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Is there a J-curve in the bilateral trade between Sweden and Germany? -A product level study-

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Abstract: The J-curve illustrates an initially negative effect of an exchange rate depreciation on the trade balance with improvement following in later periods. This paper investigates whether there is a J-curve in the bilateral trade between Sweden and Germany on a 3-digit SITC product group level. The ARDL bounds testing approach is employed to circumvent issues such as the bad small sample properties of more traditional cointegration tests. In the 149 product groups studied, no support could be found for a J-curve in Sweden's trade with Germany. For some 11 % of the groups the short-run effects of an exchange rate depreciation persist into the long run.

*Key words: B*ilateral trade, Sweden, Germany, trade balance, J-curve, ARDL, bounds testing approach

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1 Abbreviations

ARDL = Autoregressive Distributed Lag

BEC = Broad Economic Groups

DE = Germany in ISO 3166-1-alpha-2 Country code standard

ML = Marshall Lerner Condition

SE = Sweden in ISO 3166-1-alpha-2 Country code standard

TB = Trade balance

SITC = Standard International Trade Classification

UN COMTRADE = United Nations Commodity Trade

WITS = World Integrated Trade Solution

2 Introduction

After World War II, the international market was relatively stable and the Bretton Woods system with its fixed exchange rates provided an exchange rate stability that had neither been beaten in previous periods nor would be in the ones to follow (Eichengreen, 1996, p. 93). In the last years of the system an undermined, confidence in the sterling, and later also the dollar, finally led to the devaluation of the British sterling in 1967 and the Smithsonian realignment in 1971, and thereby also the devaluation of the US dollar. In the path of these devaluations, negative short-run movements in the trade balance referred to as “perverse” in the literature were observed, and gave rise to discussion about the J-curve (Magee, 1973, pp. 303, 308).

In Magee’s Currency Contracts, Pass-through and Devaluation from 1973, the author sought to explain a few confusing statements found in the Wall Street Journal regarding movements of the US trade balance as a reaction to the devaluation in the Smithsonian agreement in 1971. Magee showed that the trade balance does not necessarily have to deteriorate as a result of a devaluation and explained that in addition to a J-curve, an “alphabetical-soup analysis” could show patterns of I-, L-, M-, N-, V and W curves plus their inversions for short-run movements in the trade balance (Magee, 1973, p. 322).

The picture the economists have in their minds can be seen in Figure 1 below, it is one of a J tilted to the right, where the bottom of the J portrays the initial “perverse” response (1) and the back of the J (2) showing the gradually improving balance of trade. A J-curve would be found if the exchange rate elasticity (measuring the effect on the trade balance) would carry a negative sign followed by positive signs in following periods. Hence, a pattern with initially negative signs, followed by positive and then again negative signs and finally positive signs, would be taken as evidence of a W-curve.

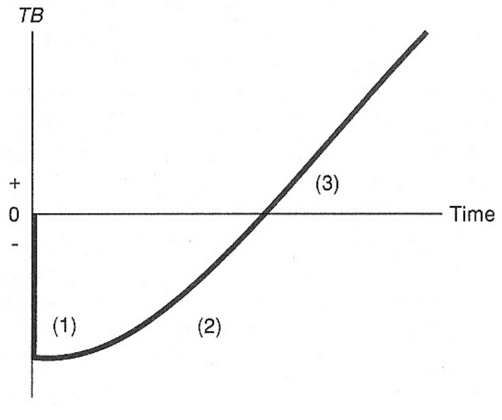

Figure 1. The J-curve, borrowed from (Caves et al., 1993)

The Marshall-Lerner condition (henceforth ML-condition) requires that the relative price elasticities of export and import demand sum up to more than unity if the trade balance is to improve as a result of depreciation in the real exchange rate, this is part (3) in Figure 1. If this holds, then a real depreciation of the domestic currency will have a positive long-run effect on the trade balance. Since economic agents need time to adjust their behavior to the moving exchange rate, the ML-condition is more of a long-run feature (Sørensen and Whitta-Jacobsen, 2010, p. 702). The ML-condition will not be of primary interest in this paper, but the J-curve will. Since the discussion on the J-curve originates from the devaluations and currency depreciations in the 1970s, it is only natural that such movements in the exchange rate are kept in a special focus throughout the paper.

2.1 Aim and Scope

The main purpose of this work was to investigate whether there was a J-curve in the bilateral merchandise trade between Sweden and Germany, on the product group level, between 1962 and 2009. The result of this work is presented in this paper. Annual data from 1962 to 2009 (48 annual time observations) from the UN Comtrade database on a SITC 3-digit level, retrieved with the World Bank WITS tool was used. For comparability with previous research the data will be analyzed within the same framework of Bahmani-Oskooee and Hajilee (2009) using an ARDL bounds testing approach. Using all product groups on the 3-digit level in the trade between Sweden and Germany, has to the author`s knowledge, not been done before and therefore provides a unique insight into this level of trade.

Germany is Sweden's largest trading partner and in the work presented in this paper the bilateral trade was studied to avoid the aggregation bias, which is when trading patterns from one country cancel out the trading patterns of another country. The choice to study trade on the commodity level is another way of dealing with the bias of aggregation but it will also provide valuable information concerning trade patterns on a disaggregated trade level.

Traditional methods of time series require the pretesting of unit roots using tests with recorded low power; however the bounds testing approach does not require this. Another advantage of the Bounds testing approach is the ability to use a series of varying orders of integration. In this method, the series can be I(1), I(0) or mutually cointegrated. A third advantage of this method is that it can be applied in studies with small sample sizes.

Data from the first version (Rev. 1) of the UN Standard International Trade Classification (SITC) will be used since it contains substantially more time observations than newer versions of the nomenclature. The trade has 182 product groups on the 3-digit level whereof 149 groups had sufficient time observations to be used. Only merchandise trade (not services) is to be studied.

2.2 Research Question

The main question to be studied is whether a J-curve pattern can be found in the Swedish data. As will be seen in the literatures review in chapter 6, other patterns than the ones of a J can appear, therefore the analysis also, to a certain extent, extends to such patterns.

3 Literature Review

Magee (1973) was, by no means the only article published in the 1970s on the J-curve subject. Junz and Rhomberg (1973), Cooper (1971), Connolly and Taylor (1972), Laffer (1976) and Salant (1976), to mention a few, also provided research. Ever since the dawn of the J-curve, there has been a steady stream of research, although yielding changing and varying “evidence” for different countries (Bahmani-Oskooee and Ratha, 2004a).

Miles (1979) could not find much evidence that devaluations affected real variables, such as the trade balance, but shortly afterwards Himarios (1985) showed that a nominal devaluation could actually affect the trade balance over a time span of three years. Unfortunately, Himarios results were later criticized by Bahmani-Oskoee and Alse (1994) for having been based on non-stationary data. Evidence for a delayed J-curve for the US was found by Rosensweig and Koch (1988) and for Australia, no J-curve could be proved by Flemmingham (1988). After a couple of years these results could be revised when Bahmani-Oskooee and Pourheydarian (1991) found a delayed J-curve for Australia. Backus (1993) found a J-curve for Japan. Bahmani-Oskooee and Malixi (1992) studied 13 LDCs and showed not only J-curve patterns for a number of countries like Brazil, Greece, Korea, and India but also found evidence of M-, N-, and I-shaped curves. Supplementary to the alphabetical-soup Backus, Kehoe and Kydland (1994) found traces of an S-curve for a couple of OECD countries when they studied the trade balance in a cross-correlation function with the terms of trade. Lal and Lowinger (2002) found different patterns for different countries in their study of several East Asian countries. Rose and Yellen (1989) could not find any exchange rate effect on the US trade balance at all, at any lag length. Shirvani and Wilbratte (1997) showed in their study of US bilateral trade that the trade balance did not react in the short-run (1-6 months) but rather in the long-run (1-24 months) to the exchange rate. Bahmani-Oskoee and Brooks (1999) used the basics of the Rose and Yellen model and failed to show any common pattern for US bilateral trading partners but did find a long-run response in the US trade balance. Bahmani-Oskooee and Ratha (2004) found evidence of a short-run negative impact and a positive long-run impact of the exchange rate on the US trade balance in the trade with Argentina, Chile, Israel, Korea, Mexico, Mexico and South Africa (Ibid).

As can be seen, the results vary with each article and by each country. For instance, for the US, various authors have reached diverse conclusions on the presence of a J-curve and, as Bahmani-Oskooee and Ratha conclude in their review article from 2004 upon which this literature review is based, if there is any consensus in the research it seems to be that there is no common impact pattern from a depreciating exchange rate on trade balances in the short-run (Ibid). This is also in line with the arguments of Magee (1973), which will be presented later, who introduced the alphabetical-soup analysis due to the many possible patterns the trade balance could show.

In studies on the impact of the exchange rate on trade flows, traditionally, total trade has been used but there is a growing literature on bilateral trade. The reason for this is that patterns of trade with one country can even out patterns of trade with another country; this is referred to as an “aggregation bias” (Irandoust et al., 2006). The bilateral trade of Sweden with various partners has been thoroughly studied on different levels with different data and methods. Hacker and Hatemi-J (2003) investigated the validity of the J-curve for the aggregated trade of Sweden, Norway, Denmark, Belgium and the Netherlands and their bilateral trade with Germany. In their use of both quarterly and monthly data, they found J-curve support in the total trade of Sweden and in the bilateral trade with Germany. In

Hatemi-J and Irandoust (2003)[1] the authors found, with the help of annual data, that the ML-condition for Sweden's bilateral trade with Germany was met. With their 2005 article, the authors returned to the subject and studied the bilateral trade with 6 large trading partners. With the help of annual data and a panel data approach, evidence that the ML-condition was met, could only be found in trade with Germany. Contradictive results were found in the 2006 article of Irandoust et al. where 8 major trading partners of Sweden were investigated; here the ML-condition was found to hold only in trade with France. Bahmani-Oskooee and Ratha (2007) studied the bilateral trade between Sweden and 17 trading partners and could not find evidence of a J-curve in the trade with, Germany. There is no other indication than that all articles on bilateral trade where Sweden and Germany have been studied have concentrated on the total trade of all sectors and industries; none seem to have disaggregated the data to the product group level. The aggregation bias mentioned earlier is also applicable to the sectors vs. total bilateral trade. J-curve patterns could even out and disappear when looking at total instead of sector trade. Table 1 portrays this knowledge gap in terms of looking for the J-curve in sector data in the bilateral trade between Sweden and Germany. There are some articles where this has been done in studies of Sweden and other partners than Germany; one example is the Bahmani-Oskooee and Hajilee (2009) article where trade between Sweden and the United States was studied on a 3-digit SITC product level. With help of the ARDL bounds testing approach for the period 1962-2004, the authors found evidence of the J-curve in 23 out of 87 sectors. A selection of the articles concerned with the Swedish trade balance can be found Below in Table 1.

The reviewed articles concerning Sweden and her major trading partners do not agree in the case of the J-curve and in the case of the Marshall-Lerner condition (ML) in the bilateral trade between Sweden and Germany. Irandoust et al. (2006) state that their differing results may be linked to not controlling for the reunification of Germany by the inclusion of a dummy variable for this historical event. But what really stands out in the literature review is that Magee was right in 1973 about the many shapes the trade balance could move in. After almost forty years of research, parts of Magee's alphabetical-soup analysis and its various patterns do seem to hold to a certain extent.

[1] Unfortunately the Hatemi-J and Irandoust (2003) article could not be retrieved, but is described in Irandoust et. al. (2006).

Article	Aim	Countries	Level	Dep. Variable	Data freq.	Time Span	Method	Result
(Bahmani-Oskooee and Hajilee, 2009)	Real Exchange rate and trade balance – J-curve Short+long run	Bilateral SE-US	Industry – 3 Digit SITC	Trade Balance	Annual	1962-2004	ARDL bounds testing approach Error-Correction	Support for J-curve in 23 /87 industries (Real depr. of SEK has favourable effects on Trade balance in the long run)
(Bahmani-Oskooee and Ratha, 2007)	Investigate short- and long run effects of real depreciation on bilateral trade balance – the J-curve	SE and 17 bilateral trade partners	Total	Trade Balance	Quarterly	1980:1-2005:4	ARDL bounds testing approach	J-curve evidence in cases of SE-AT, DK, IT, NL and UK. Real depreciation of SEK has short-and long-run effects on the trade balance in the trade with DE
(Irandoust et al., 2006)	Estimate price and income elasticities and study Marshall-Lerner condition Short+long run	Bilateral SE-FR, DK, FI, DE, NL, NO, UK and US	Total	EXP and IMP	Annual	1960-2000	Likelihood based panel cointegration	Income elasticities for all countries are positive, Marshall Lerner condition holds only for bilateral trade with FR and NL, for other six countries no evidence that SEK depreciation improves the Trade Balance
(Hatemi-J and Irandoust, 2005)	Estimate long-run bilateral trade elasticities between Sweden and her 6 major trading partners	Bilateral SE-DK, FR, DE, NO, UK, US	Total	Exp and IMP	Annual	1960-1999	Pedroni Panel	ML condition only holds between SE and DE. Export function very foreign income elastic but less price elastic
Hatemi-J & Irandoust (2003)*	Exchange rate and bilateral trade	Bilateral SE-DE	Total	NA	Annual	1960-1999	Johansen approach to cointegration	ML condition met, negative relation between exchange rate and imports
(Hacker and Hatemi-J, 2003)	Examine the validity of the J-curve for five countries	Aggregated and Bilateral SE, NO, DK, BE, NL.	Total	Export-to-import ratio	Quarterly, monthly	1975:1-2000:3 and 1976:1-1999:12 and 1991:1-2000:12	VEC,generalized impulseresponse, Johansen & Juselius (1990) maximum likelihood	J-curve support for all countries. J-curve support for Sweden's total trade and for bilateral trade with Germany.

Table1. Literature review with a selection of studies covering Sweden. *The Hatemi-J and Irandoust (2003) article could not be attained.

4 Historical Background

Since the effects of the exchange rate on the trade balance is studied in this paper the reader is in this chapter provided with a background on the Swedish monetary regime history as well as with background information on why Sweden still has her old currency and not the Euro.

4.1 Swedish Monetary Regime History in Short

In 1914, on the eve of the First World War, the Swedish central bank aborted the conversion of banknotes into gold and banned the export of gold, which meant the end of Sweden's participation in the gold standard, which started 1873. After 10 years of float the Swedish krona was back on the gold standard in 1924. The interwar gold standard lasted for Sweden only until 1931, and, after two years of various floats and pegs, the krona was pegged to the sterling in 1933, a peg that would last until the Second World War broke out. Sweden was late in joining the Bretton Woods system in 1951, which was a system with an adjustable peg to the dollar, which, in turn, was exchangeable for gold. This system allowed for devaluations of currencies to restore lost competiveness caused by appreciation. The Swedish krona enjoyed a rather stable period during the Bretton Woods era up until the collapse of the system in 1973. The subsequent system was the European Snake Arrangement, which bore the characteristics of a managed float, both through intervention and international cooperation. Originally, the Snake Agreement grew out of the Smithsonian Agreement of 1971 but outlived the Bretton Woods. The European Snake in the aftermath of Bretton Woods allowed the currencies to float but not to deviate from each other by more than plus or minus 2.25 %. In the 1970s, Sweden suffered from a structural crisis, and 1977 marked the exit from the Snake. The arrangement subsequent to the Snake became a peg to a basket of 14 currencies. The turbulent 1970s brought about a 3 % devaluation in 1976, and in 1977 the krona was devalued two times, first by 6 and then by 10 %. Sweden still suffered from the loss of competiveness and devaluated again in 1981 by another 10 %. In 1982, yet another devaluation took place in order to strengthen the economy. The 1982 devaluation was the last Swedish devaluation and in 1991 Sweden pegged its currency to the European Currency Unit (ECU). In 1992, the krona was hit by speculative attacks and the Swedish central bank tried, through all possible means, to defend the currency. Not even interest rates in the three digit dimension helped, and the krona was left to float, and has floated ever since that year in 1992 (Bohlin, 2010).

4.2 The No-Vote on the Euro

Although being an EU member, Sweden is not part of the European Monetary Union and still in 2011 the Swedish krona is the official currency. In this section a brief overview of the historical reasons to this is given.

In 2003, a referendum on introducing the Euro was held with a participation share of about 82 %. The majority of voters in favor of the Euro were geographically gathered in the southern most parts of Sweden or in and around the capital Stockholm. One of the main sources of arguments in the preceding debate came from an investigation commissioned by the Swedish government and was published in 1996. The members of the commission headed by Professor Calmfors were economists and political scientists. Some of the main arguments in favor of joining the EMU were the benefits of reducing transaction costs and less exchange rate volatility thanks to a common currency, which would generate more trade and increase competition. Major arguments against a common currency were; the loss of monetary policy autonomy and the danger of asymmetric chocks connected to it. The general recommendation was to join the monetary union but with a longer time horizon to allow the Swedish economy to regain its strength from the financial crisis of the early 1990s, before turning to the Euro. These recommendations and opinions were gradually adopted by both parliament and government. The Yes-campaign used arguments concerning participation in the European project and integration as peace ensuring mechanisms whilst the No-Campaign argued that joining the union was a threat to the Swedish welfare state and to Swedish democracy, by moving decision power to Brussels and Frankfurt. In 2003 the citizens of Sweden voted no to joining the EMU with almost 56 % of the votes (Jonung, 2004).

5 Theory

The theories provided in this chapter lies at the very heart of understanding the problem of how the trade balance works and what affects it. The reader will be confronted with topics such as; deriving the trade balance, lagged economic behaviour, pricing of trade and a brief section on time series analysis.

5.1 The Trade Balance – In a Reduced Form

The trade balance is part of a country`s balance of payments (BoP) and is the sum of imports and exports where imports are recorded with a negative sign. Thus the trade balance is, simply put, the net trade measured in domestic currency. In a traditional two country model, as described in Rose and Yellen(1989), the quantity of domestically demanded imported goods, D_m, is positively dependent on the domestic real income, Y, and negatively on the relative price of the imported goods, P_m. The demand for this country's exports, D_m^*, by a foreign country is likewise positively dependent on the foreign country's real income, Y^*, and negatively on that country's relative price of imported goods, P_m^*.

$$D_m = D_m(Y, p_m) \text{ and } D_m^* = D_m^*(Y^*, p_m^*) \quad (1)$$

The supply of exports in this perfectly competitive model of two countries is determined by the relative price. Here S_x and the S_x^* are thus the supplied quantity of exports from the home country and the foreign country, where p_x is the home country's relative price of export goods, defined as the ratio of the domestic currency price of exportable goods P_x to the domestic price level P. As a result, the p_x^* is analogously defined as the foreign currency of exportable goods divided by the foreign price level.

$$S_x = S_x(p_x) \text{ and } S_x^* = S_x^*(p_x^*) \quad (2)$$

By this, the domestic relative price of imports can be described by:

$$p_m = \frac{E \cdot P_x^*}{P} = \left(\frac{E \cdot P^*}{P}\right) \cdot \left(\frac{P_x^*}{P^*}\right) \equiv q \cdot p_x^* \quad (3)$$

Here, E is the nominal exchange rate in terms of domestic currency price of foreign exchange and q denotes the real exchange rate as $\equiv \frac{E \cdot P^*}{P}$.

This means that the analogous relative price of imports abroad can be written:

$$p_m^* = \frac{p_x}{q} \quad (4)$$

The equilibrium condition determines the traded quantities and the relative price accordingly

$$D_m = S_x^* \text{ and } D_m^* = S_x \quad (5)$$

Now, if the value of net exports, exports minus imports, is recorded in domestic currency, the trade balance, noted B, in real terms can be described as:

$$B = \underbrace{p_x \cdot D_m^*}_{Value\ of exports} - \underbrace{q \cdot p_x^* \cdot D_m}_{Value\ of\ imports} \quad (6)$$

In the Rose and Yellen (1989) format of the bilateral trade model, Eq. 1 to 5 can be solved as functions of $q, Y\ and\ Y^*$, thereby allowing for a rewrite of the trade balance in a "partial reduced form".

"Reduced form" refers to the ability of being an equation derivable from a set of structural equations that have only been solved partly.

$$B = B(q, Y, Y^{*}) \qquad (7)$$

In order to achieve a modicum of increased comprehensibility, this paper uses another notation, where B, the trade balance, is turned into TB; q which is the real exchange rate into REBEX; Y, domestic income, into $Y_{SE;}$ and foreign income, Y*, into Y_{DE}. This renders the following economic model:

$$TB = TB\left(Y_{SE}, Y_{DE,}, REBEX\right) \qquad (8)_{:}$$

The variables used in the analysis performed in this paper will be presented in chapter 6.4.

5.2 The J-Curve – An Alphabetical Roller Coaster

If the ML- condition needs a stretched time horizon to be observable, the J-curve is observable in the very short-run. Since economic agents do not change their behavior instantly to match the change in relative price, the balance of trade worsens in the short-run until it gradually improves as agents adjust to the changing conditions. This causes the trade balance to move in a J-curved manner (Sørensen and Whitta-Jacobsen, 2010, p. 702).

During the last years of the Bretton Woods it was becoming more and more difficult to hold the pegged exchange rates. Magee (1973) argues that this was partly due to the growing private capital mobility, with amounts far greater than the reserves held by central banks, and also to fast moving foreign exchange reserves held by Middle Eastern and African Oil countries (Magee, 1973, p. 305). To gain a deeper understanding of the short-run dynamics that can give rise to the various patterns in the balance of trade, Magee (1973) categorizes the problem in three short-run time periods:

1. **The Currency Contract Period**
2. **The Pass-Through Period**
3. **The Quantity Adjustment Period**

5.2.1 The Currency Contract

The currency contract period is where old contracts signed before the devaluation fall due after the devaluation. Since a changing exchange rate can have a positive or negative monetary effect on the contracted trade, exporters seek to sign currency contracts on their exports in a currency that is likely to appreciate, and importers on the contrary prefer to denote their contracts in a currency likely to depreciate. With this knowledge in mind, Magee constructs a classification system with four general cases for the short-run effects of a devaluation. For an initial adverse effect on the trade balance measured in dollars to be observable, the import contracts have to be signed in a foreign currency. Magee's classification system also identifies that in only one out of four cases is a deterioration (J-curve) of the TB inevitable, and in total, possible in only two of the four cases, provided that the TB is measured in dollars (home currency). The author provides a condition for the J-curve pattern to occur in the currency contract period:

$$\sum_j \left(s_j^x c_j^x d_j X_j^0 - s_j^m c_j^m d_j M_j^0\right) < 0 \qquad (9)$$

Where s_j^x is the share of US exports received by country j, c_j^x represents the proportion of contracts that is denominated in a country's currency for imports to the US and d_j represents the proportional increase in the dollar value of the currency of country j. The probability of the condition holding the recognition of a J-curve pattern in the TB is greater when the share of import is larger than the share of exports denominated in foreign currency$\left(c_j^m > c_j^x\right)$. In Magee's framework it is likely that the trade would be denominated in the currency choice of the price maker, and that this would be linked to the actor's relative market power. Actor's would then hold more relative market power on their export market since exports would be more specialised than imports. Trade would then be contracted by price makers in such a way that they could gain or, at least, minimize their losses from an expected devaluation. This rules out previously mentioned case 4, where a J-curve was inevitable as result of a devaluation, leaving case 2 the only case with a J-curve. In this case, the TB measured in dollars has to be in deficit prior to the devaluation in order for a J-curve pattern to occur, and both imports and exports have to be denoted in foreign currency. This fits with the circumstances prior to and following the 1971 devaluation of the dollar partly since Magee found indications that both US exports and imports were denoted in foreign currency (Magee, 1973, pp. 309-315).

5.2.2 The Pass-Through

The Pass-Through period concerns new contracts signed after the devaluation, still in the short-run, where export and import quantities have yet not changed. Pass-Through involves to what extent prices of foreign goods change in domestic prices as a result of a devaluation. Depending on how the prices change, buying patterns will adapt, and this is, in turn, affected by how much of the devaluation exporters are willing to pass through on their prices, measured in the buyer's currency. There are two possible reasons as to why the quantities have not adjusted during this period; one is due to a perfectly inelastic supply since exporters are not able to instantly change their sales abroad, and a second reason could be that the demand throughout the period is perfectly inelastic since importers cannot instantly find substitutions for the imported goods. If the US exports supply is perfectly inelastic and the demand still slightly elastic, then the demand curve for foreign buyers of US goods would not change in terms of foreign currency and the price in dollars would rise to match the amount of the devaluation. This means that there would be no pass-through to the prices in foreign currency on US exports. But if the demand for US exports would be perfectly inelastic, and the supply still somewhat elastic, then the price in dollars of US exports would remain on the same level but fall in terms of foreign currency, which would indicate a full pass-through. The same goes for the imports; if the supply of exports is perfectly inelastic, there would be no pass-through and if the demand of US imports is perfectly inelastic, there would be a pass-through. A schematic picture of this can be found below in Table 2.

	US exports	**Us imports**
Supply Perfectly inelastic	No Pass Through in FX	No Pass Trough in HomeX
	Price in HomeX ↑	Price in HomeX unchanged
	Price in FX unchanged	Price in FX ↓
Demand Perfectly inelastic	Full Pass Through in FX	Full Pass Through in HomeX
	Price in HomeX unchanged	Price in HomeX ↑
	Price in FX ↓	Price in FX ↑

Table 2. Schematic table of the Pass Through

Magee also sets up four cases of short-run effects on the TB as a result of a devaluation for this period and concludes that the worst scenario for the US TB would be a full pass-through in an inelastic demand for US imports and an inelastic demand for US exports. The best effect on the TB would be if the supply for US imports were inelastic as well as the supply for US exports. This setting was, according to Magee, empirically likely in the context of the US case (Magee, 1973, pp. 315-317).

5.2.3 The Quantity Adjustment

In both of the previous periods of Currency Contract and Pass Through, quantities were fixed but now, quantities are starting to adjust to the new conditions. What happened during the previous period of Pass Through will affect the adjustment period and, since the short-run demand curve is believed to be inelastic, quantities will start to adjust. The adjustment will cause a fall in the dollar value of US exports, and imports will fall due to the devaluation.(Magee, 1973, pp. 318-322)

Depending on the settings of the different periods, the trade balance might show different patterns in the short-run, giving rise to Magee's earlier mentioned "alphabetical-soup" analysis. As has already been shown, the US case depicted a fall during the Currency Contract Period, a rise in the Pass-Through period, and again a deterioration in the Quantity Adjustment Period and therefore it is evident why Magee introduced the W-curve (Magee, 1973, pp. 322-323).

5.2.4 Lagged Economic Behaviour – The Cause of the Patterns

In the backwash of the Smithsonian realignment of 1971, the time horizon for changes to have an effect was widely discussed and it was believed that the lion's share of the changes should have been worked through after 18 to 24 months. Junz and Rhomberg (1973) set out to shed light on the matter and in their study on trade flows of manufactured goods amongst industrialized countries they were able to reject this common belief and point towards a much longer time dimension for adaptation. The authors showed that only 50 % of the change in trade flows would take place within the first three years of a change in the relative price and it could take up to 5 years for 90 % of the change to take place (Junz and Rhomberg, 1973, pp. 412, 418).

In order to explain the long adjustment period that trade flows need following a devaluation or a change in relative price, Junz and Rhomberg identified several types of lags. The work can be seen as supplementary to the finding of Magee (1973), though containing some overlapping parts. The *recognition lag* is the first one to come into play and emphasizes the simple fact that economic actors need time before they can react to the changing conditions after an adjustment in the relative price. The authors mention how this lag might be longer in international trade than in domestic trade due to the fact that there are for instance, language and distance barriers. The second lag is the *decision lag,* which reflects that it might take tame to establish new business connections, engage in agreements and place orders. The third is the *delivery lag,* which indicates that, depending on the type of merchandise involved, months or even years can pass between the placing of an order and the delivery of the merchandise. Statistics are thereby delayed since trade flows and payments usually show up first after delivery of the goods. The *replacement lag* is the fourth lag and is characterized by the fact that it might take time to exhaust an inventory or wear out old machinery before restocking and replacing old materials and goods. The fifth and last lag is the *production lag,* which demonstrates that the decision to supply new markets, reopen closed production lines or open new ones is not a swift one. Producers and suppliers need to be convinced that the change in relative price stays around long enough for their production decision to yield revenues. The authors conclude that in the light of these lags it is advisable to study trade flows reaction to price changes in annual data rather than in quarterly (Junz and Rhomberg, 1973, p. 413).

5.3 Relative Prices and the Exchange Rate

In the traditional Keynesian model, a depreciation of the currency leads to a rise in the import prices relative to export and domestic prices. This rise in the relative price, in turn, leads to a worsening of the terms of trade, and, at the same time, the depreciating country attracts the demand of the world. The increased demand from the world for the depreciating country's output strengthens the balance of trade (Dornbusch and Krugman, 1976, p. 551). In this model it is assumed that there is little or no room for inter-temporal substitution but more room for inter-commodity substitution during exchange rate movements. Therefore a depreciation worsens the trade balance and the savings of the country. The investments in inventory also suffer since a depreciation means an increase in the relative price of imports. A depreciation leads to a weakening of domestic purchasing power which reduces real consumption spending. The reduction hits both imported and domestically produced goods (in what direction and of what amounts is determined by the import elasticities). In the long-run the substitution effect changes the demand in favour of domestic goods. If it is assumed that the savings rate is fixed, a depreciation in this framework can have the same effect that a rise in the interest rate has a deflationary effect by contracting spending on domestic goods as far as it is not hindered with policy intervention or offset by the export (Dornbusch and Krugman, 1976).

According to Dornbusch and Krugman it has been shown by authors such as Kravis and Lipsey and also by Isard that exchange rates have persistent effects on relative prices. Dornbusch and Krugman argue that there might be a difference in how goods are affected by the exchange rate. They argue that consumer goods are affected but not auction goods, like, for instance, crude materials. The logic behind this argument relies on the fact that the cost of production is not affected in the short-run and supply prices of consumer goods are therefore not affected by an exchange rate movement in terms of producer currency but rather in terms of foreign currency. Even if the supply prices of auction goods would be affected, the relative price would not be affected since these goods are traded on the international market with price clearing mechanisms. A country's competitive position has a tight link to the movement of the exchange rate, indicating that a depreciation will have a positive effect on a country's competitive position (Ibid).

Dornbusch and Krugman in their 1976 article tested for the effect of a change in relative price on export shares and concluded that there was an important but varying lagged effect amongst the tested countries. In contrast to the 3-5 year lag found by Junz and Rhomberg, mentioned earlier in this paper, Dornbusch and Krugman found a substantially different lag length of about 1 to 1½ years for most countries. The authors exclude Sweden from the results since Sweden showed "perverse elasticities", possibly because of relations with European Free Trade Association. The conclusion the authors drew from their tests was that a prolonged depreciation would improve a country's competitive position, which would increase exports over time. They also found small elasticities in the short-run, which were the first four quarters of the adjustment, indicating a J-curve for the U.S. In summary of their findings from the price responsiveness test, the authors point out that the adjustment, in terms of lags, brings the scope of quarters and passes well into years (Ibid).

Movements in the exchange rate can, in the short-run, also fuel inflation in an economy. Mainly in small and medium sized countries can a depreciation have a strong effect on whole sale and consumer prices. One of the most powerful effects of a depreciation can be displayed in the prices of imported materials which transfers the higher relative prices to consumer prices. Dornbusch and Krugman argue that this effect is potentially dangerous since a monetary expansion can lead much faster than assumed to mounting inflation pressure due to a coinciding depreciation of the domestic currency (Ibid).

5.4 Denomination of Swedish Trade Payments

There are two major cases of trade currency denomination. When trade is denominated in the importer's currency it is called *local currency pricing* (LCP). The second case is when the trade is denominated in the exporter's currency, which is referred to as *producer currency pricing* (PCP).

To restate the findings of Magee reviewed in chapter 7.2.1, the initial adverse effects on the trade balance, measured in home currency, required imports to be denoted in the home currency. He also argued that the probability of finding patterns of a J-curve in the trade balance would increase if the share of import denominated in foreign currency were larger than the share of exports measured likewise. It should also be mentioned that Magee studied very specific and short time periods close to the devaluations, whereas this paper studies a much longer time period and no specific events.

A working paper commissioned by the Swedish central bank, Riksbanken, revealed some intriguing facts about the denomination of the Swedish trade. Even though the paper is based on a snapshot of the years 1999-2002, it should be able to provide a generalized picture of the situation. One of the most interesting findings was that the overall share of Swedish imports denominated in foreign currency was larger than the share of exports in foreign currency; hence exports, and also imports, are to a larger extent denoted in foreign currency. These findings should, in line with Magee's arguments, increase the chances of finding a J-curve in the case of Sweden. The aforementioned paper contains other enlightening findings, including the wide differences in use of currency throughout different industries and a falling share of the trade denoted in kronor. The paper also shows that amongst Swedish exporters the price of a contract was 60 % of the time set in negotiations with the customers and that the majority of export contracts were set in the currency of the customers (Friberg and Wilander, 2007).

5.5 Time series

5.5.1 Stationarity

In 1974 Clive Granger and Paul Newbold published an article that would bring about a substantial change in working with time series and computers. They showed that common statistical computer software tended to find a relationship between two independent and integrated (non-stationary) series of time observations when these were used in a simple regression with one as the dependent and the other as the explaining variable, when in fact it was apparent that such a relationship would be pure nonsense or "spurious" (Granger, 2004, p. 423). Following this discovery, scholars have become cautious about including series that are not stationary in their regressions and have made it evident that it is important to know one's series well. What is it then that characterizes a stationary time series? Its mean and a variance is constant over time, and the covariance between observations depends only on the length of time between them and not on the point of time at which they are studied. Graphically it is also o rather easy to get a sense of whether the series is stationary or not, since it will be mean reverting and an integrated series might rarely return to its mean (Hill, Griffith, Lim 2008 p.326-328, 333).

5.5.2 Unit Root

A series that is non-stationary (integrated) has a unit root. In an AR(1) model, an auto regressive model of order one, the dependent variable is not only explained by an error term but also by a share of its own value in a previous period, this is the autoregressive feature. If this autoregressive share of the component is one (1) the series is said to have a unit root, the unit root means that the series is a non-stationary random walk process (Hill, Griffith, Lim 2008 p.335). Usually unit roots can be removed from series simply by differencing them and thereby making them stationary ($\Delta y = y_t - y_{t-1}$). If the series becomes stationary after being differentiated once, it is said that the series is integrated of order one I(1). If the series has to be differenced d-times to become stationary, it is integrated of order d, that is, I(d). Now it is easy to see why a stationary series is called I(0) (Hill, Griffith, Lim 2008 p.338). The I(0) series is said to have limited "memory" of its past values which means that any shocks hitting the series will eventually die out. On the other hand, I(1) series are said to have "unlimited memory" of previous events, meaning that effects of disturbances in a variable might linger persistently (Verbeek 2005 p.268)

5.5.3 Cointegration

Since it was shown that including integrated series in regressions might cause software packages to falsely detect a relationship between the variables, usually integrated series are not included. However, if the series are cointegrated, they are included. For two series to be cointegrated it is required that both series are of the same I(d), that is, they share the same unit root or stochastic trend component. The cointegration between two or more variables implies that there is a long-run equilibrium relationship between the variables. With time the system will return to the equilibrium. (Harris and Sollis, 2003, pp. 34-35). Even if most common methods can only deal with series of the same I(d), the method this paper uses can handle series of varying order of integration.

5.6 The Problem – Theory Summation

It is evident from theory that the behavior of economics agents is of a lagged nature, some say 1 to 1½ years others 3 to 5 years. Everything from the importer trying to get the imports noted in a currency likely to depreciate, from recognition lags to delivery lags and to which products really are affected by the relative price illustrates the complexity of the matter. To within a master`s thesis try to control for all these parameters seem very difficult. During the course of this study it becomes important to keep a few things in mind. In the case of Sweden and her aggregate trade and in the disaggregated trade there are diverging indications of a J-curve, see Hacker and Hatemi-J (2003) and Bahmani-Oskooee and

Hajilee (2009). Sweden`s aggregated bilateral trade balance with Germany is negative, Magee (1973) suggested this was a prerequisite for the appearance of the J-curve. On the other hand, strange results for Sweden in terms of changes in exports shares as an effect of changes in the relative price was found by Dornbusch and Krugman (1976). The varying suggestions on the time span for the J-curve is probably the most interesting fact in the theory chapter. If Dornbusch and Krugman are right in their claim of 1-1.5 year span it will be difficult to find patterns of a J-curve using annual data. But on the other hand, if the 3-5 year time span of Junz and Rhomberg holds, the analysis in this paper should be able to detect such a pattern.

6 Data

6.1 Germany – A Problematic Country in Terms of Statistics

It should be noted that retrieving long series for Germany (DE) is somewhat problematic due to the country's history of being parted into East- and West Germany. Most series start at 1991 for the newly reunified Germany. In the cases where there are longer series to be found, the data prior to 1991 often refers to West Germany or series are through various statistical measures linked together between West Germany and the reunified Germany. In this paper, the outmost care and consideration has been taken to recognize this undeniably troublesome issue, however, due to information deficits in the metadata, it cannot be ruled out that errors of this nature are hidden in the used time series. The trade balance variable should not be affected since the variable combines exports and imports for both East- and West Germany.

6.2 WITS – UNSD Comtrade

The data is retrieved from the WITS (World Integrated Trade Solution), which is a free online tool that gives access to statistics related to trades and tariffs and is provided by the World Bank. WITS uses the UNSD COMTRADE (United Nations Statistics Division Commodity Trade) database as data-provider. The COMTRADE database holds a vast amount of information in various nomenclatures and is a free online database with a limit of 50 000 rows per download. Since the SITC Rev. 1 was the first system for data collection, it is also the nomenclature under which there is the most observations to retrieve. Even if the Revision 4 of the SITC is the most up-to-date classification, it simply contains too few time observations (recording started 2007) to be usable in studies of trade flow. Sweden reports the import and export values to UN COMTRADE in SEK, which is then converted to USD using an exchange rate obtained from the IMF IFS database. The trade values are thereby presented in current prices. Note that there is a discrepancy in the way data for Germany is extracted from UN COMTRADE and WITS. In the UN database the data for Germany is found under Former Democratic Republic of Germany (DD/DDR), Former Federal Republic of Germany and Germany (DE/DEU). In the WITS tool the data for the Former Federal Republic of Germany has been linked to the data for Germany. To construct a consistent time series with data for the present geographical Germany, data for the DDR and DEU must be summed. Imports are noted in CIF (Cost, Insurance and Freight) and exports in FOB (Free On Board) (U.N. Secretariat. Economic and Social Affairs, 2010) (The-World-Bank, 2011). A table of the nomenclatures and their range can be found below in Table 3.

It is important to extract both imports and exports from one reporter, Sweden in this case, since imports tend to be recorded with more precision than exports due to tariffs and the fact that the products might be categorized differently depending on importer and exporter. Also the different recording method might cause a discrepancy of as much as 10-20 % between importer and exporter in the recorded trade value(The-World-Bank, 2011).

Nomenclature	Data from year	Data up to year	No. Of time observations
SITC Rev. 4 (S4)	2007	2009	3
SITC Rev. 3 (S3)	1986	2009	24
SITC Rev. 2 (S2)	1976	2009	34
SITC Rev. 1 (S1)	1962	2009	48

Table 3. The SITC nomenclatures and their span. Source: (The-World-Bank, 2010)

6.3 SITC

The System of International Trade Classification (SITC) stems from the Minimum List of Commodities for International Trade Statistics from the late 1930s in the League of Nations era. The "original" SITC was created in 1950 when the U.N. recommended that governments use the revised version of the so-called "Minimum List". To further enhance comparability, the SITC was revised and a second version appeared in 1961, the SITC Rev. 1. As trading patterns changed and technology progressed, there was need for a new revision resulting in the approval of the SITC Rev. 2 in 1975. A growing need for harmonization of economic classifications and for developing the subdivisions of the second revision led to the SITC Rev. 3 in 1985. In 2004, the newest version, SITC Rev. 4, came with slightly different headings and subgroups (United Nations. Statistical Office., 2006, pp. 5-8) (United Nations. Statistical Division., 2004, p. 33). Again, this paper uses the SITC Rev. 1, which has 48 time observations from 1962 to 2009.

This paper is using the Rev. 1 since it has the most time observations. The basic headings of this nomenclature are presented below in Table 4.

Product code	**Product description**
Total	Total Trade
0	Food and live animals
1	Beverages and tobacco
2	Crude materials, inedible, except fuels
3	Mineral fuels, lubricants and related materials
4	Animal and vegetable oils and fats
5	Chemicals
6	Manufactured goods classified chiefly by material
7	Machinery and transport equipment
8	Miscellaneous manufactured articles
9	Commod. & transacts. Not class. Accord. To kind

Table 4. SITC Rev.1 basic heading, 1 digit level.

The three digit product groups are 182 in the Swedish-German trade, and one subgroup from every heading is provided here for pedagogical reasons. These are the first numerical subgroups appearing in the Swedish trade with Germany. The groups presented here are far from the most important export goods in the trade. A selection of the three-digit product groups can be found below in Table 5.

Product code	Product description
001	Live animals
111	Non alcoholic beverages, n.e.s.
211	Hides & skins, exc.fur skins undressed
321	Coal, coke & briquettes
411	Animal oils and fats
512	Organic chemicals
611	Leather
711	Power generating machinery, other than electric
812	Sanitary, plumbing, heating & lighting fixtures
911	Postal packaged not classd.accord.to kind

Table 5. Showing a selection of SITC Rev. 1 three-digit headings.

6.4 Variables

In this paper a reduced form model where the demand for imports and exports or the trade balance is explained by the economic activities in each country and its respective relative price. The exchange rate will be used as proxy for the relative price. Variables will follow the Bahmani-Oskooee and Hajilee (2009) setting closely.

$$F(TB) = Y_{SE} + Y_{DE} + REBEX \qquad (10)$$

6.4.1 Trade Balance

This work is outlined to follow (Bahmani-Oskooee and Hajilee, 2009) and the trade balance of commodity i (TB_i), is defined as the trade ratio, that is the value of Swedish exports to Germany of commodity i to Sweden's imports of commodity i from Germany (Exports/Imports) in US dollars. Using this ratio has many advantages. Throughout history, defining trade balance in foreign or domestic currency has resulted in differing results, and by using the ratio of exports to imports this problem can be avoided. Another advantage is that the ratio is the same for real and nominal values, but also that it is unit free, which eliminates the issue that the trade values are recorded in US dollars (Bahmani-Oskooee, 1991, p. 404). The ratio is defined as:

$$TB_i = \frac{X_i}{M_i} \qquad (11)$$

The data that builds the trade balance is the sum of Sweden`s trade with East- and West Germany from 1962 to 2009.

The construction of the trade balance variable, according to the above described method, naturally caused a loss in observations. When taken into consideration that some groups already had alarmingly few observations at the beginning, some groups ended up with as small samples as 14, 5, 1 or even zero observations. Since this paper employs the critical values of Narayan(2004), which are suitable for sample sizes of 30 to 80 observations, it was decided to drop all product groups possessing less than 30 observations. From the original 182 groups, 33 groups with less than 30 observations where filtered out. This rendered a working sample of 149 product groups suitable for the method. The dropped groups are presented in Appendix 1. When studying the total aggregated balance of trade structural changes in the society is not likely to affect the balance since it records the total trade. On the other hand, when comparing product categories and the disaggregated balance of trade, the case could be the opposite. In this case the trade is recorded in a standard set in 1961 which makes it obvious that a product group might hold different products in 1962 and 2009. If a certain product group has increased its share from 1962 and 2009 it might be because of new products are being added or are replacing old ones. Thus such a comparison can be problematic.

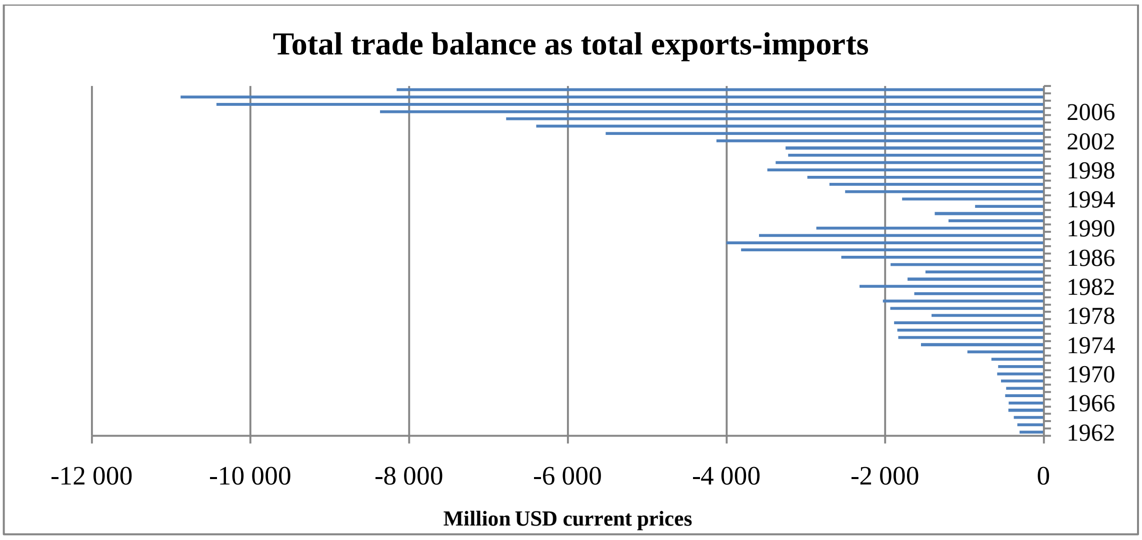

Figure 2. Showing the trade balance as exports minus imports for Swedish trade with Germany between 1962 and 2009. Source: WITS

Figure 2. above shows that the total trade balance (defined as exports minus imports) for the trade between Sweden and Germany is negative for every year in the studied time period. This reflects the large discrepancy between imports and exports. The difference between exports and imports strike an all time high in 2008. The relative importance of the export is easier seen in Figure 3 below.

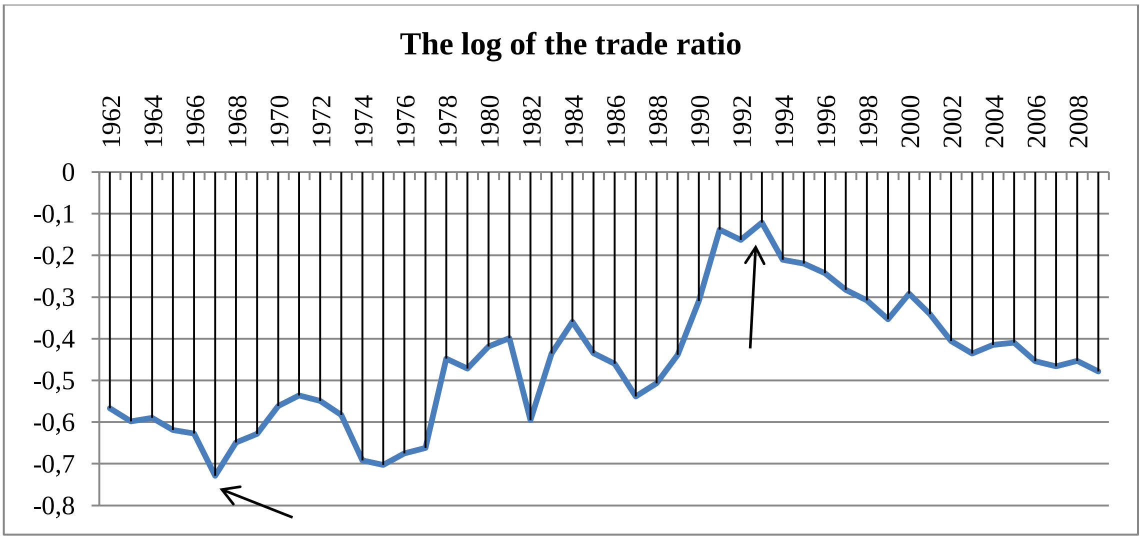

Figure 3. Showing the log of the trade ratio. Source: WITS

The log of the trade ratio is provided in Figure 3. Above and shows the relative importance of the export to the import. In this dataset 1967 marks a low point for exports relative importance whereas 1993 marks a record year in importance for the export.

6.4.1.1 Exports

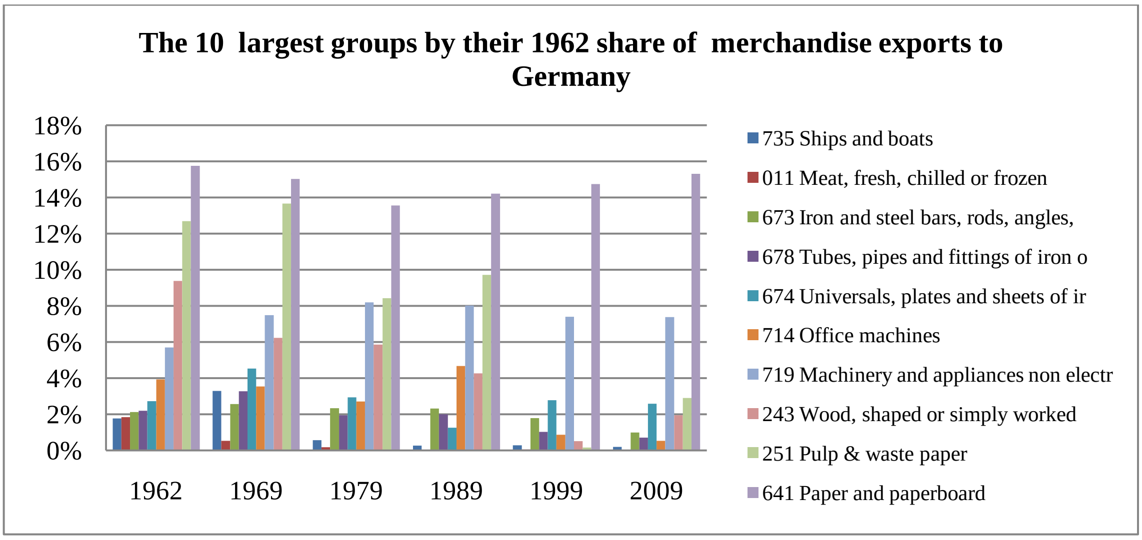

Figure 4. Shows the largest export groups in 1962. Source: WITS

Knowing that the underlying products in the groups might change over time a comparison of the top ten largest product groups in trade still is useful. In 1962 the largest product group, seen in Figure 4., in the exports to Germany measured as share of exports was 641 Paper and paperboard with a share of almost 15, 8 %. Paper and paperboard enjoys a rather stable presence in the top throughout the sample. The second largest group in 1962 was 251 Pulp and waste paper which`s share has seen a quite substantial loss in importance. The third largest group 243 Wood is also a product group that has seen a substantial loss of share in the time period.

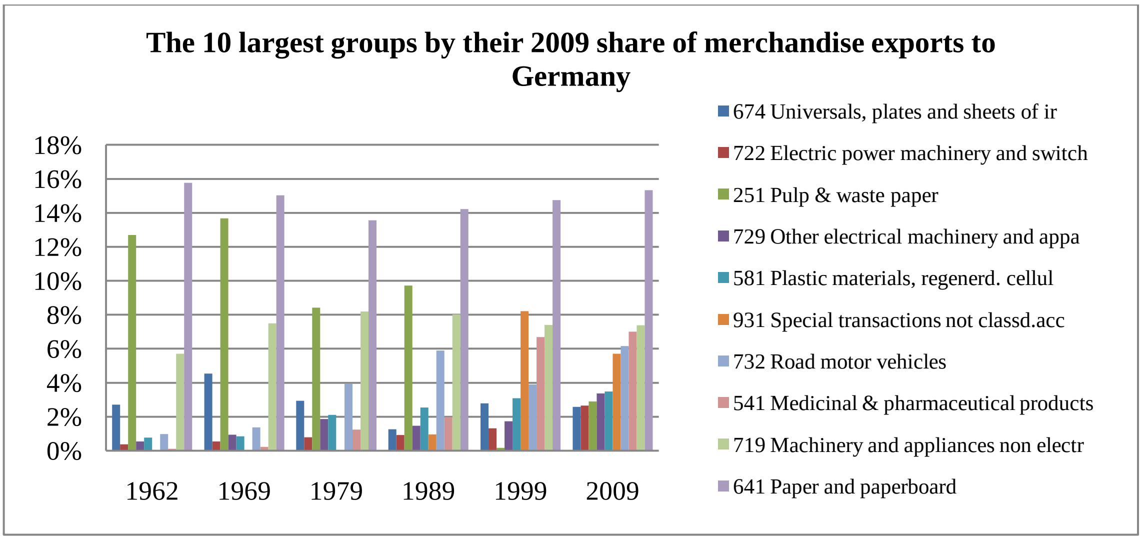

Figure 5. Showing the largest product groups in Swedish exports. Source: WITS

As can be seen in Figure 5., group 641 paper and paperboard is with its 15, 3 % still in 2009 by far the largest product group. Machinery and appliances 719 has climbed from a 4th place in 1962 to become the second largest group in the export with a rather stable share of between 7 and 8 %. Group 251 Pulp & waste paper, which for many years was the second largest group has seen its share fall to an 8th place from almost 13 % in 1962 to some 3 % in 2009. In contrast group 931 Special transactions and 541 Medicinal & pharmaceutical products have increased heavily in relative importance in the second half of the period. And the product group 732 Road motor vehicles has made its way into the top 10 group and now holds a 4th place. In summary, even if Sweden's industrial heritage still lingers in the 2009 top ten list of exports, indications of a structural shift can be seen. Products like ships, iron and steel, wood and pulp have been replaced or lost ground to road motor vehicles, medical products, plastics and electric appliances.

6.4.1.2 Imports

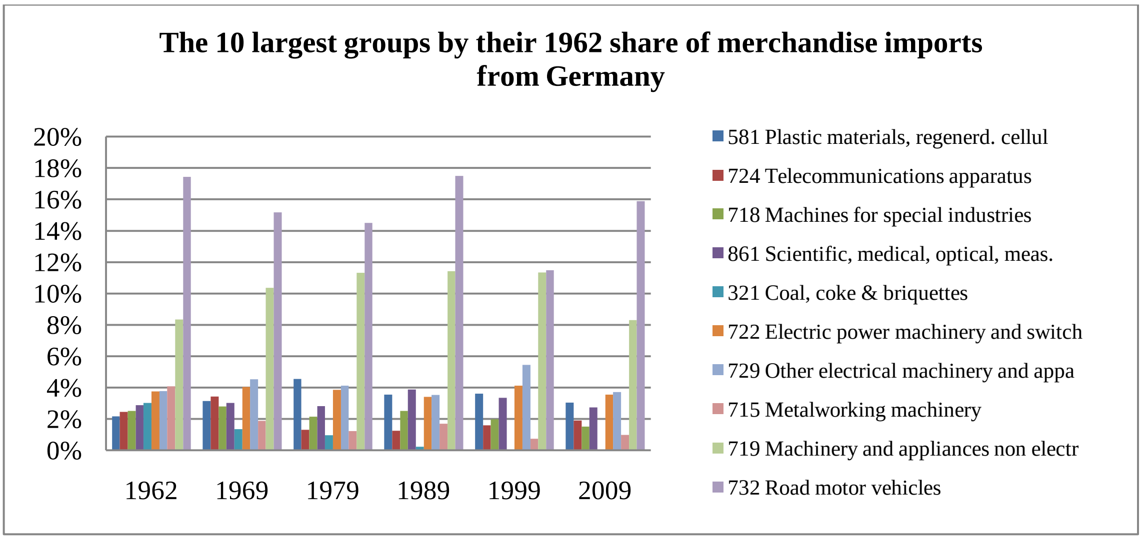

Figure 6. Showing the largest product groups in the import 1962. Source: WITS

Road motor vehicles group 732 is in 1962 the most important product group in the imports from Germany to Sweden with its 17, 4 % of the imports. This is seen in Figure 6. The group is in 2009 still the most important group still followed by the second largest group 719 non electrical machinery and appliances. The third largest product group, 715, Metalworking machinery looses ground throughout the period.

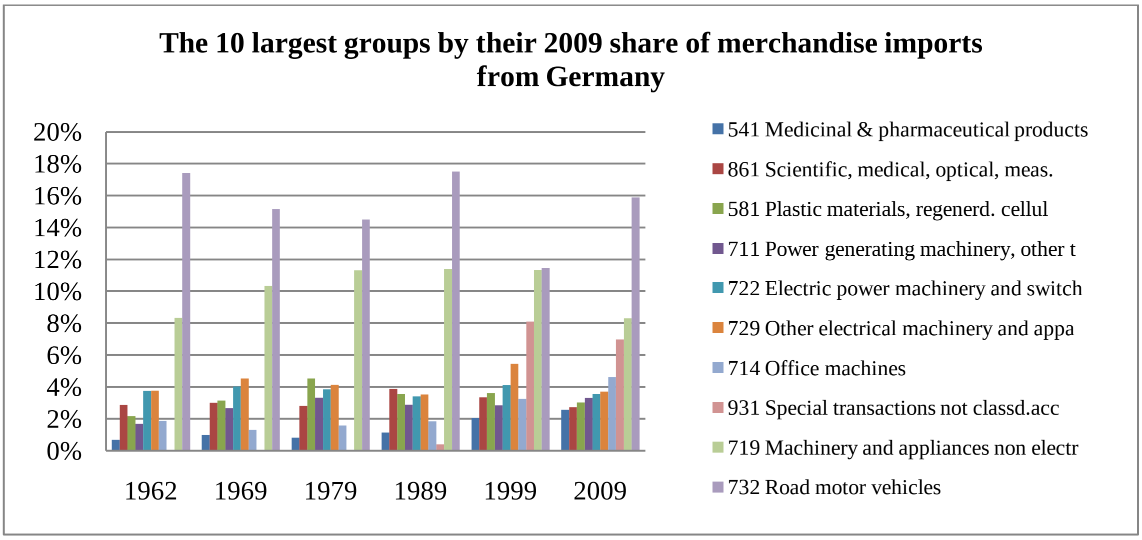

Figure 7. Showing the largest product groups in the imports in 2009. Source: WITS

Even if group 732 and 719 still are in the lead the third and the fourth place are in 2009 taken by 931 Special transactions and 714 Office Machines.

6.4.2 Economic Activity

As a measure of economic activity, the real GDP for Sweden (Y_{SE}) and Germany (Y_{SE}) are used. As economic activity in Sweden increases this ought to increase the demand for Swedish imports. Likewise, a higher economic activity in Germany is likely to increase the German demand for Swedish exports. The real GDP, found in Figure 8., could therefore also be said to act as a demand proxy.

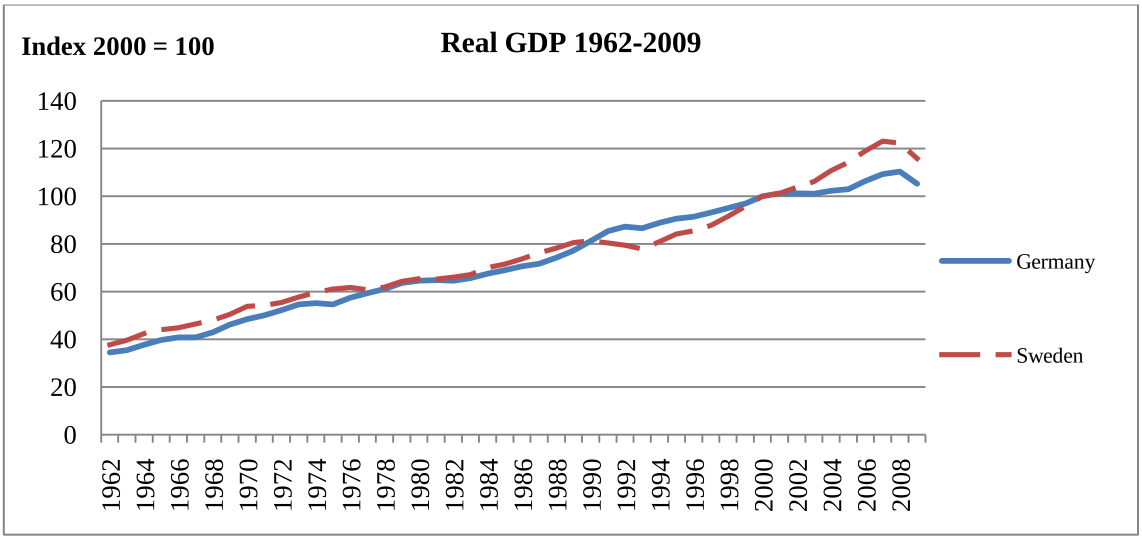

Figure 8. Shows an index of the real GDP of Sweden and Germany. Base year 2000. Source IFS and OECD

A consistent time series for German real GDP is notoriously hard to come by and had to be constructed based on OECD and IMF data. The original series from OECD Stat, stretches from 1970 to 2009 and is measured in million Euros. The data from 1991 and onwards are actual data for the reunified Germany and the data prior to 1991 are estimates for the reunified Germany. OECD estimated the series prior to 1991 based on data from West Germany and thereby constructed a complete series for the present Germany from 1970 to 2010. To complete the series back to the starting point of the time period used in this paper 1962, the OECD data was combined with data from IMF IFS. The data from IFS being a volume index is joined with ratio splicing in 1991 and 1999, due to the reunification and the change to Euro, thereby this series also covers the entire reunified Germany. The IFS data was then for use in this paper converted into the OECD base year 2000 and then the annual growth rates were extracted to be used with the OECD data to extend the series back in time from 1970 to 1962.

The real GDP for Sweden is an untreated OECD series in the prices of year 2000 measured in million SEK.

6.4.3 Exchange Rate

There is a large variety in the use of different exchange rates in previous research, e.g. the nominal effective exchange rate, the real effective exchange rate and the real bilateral exchange rate. Even if the effective exchange rate is often used in studies on how the exchange rate affects trade flows, there is a powerful argument against using this exchange rate in bilateral studies since it is a combination of bilateral exchange rates weighted with the relative importance of the country's trading partners. The real effective exchange rate therefore measures a country's total market power or competiveness against that country's major trading partners. In a bilateral study, the bilateral exchange rate is therefore more suitable since it only contains information regarding the countries in question and does not carry any excess information on other countries (Alsterlind, 2006, pp. 58-59). This paper will use the real bilateral exchange rate (REBEX henceforth) defined as:

$$Real\ bilateral\ exchange\ rate = \frac{GDP\ deflator_{DE} \times E}{GDP\ deflator_{SE}} \qquad (12)$$

The GDP deflator is used for the respective countries and E is the nominal bilateral exchange rate defined as the number of Swedish kronor over the number of Euros, $= \frac{\#\,SEK}{\#\,EUR}$. Denoted this way implies a depreciation of the SEK when the REBEX increases. Note that various measures of inflation is used in the literature, unfortunately without comment; for instance, Bahmani-Oskooee & Hajilee (2009) uses the CPI and Irandoust et al. (2006) the GDP deflator. For more information on the impact of the choice of deflator see (Bayoumi, 1999).The logic behind the use of the GDP deflator instead of CPI lie in the fact that CPI measures inflation based on household consumption and the GDP deflator is based on the entire economy. This paper argues that since agents of exports and imports are not mainly households another measure of inflation should be used, the GDP deflator. Now, it is not unproblematic to use a deflator based on the GDP in a study of merchandise trade, since this deflator also includes services. If separate models for exports and imports were to be estimated, appropriate deflators to construct a REBEX would be export and import price indices. To use such indices in a model such as the one used here would require the construction of a new combined index, and this lies outside the scope of this paper. Thus, the GDP deflator is used and the potential issues connected with it noted. The real bilateral exchange rate can be seen below in Figure 9.

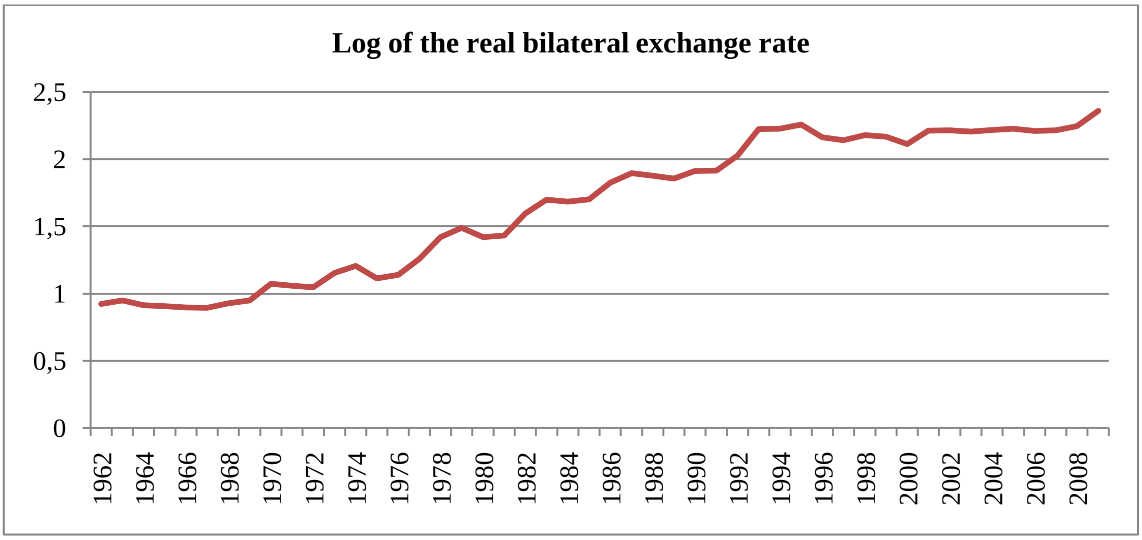

Figure 9. Showing the real bilateral exchange rate in logs.

Nominal bilateral exchange rates in local currency per US dollar were collected from OECD and then converted into number of SEK over Euros. Unfortunately the OECD metadata on the bilateral exchange rate for Germany is somewhat unclear. The series is complete from 1962 to 2009 without any notes whatsoever on statistical breaks. This causes some concern related to the history of the German GDP series.

The GDP deflators were collected from IMF IFS and also here the metadata is unsatisfying. There are no notes on statistical breaks or any change in the data.

7 Method of Detecting the J-Curve

7.1 Method

The method used here is the ARDL bounds testing approach (See Pesaran et al. 2001), which has many advantages in relation to the more widely known cointegration techniques.

The series used in this paper stretches over a 48-year span resulting in a sample size of 48 observations. It is well known that many of the standard cointegration techniques rely heavily on asymptotic theory and have bad small sample properties. Irandoust et al.(2006), list a few of the methodological issues encountered in previous research. There is a risk of using OLS on non-stationary series since it might find spurious relationships. Techniques such as the Engle-Granger approach to cointegration that are residual based can only establish one cointegration vector, and by referring to Toda's 1994 and 1995 articles the authors conclude that the Johansen (1991) approach to cointegration needs large samples and 100 observations is not enough to correctly detect the cointegration rank (Irandoust et al., 2006, p. 171).

Bahmani-Oskooee & Hajilee (2009) employ the method of Pesaran et al. (2001) with the argument that the method does not require any pre-testing of the series for the presence of unit roots (p. 84). It is well known that since standard unit root tests themselves have low power, any cointegration technique that depends on such a test will import the low power problem from the unit root test into the cointegration tests (Pesaran et al., 2001, p. 289). In his article on the Japanese aggregate import demand function, Tang (2003) argues for his use of the Pesaran et al. (2001) method with its aspects of good, finite (small) sample properties and with the fact that this method covers all the cases of classification regardless of if the regressors are purely I(0), purely I(1), or mutually cointegrated. The standard cointegration techniques like the Johansen (1988), Engle-Granger (1987) and Johansen-Juselius (1990) methods need the underlying variables to be of the same order I(1) (Tang, 2003, p. 421).

As previously shown, the Pesaran et al. (2001) approach to cointegration has many advantages. It builds on an unrestricted equilibrium error correction model in an ARDL framework and is a method that is simple to use with its two steps. The first step is to estimate the ARDL model formulated in terms of an unrestricted error correction model (UECM) Eq. (17) in Eviews using standard OLS. In the second step, a long-run relationship between the variables is searched for using a regular F-test (Wald). The F-test has a lower and an upper bound of critical values from an asymptotic non-standard distribution set. If the F-statistic falls outside the bounds the test is conclusive but if it falls within the bounds the test is inconclusive and establishing the order of integration of the series is needed (Pesaran et al., 2001, p. 290). Using the OLS estimator is not a problem within the ARDL framework, Pesaran et al. (1999) showed that for the short-run parameters, the OLS estimator is $\sqrt{T}$ consistent, and, for the long-run coefficients, the ARDL estimator is even super consistent (Pesaran and Shin, 1999).

7.2 Model

This chapter draws largely on (Jorlén, 2008), which studies Foreign Tourism demand in Sweden and (Jorlén, 2010), which studies long series of human capital in Sweden, both in the ARDL framework of

Pesaran et al.(2001). NB, both these papers interpreted the bounds test incorrectly, this has been revised and is correctly used here.

A feature of the ARDL is that the lagged dependent variable corrects for autocorrelation, it is also a suitable choice when modeling the J-curve since the model is dynamic and captures the theory that the trade balance depends on lagged values of itself and on its explanatory variables. That economic activity and decision making is lagged was shown in the Theory chapter where the findings of Magee (1973) and Junz and Rhomberg (1973) were presented. The ARDL model captures these dynamics through the lagged variables and it is reasonable to assume that the trade balance depends, to some extent, on lagged values of both itself and its explanatory variables. This strengthens the choice of model.

The model is constructed within the ARDL framework (note that logs (Ln) of all variables haven been taken and "log" will, for the sake of ease, not be include in the model). ARDL is an abbreviation for auto regressive distributed lag. The auto regressive part indicates that the dependent variable $TB_{i,t}$ has backwards looking characteristics. It is partly explained by its own value in the previous period $TB_{i,t-1}$. The distributed lag part indicates the inclusion of lagged values of the explanatory variables i.e. $REBEX_{t-k}$.

Equation (14) is an ARDL(n, n, n, n) model using the same optimal lag length on all explanatory variables and with an error correction part. It originates from the ARDL(p, q, r, s) model where the lower case letters indicate that it is possible to use different lag lengths on the different variables in the model. The "p" represents the lag length on the dependent variable, the "q" the lag length on the first explanatory variable, and so on (see (Davidson and MacKinnon, 2004). The k's below the Sigmas indicate where the lag length starts. The dependent TB variable enters the explanatory side with one lag (k=1) and then ascends to the maximal optimal selected lag, whereas the explanatory variables all start with zero lags (k=0) and then continue towards the max lag.

First, the long-run model Eq. (13) is constructed, some would object to the use of only betas as parameters, but this helps the interpretation in the coming steps and makes it easier to separate the short from the long-run.

$$TB_{i,t} = \beta_0 + \beta_1 Y_{SE,t} + \beta_2 Y_{DE,t} + \beta_3 REBEX_t + \varepsilon_{i,t} \qquad (13)$$

The long-run model Eq. (13) is then rewritten in terms of an Unrestricted Error Correction Model (UECM) in (14).

$$\begin{aligned}\Delta TB_{i,t} = \overset{\text{Intercept}}{\widehat{\alpha}} &+ \overbrace{\sum_{k=1}^{n} \gamma_k \Delta TB_{i,t-k} + \sum_{k=0}^{n} \delta_k \Delta Y_{SE,t-k} + \sum_{k=0}^{n} \varphi_k \Delta Y_{DE,t-k} + \sum_{k=0}^{n} \psi_k \Delta REBEX_{t-k}}^{\text{Short-run-dynamics}} \\ &+ \underbrace{\omega}_{\substack{\text{Adjustment-}\\ \text{parameter}}} \underbrace{\left[TB_{i,t-1} - (\beta_0 + \beta_1 Y_{SE,t-1} + \beta_2 Y_{DE,t-1} + \beta_3 REBEX_{t-1})\right]}_{\text{Equilibrium error}} \\ &+ \underbrace{\varepsilon_t}_{\text{Error term}}\end{aligned}$$

(14)[2]

[2] γ= gamma δ= delta ε= epsilon φ= phi ψ= psi ω= omega

In economics, the long-run is referred to as equilibrium, which might not always be the state of the economy since it is constantly hit by chocks of varying nature, such as a devaluation. In the above long-run model of the trade balance Eq. (13), the long-run response to a change in one of the exogenous variables say, REBEX is captured by β_3. Within the framework of the UECM in Eq. (14), a change in TB, ΔTB, as a result of a chock in an exogenous variable would be equally as large as the deviation of TB`s long-run value in the previous period: $TB_{i,t} - (\beta_0 + \beta_1 Y_{SE,t} + \beta_2 Y_{DE,t} + \beta_3 X_t)$. Above in Eq. (14), the “Short-run –dynamics stretch” frames the terms measuring the short-run effects on TB caused by a change in one of the explanatory variables. Now a chock in, again, say, REBEX would affect the TB in the short-run and cause a deviation from TB’s long-run value. This deviation is the equilibrium error. The equilibrium error will affect TB in the subsequent period and cause TB to start moving towards the equilibrium, and thereby gradually erasing the equilibrium error. The Speed of Adjustment Parameter (ω) indicates at what speed this adjustment occurs (Fregert, 2004).

The ECM model in (14), unchanged in Eq.(15), will now in a few steps be rewritten in its final form (17) :

$$\Delta TB_{i,t} = \alpha + \sum_{k=1}^{n} \gamma_k \Delta TB_{i,t-k} + \sum_{k=0}^{n} \delta_k \Delta Y_{SE,t-k} + \sum_{k=0}^{n} \varphi_k \Delta Y_{DE,t-k} + \sum_{k=0}^{n} \psi_k \Delta REBEX_{t-k}$$
$$+ \omega\left[TB_{i,t-1} - (\beta_0 + \beta_1 Y_{SE,t-1} + \beta_2 Y_{DE,t-1} + \beta_3 REBEX_{t-1})\right] + \varepsilon_t \quad (15)$$

$$\Delta TB_{i,t} = \alpha + \sum_{k=1}^{n} \gamma_k \Delta TB_{i,t-k} + \sum_{k=0}^{n} \delta_k \Delta Y_{SE,t-k} + \sum_{k=0}^{n} \varphi_k \Delta Y_{DE,t-k} + \sum_{k=0}^{n} \psi_k \Delta REBEX_{t-k} + \omega TB_{i,t-1}$$
$$- \omega\beta_0 - \omega\beta_1 Y_{SE,t-1} - \omega\beta_2 Y_{DE,t-1} - \omega\beta_3 REBEX_{t-1} + \varepsilon_t \quad (16)$$

$$\Delta TB_{i,t} = \pi_0 + \sum_{k=1}^{n} \gamma_k \Delta TB_{i,t-k} + \sum_{k=0}^{n} \delta_k \Delta Y_{SE,t-k} + \sum_{k=0}^{n} \varphi_k \Delta Y_{DE,t-k} + \sum_{k=0}^{n} \psi_k \Delta REBEX_{t-k}$$
$$+ \pi_1 TB_{i,t-1} + \pi_2 Y_{SE,t-1} + \pi_3 Y_{DE,t-1} + \pi_4 REBEX_{t-1} + \varepsilon_t \quad (17)$$

The model above in Eq. (17) is the model the paper will be working with, and it is an Unrestricted Error Correction Model (UECM). The last step, between Eq. (16) and (17), is to replace the parameters with π_i, where: $\pi_0 = \alpha - \omega\beta_0$, $\pi_1 = \omega$, $\pi_2 = -\omega\beta_1$, $\pi_3 = -\omega\beta_2$, $\pi_4 = -\omega\beta_3$ Later in the estimation of Eq. (17) using OLS, π_i, will provide the key to identifying the coefficients of Eq. (16).

Obtaining the long-run elasticities will be done accordingly:

$$0 = \pi_1 \overline{TB} + \pi_2 \overline{Y_{SE}} + \pi_3 \mathrm{Y_{DE}} + \pi_4 \overline{REBEX} \quad (18)$$

$$\overline{\boldsymbol{TB}} = \frac{-\pi_2 \overline{Y_{SE}} - \pi_3 \overline{\mathrm{Y_{DE}}} - \pi_4 \mathrm{REBE\overline{X}}}{\pi_1} \quad (19)$$

$$\overline{\boldsymbol{TB}} = -\frac{\pi_2}{\pi_1} * \overline{Y_{SE}} - \frac{\pi_3}{\pi_1} * \overline{Y_{DE}} - \frac{\pi_4}{\pi_1} * \overline{REBEX} \quad (20)$$

$$-\frac{\pi_2}{\pi_1} = -\frac{(-\omega\,\beta_1)}{\omega} = \boldsymbol{\beta_1} \text{ Swedish income elasticity} \quad (21)$$

$$-\frac{\pi_3}{\pi_1} = -\frac{(-\omega\beta_2)}{\omega} = \boldsymbol{\beta_2} \text{ German income elasticity,} \quad (22)$$

$$-\frac{\pi_4}{\pi_1} = -\frac{(-\omega\beta_3)}{\omega} = \boldsymbol{\beta_3} \text{ Exchange rate elasticity} \quad (23)$$

Step1.

The first step is to establish the appropriate lag length using SBC and then to estimate Eq. (17) with OLS in Eviews. Pesaran and Shin (1999) suggested the use of the Schwarz Bayesian information criterion to select the lag length since the SBC performed slightly better in small samples. They also recommended using a maximum of two lags in the use of annual data. But considering the findings of Junz and Rhomberg and those of Dornbusch and Krugman with lag lengths between 1 and 5 years was found, this paper chooses a middle way and opts for a maximum of three lags. In finding the lag length the sample was fixed for best possible result, see (Ng and Perron, 2005). Models presented are all with the optimal lag length. Off course long-run estimates are less interesting if no cointegration has been established. Due to this the results from step 2 are presented before those of step 1.

Step 2.

In investigating the presence of a long-run relationship a restriction is imposed on the model the lagged-level variables (the long-run variables) are excluded from the UECM. If the long-run parameters turn out to be zero, a long-run relationship simply cannot exist. This is tested with the use of a Wald-test (F-statistic). The null of no cointegration H_0: $\pi_1 = \pi_2 = \pi_3 = \pi_4 = 0$ is tested against the alternative of cointegration H_A: $\pi_1 \neq \pi_2 \neq \pi_3 \neq \pi_4 \neq 0$. Under the null, the F-statistic has an asymptotic non-standard distribution regardless of if all variables are I(0), I(1) or mutually cointegrated. The critical values form a lower and an upper bound for the opposite cases where all variables are I(0) or I(1). Using variables of different I(d) is not a problem since the bounds cover all situations. The advantage with the bounds test is that if the F-statistic falls outside the bounds no knowledge is needed about the characteristics of the integration or the cointegration. The disadvantage is that if the F-statistic falls inside the bounds, the test is inconclusive, which means that more knowledge about the series is needed (Pesaran et al., 2001, p. 290). Due to the small sample size used, this paper opts for the critical values provided by Narayan (2004) rather than the original values reported in e.g. Pesaran (2001). The reason behind this is the fact that the values of Narayan (2004) are suitable for small sample sizes between 30 and 80 observations whereas original critical values are based on much larger samples of between 500 and 1000 observations (Narayan, 2004, p. 16). The null can be rejected if the calculated F-stat lies above the upper bounds, whereas the null cannot be rejected if the F-statistic falls below the lower bound.

8 Results

The results from the bounds test can be seen below in Table 6. Among the 149 product groups a long-run relationship could be found in 51 groups (white rows). For 19 groups the inference was inconclusive.

Product Group	LL	Obs	F-stat	I(0)	I(1)	Result	Adj R2
001 Live animals	0	44	2,183	3,078	4,022	Below	0,245
012 Meat, dried, salted or smoked	0	34	5,938	3,160	4,218	Above	0,468
013 Meat in airtight containers n.e.s & meat preparations	0	44	2,251	3,078	4,022	Below	0,153
022 Milk and cream	3	32	5,729	3,208	4,252	Above	0,577
024 Cheese and curd	0	44	2,023	3,078	4,022	Below	0,170
025 Eggs	2	35	6,066	3,164	4,194	Above	0,535
031 Fish, fresh & simply preserved	0	44	1,756	3,078	4,022	Below	0,071
032 Fish, in airtight containers, n.e.s & fish preparations.	0	44	2,342	3,078	4,022	Below	0,221
045 Cereals, unmilled excl. wheat, rice, barley & maize	0	44	4,388	3,078	4,022	Above	0,215
048 Cereal preps & preps of flour of fruits & vegs.	0	44	4,398	3,078	4,022	Above	0,313
051 Fruit, fresh, and nuts excl. Oil nuts	1	44	5,574	3,078	4,022	Above	0,486
053 Fruit, preserved and fruit preparations	0	44	1,555	3,078	4,022	Below	0,167
054 Vegetables, roots & tubers, fresh or dried	0	44	3,926	3,078	4,022	Inconcl.	0,265
055 Vegetables, roots & tubers pres or prepared n.e.s.	0	44	0,816	3,078	4,022	Below	0,174
062 Sugar confectionery, sugar preps. Ex chocolate confy	0	44	2,887	3,078	4,022	Below	0,236
071 Coffee	0	44	3,819	3,078	4,022	Inconcl.	0,188
073 Chocolate & other food preptns. cont. Cocoa, n.e.s.	0	44	3,085	3,078	4,022	Inconcl.	0,149
075 Spices	0	44	4,402	3,078	4,022	Above	0,373
081 Feed. Stuff for animals excl. unmilled cereals	1	44	1,630	3,078	4,022	Below	0,537
091 Margarine & shortening	0	41	2,014	3,078	4,022	Below	0,172
099 Food preparations, n.e.s.	0	44	4,987	3,078	4,022	Above	0,263
111 Non alcoholic beverages, n.e.s.	0	39	2,701	3,116	4,094	Below	0,108
112 Alcoholic beverages	0	44	1,423	3,078	4,022	Below	0,030
122 Tobacco manufactures	0	44	1,268	3,078	4,022	Below	0,037
211 Hides & skins, exc.fur skins undressed	0	44	4,776	3,078	4,022	Above	0,375
221 Oil seeds, oil nuts and oil kernels	0	45	2,759	3,078	4,022	Below	0,202
231 Crude rubber incl. synthetic & reclaimed	0	45	2,923	3,078	4,022	Below	0,196
241 Fuel wood & charcoal	0	42	3,528	3,078	4,022	Inconcl.	0,167
242 Wood in the rough or roughly squared	0	40	2,683	3,100	4,088	Below	0,125
243 Wood, shaped or simply worked	0	45	2,645	3,078	4,022	Below	0,352
251 Pulp & waste paper	0	44	3,559	3,078	4,022	Inconcl.	0,308
262 Wool and other animal hair	0	31	2,151	3,256	4,264	Below	0,123
266 Synthetic and regenerated artificial fibres	0	42	1,933	3,078	4,022	Below	0,120
267 Waste materials from textile fabrics, incl. rags	0	45	1,949	3,078	4,022	Below	0,137
273 Stone, sand and gravel	0	45	7,231	3,078	4,022	Above	0,359
275 Natural abrasives incl. industrial diamonds	0	31	1,599	3,256	4,264	Below	0,132
276 Other crude minerals	0	45	4,281	3,078	4,022	Above	0,268
282 Iron and steel scrap	0	45	1,235	3,078	4,022	Below	0,057
283 Ores & concentrates of non ferrous base metals	0	45	3,053	3,078	4,022	Below	0,185
284 Non ferrous metal scrap	0	44	10,838	3,078	4,022	Above	0,574
291 Crude animal materials, n.e.s.	0	45	2,661	3,078	4,022	Below	0,243

292 Crude vegetable materials, n.e.s.	0	45	4,192	3,078	4,022	Above	0,311
321 Coal, coke & briquettes	0	45	4,992	3,078	4,022	Above	0,273
331 Petroleum, crude and partly refined	0	45	1,983	3,078	4,022	Below	0,099
341 Gas, natural and manufactured	0	38	13,295	3,130	4,128	Above	0,692
411 Animal oils and fats	0	45	2,025	3,078	4,022	Below	0,118
421 Fixed vegetable oils, soft	0	45	5,080	3,078	4,022	Above	0,277
431 Anim./veg. Oils & fats, processed, and waxes	0	45	2,398	3,078	4,022	Below	0,168
512 Organic chemicals	0	45	3,146	3,078	4,022	Inconcl.	0,148
513 Inorg. chemicals elems., oxides, halogen salts	0	45	4,495	3,078	4,022	Above	0,419
514 Other inorganic chemicals	2	43	6,304	3,078	4,022	Above	0,523
515 Radioactive and associated materials	0	45	4,744	3,078	4,022	Above	0,300
521 Crude chemicals from coal, petroleum and gas	0	40	2,303	3,100	4,088	Below	0,212
531 Synth. organic dyestuffs, natural indigo & lakes	0	45	3,093	3,078	4,022	Inconcl.	0,202
532 Dyeing & tanning extracts, synth. tanning mat.	0	41	1,464	3,078	4,022	Below	0,129
533 Pigments, paints, varnishes & related materials	0	45	1,119	3,078	4,022	Below	0,067
541 Medicinal & pharmaceutical products	0	45	2,199	3,078	4,022	Below	0,329
551 Essential oils, perfume and flavour materials	0	45	4,308	3,078	4,022	Above	0,259
553 Perfumery, cosmetics, dentifrices, etc.	0	45	2,239	3,078	4,022	Below	0,052
554 Soaps, cleansing & polishing preparations	0	45	2,370	3,078	4,022	Below	0,084
561 Fertilizers manufactured	2	43	7,275	3,078	4,022	Above	0,485
571 Explosives and pyrotechnic products	0	45	2,296	3,078	4,022	Below	0,130
581 Plastic materials, regenerd. cellulose & resins	0	45	1,878	3,078	4,022	Below	0,163
599 Chemical materials and products, n.e.s.	0	45	2,134	3,078	4,022	Below	0,161
611 Leather	0	45	2,382	3,078	4,022	Below	0,158
612 Manuf. of leather or of artif. or reconst. leather	2	43	4,789	3,078	4,022	Above	0,435
613 Fur skins, tanned or dressed, including dyed	1	41	5,756	3,078	4,022	Above	0,356
621 Materials of rubber	0	45	6,772	3,078	4,022	Above	0,505
629 Articles of rubber, n.e.s.	0	45	3,929	3,078	4,022	Inconcl.	0,294
631 Veneers, plywood boards & other wood, worked, n.e.s.	0	45	3,249	3,078	4,022	Inconcl.	0,115
632 Wood manufactures, n.e.s.	0	45	8,826	3,078	4,022	Above	0,467
633 Cork manufactures	0	42	1,765	3,078	4,022	Below	0,066
641 Paper and paperboard	0	45	6,083	3,078	4,022	Above	0,390
642 Articles of paper, pulp, paperboard	0	45	2,885	3,078	4,022	Below	0,183
651 Textile yarn and thread	0	45	1,499	3,078	4,022	Below	0,054
652 Cotton fabrics, woven ex. narrow or spec. fabrics	0	45	0,880	3,078	4,022	Below	-0,072
653 Text fabrics woven ex narrow, spec, not cotton	0	45	3,354	3,078	4,022	Inconcl.	0,241
654 Tulle, lace, embroidery, ribbons, trimmings	2	43	2,535	3,078	4,022	Below	0,242
655 Special textile fabrics and related products	0	45	2,505	3,078	4,022	Below	0,218
656 Made up articles, wholly or chiefly of text.mat.	0	45	2,325	3,078	4,022	Below	0,075
657 Floor coverings, tapestries, etc.	3	42	5,049	3,078	4,022	Above	0,570
661 Lime, cement & fabr. bldg.mat. Ex glass/clay mat	0	45	0,626	3,078	4,022	Below	-0,029
662 Clay and refractory construction materials	0	45	4,379	3,078	4,022	Above	0,253
663 Mineral manufactures, n.e.s.	0	45	3,304	3,078	4,022	Inconcl.	0,144
664 Glass	1	44	2,336	3,078	4,022	Below	0,243
665 Glassware	1	44	2,907	3,078	4,022	Below	0,378
666 Pottery	0	45	2,538	3,078	4,022	Below	0,144
667 Pearls and precious and semi precious stones	1	35	1,838	3,164	4,194	Below	0,582

671 Pig iron, spiegeleisen, sponge iron etc	0	45	1,404	3,078	4,022	Below	-0,027
672 Ingots & other primary forms of iron or steel	3	41	1,326	3,078	4,022	Below	0,664
673 Iron and steel bars, rods, angles, shapes, sections	3	41	9,086	3,078	4,022	Above	0,732
674 Universals, plates and sheets of iron or steel	2	42	4,167	3,078	4,022	Above	0,505
676 Rails & rlwy track constr mat. Of iron or steel	0	43	1,695	3,078	4,022	Below	0,066
677 Iron and steel wire, excluding wire rod	0	43	4,502	3,078	4,022	Above	0,252
678 Tubes, pipes and fittings of iron or steel	0	43	3,833	3,078	4,022	Inconcl.	0,389
679 Iron steel castings forgings unworked, n.e.s.	0	43	1,157	3,078	4,022	Below	-0,051
681 Silver and platinum group metals	0	43	3,009	3,078	4,022	Below	0,196
682 Copper	0	43	1,945	3,078	4,022	Below	0,025
683 Nickel	0	43	4,934	3,078	4,022	Above	0,236
684 Aluminium	2	42	6,176	3,078	4,022	Above	0,505
685 Lead	2	42	6,884	3,078	4,022	Above	0,618
686 Zinc	0	40	4,317	3,100	4,088	Above	0,419
687 Tin	0	40	9,088	3,100	4,088	Above	0,584
689 Miscell.non ferrous base metals	0	43	1,696	3,078	4,022	Below	0,285
691 Finished structural parts and structures, n.e.s	0	43	2,815	3,078	4,022	Below	0,115
692 Metal containers for storage and transport	0	43	5,794	3,078	4,022	Above	0,473
693 Wire products ex electric & fencing grills	0	43	0,858	3,078	4,022	Below	-0,060
694 Nails, screws, nuts, bolts, rivets and sim. articles	0	43	1,887	3,078	4,022	Below	0,070
695 Tools for use in the hand or in machines	0	43	1,743	3,078	4,022	Below	0,075
696 Cutlery	0	43	1,714	3,078	4,022	Below	-0,014
697 Household equipment of base metals	0	43	1,434	3,078	4,022	Below	0,005
698 Manufactures of metal, n.e.s.	0	43	2,603	3,078	4,022	Below	0,153
711 Power generating machinery, other than electric	0	43	2,285	3,078	4,022	Below	0,122
712 Agricultural machinery and implements	0	43	2,278	3,078	4,022	Below	0,055
714 Office machines	0	43	1,903	3,078	4,022	Below	0,143
715 Metalworking machinery	0	43	4,661	3,078	4,022	Above	0,238
717 Textile and leather machinery	0	43	5,854	3,078	4,022	Above	0,378
718 Machines for special industries	0	43	2,946	3,078	4,022	Below	0,348
719 Machinery and appliances non electrical parts	0	43	5,471	3,078	4,022	Above	0,291
722 Electric power machinery and switchgear	0	43	3,806	3,078	4,022	Inconcl.	0,190
723 Equipment for distributing electricity	0	43	4,716	3,078	4,022	Above	0,249
724 Telecommunications apparatus	0	43	4,737	3,078	4,022	Above	0,269
725 Domestic electrical equipment	0	43	2,979	3,078	4,022	Below	0,120
726 Elec. apparatus for medic.purp., radiological ap.	0	43	2,625	3,078	4,022	Below	0,240
729 Other electrical machinery and apparatus	0	43	1,680	3,078	4,022	Below	0,054
731 Railway vehicles	0	43	3,092	3,078	4,022	Inconcl.	0,127
732 Road motor vehicles	0	43	3,832	3,078	4,022	Inconcl.	0,160
733 Road vehicles other than motor vehicles	0	43	8,141	3,078	4,022	Above	0,516
734 Aircraft	0	43	6,294	3,078	4,022	Above	0,489
735 Ships and boats	0	43	6,223	3,078	4,022	Above	0,384
812 Sanitary, plumbing, heating & lighting fixtures	0	43	5,866	3,078	4,022	Above	0,284
821 Furniture	0	43	2,546	3,078	4,022	Below	0,279
831 Travel goods, handbags and similar articles	0	43	2,328	3,078	4,022	Below	0,109
841 Clothing except fur clothing	1	43	5,581	3,078	4,022	Above	0,333
842 Fur clothing and articles of artificial fur	0	43	3,292	3,078	4,022	Inconcl.	0,388

851 Footwear	0	43	2,543	3,078	4,022	Below	0,099
861 Scientific, medical, optical, meas./contr. instrum.	0	43	3,510	3,078	4,022	Inconcl.	0,163
862 Photographic and cinematographic supplies	0	43	0,745	3,078	4,022	Below	0,267
863 Developed cinematographic film	0	34	5,250	3,160	4,218	Above	0,297
864 Watches and clocks	0	43	2,436	3,078	4,022	Below	0,111
891 Musical instruments, sound recorders and parts	0	43	2,087	3,078	4,022	Below	0,064
892 Printed matter	0	43	3,629	3,078	4,022	Inconcl.	0,138
893 Articles of artificial plastic materials n.e.s.	1	43	3,628	3,078	4,022	Inconcl.	0,325
894 Perambulators ,toys, games and sporting goods	2	42	7,691	3,078	4,022	Above	0,449
895 Office and stationery supplies, n.e.s.	0	43	5,891	3,078	4,022	Above	0,375
896 Works of art, collectors pieces and antiques	0	43	7,430	3,078	4,022	Above	0,409
897 Jewellery and gold/silver smiths wares	0	43	2,088	3,078	4,022	Below	0,027
899 Manufactured articles, n.e.s.	0	43	1,049	3,078	4,022	Below	-0,051
951 Firearms of war and ammunition therefor	0	43	2,909	3,078	4,022	Below	0,085

Table 6. A joint hypothesis test of H_0: $\pi_1 = \pi_2 = \pi_3 = \pi_4 = 0$. A total of 149 groups for which 51 cointegration was found (white rows). LL indicates optimal lag length. The observations are the Wald adjusted ones.

In the top ten export groups, cointegration was only found for three groups; 674 Plates and sheets of iron, 719 Non-electric machinery and for group 641 Paper and Paperboard. For the top ten import group, cointegration was only found for group 719.

There are some further 5 groups which have been dropped from the data set. They had their sample size adjusted first with the difference operator and then in the Wald test, to fall below 30 observations. The above table 6 shows the results from the cointegration test, as can be seen some series fall inside the bounds and the test is thereby inconclusive. Since the regular unit root testing is needed for proper inference on theses series they will be left aside. Such testing lies outside the scope of this paper. But indeed a long-run relationship between the exchange rate and 51 of the groups could be found.

As the J-curve is a short-run phenomenon the short-run estimates are devoted special attention. Since this paper is concerned mainly with the effect the real bilateral exchange rate (REBEX) has on the trade balance other estimates than the REBEX are left out. The trade balance is said to worsen due to depreciation of the exchange rate, hence the effect on the trade balance should initially be negative to later improve. Thus the short-run coefficients of the REBEX should show negative signs and be followed by lagged coefficients with positive signs in order to fit a J-curve. This is the traditional definition of the J-curve (Bahmani-Oskooee and Ratha, 2004).

A newer definition of the J-curve takes a broader view on the matter and relates short-run behavior to the long-run. To meet the newer definition, negative significant short-run coefficients have to be followed by positive and significant long-run coefficients (Ibid). To be able to apply this definition in the ARDL framework of this paper cointegration must be at hand, otherwise the long-run estimates are not applicable.

Below in Table 7, short- and long-run estimates are presented.

	Short-run estimates					Long-run estimates		
Product group	**ΔREBEX**	**ΔREBEX-1**	**ΔREBEX-2**	**ΔREBEX-3**	**Constant**	**Yse**	**Yde**	**REBEX**
001 Live animals	0,01(0,995)				-30,50(0,310)	-17,12(0,075)	25,30(0,096)	-3,85(0,458)
012 Meat, dried, salted or smoked	-3,91(0,212)				-23,98(0,600)	-10,37(0,005)	12,55(0,027)	-6,12(0,007)
013 Meat in airtight containers n.e.s & meat preparations	-4,04(0,072)				-52,62(0,121)	-27,30(0,061)	49,85(0,040)	-18,11(0,040)
022 Milk and cream	-3,35(0,707)	-10,15(0,280)	-10,09(0,176)	-14,35(0,016)	16,45(0,890)	-14,71(0,136)	14,13(0,410)	-3,15(0,629)
024 Cheese and curd	-1,04(0,780)				24,84(0,633)	-17,68(0,221)	12,40(0,585)	-1,89(0,811)
025 Eggs	4,21(0,606)	-5,39(0,462)	4,33(0,540)		399,93(0,010)	15,73(0,075)	-42,32(0,010)	10,89(0,043)
031 Fish, fresh & simply preserved	-0,84(0,476)				-0,79(0,965)	2,91(0,572)	-2,54(0,757)	-0,65(0,798)
032 Fish, in airtight containers, n.e.s & fish preparations.	-0,65(0,762)				-14,24(0,662)	-5,78(0,276)	8,36(0,353)	-3,68(0,301)
045 Cereals, unmilled excl. wheat, rice, barley & maize	-5,24(0,401)				-75,36(0,394)	-1,14(0,900)	9,49(0,525)	-10,04(0,112)
048 Cereal preps & preps of flour of fruits & vegs.	0,28(0,749)				27,69(0,048)	1,25(0,707)	-8,09(0,155)	4,36(0,042)
051 Fruit, fresh, and nuts excl. Oil nuts	-2,12(0,212)	2,07(0,161)			16,07(0,575)	5,98(0,103)	-7,94(0,210)	-1,96(0,342)
053 Fruit, preserved and fruit preparations	1,65(0,175)				-16,74(0,338)	-9,48(0,200)	15,66(0,139)	-4,11(0,318)
054 Vegetables, roots & tubers, fresh or dried	-0,64(0,595)				16,35(0,322)	-2,45(0,153)	1,03(0,692)	0,09(0,927)
055 Vegetables, roots & tubers pres or prepared n.e.s.	-1,03(0,461)				-0,77(0,968)	0,82(0,931)	-0,78(0,958)	1,32(0,808)
062 Sugar confectionery, sugar preps. Ex chocolate confy	4,61(0,018)				15,09(0,559)	6,14(0,341)	-9,49(0,307)	3,13(0,345)
071 Coffee	1,38(0,517)				-30,81(0,301)	2,76(0,536)	1,08(0,878)	-1,84(0,475)
073 Chocolate & other food preptns. cont. Cocoa, n.e.s.	2,18(0,239)				25,44(0,403)	-6,56(0,173)	2,14(0,778)	4,05(0,261)
075 Spices	3,29(0,155)				21,98(0,494)	5,01(0,159)	-7,10(0,205)	-0,74(0,698)
081 Feed. Stuff for animals excl. unmilled cereals	-3,62(0,136)	-2,41(0,247)			-44,78(0,430)	16,77(0,054)	-8,62(0,448)	-2,21(0,721)
091 Margarine & shortening	-1,06(0,701)				-3,95(0,920)	11,18(0,241)	-10,21(0,533)	-0,86(0,887)
099 Food preparations, n.e.s.	0,95(0,458)				-7,06(0,688)	0,55(0,774)	-0,01(0,996)	-0,14(0,899)
111 Non alcoholic beverages, n.e.s.	1,82(0,555)				12,93(0,749)	-5,50(0,545)	2,24(0,881)	3,71(0,526)
112 Alcoholic beverages	2,86(0,124)				2,59(0,918)	11,56(0,363)	-13,40(0,477)	6,12(0,363)
122 Tobacco manufactures	-0,37(0,905)				30,02(0,508)	-6,71(0,619)	-1,03(0,958)	3,32(0,665)
211 Hides & skins, exc.fur skins undressed	3,27(0,142)				-41,70(0,172)	0,91(0,780)	3,24(0,523)	-3,91(0,045)
221 Oil seeds, oil nuts and oil kernels	-0,68(0,877)				7,77(0,895)	13,96(0,225)	-14,64(0,411)	-5,77(0,363)
231 Crude rubber incl. synthetic & reclaimed	-1,13(0,473)				26,92(0,189)	-3,11(0,351)	-0,34(0,939)	1,44(0,367)
241 Fuel wood & charcoal	0,25(0,943)				72,22(0,108)	-31,57(0,223)	-1,17(0,975)	21,42(0,109)
242 Wood in the rough or roughly squared	2,50(0,517)				46,83(0,382)	29,82(0,240)	-50,93(0,205)	18,56(0,218)

243 Wood, shaped or simply worked	-0,39(0,747)				10,66(0,487)	-7,14(0,039)	6,42(0,106)	-0,82(0,486)
251 Pulp & waste paper	-1,01(0,630)				74,80(0,034)	10,55(0,030)	-19,86(0,016)	3,54(0,170)
262 Wool and other animal hair	0,23(0,933)				-39,63(0,342)	0,82(0,911)	4,74(0,590)	-5,20(0,126)
266 Synthetic and regenerated artificial fibres	-0,17(0,924)				13,32(0,554)	-37,29(0,028)	32,96(0,105)	-1,57(0,780)
267 Waste materials from textile fabrics, incl. rags	-0,25(0,934)				27,77(0,477)	5,87(0,445)	-10,06(0,355)	3,47(0,353)
273 Stone, sand and gravel	-1,01(0,034)				-5,53(0,339)	-5,85(0,000)	6,75(0,000)	-1,53(0,003)
275 Natural abrasives incl. industrial diamonds	-0,65(0,909)				36,41(0,607)	0,32(0,976)	-3,37(0,812)	-0,09(0,983)
276 Other crude minerals	-1,38(0,254)				-22,60(0,131)	-3,70(0,046)	6,01(0,038)	-2,54(0,028)
282 Iron and steel scrap	0,06(0,979)				2,27(0,942)	16,67(0,177)	-17,68(0,256)	1,24(0,834)
283 Ores & concentrates of non ferrous base metals	-2,30(0,434)				-44,63(0,269)	-6,14(0,338)	12,42(0,216)	-6,42(0,090)
284 Non ferrous metal scrap	-2,14(0,048)				-56,72(0,001)	-4,24(0,002)	8,58(0,000)	-3,41(0,000)
291 Crude animal materials, n.e.s.	-1,93(0,047)				20,11(0,104)	-0,49(0,865)	-2,73(0,514)	-0,32(0,857)
292 Crude vegetable materials, n.e.s.	-0,66(0,448)				-23,98(0,043)	-7,76(0,197)	18,98(0,049)	-9,18(0,012)
321 Coal, coke & briquettes	4,72(0,320)				-9,79(0,869)	-4,45(0,573)	4,66(0,698)	4,74(0,284)
331 Petroleum, crude and partly refined	1,61(0,359)				-5,02(0,825)	0,50(0,898)	-0,25(0,966)	3,30(0,155)
341 Gas, natural and manufactured	-16,24(0,008)				186,51(0,041)	-24,21(0,000)	17,75(0,017)	1,92(0,335)
411 Animal oils and fats	-3,52(0,149)				-27,83(0,376)	-9,88(0,434)	19,81(0,307)	-10,30(0,149)
421 Fixed vegetable oils, soft	8,89(0,005)				112,82(0,016)	21,46(0,001)	-34,04(0,002)	7,66(0,018)
431 Anim./veg. Oils & fats, processed, and waxes	0,04(0,955)				-10,33(0,275)	-0,09(0,955)	1,70(0,518)	-0,94(0,329)
512 Organic chemicals	0,76(0,269)				4,61(0,583)	2,92(0,089)	-3,86(0,128)	1,10(0,220)
513 Inorg. chemicals elems., oxides, halogen salts	0,93(0,414)				-0,13(0,993)	7,33(0,006)	-7,55(0,030)	0,23(0,816)
514 Other inorganic chemicals	-3,23(0,016)	-1,25(0,203)	-3,37(0,003)		13,50(0,308)	11,32(0,187)	-18,01(0,167)	2,90(0,481)
515 Radioactive and associated materials	-2,90(0,648)				59,38(0,454)	-26,65(0,011)	22,38(0,104)	-0,38(0,931)
521 Crude chemicals from coal, petroleum and gas	-5,77(0,314)				143,72(0,078)	-45,17(0,239)	-8,38(0,887)	28,85(0,172)
531 Synth. organic dyestuffs, natural indigo & lakes	-0,68(0,597)				-26,64(0,161)	3,10(0,218)	-0,64(0,837)	-0,35(0,764)
532 Dyeing & tanning extracts, synth. tanning mat.	5,72(0,175)				26,62(0,589)	8,21(0,509)	-14,13(0,483)	1,08(0,895)
533 Pigments, paints, varnishes & related materials	-0,29(0,449)				-3,95(0,464)	-0,30(0,910)	1,78(0,646)	0,22(0,874)
541 Medicinal & pharmaceutical products	0,11(0,723)				-12,81(0,025)	-7,15(0,015)	13,17(0,010)	-2,43(0,078)
551 Essential oils, perfume and flavour materials	1,09(0,295)				13,08(0,365)	-8,02(0,010)	5,52(0,198)	1,97(0,283)
553 Perfumery, cosmetics, dentifrices, etc.	-0,46(0,679)				3,28(0,829)	-5,05(0,158)	4,18(0,456)	1,02(0,594)
554 Soaps, cleansing & polishing preparations	-0,17(0,840)				-23,14(0,051)	-4,04(0,231)	9,89(0,058)	-3,08(0,107)

561 Fertilizers manufactured	-1,77(0,597)	0,23(0,933)	3,25(0,201)		126,02(0,002)	-13,98(0,126)	-3,33(0,761)	6,02(0,073)
571 Explosives and pyrotechnic products	-1,59(0,527)				-24,15(0,448)	7,18(0,332)	-3,30(0,745)	-3,86(0,263)
581 Plastic materials, regenerd. cellulose & resins	0,04(0,927)				-7,63(0,135)	0,67(0,565)	0,52(0,756)	0,50(0,490)
599 Chemical materials and products, n.e.s.	-0,55(0,144)				-3,53(0,446)	3,76(0,038)	-3,03(0,195)	0,17(0,825)
611 Leather	1,33(0,362)				-13,50(0,465)	-2,38(0,598)	4,99(0,462)	-1,11(0,631)
612 Manuf. of leather or of artif. or reconst. leather	1,26(0,449)	1,32(0,310)	1,87(0,129)		-13,92(0,400)	-2,14(0,305)	2,98(0,311)	1,15(0,263)
613 Fur skins, tanned or dressed, including dyed	0,02(0,996)	12,06(0,006)			9,77(0,873)	1,93(0,769)	-2,49(0,771)	-2,12(0,476)
621 Materials of rubber	-1,00(0,017)				-14,04(0,029)	-3,49(0,000)	4,70(0,001)	-0,14(0,674)
629 Articles of rubber, n.e.s.	-0,57(0,270)				-1,29(0,837)	-0,74(0,538)	0,94(0,606)	-0,68(0,300)
631 Veneers, plywood boards & other wood, worked, n.e.s.	-2,25(0,071)				-27,82(0,078)	-14,23(0,005)	20,39(0,005)	-5,06(0,029)
632 Wood manufactures, n.e.s.	-1,03(0,116)				9,02(0,278)	-15,02(0,000)	13,98(0,000)	0,28(0,740)
633 Cork manufactures	2,30(0,503)				-37,38(0,458)	-38,35(0,060)	52,12(0,079)	-13,05(0,227)
641 Paper and paperboard	-0,27(0,458)				-5,79(0,151)	-1,72(0,005)	2,47(0,006)	-0,86(0,007)
642 Articles of paper, pulp, paperboard	0,25(0,733)				-9,74(0,297)	-8,19(0,022)	11,05(0,033)	-1,97(0,267)
651 Textile yarn and thread	-1,04(0,306)				-7,27(0,575)	-3,53(0,450)	5,50(0,448)	-0,68(0,800)
652 Cotton fabrics, woven ex. narrow or spec. fabrics	-0,29(0,681)				-4,63(0,600)	-6,53(0,237)	8,79(0,254)	-2,13(0,439)
653 Text fabrics woven ex narrow, spec, not cotton	0,68(0,168)				4,44(0,476)	-1,98(0,209)	0,97(0,653)	2,01(0,017)
654 Tulle, lace, embroidery, ribbons, trimmings	0,02(0,984)	-0,93(0,329)	-0,34(0,718)		1,93(0,876)	0,15(0,968)	-1,01(0,855)	1,97(0,330)
655 Special textile fabrics and related products	-0,75(0,199)				1,31(0,852)	-2,37(0,282)	2,00(0,509)	0,70(0,529)
656 Made up articles, wholly or chiefly of text.mat.	-0,39(0,671)				1,37(0,905)	-9,34(0,037)	9,06(0,150)	0,08(0,969)
657 Floor coverings, tapestries, etc.	-4,03(0,018)	1,82(0,183)	-2,91(0,016)	1,11(0,282)	-49,54(0,017)	-99,47(0,010)	190,24(0,004)	-69,99(0,006)
661 Lime, cement & fabr. bldg.mat. Ex glass/clay mat	-0,63(0,720)				3,63(0,871)	-2,36(0,859)	0,68(0,974)	0,35(0,964)
662 Clay and refractory construction materials	-0,48(0,596)				-13,19(0,235)	-6,43(0,001)	7,79(0,005)	-0,12(0,890)
663 Mineral manufactures, n.e.s.	-0,67(0,376)				0,11(0,991)	-6,19(0,011)	6,18(0,085)	-0,31(0,792)
664 Glass	-1,07(0,212)				-16,65(0,171)	-2,34(0,775)	11,37(0,373)	-5,34(0,196)
665 Glassware	-1,35(0,067)	0,53(0,411)			10,02(0,312)	-0,30(0,938)	-2,13(0,636)	0,15(0,921)
666 Pottery	-0,33(0,728)				-20,35(0,108)	-9,19(0,049)	15,39(0,030)	-4,92(0,056)
667 Pearls and precious and semi precious stones	0,95(0,743)	4,97(0,062)			51,24(0,282)	3,97(0,670)	-9,67(0,321)	4,57(0,136)
671 Pig iron, spiegeleisen, sponge iron etc	-0,31(0,886)				13,21(0,645)	2,61(0,755)	-5,86(0,648)	0,78(0,868)
672 Ingots & other primary forms of iron or steel	-4,08(0,059)	-3,62(0,184)	-4,32(0,051)	-2,12(0,257)	30,81(0,403)	14,77(0,137)	-22,99(0,183)	5,92(0,310)
673 Iron and steel bars, rods, angles, shapes, sections	1,13(0,080)	-0,71(0,365)	0,93(0,186)	-0,11(0,842)	19,01(0,088)	0,37(0,684)	-2,32(0,168)	2,18(0,003)

674 Universals, plates and sheets of iron or steel	1,58(0,091)	-0,18(0,809)	0,54(0,465)	-18,55(0,141)	0,05(0,965)	1,76(0,377)	-1,05(0,169)
676 Rails & rlwy track constr mat. Of iron or steel	0,14(0,971)			-35,40(0,531)	-19,41(0,097)	26,14(0,160)	-6,05(0,358)
677 Iron and steel wire, excluding wire rod	-0,63(0,312)			11,86(0,183)	-1,09(0,264)	0,09(0,950)	0,74(0,175)
678 Tubes, pipes and fittings of iron or steel	-1,19(0,005)			7,02(0,219)	-0,64(0,520)	-0,51(0,749)	0,98(0,104)
679 Iron steel castings forgings unworked, n.e.s.	0,01(0,996)			7,51(0,766)	15,73(0,154)	-18,99(0,271)	2,68(0,685)
681 Silver and platinum group metals	1,75(0,578)			-48,40(0,290)	6,72(0,299)	-0,75(0,942)	-2,64(0,476)
682 Copper	-0,17(0,822)			-7,79(0,507)	-1,00(0,774)	2,88(0,541)	-0,65(0,716)
683 Nickel	-0,12(0,936)			-8,61(0,698)	-2,48(0,323)	3,39(0,413)	-0,42(0,770)
684 Aluminium	0,57(0,614)	-0,16(0,866)	-0,42(0,638)	-4,35(0,733)	-1,64(0,376)	2,02(0,490)	0,39(0,679)
685 Lead	-3,65(0,270)	3,43(0,229)	2,68(0,301)	-192,69(0,000)	-9,93(0,059)	31,50(0,001)	-11,73(0,000)
686 Zinc	6,34(0,106)			67,77(0,170)	2,34(0,532)	-7,38(0,213)	4,76(0,035)
687 Tin	-9,96(0,011)			-71,38(0,196)	-3,41(0,294)	7,13(0,178)	-4,05(0,043)
689 Miscell.non ferrous base metals	1,34(0,240)			42,22(0,029)	6,22(0,446)	-23,95(0,063)	10,48(0,046)
691 Finished structural parts and structures, n.e.s	-3,03(0,036)			-39,04(0,119)	-8,02(0,071)	15,47(0,056)	-4,42(0,115)
692 Metal containers for storage and transport	1,18(0,249)			-27,59(0,066)	-3,86(0,140)	7,92(0,063)	-0,99(0,534)
693 Wire products ex electric & fencing grills	-0,68(0,607)			-9,68(0,638)	0,26(0,968)	2,30(0,814)	-1,15(0,755)
694 Nails, screws, nuts, bolts, rivets and sim. articles	-0,35(0,473)			-5,00(0,479)	-0,68(0,662)	1,56(0,536)	-0,55(0,550)
695 Tools for use in the hand or in machines	-0,70(0,314)			18,43(0,103)	-3,33(0,470)	-2,72(0,654)	2,27(0,312)
696 Cutlery	0,37(0,770)			-13,97(0,490)	0,07(0,991)	3,77(0,718)	-1,92(0,627)
697 Household equipment of base metals	-0,31(0,658)			15,56(0,205)	0,93(0,722)	-4,98(0,279)	3,17(0,154)
698 Manufactures of metal, n.e.s.	-0,34(0,538)			-25,81(0,022)	-1,18(0,206)	4,16(0,032)	-1,12(0,088)
711 Power generating machinery, other than electric	-1,39(0,100)			-12,15(0,374)	-0,93(0,648)	2,77(0,437)	-0,80(0,544)
712 Agricultural machinery and implements	-0,40(0,611)			-15,67(0,186)	-5,66(0,053)	9,16(0,058)	-1,88(0,252)
714 Office machines	0,58(0,473)			41,04(0,020)	-7,14(0,105)	-0,46(0,909)	3,01(0,065)
715 Metalworking machinery	0,07(0,933)			14,86(0,221)	-0,09(0,946)	-1,61(0,465)	1,59(0,062)
717 Textile and leather machinery	-1,18(0,078)			-24,68(0,057)	-3,39(0,009)	5,89(0,014)	-1,48(0,056)
718 Machines for special industries	1,40(0,030)			8,22(0,384)	-1,08(0,290)	0,14(0,930)	0,79(0,232)
719 Machinery and appliances non electrical parts	-0,06(0,806)			6,86(0,064)	-0,39(0,349)	-0,43(0,526)	0,64(0,022)
722 Electric power machinery and switchgear	-0,27(0,539)			-21,60(0,009)	-0,53(0,618)	3,89(0,049)	-1,09(0,110)
723 Equipment for distributing electricity	-0,44(0,609)			-17,33(0,185)	0,22(0,911)	1,82(0,555)	0,54(0,629)
724 Telecommunications apparatus	0,07(0,944)			-15,53(0,299)	-6,73(0,025)	9,32(0,048)	0,10(0,954)

725 Domestic electrical equipment	-0,14(0,833)			12,63(0,197)	-0,04(0,984)	-2,29(0,419)	2,56(0,035)
726 Elec. apparatus for medic.purp., radiological ap.	0,81(0,250)			-0,06(0,996)	-6,38(0,022)	6,49(0,127)	-0,20(0,868)
729 Other electrical machinery and apparatus	0,35(0,444)			-0,13(0,984)	0,56(0,689)	-0,76(0,738)	0,96(0,319)
731 Railway vehicles	-1,10(0,617)			-7,32(0,820)	0,62(0,878)	0,15(0,982)	-0,37(0,883)
732 Road motor vehicles	0,18(0,786)			-9,66(0,303)	-2,11(0,128)	3,11(0,165)	0,67(0,484)
733 Road vehicles other than motor vehicles	0,22(0,679)			-2,40(0,779)	-6,31(0,015)	6,95(0,055)	-0,75(0,563)
734 Aircraft	-0,34(0,881)			-145,10(0,001)	-0,82(0,765)	10,97(0,016)	-3,07(0,056)
735 Ships and boats	-6,34(0,062)			-7,25(0,883)	-10,80(0,076)	11,67(0,230)	0,47(0,893)
812 Sanitary, plumbing, heating & lighting fixtures	-0,01(0,975)			7,56(0,178)	-1,75(0,112)	0,41(0,816)	0,12(0,845)
821 Furniture	0,84(0,098)			4,31(0,587)	-6,99(0,048)	5,23(0,361)	0,65(0,777)
831 Travel goods, handbags and similar articles	0,06(0,950)			-12,59(0,383)	-2,35(0,600)	5,67(0,437)	-1,36(0,644)
841 Clothing except fur clothing	-0,69(0,173)	0,20(0,662)		-20,28(0,024)	-3,00(0,067)	6,88(0,011)	-2,77(0,009)
842 Fur clothing and articles of artificial fur	2,65(0,298)			-45,55(0,211)	11,03(0,135)	-2,97(0,799)	-4,83(0,247)
851 Footwear	-1,38(0,245)			2,79(0,873)	-4,97(0,423)	4,33(0,662)	-1,61(0,654)
861 Scientific, medical, optical, meas./contr. instrum.	-0,10(0,775)			-3,96(0,439)	-1,20(0,255)	1,77(0,302)	0,42(0,490)
862 Photographic and cinematographic supplies	2,20(0,027)			-3,21(0,820)	2,11(0,898)	0,75(0,976)	-2,34(0,801)
863 Developed cinematographic film	-1,35(0,486)			62,61(0,095)	-5,87(0,207)	1,29(0,772)	1,52(0,282)
864 Watches and clocks	-1,91(0,116)			-49,53(0,041)	-3,48(0,319)	12,39(0,061)	-4,55(0,066)
891 Musical instruments, sound recorders and parts	-0,62(0,393)			-22,38(0,048)	-2,53(0,439)	8,68(0,108)	-3,12(0,113)
892 Printed matter	-0,49(0,337)			-16,23(0,039)	-6,46(0,008)	10,92(0,006)	-3,49(0,014)
893 Articles of artificial plastic materials n.e.s.	-0,76(0,113)	0,23(0,574)		-6,32(0,334)	-3,54(0,036)	4,76(0,062)	-0,54(0,508)
894 Perambulators ,toys, games and sporting goods	0,32(0,641)	1,45(0,015)	-0,93(0,092)	-17,33(0,056)	-4,56(0,000)	6,33(0,001)	-0,44(0,403)
895 Office and stationery supplies, n.e.s.	-1,03(0,093)			-4,34(0,612)	-2,96(0,003)	3,20(0,031)	0,30(0,564)
896 Works of art, collectors pieces and antiques	-2,21(0,478)			-71,02(0,138)	2,00(0,532)	2,31(0,644)	-1,19(0,516)
897 Jewellery and gold/silver smiths wares	-1,11(0,420)			-37,96(0,132)	0,03(0,993)	5,80(0,335)	-2,63(0,254)
899 Manufactured articles, n.e.s.	0,27(0,700)			-2,24(0,822)	-5,27(0,595)	7,37(0,647)	-0,92(0,899)
951 Firearms of war and ammunition therefor	-0,41(0,844)			-22,13(0,465)	-4,99(0,361)	8,75(0,323)	-3,07(0,334)

Table 7. above shows the results of the OLS estimation of the UECM model in Eq.(17). P-values presented in brackets.

If first the short-run results are considered, there are 17 groups, found in the table 7 above, with at least one significant short-run coefficient, indicating that the depreciation of Swedish kronor will have short run effects in these groups. Six groups benefit from depreciation, since their coefficients carry positive signs, and 11 groups are affected negatively. The six affected positively are: 062 Sugar confectionary, 421 Fixed vegetable oils, 613 Fur skins, 718 Machines for special industries, 862 Photographic and cinematographic supplies and 894 Prams, toys and games.

The 17 groups affected by short run depreciation
022 Milk and cream
062 Sugar confectionery, sugar preps. Ex chocolate confy
273 Stone, sand and gravel
284 Non ferrous metal scrap
291 Crude animal materials, n.e.s.
341 Gas, natural and manufactured
421 Fixed vegetable oils, soft
514 Other inorganic chemicals
613 Fur skins, tanned or dressed, including dyed
621 Materials of rubber
657 Floor coverings, tapestries, etc.
678 Tubes, pipes and fittings of iron or steel
687 Tin
691 Finished structural parts and structures, n.e.s
718 Machines for special industries
862 Photographic and cinematographic supplies
894 Perambulators ,toys, games and sporting goods

Table 8. Groups on darkened rows are affected negatively by depreciation in the short run, others positively.

In the long-run results there are 17 product groups that fit the cointegration requirement and also have significant long-run coefficients for the exchange rate. Out of these, there are 6 groups who have positive long run coefficients and therefore benefits from a depreciation of the Swedish krona; 025 Eggs, 048 Cereals, 421 Vegetable oils, 673 Iron and steel bars, 686 Zinc and 719 Machinery. The remaining 11 groups are affected negatively by depreciation.

The 17 groups with long-run effect of depreciation
012 Meat, dried, salted or smoked
025 Eggs
048 Cereal preps & preps of flour of fruits & vegs.
211 Hides & skins, exc.fur skins undressed
273 Stone, sand and gravel
276 Other crude minerals
284 Non ferrous metal scrap
292 Crude vegetable materials, n.e.s.
421 Fixed vegetable oils, soft
641 Paper and paperboard
657 Floor coverings, tapestries, etc.
673 Iron and steel bars, rods, angles, shapes, sections
685 Lead
686 Zinc
687 Tin
719 Machinery and appliances non electrical parts
841 Clothing except fur clothing

Table 9. Groups with darkened rows are affected negatively by exchange rate depreciation in the long-run and others positively.

There are no groups complying with the old definition of the J-curve, i.e. initial negative short-run coefficients followed by positive ones. No J-curve pattern can be found using this definition.. Groups need multiple significant coefficients to be able to show patterns of any letters in the “alphabetical-soup analysis”. Two product groups can be analysed in this framework, 514 Other inorganic chemicals and group 657 Floor coverings, have negative coefficients followed by again negative ones. It is hard to find a letter corresponding to this pattern of a worsening of the trade balance over multiple lags and no improvement but perhaps the letter I- could be suitable for such a pattern.

In order to detect a J-curve pattern according to the new definition, the product groups have to show negative significant short coefficients followed by a positive and significant long-run coefficients of the exchange rate. There are no product groups among the 5 possible candidates, seen in Table 10 below, for an “alphabetical-soup analysis” in this setting. Group 273 Stone and gravel have negative coefficients in both the short and long run. This pattern goes for 284 Non-ferrous metal scrap, 657 Floor coverings and also for group 687 Tin. These 4 groups could be showing I-curve patterns. Group 421 Fixed vegetable oils, on the other hand, has positive coefficients both in the short and in the long run, this could be interpreted as an inverse I-curve, depending on the definition.

	Short-run estimates				**Long-run**
Product group	**ΔREBEX**	**ΔREBEX-1**	**ΔREBEX-2**	**ΔREBEX-3**	**REBEX**
273 Stone, sand and gravel	-1,01(0,034)**				-1,53(0,003)**
284 Non ferrous metal scrap	-2,14(0,048)**				-3,41(0,000)**
421 Fixed vegetable oils, soft	8,89(0,005)**				7,66(0,018)**
657 Floor coverings, tapestries, etc.	-4,03(0,018**)	1,82(0,183)	-2,91(0,016)**	1,11(0,282)	-69,99(0,006)**
687 Tin	-9,96(0,011)**				-4,05(0,043)**

Table 10. Shows a selection from the large Table 7. ** indicates significant at the 5% level or less.

In a brief summary of the results, it becomes evident that only 17 groups show signs of being affected in the short-run by exchange rate depreciation. Not more than 17 groups are affected by exchange rate depreciation in the long run and there are no patterns of a J-curve. Since the sample covers 149 product groups the 17 product groups make out approximately 11.4 % of the entire sample, this means than little can be said about the entire sample concerning the short-and long-run effects. There are possible indications of a small number of I-curves and inversed I-curves.

9 Discussion and Conclusion

Not finding any J-curve in the bilateral trade between Sweden and Germany is in line with the findings of Bahmani-Oskooee and Ratha (2007). On the other hand, using the same method but utilizing quarterly data they found evidence of an unfavorable effect in both the short-and the long run on the total trade balance. In this paper using annual data, no such relationship could be found.

Irandoust et al. 2006 found that a depreciation of the Swedish krona did not improve the trade balance since both imports and exports showed signs of a positive effect due to exchange rate depreciation. Hatemi-J and Irandoust (2003) found contradicting indications of negative signs on the elasticity for exports and imports in the long run as well as support for a J-curve in the bilateral Swedish trade with Germany. Again, no such indications were found in this paper.

If the effects of an exchange rate depreciation on the trade balance could still be seen as long as 3-5 years after the event, as Junz and Rhomberg (1973) argued, the analysis presented here ought to have been able to detect such patterns. The use of annual data and a lag length up to 3 years should have been sufficient to detect any pattern of a J-curve. Dornbusch and Krugman (1976) argued for a substantially shorter time span of 1 to 1.5 years for the effects of exchange rate depreciation on the trade balance to disappear. If their argument holds, the detection of any patterns should be impossible or at least, very difficult using annual data, such as used here. Hence the interpretation of the findings is that there seem not to be any pattern detectable with annual data, which supports the shorter time span presented by Dornbusch and Krugman. Quarterly or monthly data would be better suited for such an investigation. Another interpretation of these findings regards the definition of the short- and the long-run. Put rather boldly, the findings indicate years being the long- run and higher frequency data being definable as the short-run.

There is no indication of a J-curve or any other pattern complying with the old definition, in the short-run analysis. Neither could any J-curve be found through employing the newer definition. In the cases where product groups showed more than one significant coefficient, these always showed the same sign; a negative coefficient followed by another negative and vice versa. Thus, there are no indications of a J-curve in these results. Magee (1973) noted that the trade balance could go either way in the short run. The findings presented in this paper cannot refute such an argument. With the use of the bounds testing procedure and annual data, little or no support could be found for the exchange rate affecting the Swedish trade balance at the product level, in the trade with Germany.

10 Appendix 1

Dropped series due to too few obs.

011 Meat, fresh, chilled or frozen

023 Butter

041 Wheat including spelt and meslin

042 Rice

043 Barley, unmilled

044 Maize corn unmilled

046 Meal and flour of wheat or of mesli

047 Meal & flour of cereals, except whe

052 Dried fruit including artificially

061 Sugar and honey

072 Cocoa

074 Tea and mate

121 Tobacco, unmanufactured

212 Fur skins, undressed

244 Cork, raw and waste

261 Silk

263 Cotton

264 Jute

265 Vegetable fibres, except cotton and

271 Fertilizers, crude

274 Sulphur & unroasted iron pyrites

281 Iron ore & concentrates

285 Silver & platinum ores

286 Ores & concentrates of uranium & th

332 Petroleum products

351 Electric energy

422 Other fixed vegetable oils

675 Hoop and strip of iron or steel

688 Uranium and thorium and their alloy

911 Postal packages not classified acco

931 Special transactions not classd.acc

941 Animals, n.e.s. incl.zoo animals, d

961 Coin other than gold ,not being leg

Appendix 1. A table over all the dropped variables throughout the different stages of the analysis.

11 Endnotes

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