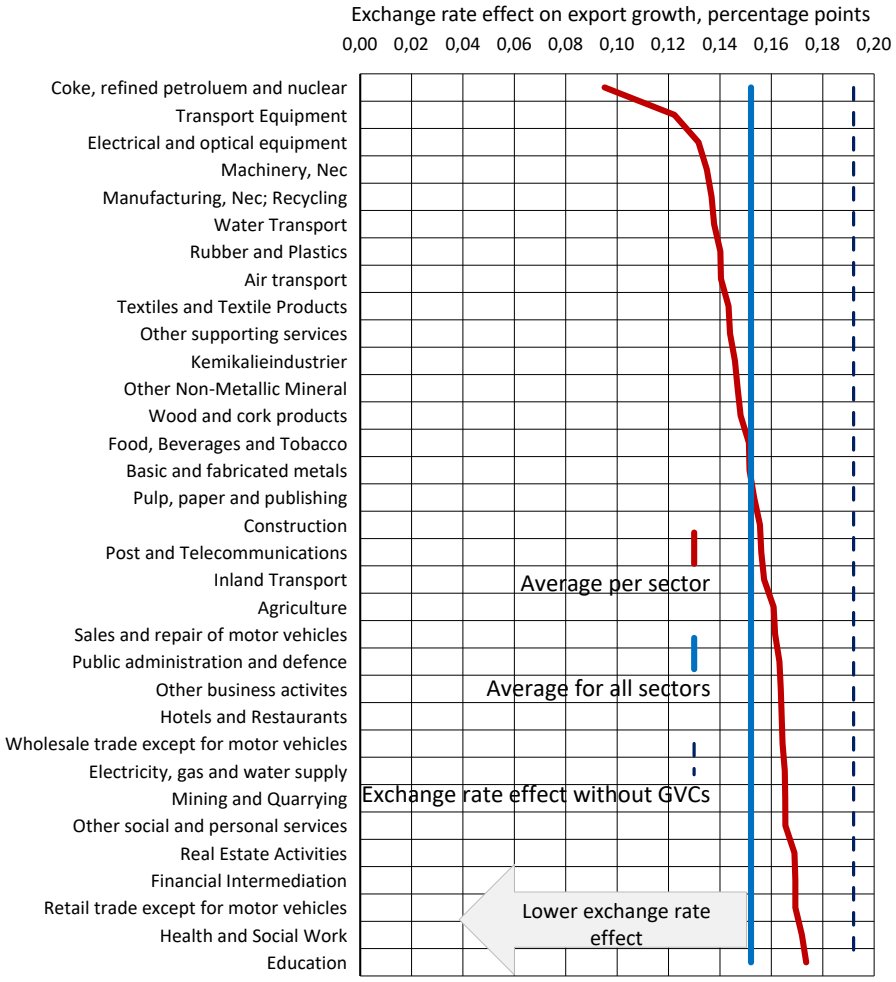
Positive exchange rate effects in all industries...

Figure 3 shows how a depreciation of the krona of one percentage point affects export volumes for Swedish industries participating in value chains. Swedish industries are listed in the rows and the broken dark blue line represents the estimated average exchange rate

[19] In this example, the Swedish exports are exported and reimported in the same year. In practice, there will certainly be a delay.
[20] See de Soyres et al. (2018).
[21] The estimates control for international demand per industry and other international factors that could affect the result.
[22] The results refer to columns 4-6 in table 3 of de Soyres et al. (2018) and give an average exchange rate impact on exports for industries to different destinations. But, at the same time, we know from the literature that the exchange rate impact is different in different sectors, even without participation in global value chains (Imbs and Mejean 2017).
[23] As 2009 was a period of great decline in international trade and global value chains, 2008 is used as a benchmark. Later periods are not available.
[24] See, for example https://data.oecd.org/trade/import-content-of-exports.htm#indicator-chart

effect with no participation in value chains for all industries.[25] The blue line shows an average of exchange rate effects calculated for all Swedish industries when they participate in value chains. The red line is the average exchange rate effect per industry when participation in value chains is taken into account.[26] It is important to point out that other factors also affect the impact of the exchange rate in each industry. The composition of the products to be exported, the currency in which the exports are priced (Boz et al. 2018) and how the companies adjust their mark-ups to exchange rate changes (Amiti et al. 2014) also play an important part, but are disregarded here.

Figure 3. The krona exchange rate's effect on export growth and how Swedish participation in value chains dampens the effect.
(refers to a weakening of the krona by one percentage point)



Note. Swedish industries are listed in the rows. The columns show the effect of the exchange rate on exports. The red line indicates the average of the exchange rate's effect per industry. The unbroken blue line is an average of the exchange rate's effect on exports for all industries. The broken dark blue line is an average of the exchange rate's effect on exports without any participation in value chains for all industries. The estimates come from Table 3 Column 4 in de Soyres et al. (2018). Refers to value chain participation in 2008.

The difference between the blue and the broken dark blue lines represents the average change of the exchange rate's effect on Swedish industries when participation in value chains is also included in the calculations. This exercise suggests that the exchange rate effect on Swedish exports is around one-fifth lower on average when value chain participation is

[25] The exchange rate effect on export volumes without value chain participation is the coefficient of β_{exr} from equation 18 in de Soyres et al. (2018). The effect has been estimated for 40 countries and 33 industries between the years 1997 and 2009 and is an average of the exchange rate impact for all industries and countries.
[26] The subdued exchange rate effect on export volumes from value chain participation per industry is the effect of the interaction coefficients in equation 18 on the exchange rate effect.

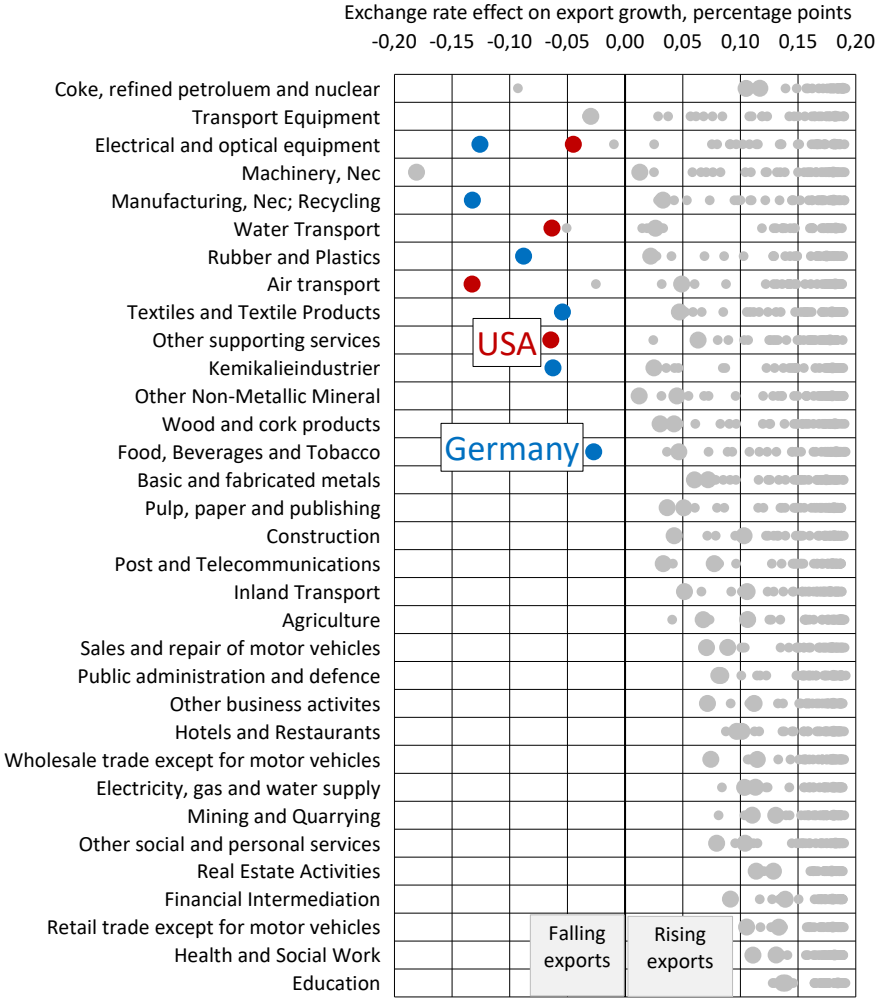
included in the calculations.[27] But the red line shows that great variation exists between industries. For example, the sectors coke, refined petroleum and nuclear fuel, the manufacture of transport equipment, electrical and optical equipment manufacturing and other machine manufacturing are strongly integrated into international production networks.

... but exports to some countries may fall with a krona depreciation

In the data material, it is also possible to see which countries participate in value chains with Swedish industries. Consequently, it is possible to obtain a detailed view of how a krona depreciation can effect Swedish industries' exports to different trading partners.

Figure 4 shows that exports to most countries (grey circles) would be affected positively by a krona depreciation, even when participation in value chains is taken into account.

Figure 4. The krona exchange rate's effect on export growth to our trading partners
(refers to a weakening of the krona by one percentage point)



Note. Swedish industries are listed in the rows. The columns show the exchange rate's effect on exports when value chain participation is taken into account. The grey circles are different countries to which these industries export. The estimates come from Table 3 Column 4 in de Soyres et al. (2018). Refers to value chain participation in 2008.

[27] The estimated exchange rate effect on exports of a krona depreciation is 0.192. The average of exchange rate effects for Swedish industries is 0.152 when value chain participation is taken into account. The difference is (0.152/0.192-1) = 21 per cent.

This is illustrated by the cluster of countries to the right of the zero mark. However, for some industries and countries, exports may be affected negatively by a krona depreciation. This applies primarily to the United States (red circles) and Germany (blue circles) and, above all, to exports from coke, refined petroleum and nuclear fuel, the manufacturing industry (transport, computers, electronics and optics, other manufacturing, textiles and food) and transportation services that may fall in the event of a depreciation of the krona against the euro and dollar.[28] However, this does not mean that the *aggregated* exports to these countries fall when the exchange rate weakens, but rather that the total exchange impact may be lower.

This analysis has illustrated how participation in global value chains can dampen the effects of exchange rates on exports. At the same time, it is important to point out that it makes a couple of very strong assumptions. Firstly, we allow only value chain participation to affect the impact of exchange rates. In reality, other factors also affect the impact per industry. Differences in productivity development from industry to industry[29], variations between industries in the adjustment of mark-ups[30], and the currency actually used in the transactions[31] are all important factors. Another important factor that has an influence on what the effect will be on different occasions is the underlying economic event that has caused the exchange rate to depreciate. If lower international demand for Swedish goods and services leads to lower demand for Swedish kronor and thereby to a weaker krona exchange rate, the impact of the exchange rate should be significantly weaker – or even negative – than it would be if the exchange rate was weakened by monetary policy stimulation measures, for example.

But regardless of how other factors influence the exchange rate effect, it is likely that participation in global value chains dampens the actual impact on Swedish exports. Estimates that do not take this into account may therefore overestimate the impact of the krona exchange rate on Swedish export volumes. The results do not, however, suggest that exports are disconnected from the krona exchange rate.

[28] The horizontal axis has been broken at -0.20 percentage points to simplify the graph. Only three observations are below that value.
[29] Demian and di Mauro (2017).
[30] Amiti et al. (2014).
[31] Boz et al. (2018).

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