Federal Reserve Bank of Dallas
Globalization and Monetary Policy Institute
Working Paper No. 77
http://www.dallasfed.org/institute/wpapers/2011/0077.pdf

Export Basket and the Effects of Exchange Rates on Exports – Why Switzerland Is Special*

Raphael Auer
Swiss National Bank

Philip Saure
Swiss National Bank

April 2011

Abstract

Why has Swiss export performance been so strong during the past quarters despite the strong appreciation of the CHF? In this paper, we use historical data on exchange rates and trade at the sectoral level to document that a contributing factor behind the limited impact of the exchange rate is the unique composition of Swiss exports. In particular, we document that the Swiss export basket is heavily concentrated in price-insensitive goods such as machinery or pharmaceuticals, where prices and thus the exchange rate have relatively little importance for demand. This makes the aggregate volume of Swiss exports less responsive to exchange rate changes than exports of other OECD nations.

JEL codes: F10, F14

* Raphael Auer, Swiss National Bank, Börsenstrasse 15, P.O. Box Ch-8022, Zürich, Switzerland. raphael.auer@snb.ch. + 41-44-631-38-84. Philip Saure, Swiss National Bank, Börsenstrasse 15, P.O. Box Ch-8022, Zürich, Switzerland. Philip.Saure@snb.ch. +41-44-631-39-16. We thank Andreas Fischer, Andreas Kropf and Caroline Schmidt for comments and Andreas Kropf for providing excellent research assistance. The views in this paper are those of the authors and do not necessarily reflect the views of the Swiss National Bank, the Federal Reserve Bank of Dallas or the Federal Reserve System.

1. Exchange Rates and Demand Growth as Drivers of Swiss Exports

Demand for Swiss products is likely to grow whenever expenditure in its export destinations rises. Conversely, demand for Swiss products falls when the CHF appreciates against the trade partner currency, making Swiss exports expensive.

With these two export determinants in mind – exchange rates and foreign GDP – we aim to understand whether Switzerland's export basket is exceptional along one of these dimensions. First, Switzerland's exports could be exceptional because of a concentration in sectors where demand contracted strongly during the crisis and rebounded subsequently. In fact, there exists both formal and anecdotal evidence for this channel, for example by researchers (Schmidt (2009), policy makers (see for example Hildebrand (2010)), and also the popular press (see for example Lanz (2011)).

Second, Switzerland's exports could be exceptional because of a concentration in sectors with low exchange rate sensitivity. For example, it is quite likely that for "precision instruments" in which only few nations compete, export demand does not change much with the exchange rate. On the other hand, demand for apparel is likely to be sensitive to the exchange rate. Obviously, precision instruments are more important for Switzerland than for other economies, and consequently, the overall low importance of the exchange rate for Swiss exports could result from the sectoral composition of exports.

We next formally investigate both of these channels –exchange rate sensitivity and export market growth – in a unified statistical framework. We use a panel dataset that enables us to estimate sector-specific elasticities of export demand with respect to foreign GDP and bilateral exchange rates. To estimate these gravity specifications at the sector level, we collect bilateral trade data from the National Bureau of Economics Research - United Nations (NBER-UN) Trade Data, which covers 865 sectors (at the 4-digit level for the Standard International Trade Classification, revision 2), each with enough observations to conduct our estimations. We obtain data on bilateral exchange rates and information on GDP from Datastream.

The NBER-UN trade data covers nearly all countries, but we include only OECD countries in our analysis, since this group of countries is the one that most researchers would argue to be the benchmark for the Swiss economy. Since the overlap of the NBER-UN trade data and the other variables in the study yields an annual panel including the years from 1972 to 2000, we exclude the former members of the Warsaw Pact that are now OECD members.

Our sample thus includes 24 countries (Austria, Australia, Belgium, Canada, Switzerland, Denmark, Germany, Spain, Finland, France, Great Britain, Greece, Israel, Italy, Japan, South Korea, Netherlands, Norway, New Zealand, Portugal, Sweden, Turkey, and the United States) and 24*(24-1)=552 country pairs.

For each sector, we estimate the elasticity of bilateral trade with respect to the bilateral exchange rate and with respect to foreign GDP. Subsequently, we compute averages weighted by the country-specific importance of each sector.

We start our approach from a standard gravity equation in the spirit of Anderson and van Wincoop (2003) that is augmented by the time dimension: it relates bilateral trade flows at the sectoral level to both time-constant country characteristics and other measures that vary over time. A baseline estimation conditions on bilateral geographic distance, common border or language, and other measures constant throughout time. Second, it also includes time varying measures such as importer GDP, exporter GDP, and the bilateral exchange rate. We capture all time-constant factors by exporter-importer fixed effects, thus yielding

$$\ln(Exports_{s,Exporter,importer,t}) = \alpha_c + \alpha_{e,s}\ln(GDP_{Exporter,t}) + \alpha_{i,s}\ln(GDP_{\text{Im}porter,t}) + \ldots$$
$$\ldots\beta_s \ln(EXR_{Exporter,importer}) + Dummy_{Exporter,\text{Im}porter,} + \widetilde{\varepsilon}_{s,Exporter,importer,t}$$

We are not interested in levels of exports, but rather in how export levels co-move with the exchange rate, i.e. in changes. Denoting the percentage change in a variable by a "Δ", subtracting the lagged value of exports on both sides of the above equation yields a panel estimation that relates the sensitivity of exports to both foreign GDP growth and the bilateral exchange rate for each sector *s* separately.[2]

$$\Delta Exports_{s,Exporter,importer} = \alpha_{e,s}\Delta GDP_{Exporter,t} + \alpha_{i,s}\Delta GDP_{\text{Im}porter,t} + \beta_s\Delta EXR_{Exporter,importer} + \varepsilon_{s,Exporter,importer}$$

The annual percentage change of bilateral export volume (in exporter currency) from one country (exporter) to another country (importer) is denoted by $\Delta Exports_{S,Exporter,importer}$ the percentage change in the foreign market GDP (in local currency units) is denoted by $\Delta GDP_{importer}$ and the nominal percentage change in the bilateral exchange rate by $\Delta EXR_{Exporter,importer}$.

The above equation constitutes our main equation of interest. In each of the 865 SITC sectors, we next estimate this gravity-style estimation relating the change in the exchange rate and the change in importer GDP to the change in the import volume. This yields 865 coefficients for the elasticity of the export volume with respect to the exchange rate and also 865 coefficients for the elasticity of the export volume with respect to import GDP.

Do the elasticity estimates obtained in this way make sense? Table 1 presents some examples for selected sectors. We first pick the two sectors close to the 10th percentile in the distribution of estimated exchange rate elasticities. Indeed, the two sectors are "Centrifuges" and "Milling Machinery", both sectors for which anecdotal evidence suggests

[2] Given that exports are a part of exporter GDP, regressing changes in exports on changes of exporter GDP amounts to some extent to a spurious regression. We thus drop exporter GDP from all specifications.

that product characteristics such as good quality are relatively more important than in other sectors, whereas the good's price takes a relatively minor role.

Table 1 - GDP Elasticity and Exchange Rate Sensitivity for Selected Sectors

Low Response to Exchange Rate Changes (Sectors Close to the 10th decile)		
Sector Description	***GDP Elasticity***	***Exchange Rate Sensitivity***
Centrifuges	0.3079868	0.549822
Milling Machinery	0.1520641	0.5651883
High Response to Exchange Rate Changes (Sectors Close to the 90th decile)		
Sector Description	***GDP Elasticity***	***Exchange Rate Sensitivity***
Apparel and Clothing	0.3176782	1.255084
Frozen Fish Fillets	0.0510448	1.245665
Low Response to GDP Growth (Sectors Close to the 10th decile)		
Sector Description	***GDP Elasticity***	***Exchange Rate Sensitivity***
Bird Eggs Not in Shell	0.127234	1.42264
Wheat	0.1240657	0.4068199
High Response to GDP Growth (Sectors Close to the 90th decile)		
Sector Description	***GDP Elasticity***	***Exchange Rate Sensitivity***
Poultry, Whole	0.850571	1.12123
Refractory Ceramic Goods	0.8491695	1.091864

In contrast, two sectors close to the 90^{th} percentile in the distribution of estimated exchange rate elasticities are "Apparel and Clothing" and "Frozen Fish Fillets", two sectors one would indeed expect to be competitive so that the exchange rate might matter substantially for demand.

Also our estimated elasticities of demand with respect to importer GDP make sense intuitively: for example, the demand for wheat and eggs seems satiated in the OECD economies of our sample and should only co-move little with importer GDP demand. Demand for poultry might not be as saturated, especially in the poorer parts of the OECD. Indeed, we find that the elasticity is much higher for poultry than for wheat or eggs. Also demand for technical goods, here exemplified by "Refractory Ceramic Goods" co-moves more than 1-to-1 with the importer GDP, i.e., they are superior goods.

What is the range of the estimated elasticities and is there substantial variation across the sectors? In Figures 1 and 2, we examine the distribution of estimated elasticities. **Figure 1** presents a histogram of the estimated elasticities with respect to the exchange rate. It is rather well behaved, i.e., there are no fat tales and the elasticity is estimated positive in almost all sectors. Most importantly, the estimation reveals that there is substantial variation in the elasticity, with a large mass of observations lying in the

interval 0 to 2. Also the distribution of elasticities with respect to the importer GDP growth (see **Figure 2**) is well behaved and displays substantial variation.

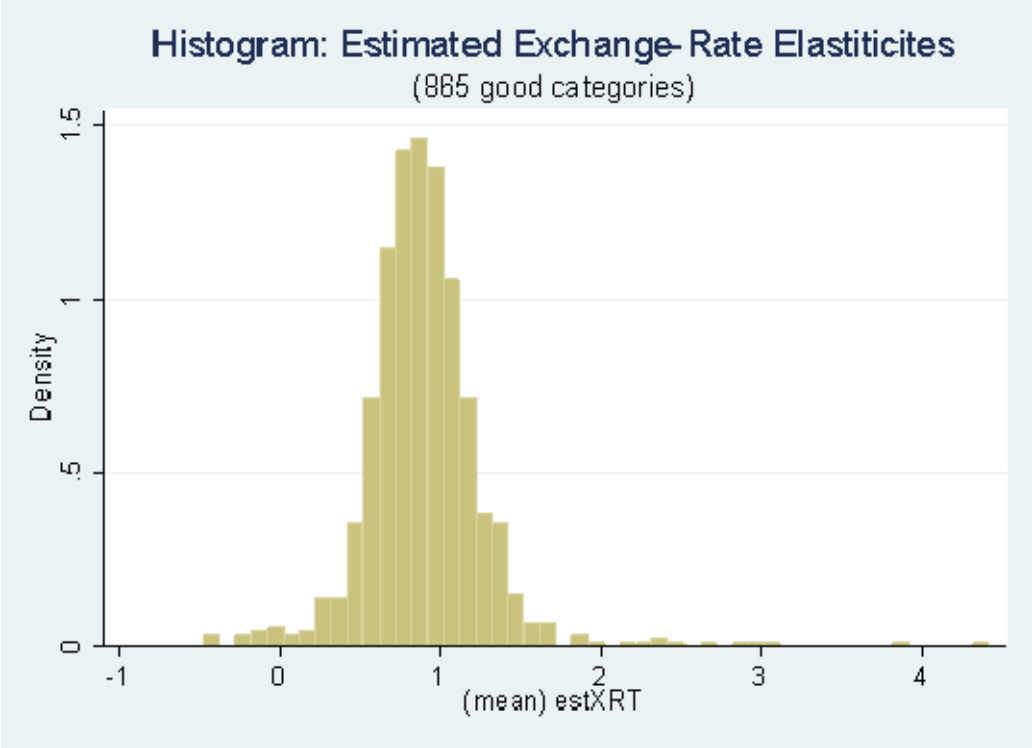

Figure 1

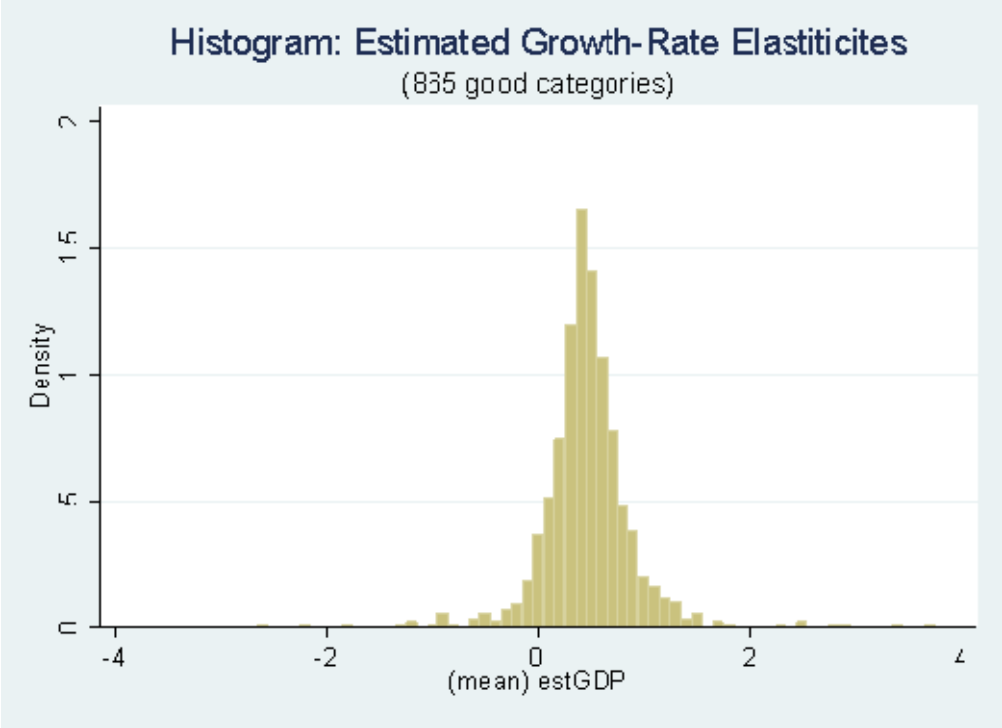

Figure 2

2. Export Basket and Aggregate Exchange Rate Elasticity

The above analysis unveils that elasticities of import volume with respect to the exchange rate and importer GDP vary widely across the sectors. This observation constitutes strong reasons to believe that the composition of a nation's exports has a first-order impact on how important the exchange rate is for aggregate export performance.

In this section, we conduct an international comparison to document that a unique structure of the Swiss industry limits the importance of the exchange rate for Swiss exports. More precisely, we show that Swiss exports exhibit a high share of industries with a low exchange rate elasticity. The corresponding aggregate Swiss elasticity to foreign GDP, in contrast, is not exceptional by international comparison.

Our measure of a country's average exchange rate sensitivity is based on the exchange rate sensitivity at the sectoral level and the importance of the respective sector for the country. For example, for Switzerland, the average weighted coefficients is equal to:

$$\alpha_{CH} = \sum_{all\ Sectors} w_{s,CH}\alpha_{CH}$$

where $w_{S,CH}$ is the export weight of sector *s* in Switzerland, i.e., the share of Swiss exports that is in sector *s*. This measure has the following economic interpretation. If the CHF appreciates by 1% against all other currencies, Swiss export volume in CHF decreases by α_{CH} %.

Figure 3 shows that the Swiss export industry is exceptional: in our sample of 24 OCED economies, Switzerland is the country most concentrated in sectors featuring low sensitivity of demand with respect to exchange rate changes. Overall, the Swiss export performance is thus much less affected by the strength of its currency than any other nation would be.

To uncover whether the extraordinary Swiss export basket is a new phenomenon or whether it has always existed, we decompose the estimates by year. **Figure 4** displays the yearly average elasticity of Swiss exports and contrasts this to the corresponding number for rest of the countries (unweighted averages over the countries).[3] A quick inspection shows that the exceptional Swiss export basket has already existed for the last two decades. However, the difference with the rest of the world has become even more pronounced.[4]

[3] It is important to note that our empirical estimation technique restricts the sector-specific elasticities to be constant over time. The time-changing average elasticity thus can only result from a shifting sectoral composition of the world's (or Switzerland's) industry composition.

[4] Our dataset only spans the years leading up to 2000, it would be worthwhile to reproduce this finding for more recent data. However, this is not possible since dataset that do include recent years

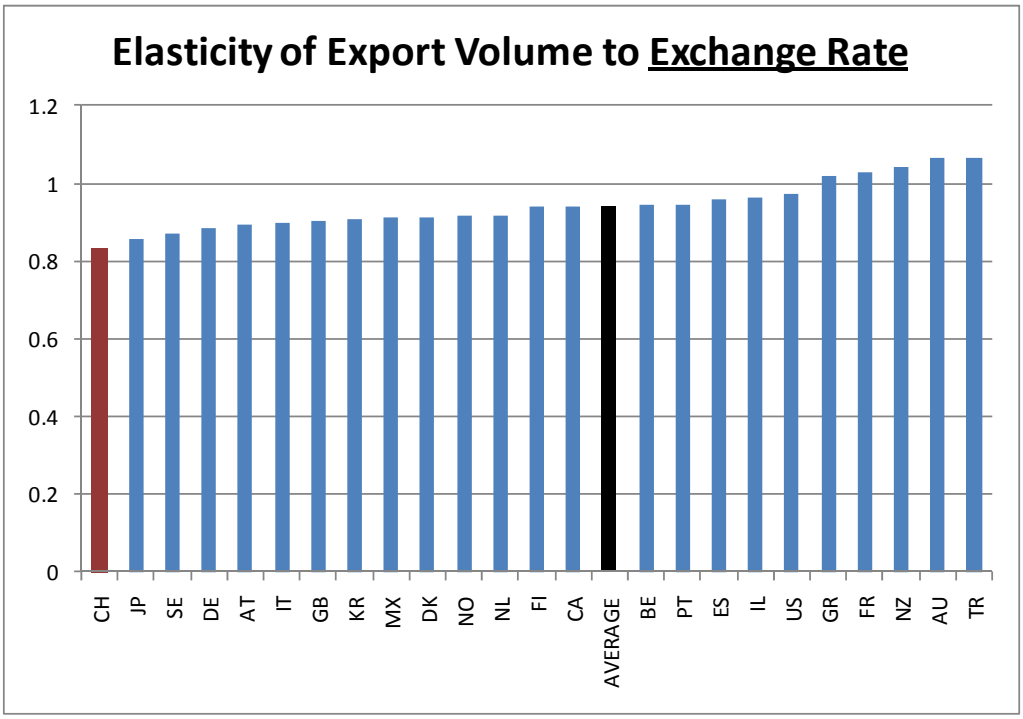

Figure 3

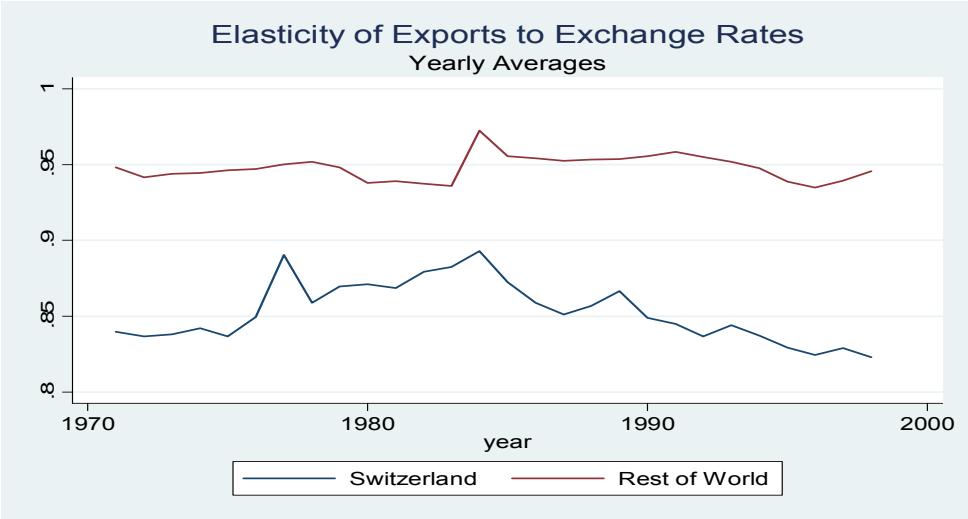

Figure 4

do not reach back far enough in time that we have sufficient information to conduct the analysis undertaken here.

Next, we turn to the parallel cross-country comparison regarding the export sensitivity to demand growth in export markets. The weighted averages of elasticities are computed parallel to those regarding exchange rates. For example, this variable for Switzerland is equal to:

$$\beta_{CH} = \sum_{all\ Sectors} w_{s,CH}\beta_{CH} .$$

This measure has the following economic interpretation. If GDP growth in all trade partners of Switzerland is equal to 1%, Swiss export volume in CHF increases by β_{CH} %. **Figure 5** shows that in terms of GDP sensitivity, the Swiss export basket is not special compared to other OECD nations and the average elasticity of Swiss exports with respect to GDP is not too far off from the average.

The observations gathered in this section leads us to conclude that a truly remarkable feature of Swiss exports is its relative high insensitive to exchange rate fluctuations.

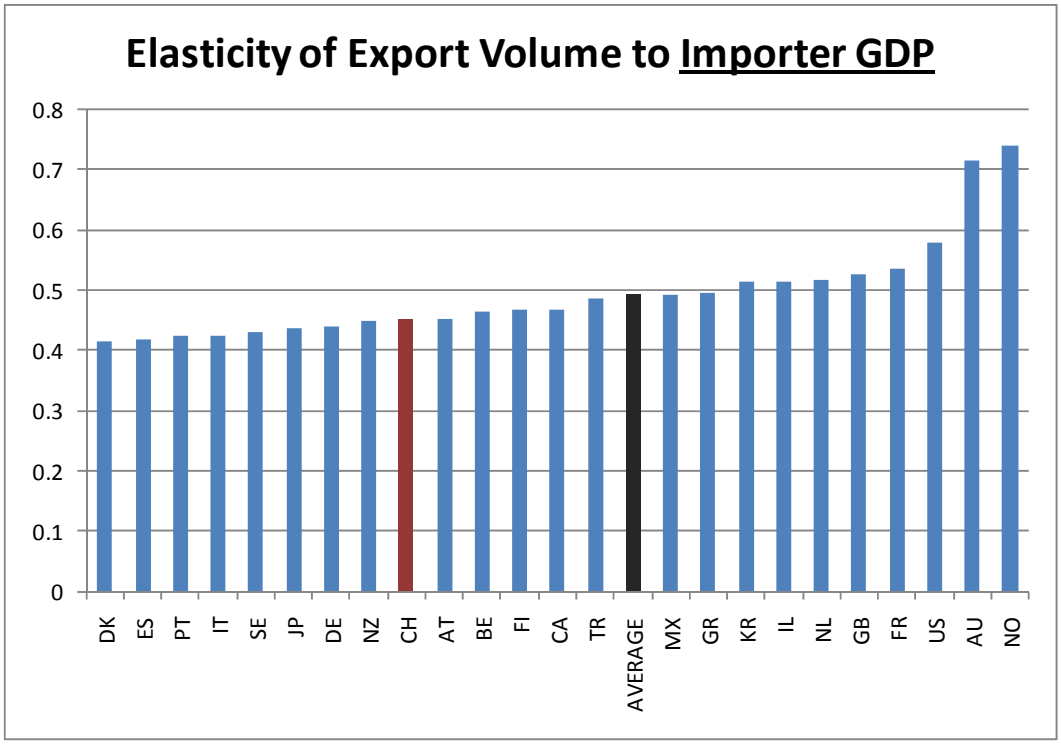

Figure 5

3. The Sensitivity of Imports to Exchange Rate Movements

A second question of interest concerns how the trade balance reacts to exchange rate changes. To answer this question, we also need to know how Swiss imports react to the exchange rate. We thus define the weighted elasticity of Swiss imports with respect to the exchange rate and foreign GDP to equal

$$\tilde{\alpha}_{CH} = \sum_{allSectors} \tilde{w}_{s,CH} \alpha_{CH} \quad \text{and} \quad \tilde{\beta}_{CH} = \sum_{allSectors} \tilde{w}_{s,CH} \beta_{CH} \quad \text{respectively.}$$

Here, $\tilde{w}_{s,CH}$ is the import weight of sector *s* in Switzerland, i.e., the share of Swiss imports in sector *s*.

Figures 6 and 7 document that the Swiss import basket is in no way special when it comes to how it reacts to changes of the exchange rate or the GDP of export markets. Both the average response of imports to the exchange rate as well as the average response of imports to importer GDP is rather close to the sample average.

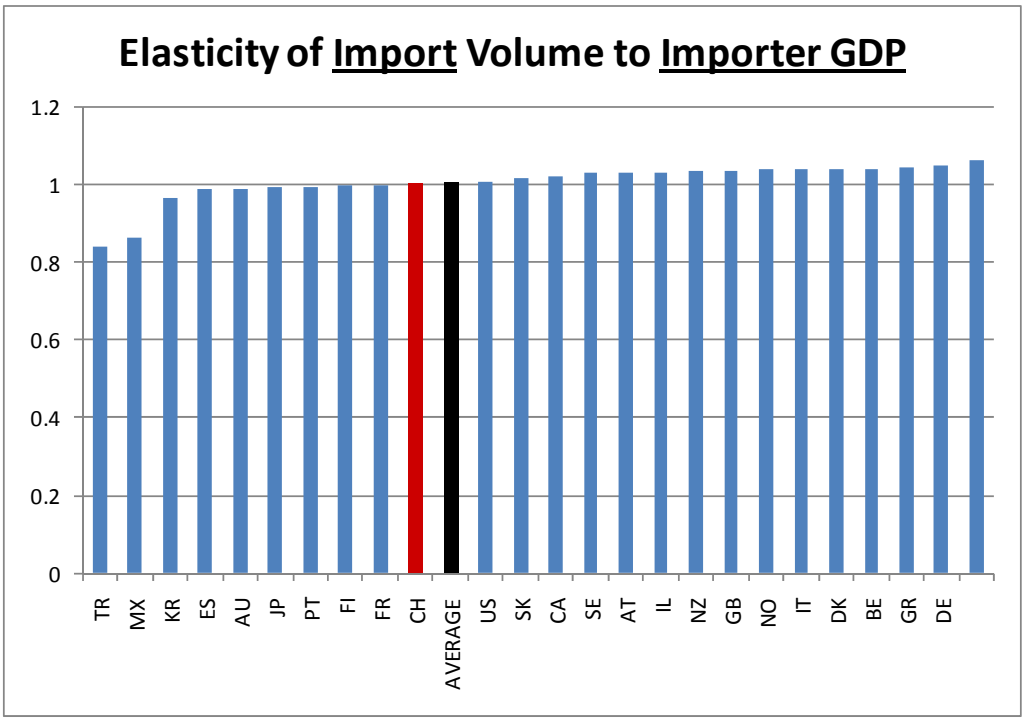

Figure 6

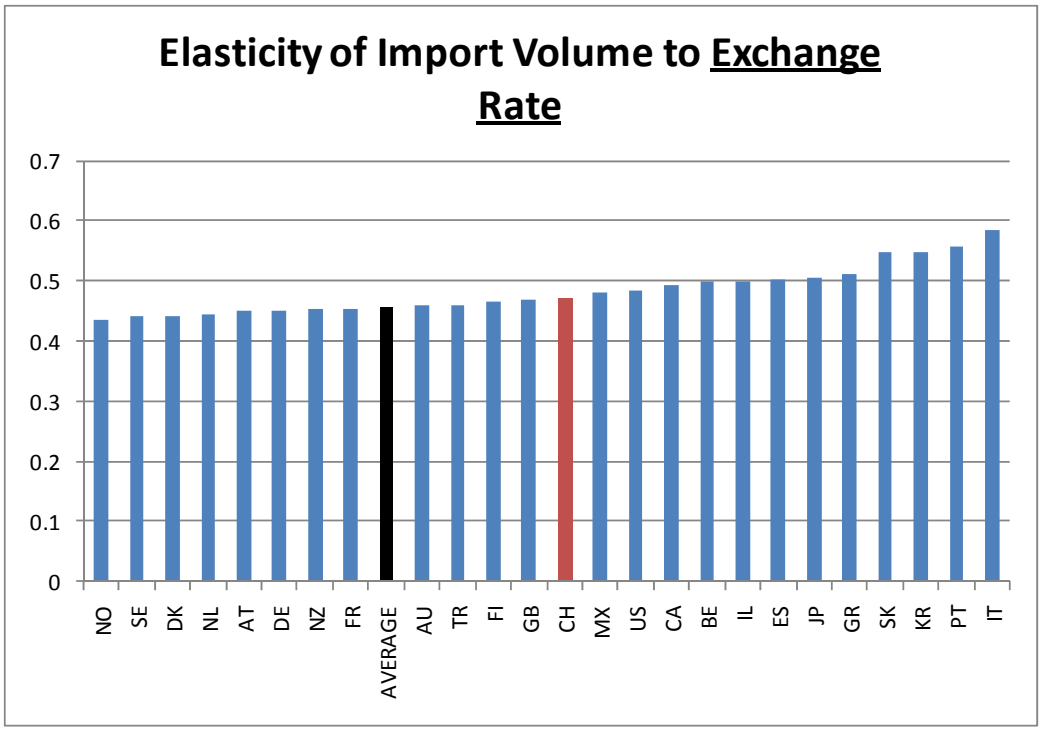

Figure 7

4. Conclusion

In times of a strong CHF appreciation, the Swiss export performance has proven to be exceptionally robust. This may be explained by the fact that global demand has recovered and that during the recent crisis pressures for across-the-board protectionist measures have been rather contained (see for example Evenett (2010)). Still, what is puzzling is that Swiss exports have risen as fast or even faster than those of other rich nations, despite the strong appreciation of the CHF.

We have documented that this puzzling observation can partly be attributed to the unique composition of the Swiss export basket. What does this result imply for the outlook of Swiss exports in the near future? For example, what would happen if the CHF strength intensified? Our results suggest that if this were the case, there would be a substantial but not dramatic decrease of Swiss exports. Our results also indicate that while Swiss exports are atypical, the behaviour of imports is very comparable to that of other OECD economies.

5. References

Raphael Auer and Philip Saure, 2011 "CHF Strength and Swiss Export Performance – Evidence and Outlook From a Disaggregate Analysis", Working Papers 11.03, Swiss National Bank, Study Center Gerzensee, April 2011

James E. Anderson & Eric van Wincoop, 2003. "Gravity with Gravitas: A Solution to the Border Puzzle," American Economic Review, American Economic Association, vol. 93(1), pages 170-192, March.

Richard Baldwin (Editor) "The great trade collapse: Causes, Consequences and Prospects"; VoxEU.org, Published 27 November 2009

Christian Broda and David Weinstein. (2006). "Globalization and the Gains from Variety." The Quarterly Journal of Economics, 121 (2): 541--585.

Simon J Evenett, Tensions Contained... For Now: The 8th GTA Report, 8 November 2010

Philipp Hildebrand, Monetary policy challenges: Swiss exports in a globalised world, Talk Held at the Swiss Mission the European Union, Brussels on 23.11.2010

Caroline Schmidt (2009)"Is Switzerland different? The role of trade in the current crisis" Research Note, Economic Analysis, 05 October 2009,

Martin Lanz (2011), Kontroverse um Frankenstärke, Neue Zürcher Zeitung, 13.01.2011

Robert C. Feenstra, Robert E. Lipsey, Haiyan Deng, Alyson C. Ma, Hengyong Mo 2005 "WORLD TRADE FLOWS: 1962-2000" Working Paper 11040, National Bureau of Economic Research.