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Marina Dyadkova, Georgi Momchilov

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SUMMARY: Constant market shares analysis (or shift-share analysis) is a tool that is used to explain changes in exports market shares of a focus country. It decomposes the aggregate export growth to a "structural change" effect and a "competitiveness" effect. This paper proposes a methodological improvement that allows to capture additional factors contributing to export growth outside the aforementioned effects, namely on the extensive margin of trade (trade over new trade lines) and effects of specialization. Therefore, we use the traditional decomposition only on the intensive margin (trade over existing trade lines) and propose two new effects to account for the rest – an "extensive margin" effect and an "opportunity loss" effect. Furthermore, we propose a method to obtain inter-temporally additive contributions to cumulative export growth rates across time intervals spanning for more than one period while taking into account structural changes in exports throughout the whole interval. Finally, we apply the proposed methodology on highly disaggregated trade data for major exporters, thus obtaining a dataset suitable for further research, economic analysis and policy recommendations.

Keywords: shift-shares analysis, constant market shares, competitiveness, opportunity loss, intensive margin, extensive margin

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1 Introduction

The global financial crisis of 2008 raised a number of concerns about both internal and external competitiveness of developed economies. The issue of refining and proposing new measures of competitiveness has re-surfaced in an attempt to re-assess factors influencing economic performance and provide better policy recommendations. Constant market shares analysis, hearafter CMSA, (or shift-share analysis) has been widely used as an instrument for retrospectively explaining exports growth of an economy, thus allowing the researcher to compare export performance between competitors and between different time periods (e.g. Wörz, 2005; Brenton & Newfarmer, 2007; Amador & Cabral, 2008; Jimènez & Martín, 2010).

The CMSA was first applied to trade flows by Tyszynski (1951). In the following decades the methodology underwent various modifications aimed at enriching its analytical features and tackling some issues with its application. All formulations of the CMSA try to explain the change in the aggregate export market share of a country by attributing it to two main factors – the particular structure of exports and the competitiveness of its products. Thus, the change is decomposed to the so called "structure" and "competitiveness" effects.

The CMSA decomposition is usually applied to the intensive margin[1] as it is technically easier to implement and because most of the volume and nominal value of international trade is on the intensive margin (Brenton and Newfarmer (2007), Amurgo–Pacheco and Pierola (2008)). Furthermore, the intensive margin proved to be the most important channel for stable and long-term growth (Cadot, Carrere & Strauss–Khan, 2009).

Despite the fact that the extensive margin does not play a major role in world total export growth, the sheer number of trade flows that fail or emerge is worth further analysis. Moreover, the extensive margin is an important factor in economic analysis of international trade, as it plays an important role as a driver of diversification (Cadot et al., 2009).

Therefore, in this paper we extend the analytical features of the CMS methodology in a way that enables us to capture export growth outside the intensive margin of trade. We add two new effects – the "extensive margin"

[1] We define the intensive margin as exports over trade lines that exist in at least two consecutive periods. We use the term trade line (or a trade relationship) as exports of a specific commodity group to a specific partner (e.g., exports of electrical machinery to Germany, exports of textile to Germany and exports of textile to Italy are three different trade lines). That is, the intensive margin represents deepening of the trade flows. The extensive margin, on the other hand, consists of trade lines that do not exist either in the initial period, or in the final period, i.e. it measures horizontal widening of trade.

effect that accounts for the trade flows on the extensive margin of trade and the "oppotunity loss" effect that captures the non-utilized potential for exports growth (trade flows that are non-existent in the focus economy's export portfolio but can be found elsewhere in the world). We further propose a method to apply CMSA on a discrete time interval spanning for more than one period and obtain results that take into account changes in the structure of exports throughout the whole interval. This allows analysis of longer-term export growth dynamics without the issues posed by the index number problem (see Section 3.3). We also apply the proposed methodology on highly disaggregated trade data for major exporters. The resulting dataset includes calculated contributions to all (intensive and extensive margin) CMS effects from each product, market and product – market combination for 47 major exporters using highly disaggregated (Harmonised System 6-digit product classification, hereafter HS6) trade data for the period 1998 – 2011. The results can be obtained from the authors upon request and are suitable for further research, economic analysis and policy recommendations.

The paper is structured as follows. In the next section we give a summary of the development of the CMS methodology in the literature. In Section 3 we propose our modification to the method with "extensive margin" and "opportunity loss" effects and propose a method to come up with inter-temporally additive cumulative growth rates. Section 4 gives a brief discussion on the interpretation of the decomposition effects. In Section 5 we give an overview of the detailed results. Finally, we conclude.

2 Development of CMSA

2.1 CMS decomposition of trade

The starting point of the methodology, as first proposed by Tyszynski (1951), is expressing the total value of exports of the focus country by using its market share in world exports. Let us denote with $w^A_{jk}(t)$ the focus country A's share in world exports of the *k*th product to the *j*th trade partner in time[2] t.

$$w^A_{jk}(t) = \frac{V^A_{jk}(t)}{V^*_{jk}(t)}$$

where V^A_{jk} and V^*_{jk} stand for the focus country (A) and the world (*) product *k*'s exports to trade partner *j*.

[2] Throughout the text we use (t) (in brackets) to denote time in the continuous case and a subscript t to denote time in the discrete case.

Then, total exports of *A* can be expressed as:

$$V^A(t) = w^A(t)V^*(t) = \sum_{j=1}^{M}\sum_{k=1}^{N} w_{jk}^A(t)V_{jk}^*(t) \tag{1}$$

where V^* and V^A denote total world exports and the focus country (A) total exports, w^A is the share of the focus country exports in total world exports and *M* and *N* denote the total number of trade partners and products of *A*'s exports portfolio.

Further, we can express $V^*_{jk}(t)$ by its share in total world exports (s^*_{jk}) and substitute in (1)

$$s_{jk}^*(t) = \frac{V_{jk}^*(t)}{V^*(t)}$$

to come up with

$$V^A(t) = \sum_{j=1}^{M}\sum_{k=1}^{N} w_{jk}^A(t)s_{jk}^*(t)V^*(t) \tag{2}$$

Then, the CMS decomposition of export growth is derived by differentiation of (2) with respect to time:

$$\frac{dV^A(t)}{dt} = \underbrace{\sum_{j=1}^{M}\sum_{k=1}^{N} w_{jk}^A(t)\frac{dV_{jk}^*(t)}{dt}}_{\text{World Growth Effect}} + \tag{3}$$

$$+ \underbrace{\sum_{j=1}^{M}\sum_{k=1}^{N} V_{jk}^A(t)\frac{ds_{jk}^*(t)}{dt}}_{\text{Structural Effect}} + \underbrace{\sum_{j=1}^{M}\sum_{k=1}^{N} V_{jk}^*(t)\frac{dw_{jk}^A(t)}{dt}}_{\text{Competitiveness Effect}}$$

The first term on the right-hand side is the growth of country A's exports, if it were to maintain its market shares in world exports for each trade line (world growth effect). The second term represents the change in A's exports that are a result of the change in specific portfolio structure (structural effect) and the last term stands for changes in exports because of gained market shares (competitiveness effect).

Later versions of the CMSA extend the methodology by including additional effects. Leamer and Stern (1970) propose a further decomposition of

the structural effect into commodity and market effects (see Appendix B). In their formulation the market and commodity distribution effect measure the extent to which specialisation in specific geographic markets and commodity groups affects export growth.

2.2 Flaws of the traditional CMS decomposition

Richardson (1971b) and Bowen and Pelzman (1984) point out several shortcomings of the traditional CMS methodology.

First, the results of the CMSA are sensitive to the level of commodity disaggregation and the degree of market consolidation, that is whether the partner countries are included separately or as country groups. Also, the results are sensitive to level of disaggregation in the trade classification. This problem can be interpreted as dependency of the results on the number of disaggregated series included in the final computation.

Second, the value of the individual commodity and market effect (as in Leamer and Stern (1970)) depends on the order of their computation, although their sum remains the same.

Then, the choice of the benchmark region (or standard area), which usually is the world[3], also affects the results. In principle, the appropriate benchmark region should include only true competitors. Thus, it should vary depending on the focus country and then, there is hardly an objective choice for "true" competitors.

Furthermore, CMSA is applied on datasets with discrete observations, while traditional theory uses continuous variables – the so-called index number problem (see Section 3.3). Equation (3) cannot be applied directly to trade flows from statistical databases since the methodology can be applied to continuous variables only. This means that the identity must be rewritten in terms of differences, growth rates and contributions to growth rates and the researcher faces the choice of what weights to use to calculate those.

To tackle the last problem various approaches are used in the literature. Tyszynski (1951), for example, applies weights from the initial as well as from the final period (see Appendix B for a discrete time formulation of Tyszynski (1951) and Leamer and Stern (1970))[4]. In the discrete case let us denote the share of the focus country total exports in world exports with w^A and the share of an individual trade line with $w^A_{jk} s^*_{jk}$ stands for the share of the indi-

[3] We will use "benchmark region" and "rest of the world" interchangeably throughout the text.

[4] Tyszynski (1951), Leamer and Stern (1970) and Baldwin (1958) use only product group shares in their formulation. Here we use product-market shares for consistency.

vidual trade line for the world in total world exports. Then, using the same notation as in (2), the first differences can be formulated as:

$$\Delta w^A = w_t^A - w_0^A$$
$$\Delta w_{jk}^A = w_{jkt}^A - w_{jk0}^A$$
$$\Delta s_{jk}^* = s_{jkt}^* - s_{jk0}^*$$

Then:

$$\Delta w^A = \sum_{j=1}^{M}\sum_{k=1}^{N} w_{jk0}^A \Delta s_{jk}^* + \sum_{j=1}^{M}\sum_{k=1}^{N} s_{jkt}^* \Delta w_{jk}^A \tag{4}$$

If weights from the same period (initial or final) are used to calculate each of the effects, an additional term arises. Baldwin (1958) calls it an "interaction effect".

$$\Delta w^A = \sum_{j=1}^{M}\sum_{k=1}^{N} w_{jk0}^A \Delta s_{jk}^* + \\ + \sum_{j=1}^{M}\sum_{k=1}^{N} s_{jk0}^* \Delta w_{jk}^A + \underbrace{\sum_{j=1}^{M}\sum_{k=1}^{N} \Delta w_{jk}^A \Delta s_{jk}^*}_{\text{Interaction Effect}} \tag{5}$$

This effect is interpreted in various ways in the literature. Richardson (1971a) views it as an additional measure of competitiveness, since it reflects the exporting country's reaction to the growth rate of demand for commodities and markets. Milana (1988), on the other hand, argues that this is part of the index number problem, since this additional term is not present in the continuous-time decomposition.

An additional issue is that in the traditional formulation of the CMS analysis the competitiveness effect is a residual effect calculated as the difference between the change in the aggregate export share and the structural effect. This makes the results sensitive to the level of disaggregation of the geographical markets and the commodity group classification.

2.3 Further Development of CMSA

In order to avoid some of the methodological shortcomings pointed out by Richardson (1971b) and Bowen and Pelzman (1984) several modifications to the original decomposition formula are proposed in the literature.

2.3.1 The index number problem

Milana (1988) suggests the index number problem can be overcome by using Diewert's (1976) superlative index numbers. This requires reformulation of the discrete-time version of the accounting decomposition by using more flexible index numbers, instead of the fixed-weight Laspeyres- or Paasche-type indexes. CMSA is expressed in terms of relative changes approximating the line integrals of the decomposition equation by Törnqvist indices using discrete-time observations. The weights are averages of the initial and the final period. Since shorter time intervals and smaller rates of change give a closer discrete approximation to the continuous case, Milana recommends applying the decomposition to the shortest intervals for which the data are available and then chaining the indices.

ECB (2005) propose the decomposition to be done for one-year periods, which limits the index number problem, since the structure changes less for such relatively short periods. The weights are derived solely from the initial period, thus obtaining additive effects to the total growth rate.

2.3.2 Calculation of the structural and competitiveness effects

Milana (1988) calculates the competitiveness effect as a separate effect, not depending on the value of the structural effect. Furthermore, the residual term interpreted as the "interaction effect" is ruled out as not bearing any meaningful economic information and is being distributed to the other components of the CMS analysis.

2.3.3 Calculation of the commodity and market effects

To overcome the problem with sensitivity of the results to the order of computation Milana also refines the separation of the structural effect. The Product and the Market effects (hereafter, PE and ME, respectively) are calculated in a symmetrical way, which leaves a third effect – Specific market-product effect or Residual.

The new formulation of Milana can be written as follows:

Total Effect = Competitiveness Effect + Structural Effect

Structural Effect = Market Effect + Product Effect + Residual Structural Effect

The total effect measures the change of the total export share of a country over the reviewed period. Again, the competitiveness effect measures the influence of changes in price and non-price factors on export performance. The interpretation of the product and the market effect is the same as in Leamer and Stern (1970) – contributions to exports growth rate differentials due to specialization in specific products groups and/or geographical markets. The residual represents the effect of specific market-product combina-

tions in comparison to the market and product mean distribution of a given country's exports (Simonis, 2000).

2.4 Other approaches to CMSA

2.4.1 Using data for trade flows on the intensive margin only

ECB (2005) use data only on the intensive margin and a specification of the CMS methodology in which the change in the world export market share is computed using the difference between its export growth rate and the average export growth rate of the world. Again, one part of this difference is due to the particular structure of the focus country's exports, the structural effect. The rest is interpreted as the competitiveness effect. The structural effect is decomposed to product and market effects, calculated in a symmetrical way, and a structural-mixed effect (residual structural effect). Since ECB (2005) use shares from the initial period, let s^A_j, s^A_k, s^A_{jk}, s^*_j and s^*_{jk} denote shares in the initial period of market *j*, product *k* and individual trade line *jk* in the focus country *A* exports, respectively and similarly for the benchmark region(*).

$$s^A_j = \frac{V^A_{j0}}{V^A_0},\ s^A_k = \frac{V^A_{k0}}{V^A_0},\ s^A_{jk} = \frac{V^A_{jk0}}{V^A_0}$$
$$s^*_j = \frac{V^*_{j0}}{V^*_0},\ s^*_k = \frac{V^*_{k0}}{V^*_0},\ s^*_{jk} = \frac{V^*_{jk0}}{V^*_0}$$

Further, let us denote the growth rates of total exports for the focus country and the world as g^A and g^*.

$$g^A = \frac{V^A_t}{V^A_0} - 1$$
$$g^* = \frac{V^*_t}{V^*_0} - 1$$

Similarly, we can calculate export growth rates for specific product groups, geographicmarkets or individual trade lines. Let g^A_k, g^A_j and g^A_{jk} stand for those terms for the focus country and g^*_k, g^*_j and g^*_{jk} – for the benchmark region.

$$g^A_k = \frac{V^A_{kt}}{V^A_{k0}} - 1,\ g^A_j = \frac{V^A_{jt}}{V^A_{j0}} - 1,\ g^A_{jk} = \frac{V^A_{jkt}}{V^A_{jk0}} - 1$$
$$g^*_k = \frac{V^*_{kt}}{V^*_{k0}} - 1,\ g^*_j = \frac{V^*_{jt}}{V^*_{j0}} - 1,\ g^*_{jk} = \frac{V^*_{jkt}}{V^*_{jk0}} - 1$$

Then, the growth rate difference can be expressed as:

$$g^A - g^* = \underbrace{\sum_{j=1}^{M}\sum_{k=1}^{N}(s_{jk}^A - s_{jk}^*)g_{jk}^*}_{\text{Structural Effect(SE)}} + \underbrace{\sum_{j=1}^{M}\sum_{k=1}^{N}s_{jk}^A(g_{jk}^A - g_{jk}^*)}_{\text{Competitiveness Effect(CE)}} \quad (6)$$

The structural effect is further decomposed as follows:

$$\underbrace{\sum_{j=1}^{M}\sum_{k=1}^{N}(s_{jk}^A - s_{jk}^*)g_{jk}^*}_{\text{Structural Effect(SE)}} = \underbrace{\sum_{j=1}^{M}(s_j^A - s_j^*)g_j^*}_{\text{Market Effect(ME)}} + \underbrace{\sum_{j=k}^{N}(s_k^A - s_k^*)g_k^*}_{\text{Product effect(PE)}} + \quad (7)$$

$$+ \underbrace{\sum_{j=1}^{M}\sum_{k=1}^{N}\left[(s_{jk}^A - s_{jk}^*) - (s_k^A - s_k^*)\frac{s_{jk}^*}{s_k^*} - (s_j^A - s_j^*)\frac{s_{jk}^*}{s_j^*}\right]g_{jk}^*}_{\text{Structural Mixed Effect(SME)}}$$

2.4.2. Econometric Techniques

Another approach is presented in Cheptea, Gaulier and Zignago (2005) where they build on Jayet (1993) to develop an econometric technique to estimate the structural and competitiveness decomposition of export growth rates. The growth rate of exports of product *k* to market *j* by country *i* (g_{ijk}) is presented as the sum of four effects, as follows:

$$g_{ijk} = m + \alpha_i + \beta_j + \gamma_k + \epsilon_{ijk}$$

where *m* is the intercept and denotes the average world growth rate, α_i, β_j, γ_k denote focus country, partner and product dummies (fixed effects). This equation is econometrically estimated using weighted ordinary least squares with the weights being the volume of the trade flows in the initial period.

$$\psi_{ij} = \frac{V_{ij0}}{V_{i0}}, \ \phi_{ik} = \frac{V_{ik0}}{V_{i0}}$$

The estimated parameters, therefore, represent respectively the world trade, competitiveness (or "pure performance"), commodity and geographical effect and are then used to construct an equation for each focus country in the following form:

$$g_i = \hat{m} + \hat{\alpha}_i + \sum_{j=1}^{M} \psi_{ij}\hat{\beta}_j + \sum_{k=1}^{N} \phi_{ik}\hat{\gamma}_k$$

with hat denoting the estimate for each parameter and ψ_{ij} and φ_{ik} – the weights of the respective focus country's market share and commodity group in their total exports.

An additional benefit of this approach is that it also produces standard errors for all parameters and therefore inference on the statistical significance of the estimates can be made. This method is then applied with minor modifications by Cheptea, Fontagné and Zignago (2012). Despite the fact that this approach can easily and inexpensively be applied, the resulting effects come in as aggregates and, as opposed to the classical accounting method, obtaining contributions to the different effects from specific trade lines, product groups or geographic markets is difficult. This makes the analysis suffer from its inability to decompose structural and competitiveness effects to their components and makes analysing specific product or geographic markets across different effects infeasible.

3 Extending the CMS decomposition

3.1 Motivation

The economic downturn during and after the crisis of 2008 was responsible for a severe decline in international trade with both the contraction and the recovery of external trade marked by heterogeneity across different countries and regions and volatility on both the intensive and the extensive margin (Table 1 and Table 2[5,6]).

However, in most of the empirical studies that use the CMS methodology to analyse this dynamics the decomposition effects are applied on trade lines on the intensive margin only. This leaves trade lines on the extensive margin unaccounted for while decomposing them could bring additional information to use for economic analysis.

[5] The abbreviations used throughout the text are as follows: EU27 – European Union; EA17 – all eurozone members as of 2013; EU3 – the United Kingdom, Denmark and Sweden, EU7 – Bulgaria, Romania, Hungary, the Czech Republic, Lithuania, Latvia, Poland; BRIC – Brazil, the Russian Federation, India, China.

[6] The data used is HS6 (Harmonised System 6-digit product classification) trade data from the BACI database for the period 1998–2011. All bilateral trade flows, reporters and partners are included, save for independent territories.

Table 1

NOMINAL EXPORTS (IN USD) GROWTH IN %

	1999–2002	2002–2005	2005–2008	2008–2011
EU27	11.6	53.9	44.5	3.1
EA17	11.6	53.6	43.5	2.5
EU3	2.8	42.8	32.2	-0.8
USA	-2.5	28.1	41.6	9.3
Japan	1.9	42.1	30.8	4.6
EU7	45.0	87.6	79.6	14.3
BRIC	46.6	109.2	77.9	25.6

During the years prior to the crisis (1998-2008) economies in the eurozone demonstrated ostensibly high export performance compared to other developed economies, *inter alia* USA and Japan. These results came mainly from growth on the intensive margin of trade where existing trade flows were deepened as opposed to the low levels of growth on the extensive margin. This pattern was even more pronounced for the US and Japan where the extensive margin brought negative contributions to export growth for almost the entire period.

At the same time, developing economies like the new members states of the European Union and the BRICs registered much higher growth rates with the extensive margin of trade much more important. This is not surprising as less developed economies tend to experience more rapid export growth while widening their product and geographic market portfolio.

Table 2

CONTRIBUTION OF THE EXTENSIVE MARGIN TO EXPORTS GROWTH (P.P)

	1999–2002	2002–2005	2005–2008	2008–2011
EU27	5.1	2.7	-0.1	4.3
EA17	4.0	2.0	-1.7	4.1
EU3	4.8	3.2	-0.1	1.1
USA	42.4	-1.3	-6.7	-6.0
Japan	-7.7	-0.1	-14	-1.4
EU7	9.8	7.4	3.9	5.7
BRIC	2.1	2.7	0	1.7

An interesting observation is the fact that although most of the trade growth comes from the intensive margin, a big chunk of the established trade flows do not survive even for a single year. Table 3 presents the share of bilateral trade flows that survived for at least two consecutive years. This phe-

nomenon is more pronounced for developing countries where the "mortality" of existing trade flows is much higher. This can easily be explained with the fact that exporters from developing countries are still trying to explore new business opportunities abroad and experience a high bilateral trade flow mortality rate while developed countries have established much more stable and persistent external trade relationships.

Table 3

AVERAGE SHARE OF ANNUAL SURVIVING TRADE FLOWS IN %

	1999–2002	2002–2005	2005–2008	2008–2011
EU27	62.2	63	63.7	65.2
EA17	64	64.7	65.4	66.8
EU3	63.2	64	64.7	65.6
USA	69.6	70	70.1	71.2
Japan	66.8	67.2	67.3	67.8
EU7	52.1	54.2	56.4	59.3
BRIC	58	61.1	64.4	66.6

The overall number of non-surviving trade flows is quite significant for both developed and developing countries. In highly disaggregated trade data there is a large number of products that are close substitutes. Therefore, a shift in the structure of exports from one product to a close substitute will result in both a new entry (newly established trade line) and a failure (a trade line that did not survive for at least two consecutive years). Moreover, the difference between the number of new entries and failures does not seem to be significant compared to the total number of trade flows and the total nominal value of exports.

Since non-zero values are needed for both the initial and the final period when calculating growth rates and contributions to growth, all trade lines on the extensive margin do not usually fall in any of the discussed contributions (effects).

Constricting the analysis to the intensive margin of exports growth only is tempting as it seems to have several advantages. First of all, it answers Richardson's critique concerning the choice of standard area. Richardson (1971b) points out that the focus country should compare itself only with its true competitors. Limiting the calculation of the effects to the intensive margin only automatically changes the relevant area for each country, thus satisfying this requirement.

Then, if trade lines on the extensive margin are not removed from the dataset before performing the CMS decomposition, they lead to underesti-

mation of the total product, market and structural mixed effect (structural effects), since their respective shares in the export basket of the focus country are scaled down by the residual trade flows on the extensive margin.

Another issue is the treatment of trade lines that the focus country does not have but that exist in the benchmark region. Since the change in benchmark region export market share of a country is a result of the difference between its export growth rate and the average export growth rate of the benchmark region, these trade lines should also be included in the traditional computation. This distorts the structural effect and all of its component effects. The exporter is "punished" for not exporting the whole range of available products in the benchmark region and/or to the whole range of available partners in the benchmark region. Constricting the analysis to the intensive margin of trade eliminates this issue.

This approach, however, ignores useful information contained in exports growth on the extensive margin and cannot fully employ all the trade data available for exporters, markets and products outside the export basket of the analysed country. The next section is devoted to an extension of the methodology that alleviates these issues.

3.2 Extending the specification

Our starting point is the specification and notation of the CMS decomposition as in ECB (2005) (see Section 2.4.1). We take into consideration the discussion in Section 3.1 to try and improve the methodology.

Addressing the issues in the previous section, we constrain the traditional decomposition only to the intensive margin of trade. However, the intensive margin alone cannot give the whole picture regarding the factors behind the change of the aggregate export market share of the focus country. The part that remains unexplained can be thought of as a residual that captures the change in trade lines on the extensive margin and trade lines not in the export basket of the focus country.

Let us denote the shares shares of the intensive and the extensive margin in total exports of *A* in the initial period with s^A_{int} and s^A_{ext} :

$$s^A_{int} = \sum_{j=1}^{M_{int}} \sum_{k=1}^{N_{int}} s^A_{jk}$$

$$s^A_{ext} = 1 - s^A_{int}$$

where M_{int} and N_{int} stand for the total number of geographic markets and product groups only on the intensive margin of *A*. We can use a similar notation for the benchmark region with one important caveat – some trade lines do not exist in the focus country's export portfolio but do exist in the export structure of the benchmark region. Let us use subscript opl to denote that, so that M_{opl} and N_{opl} stand for the total number of geographic markets and product groups that are non-existent for the focus country but exist for the benchmark region in the initial period. Then:

$$s^*_{int} = \sum_{j=1}^{M_{int}} \sum_{k=1}^{N_{int}} s^*_{jk}$$

$$s^*_{opl} = \sum_{j=1}^{M_{opl}} \sum_{k=1}^{N_{opl}} s^*_{jk}$$

$$s^*_{ext} = 1 - s^*_{int} - s^*_{opl}$$

Let g^A_{int} and g^A_{ext} [7] stand for the growth rates on the intensive and extensive margins of country *A* and a similar notation for the benchmark region, so that:

$$g^A_{int} = \frac{V^A_{int\,t}}{V^A_{int0}} - 1,\ g^A_{ext} = \frac{V^A_{ext\,t}}{V^A_{ext0}} - 1$$

$$g^*_{int} = \frac{V^*_{int\,t}}{V^*_{int0}} - 1,\ g^*_{ext} = \frac{V^*_{ext\,t}}{V^*_{ext0}} - 1$$

Then, we can express the total growth rate of exports of *A*, g^A as:

$$g^A = \underbrace{s^A_{int} \times g^A_{int}} + \underbrace{s^A_{ext} \times g^A_{ext}}$$

Similarly, if g^*_{int}, g^*_{ext} and g^*_{opl} are the growth rates of the benchmark region for the trade lines on the intensive margin of *A*, the trade lines on the extensive margin of *A* and the trade lines outside the export basket of country A, respectively, then for the benchmark region the total growth rate g* would be:

[7] To calculate the growth rate of the extensive margin we use $V_{ext} = V - V_{int}$.

$$g^* = \underbrace{s^*_{int} \times g^*_{int}}_{\text{Intensive margin}} + \underbrace{s^*_{ext} \times g^*_{ext}}_{\text{Extensive margin}} + \underbrace{s^*_{opl} \times g^*_{opl}}_{\text{Opportunity loss}}$$

Finally, the total growth differential between country *A* and the benchmark region is:

$$\begin{aligned} \underbrace{g^A - g^*}_{\text{Growth differential}} &= \underbrace{s^A_{int} \times g^A_{int} - s^*_{int} \times g^*_{int}}_{\text{Intensive margin differential}} + \\ &+ \underbrace{s^A_{ext} \times g^A_{ext} - s^*_{ext} \times g^*_{ext}}_{\text{Extensive margin differential}} - \underbrace{s^*_{opl} \times g^*_{opl}}_{\text{Opportunity loss}} \end{aligned} \tag{8}$$

That is why we propose to add two new effects to the CMSA. Let us call them the Extensive margin effect (EME) and the Opportunity loss effect (OLE). Then, the total growth differential is decomposed to:

$$g^A - g^* = (SE + CE) + EME + OLE \tag{9}$$

The SE and CE, as well as the SE component effects PE, ME and SME, are calculated as in (6).

$$SE + CE = s^A_{int} \times g^A_{int} - s^*_{int} \times g^*_{int} =$$

$$= \sum_{j=1}^{M_{int}} \sum_{k=1}^{N_{int}} (s^A_{jk} - s^*_{jk}) g^*_{jk} + \sum_{j=1}^{M_{int}} \sum_{k=1}^{N_{int}} s^A_{jk} (g^A_{jk} - g^*_{jk})$$

For the extensive margin effect we use values of exports (*V*) as shares and growth rates cannot be obtained on the extensive margin since the trade lines do not exist in the initial or in the final period. Let M_{ext} and N_{ext} stand for the total number of geographic markets and product groups on the extensive margin of *A*. Then, the two new effects can be formulated as follows:

$$EME = \sum_{j=1}^{M_{ext}} \sum_{k=1}^{N_{ext}} \left(\frac{V^A_{jkt} - V^A_{jk0}}{V^A_0} - \frac{V^*_{jkt} - V^*_{jk0}}{V^*_0} \right) \tag{10}$$

and

$$OLE = \sum_{j=1}^{M_{opl}} \sum_{k=1}^{N_{opl}} -s^*_{jk} g^*_{jk} \tag{11}$$

The structural effect is further decomposed as in (7):

$$\begin{aligned} SE &= \sum_{j=1}^{M_{int}} \sum_{k=1}^{N_{int}} (s^A_{jk} - s^*_{jk}) g^*_{jk} = \\ &= \sum_{j=1}^{M_{int}} (s^A_j - s^*_j) g^*_j + \sum_{k=1}^{N_{int}} (s^A_k - s^*_k) g^*_k + \\ &+ \sum_{j=1}^{M_{int}} \sum_{k=1}^{N_{int}} \left[(s^A_{jk} - s^*_{jk}) - (s^A_k - s^*_k) \frac{s^*_{jk}}{s^*_k} - (s^A_j - s^*_j) \frac{s^*_{jk}}{s^*_j} \right] g^*_{jk} = \\ &= PE + ME + SME \end{aligned}$$

3.3 Treatment of the index number problem

As discussed in 2.2, the index number problem arises when the continuous time-changes are rewritten in terms of differences and use of different weights yields different results and interpretation. This problem is particularly relevant when the CMS decomposition is applied over long time-series. Different solutions are proposed in the literature. Among these the most popular are those of Milana (1988) and ECB (2005). Milana uses more flexible index numbers, where the weights are derived as an average of exports shares in the initial and the final period. Furthermore, the period analysed is divided into short periods and then the indices measuring the different effects are chained and aggregated for the whole period. ECB (2005) argue that using weights solely from the initial period does not lead to great distortions, if the decomposition is done over one-year periods, since the change of structure is relatively small.

We adopt the approach used in ECB (2005), which is to calculate the effects for one-year periods. This confronts us with the problem of how to properly aggregate the effects for long periods, while taking into account the change in exports structure and keeping the additivity of the components to the total cumulative export growth rate of the focus country.

The approach we propose is the following: First, we transform the results for each of the effects into levels. We do that to calculate the decomposition in terms of first differences, instead of in terms of growth rates. This can be

done by using a base year and constructing indices or by simply multiplying the results obtained with (9) by the value of exports of the focus country in the previous period. The second step is to aggregate the yearly effects by summing them up for the period of interest. Finally, in order to compute contributions to cumulative growth for the period of interest, we divide all of the effects by the value of exports of the focus country in the initial period.

This gives the following formulation:

$$\frac{1}{V_0^A}\sum_{t=0}^{T-1} g_{t+1}^A \times V_t^A - \frac{1}{V_0^A}\sum_{t=0}^{T-1} g_{t+1}^* \times V_t^A = \frac{1}{V_0^A}\sum_{t=0}^{T-1}\sum_{E\in Z} E_{t+1} \times V_t^A,$$

$$Z = \{PE, ME, SME, CE, EME, OLE\}$$

where period 0 is the initial period and period T is the final period.

This approach, though, slightly changes the original interpretation of the ECB decomposition. Instead of decomposing the difference of the cumulative export growth rate of the focus country and the cumulative export growth rate of the benchmark region, it introduces again (as in earlier versions of the CMSA) a benchmark region growth effect, that depends on the value of the focus country's exports.

4 Interpretation

4.1 Traditional effects

A positive growth differential indicates an increase in the global export market share of the focus country. If the cumulative growth rate over long periods of time is higher than the "world effect", the focus country has gained market shares.

The interpretation of the traditional (structural and competitiveness) effects is altogether the same as the interpretation of other authors. The structural effect represents growth due to the overall expansion of exports of each trade line in the export basket of the focus country, while the competitiveness effect is growth due to the increase of the share of the focus country in world exports.

The contribution to export growth from the initial structure of exports on the intensive margin of trade can be presented as relative specialization in markets (product or geographic) with fast growing demand. It could also be stated that external demand "pulls" exports. Conversely, the competitiveness effect indicates the presence of factors outside the bare export structure that contribute to growth, i.e. the focus country "pushes" competitors out of

established markets and gains market shares. Since the intensive margin of trade is important for a stable, long-term increase in exports, both favourable specialization and good competitiveness are desirable features.

The competitiveness effect gives the aggregate impact of changes in market shares of each product in each destination market but the factors behind this may be both price or non-price factors and cannot be distinguished using CMSA. Among the non-price factors could be differential rates of quality improvement, development of new exports, better marketing, terms of financing the sale of export goods, or simple preferences and taste; differential changes in the ability for prompt fulfillment of export orders (Fleming& Tsiang, 1956).

As for the decomposition of the structural effect to product, market and structural mixed effect, we offer a slightly different reasoning. Calculating the product and the market effect in a symmetric way has the disadvantage of incorporating a single trade line in both effects – each trade line is used in calculating both the product and the market effects. Consequently, the sum of the product and the market effect is overestimated and the structural mixed effect is simply the difference between the structural effect and the sum of the product and market effect. That makes the interpretation of the structural mixed effect meaningless. Furthermore, the geographical distribution of exports (especially on the intensive margin) is highly dependent on the particular product structure of exports.

The above considerations, alongside the fact that in the short-run the product structure of exports is not particularly flexible, suggest that it is more meaningful to calculate the product effect first. As usual it is a measure of the extent to which exports are concentrated in products with high growing demand. Then the remainder to the total structural effect (the sum of the market and the structural mixed effect) assesses how well the exporters managed to direct their products to destination markets. For long time intervals the product structure of exports can also be deemed flexible and then the analysis can be made in a symmetrical manner for the market distribution – for a given market specialization, as measured by the market effect, how well the exporters managed to adapt their product portfolio.

If the CMS decomposition is applied on data in nominal values, the interpretation of the structural effect requires additional attention. Different product groups and geographical markets might have different price developments over time. Hence, as already mentioned, the product effect also reflects those while not being able to distinguish between price and non-price dynamics.

4.2 Newly proposed effects

4.2.1 The extensive margin effect

As constructed in (10) *the extensive margin effect* is calculated as the difference between the contribution to export growth of each trade line on the extensive margin of the focus country and the average contribution to export growth of the same trade line for the world. Therefore, there are a few factors which determine the sign and magnitude of the effect as shown in Table 4. Intuitively, each trade line on the extensive margin has a positive contribution to export growth only if it is a new entry – a failure would render a negative contribution to growth. The two cases where the sign of the average contribution of this trade line in the world is opposite to its counterpart for the focus country are trivial. The cases when both the focus exporter and the average world exporter have same-sign contributions are more interesting. Then, magnitude is what determines the final extensive margin effect for the specific trade line. Let us consider both cases.

Table 4

TRADE FLOWS CONTRIBUTIONS SIGNS AND EXTENSIVE MARGIN EFFECT SIGN

	Entry	Failure
World Positive	+ -	- -
World Negative	+ +	- +

• Reporting country and world average contributions to growth are positive. Even if this is a new entry for the focus country, it could have a negative contribution to the growth differential, if the average world exporter was able to increase their exports on the trade line faster than the focus country. On the other hand, if the newly established for the exporter trade flow boosts exports growth more than it does for the rest of the world, the net external margin effect is positive.

• Focus country and world average contributions to growth are negative: In this case even if the trade line dies in the final period, it could still have a positive contribution to the export growth differential. If the exporter leaves markets with falling demand and thus minimizes exports decline better than the average world exporter, the net effect on the extensive margin for the focus country is positive.

The aggregated extensive margin effect is difficult to interpret, though. There are six distinct cases that determine its sign and magnitude. Therefore,

it is much more useful to combine these contributions with other structural effects to draw conclusions for specific trade lines.

The disaggregated extensive margin effect gives another interesting aspect to the CMSA – it allows tracking the performance of different trade lines through time – not only on the intensive but also on the extensive margin. This could facilitate research into the evolution of product groups and geographic markets over time without "losing" them even on the highest level of data disaggregation as would be the case, if the researcher analyses export performance on the intensive margin only.

4.2.2 The opportunity loss effect

The opportunity loss effect represents the penalty imposed on the focus country for not exporting all commodity groups to all geographic markets. In periods when global external trade is growing this effect is expected to bring a negative contribution to the focus country's growth differential since normally it cannot export all commodity groups to all geographic markets - this is especially true on a high level of data disaggregation.

The opportunity loss effect, naturally, can also be thought of as the cost of specialization in specific product and geographic markets and missing other opportunities for exports. It can be compared with the sum of the structural effects (product, market and mixed structural effects) to obtain a measure of specialization/diversification gains.

The opportunity loss effect cannot, of course, be interpreted as an absolute measure of missed export opportunities. There are numerous factors and constraints which affect the ability of an exporter to reach geographic markets and supply the whole diversity of products. However, it can be used in comparative studies to analyse export opportunities relative to subjectively chosen competitors. Disaggregating the total opportunity loss effect to contributions from different trade lines can also point to markets or commodity groups that might have high potential for the focus country but have not been explored yet.

5 Data and results

5.1 Data

We apply the described CMS methodology on trade data from the BACI World trade database. BACI provides bilateral export nominal values in USD and quantities at the HS 6-digit product disaggregation covering over 5,000 commodity groups for more than 200 countries (see Table 5). The database is constructed using the United Nations COMTRADE data but a procedure

to reconcile import and export data is applied to achieve higher quality of the data (Gaulier & Zignago, 2010).

In our CMS decomposition we use the 1998–2011 version of the database – it covers a decade before the global financial crisis as well as the recovery in international trade after 2009. We clean the data from independent territories and country groups. As the level of commodity groups disaggregation is an important issue for the CMSA, we construct two additional datasets for the HS 4-digit and HS 2-digit from the original dataset by simple aggregation.

Table 5

BACI DATASET SUMMARY ON THE HS6 LEVEL OF DISAGGREGATION

period	tradeflows	exporters	importers	products
1998	5 202 718	230	231	5 111
1999	5 432 870	230	231	5 111
2000	5 663 834	240	239	5 111
2001	5 899 647	239	240	5 111
2002	6 060 118	239	241	5 111
2003	6 338 894	237	240	5 111
2004	6 633 832	237	239	5 111
2005	6 930 969	234	234	5 109
2006	7 113 702	234	234	5 104
2007	7 234 714	234	234	5 098
2008	7 337 482	234	234	5 079
2009	7 079 969	234	234	5 076
2010	7 257 250	234	234	5 049
2011	7 243 742	236	236	5 025

The resulting input dataset is summarised in Table 5. The commodity group and geographic representation of the dataset is stable over time but the number of trade flows increases substantially (by 41%) in the period 1998–2008. A drop in this number is clearly visible in 2009 when the value and volume of international trade declined, thus producing volatility on the extensive margin.

5.2 Results

We apply our extended CMS methodology on the three datasets (original HS6 and our HS4 and HS2 aggregations) constructed from the BACI 1998–2011 dataset. The calculations are used to decompose the export growth differentials for a set of 47 selected countries. Detailed results can be obtained from the authors upon request and include the effects on the intensive and the extensive margin-product, market, structural mixed, com-

petitiveness, extensive margin and opportunity loss effects. Each of these is further decomposed to contributions from trade lines, i.e. the product effect for each period is decomposed to obtain specific product group contributions to growth and the same is done for the market effect. The remaining effects are decomposed into contributions from trade lines (i.e. product-market contributions). Those can easily be aggregated to obtain specific product or market effects, so the user could construct various indicators to compare, for example, performance on specific products and markets, specialization (intensive margin) vs diversification (extensive margin and opportunity loss) dynamics, or structural versus competitiveness gains.

Appendix E presents plots showing contributions to cumulative growth rates over intervals spanning for more than one year as discussed in 3 and aggregated results for one-year periods between 1999 and 2011 for a selected set of countries.

Different levels of disaggregation of the input data yield different final absolute results as discussed in Section 2.2. Fewer trade flows, as obtained from low levels of disaggregation, result in effects on the intensive margin getting a much higher share of the final export differential as compared to the extensive margin and opportunity loss effects. However, the dynamics of the effects across different classifications are similar and obviously does not significantly change the economic interpretation.

Competitiveness seems much more important in periods when overall international trade grows slowly as compared to when it is much more robust. In the beginning of the XXI century and during the global financial crisis emerging and developing economies were able to get relatively high competitiveness gains and dwarf the average exporter. However, during times of rapid economic and trade growth in the world competition pressures are much smaller and structural effects tend to be much more important.

Big developed economies tend to exhibit below-average growth rates during the last decade and are being pushed out of export markets. This is not surprising with emerging economies registering high economic growth and becoming much more active in international trade. At the same time, economies in the eurozone, USA and Japan are much more diversified and do not suffer much from missed export opportunities as is the case with emerging and developing economies. Very few exporters have substantial contributions from the extensive margin effect over a prolonged period of time and these are usually small economies that were able to successfully explore new niches.

6 Conclusion

This paper tries to add to the available tools for analysing external competitiveness of exports by proposing an extension to the widely used constant market shares (or shift-shares) analysis. The traditional CMSA decomposes export growth arithmetically to contributions of the particular structure of exports and competitiveness. This decomposition is usually applied to the intensive margin of export growth, since it plays a major role in international trade. Nevertheless, a number of studies show that the extensive margin of trade is also important, as it is a driver of diversification. Moreover, the number of trade flows that comprise the extensive margin, trade flows that fail and new entries, turns out to be significant. Therefore, we modify the CMSA methodology to be able to account separately for the intensive margin of export growth and the extensive margin.

In addition to that modification, the paper tackles some other issues, related to the CMSA methodology. First, it offers a slightly different approach to the interpretation of the traditional product and market effects. Then, it proposes a way to use the CMSA for measuring gains/losses from specialization. Further, it describes an approach to applying the CMSA over long periods of time, while taking into consideration the changes in the structure of exports throughout the period.

Finally, we apply the extended CMSA methodology to highly disaggregated (HS6) annual data from the BACI database for 47 countries. We provide the detailed disaggregated results for further analysis, research and policy recommendations.

An area of further empirical research can be finding the drivers of competitiveness that the proposed CMS approach measures. Coupling the resulting dataset with other databases and indicators might shed more light on the determinants of export performance and the different channels through which exporters push their productivity frontiers and export success.

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Appendices

A Variables

V^A_t – value of total exports of country A in period t;

V^A_{jt} – value of country A's exports to trade partner ***j*** in period t;

V^A_{kt} – value of country A's exports of product k in period t;

V^A_{jkt} – value of country A's exports of product k to partner ***j*** in period t;

V^*_t – value of total exports of the benchmark region in period t;

V^*_{jt} – value of benchmark region's exports to trade partner ***j*** in period t;

V^*_{kt} – value of benchmark region's exports of product k in period t;

V^*_{jkt} – value of benchmark region's exports of product k to partner ***j*** in period t;

w^A_t – share of country A's total exports in benchmark region's total exports in period t;

w^A_{jt} – share of country A's exports to trade partner ***j*** in benchmark region's exports to country ***j*** in period t;

w^A_{kt} – share of country A's exports of product k in benchmark region's exports of product k in period t;

w^A_{jkt} – share of country A's exports of product k to trade partner ***j*** in benchmark region's exports of product k to country ***j*** in period t;

s^A_{jt} – share of country A's exports to trade partner ***j*** in its total exports in period t;

s^A_{kt} – share of country A's exports of product k in its total exports in period t;

s^{A}_{jkt} – share of country A's exports of product k to trade partner ***j*** in its total exports in period t;

$s^{A}_{int,jt}$ – share of country A's exports to trade partner ***j*** in exports on the intensive margin only in period t;

$s^{A}_{int,kt}$ – share of country A's exports of product k in exports on the intensive margin only in period t;

$s^{A}_{int,jkt}$ – share of country A's exports of product k to trade partner ***j*** in exports on the intensive margin only in period t;

s^{A}_{int} – share of country A's exports on the intensive margin in its total exports;

s^{A}_{ext} – share of country A's exports on the extensive margin in its total exports;

s^{*}_{jt} – share of benchmark region's exports to trade partner ***j*** in its total exports in period t;

s^{*}_{kt} – share of benchmark region's exports of product k in its total exports in period t;

$s^{*}_{j\ kt}$ – share of benchmark region's exports of product k to trade partner ***j*** in its total exports in period t;

s^{*}_{int} – share of benchmark region's exports on the intensive margin of country A in the total exports of the benchmark region;

s^{A}_{ext} – share of benchmark region's exports on the extensive margin of country A in the total exports of the benchmark region;

s^{*}_{opl} – share of benchmark region's exports on trade lines not in the export basket of country A in the total exports of the benchmark region;

g^{A} – growth rate of total exports of country A between the initial and the final period;

g^{A}_{j} – growth rate of country A's exports to trade partner ***j*** between the initial and the final period;

g^{A}_{k} – growth rate of country A's exports of product k between the initial and the final period;

g^{A}_{jk} – growth rate of country A's exports of product k to trade partner ***j*** between the initial and the final period;

g^{A}_{int} – growth rate of country A's exports on the intensive margin between the initial and the final period;

g^{A}_{ext} – growth rate of country A's exports on the extensive margin between the initial and the final period;

g^{*} – growth rate of total exports of the benchmark region between the initial and the final period;

g^{*}_{j} – growth rate of benchmark region's exports to trade partner ***j*** between the initial and the final period;

g^{*}_{k} – growth rate of benchmark region's exports of product k between the initial and the final period;

g^{*}_{jk} – growth rate of benchmark region's exports of product k to trade partner ***j*** between the initial and the final period;

g^{*}_{int} – growth rate of benchmark region's exports on the intensive margin of country A between the initial and the final period;

g^{*}_{ext} – growth rate of benchmark region's exports on the extensive margin of country A between the initial and the final period;

g^{*}_{opl} – growth rate of benchmark region's exports on trade lines not in the export basket of country A between the initial and the final period;

M – number of trade partner countries in the export basket of country A;

M_{int} – number of trade partner countries in the intensive margin portfolio of country A;

M_{ext} – number of trade partner countries in the extensive margin portfolio of country A;

M_{opl} – number of trade partner countries existing in the benchmark region but not in the export portfolio of country A;

N – number of products in the export basket of country A;

N_{int} – number of products in the intensive margin portfolio of country A;

N_{ext} – number of products in the extensive margin portfolio of country A;

N_{opl} – number of products in the benchmark region but not in the export portfolio of country A;

B Tyszynski and Leamer and Stern formulations

Tyszynski uses a discrete-time formulation:

$$\Delta w^A = \frac{V_t^A}{V_t^*} - \frac{V_0^A}{V_0^*} =$$

$$= \sum_{k=1}^{N} \left[\frac{(g_k^* + 1)V_{k0}^A}{V_t^*} - \frac{V_0^A}{V_0^*} \right] + \sum_{k=1}^{N} \left[\frac{V_t^A}{V_t^*} - \frac{(g_k^* + 1)V_{k0}^A}{V_t^*} \right]$$

The change in a country's share in world exports equals the change that would have occurred, had its share in each commodity group been maintained, plus the competitiveness residual.

The four-term specification of Leamer and Stern (1970) has the following form:

$$V_t^A - V_0^A = \underbrace{g^* V_0^A}_{\text{growth due to general rise in world exports}} + \underbrace{\sum_k (g_k^* - g^*) V_{k0}^A}_{\text{growth due to the commodity composition of } A\text{'s exports}} +$$

$$+ \underbrace{\sum_j \sum_k (g_{jk}^* - g_k^*) V_{jk0}^A}_{\text{growth due to the market distribution of } A\text{'s exports}} + \underbrace{\sum_j \sum_k (V_{jkt}^A - V_{jk0}^A - g_{jk}^* V_{jk0}^A)}_{\text{a residual reflecting the difference between the actual export growth and the growth that would have occurred if } A \text{ had maintained its export share for each trade line}}$$

The commodity-composition effect reflects the extent to which the focus country's exports are concentrated in commodity groups with growth rates more favourable than the world average. The market distribution effect is positive, if the exporter concentrates their exports in markets that experience relatively rapid growth. Respectively, it is negative for stagnant regions.

C Fagerberg and Sollie formulation

$$\Delta w^A = \underbrace{\sum_j M^p_{jt-1}\Delta c^p_j}_{\text{Market distribution effect}} + \underbrace{\sum_j\sum_i a^p_{ijt-1}\Delta\left[\frac{Q^*_{ij}}{\sum_i Q^*_{ij}}\right]c^p_{jt-1}}_{\text{Commodity-composition effect}} +$$

$$+ \underbrace{\sum_j\sum_i \Delta a^p_{ij}\frac{Q^*_{ijt-1}}{\sum_i Q^*_{ijt-1}}c^p_{jt-1}}_{\text{Market-share effect (Competitiveness effect)}}$$

$$+ \underbrace{\sum_j\sum_i \Delta a^p_{ij}\Delta\left[\frac{Q^*_{ijt-1}}{\sum_i Q^*_{ijt-1}}\right]c^p_{jt-1}}_{\text{Commodity adaptation effect}} + \underbrace{\sum_i \Delta M^p_{jt}\Delta c^p_{jt}}_{\text{Market-adaptation effect}}$$

Where *a* is the share of country *p* in the world exports; Q^*_{ijt} is world imports of product *i* from country *j* in period *t*; *M* is the market share of the focus country in country ***j'***s imports $\left(M^p_j = \sum_i a^p_{ijt}\frac{Q^*_{ijt}}{\sum_i Q^*_{ijt}}\right)$

c is country ***j'***s share of world imports $\left(c^p_{jt} = \frac{\sum_i Q^*_{ijt}}{\sum_i\sum_j Q^*_{ijt}}\right)$;

D Formulas

D.1 Proof

$$g^A - g^* = \underbrace{\sum_j \sum_k (s^A_{jk} - s^*_{jk}) g^*_{jk}}_{\text{Structural Effect(SE)}} + \underbrace{\sum_j \sum_k s^A_{jk}(g^A_{jk} - g^*_{jk})}_{\text{Competitiveness Effect(CE)}}$$

$$SE + CE = \sum_j \sum_k (s^A_{jk} - s^*_{jk}) g^*_{jk} + \sum_j \sum_k s^A_{jk}(g^A_{jk} - g^*_{jk}) =$$

$$= \sum_j \sum_k s^A_{jk} g^*_{jk} - \sum_j \sum_k s^*_{jk} g^*_{jk} +$$

$$+ \sum_j \sum_k s^A_{jk} g^A_{jk} - \sum_j \sum_k s^A_{jk} g^*_{jk}$$

$$\sum_j \sum_k s^*_{jk} g^*_{jk} = g^*$$

$$\sum_j \sum_k s^A_{jk} g^A_{jk} = g^A$$

$$\Rightarrow SE + CE = g^A - g^*$$

$$\underbrace{\sum_k (s^A_k - s^*_k) g^*_k}_{\text{Product effect(PE)}} + \underbrace{\sum_j (s^A_j - s^*_j) g^*_j}_{\text{Market Effect(ME)}} +$$

$$+ \underbrace{\sum_j \sum_k [(s^A_{jk} - s^*_{jk}) - (s^A_k - s^*_k)\frac{s^*_{jk}}{s^*_k} - (s^A_j - s^*_j)\frac{s^*_{jk}}{s^*_j}] g^*_{jk}}_{\text{Structural Mixed Effect(SME)}}$$

$$
\begin{aligned}
&PE + ME + SME = \\
&= \sum_k s_k^A g_k^* - \sum_k s_k^* g_k^* + \sum_j s_j^A g_j^* - \sum_j s_j^* g_j^* + \sum_j \sum_k s_{jk}^A g_{jk}^* - \\
&- \sum_j \sum_k s_{jk}^* g_{jk}^* - \sum_j \sum_k s_k^A \frac{s_{jk}^*}{s_k^*} g_{jk}^* + \sum_j \sum_k s_k^* \frac{s_{jk}^*}{s_k^*} g_{jk}^* - \\
&- \sum_j \sum_k s_j^A \frac{s_{jk}^*}{s_j^*} g_{jk}^* + \sum_j \sum_k s_j^* \frac{s_{jk}^*}{s_j^*} g_{jk}^* = \\
&= \sum_k s_k^A g_k^* - g^* + \sum_j s_j^A g_j^* - g^* + \sum_j \sum_k s_{jk}^A g_{jk}^* - g^* - \\
&- \sum_k \frac{s_k^A}{s_k^*} s_k^* g_k^* + \sum_j \sum_k s_{jk}^* g_{jk}^* - \sum_j \frac{s_j^A}{s_j^*} s_j^* g_j^* + \sum_j \sum_k s_{jk}^* g_{jk}^* = \\
&= \sum_k s_k^A g_k^* - g^* + \sum_j s_j^A g_j^* - g^* + \sum_j \sum_k s_{jk}^A g_{jk}^* - g^* - \\
&- \sum_k s_k^A g_k^* + g^* - \sum_j s_j^A g_j^* + \sum_j \sum_k s_{jk}^* g_{jk}^* = \\
&= \sum_j \sum_k s_{jk}^A g_{jk}^* - \sum_j \sum_k s_{jk}^* g_{jk}^* = \\
&= \sum_j \sum_k (s_{jk}^A - s_{jk}^*) g_{jk}^* = \\
&= SE
\end{aligned}
$$

D.2 Interpretation

$$SE = \sum_j \sum_k s_{jk}^A g_{jk}^* - g^*$$

The first term represents a hypothetical growth rate of country A's exports in case the growth rate of each of its trade lines was equal to the average growth rate of the world for these trade lines; thus, the structural effect measures the contribution to the growth differential of the particular product-market structure of the exports of country A.

$$CE = g^A - \sum_j \sum_k s_{jk}^A g_{jk}^*$$

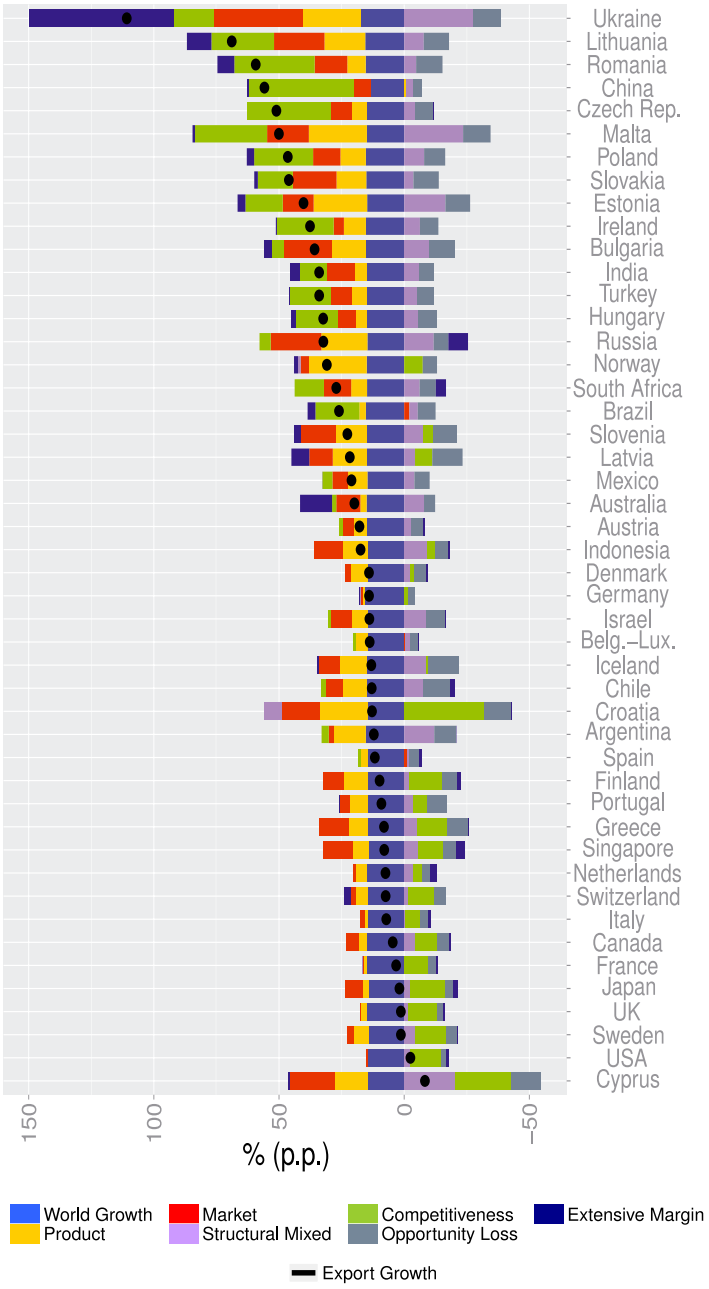
The competitiveness effect is growth of A's exports unexplained by the structure; it is a result of the difference between the actual growth rate of each trade line of A and the average growth rate of these trade lines of the world. Hence, a positive value of this term points to faster growth of A's exports, which indicates preference for A's goods. A negative value indicates that A's goods had been substituted by goods of competitor countries' goods.

$$PE = \sum_k s_k^A g_k^* - g^*$$

The product effect is a hypothetical growth of A's exports in case the growth rate of each of its products was equal to the average growth rate of the world for these products; thus, the product effect measures the contribution to the growth differential of the particular product structure of the exports of country A; a positive value of the effect points to product structure favourable for higher than the world average export growth.

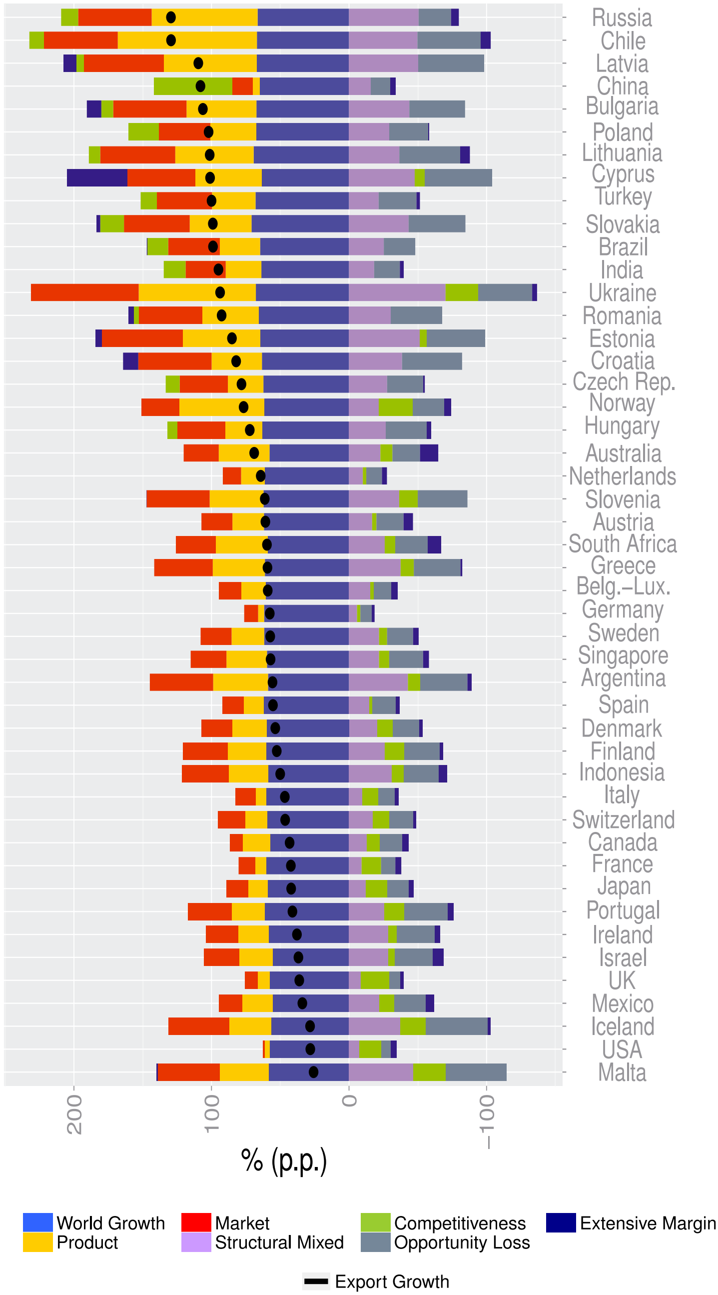
$$ME = \sum_j s_j^A g_j^* - g^*$$

The market effect is a hypothetical growth of A's exports in case the growth rate to each of its trading partners was equal to the average growth rate of the world to these markets; thus, the market effect measures the contribution to the growth differential of the particular market structure of the exports of country A; a positive value of the effect points to market structure favourable for higher than the world average export growth.


CONTRIBUTIONS TO EXPORT GROWTH OF SELECTED COUNTRIES (BACI, HS6)
1999–2002
Ukraine
Lithuania
Romania
China
Czech Rep.
Malta
Poland
Slovakia
Estonia
Ireland
Bulgaria
India
Turkey
Hungary
Russia
Norway
South Africa
Brazil
Slovenia
Latvia
Mexico
Australia
Austria
Indonesia
Denmark
Germany
Israel
Belg.–Lux.
Iceland
Chile
Croatia
Argentina
Spain
Finland
Portugal
Greece
Singapore
Netherlands
Switzerland
Italy
Canada
France
Japan
UK
Sweden
USA
Cyprus
150
100
50
0
−50
% (p.p.)
World Growth
Product
Market
Structural Mixed
Competitiveness
Opportunity Loss
Extensive Margin
Export Growth

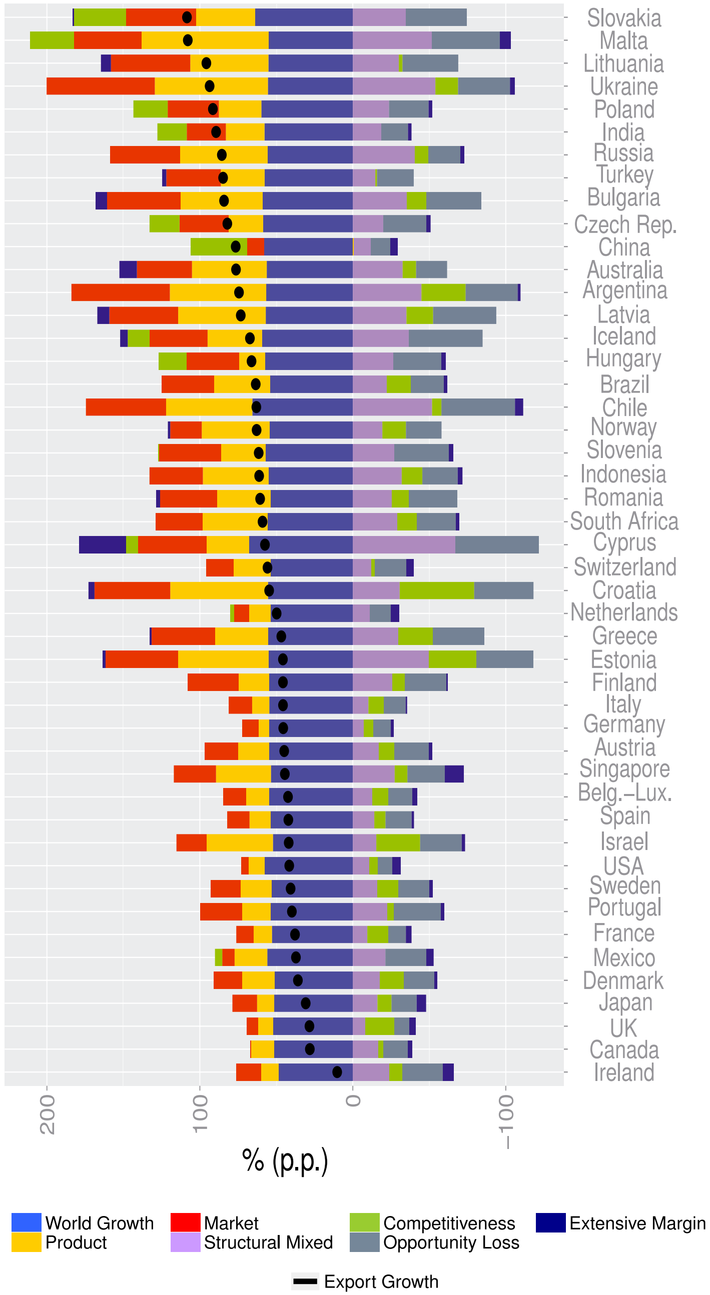
CONTRIBUTIONS TO EXPORT GROWTH OF SELECTED COUNTRIES (BACI, HS6)

2002–2005

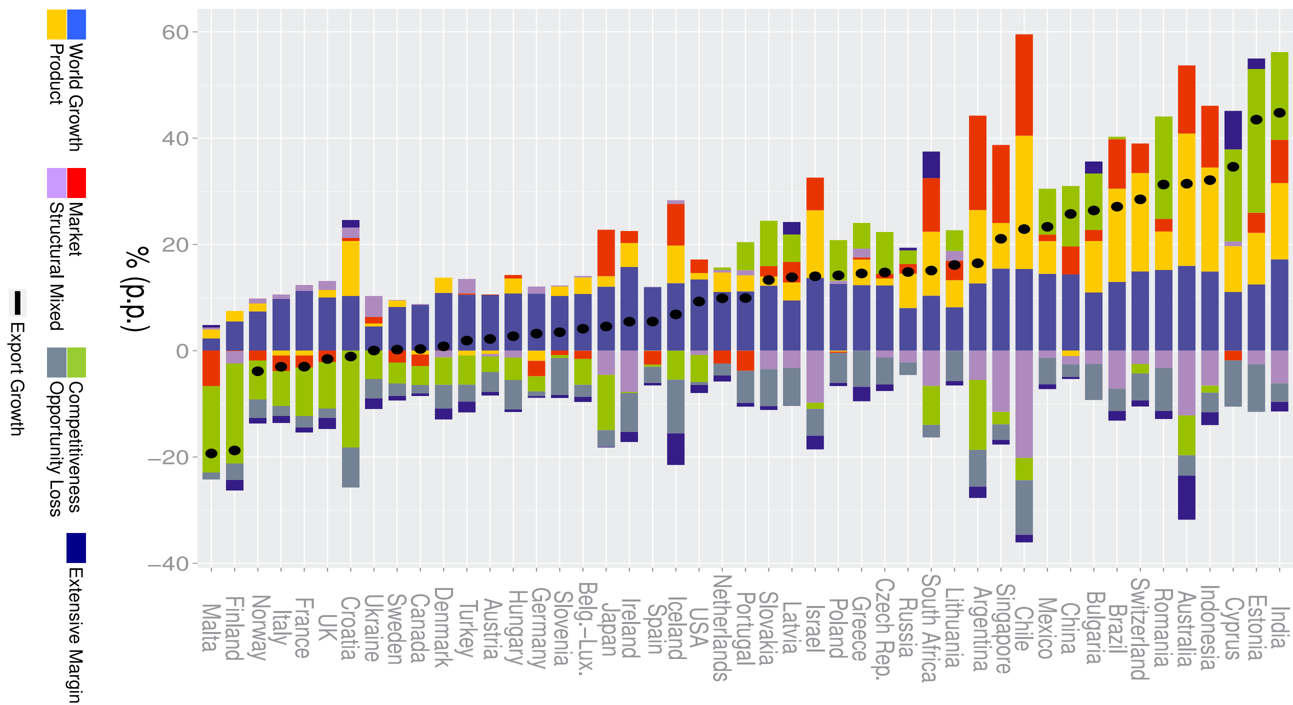


CONTRIBUTIONS TO EXPORT GROWTH OF SELECTED COUNTRIES (BACI, HS6)

2005–2008

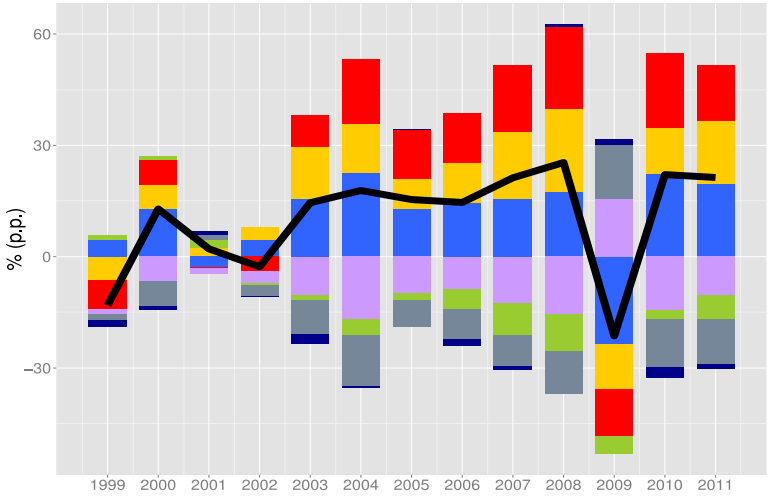


CONTRIBUTIONS TO EXPORT GROWTH OF SELECTED COUNTRIES (BACI, HS6)
2008–2011

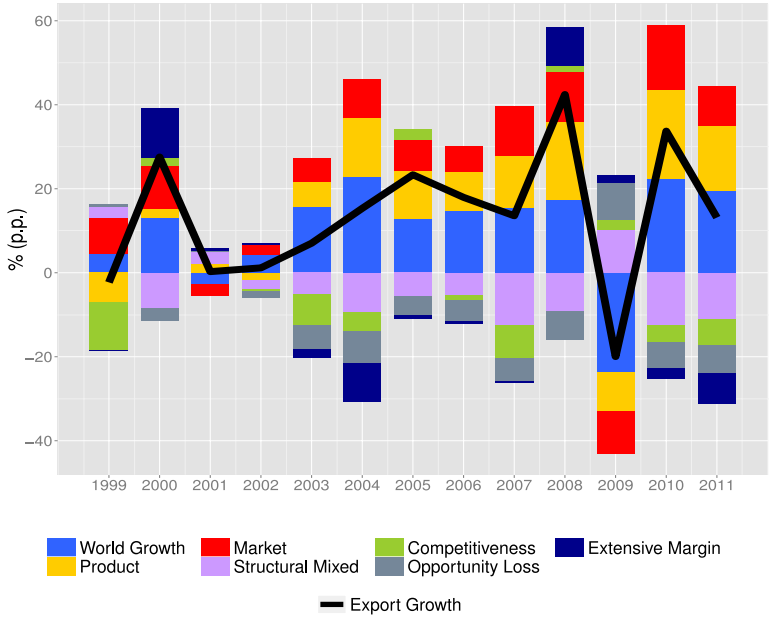


CONTRIBUTIONS TO EXPORTS' GROWTH RATE (BACI, HS6)

Argentina

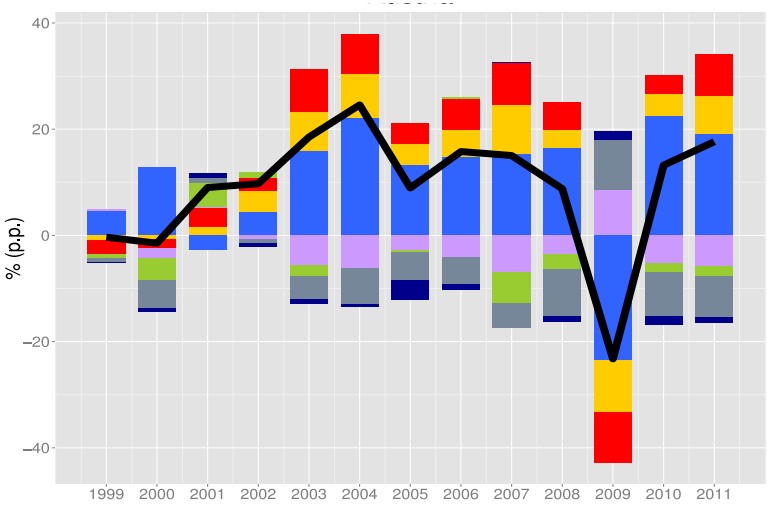


Australia

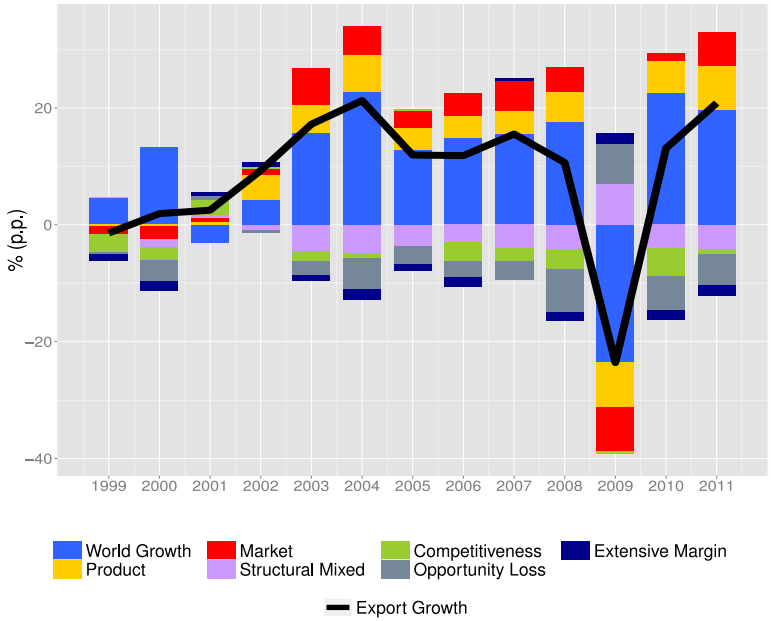


CONTRIBUTIONS TO EXPORTS' GROWTH RATE (BACI, HS6)

Austria



Belgium−Luxembourg



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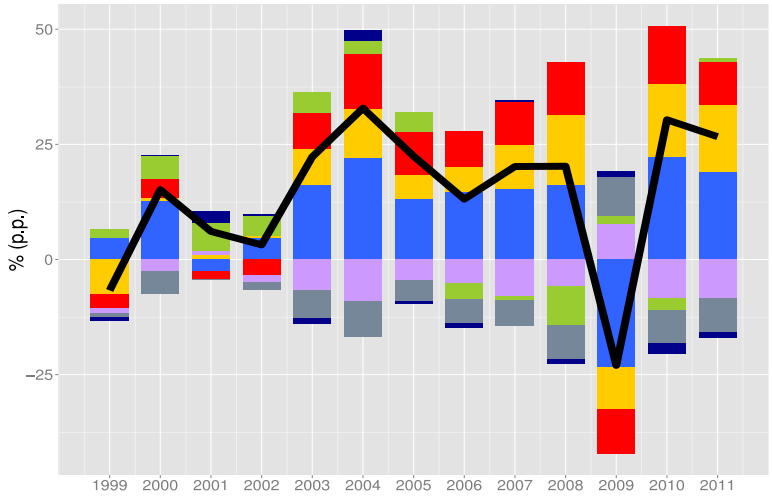
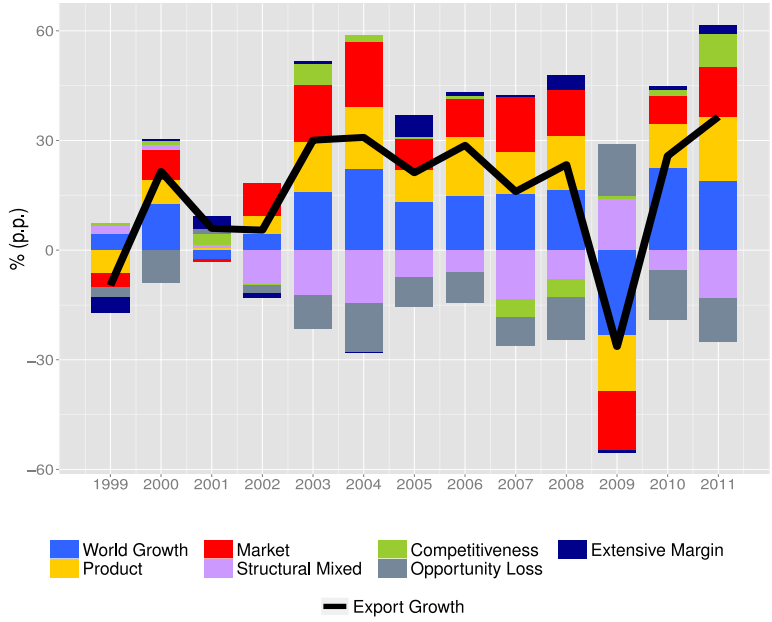
Brazil



Bulgaria



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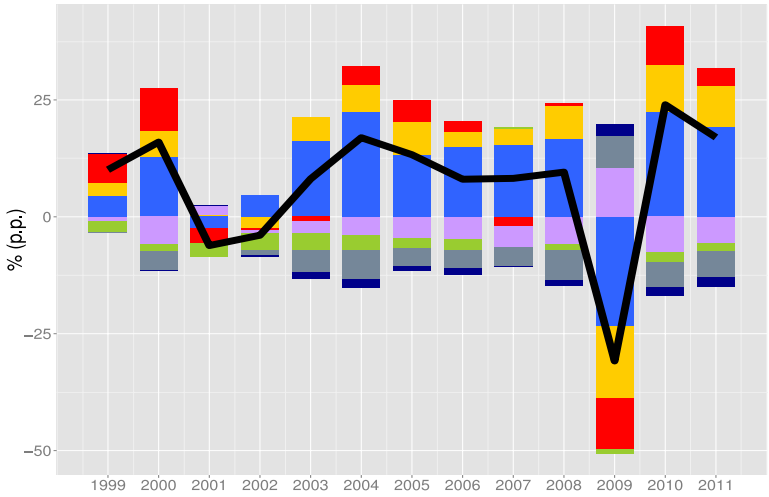
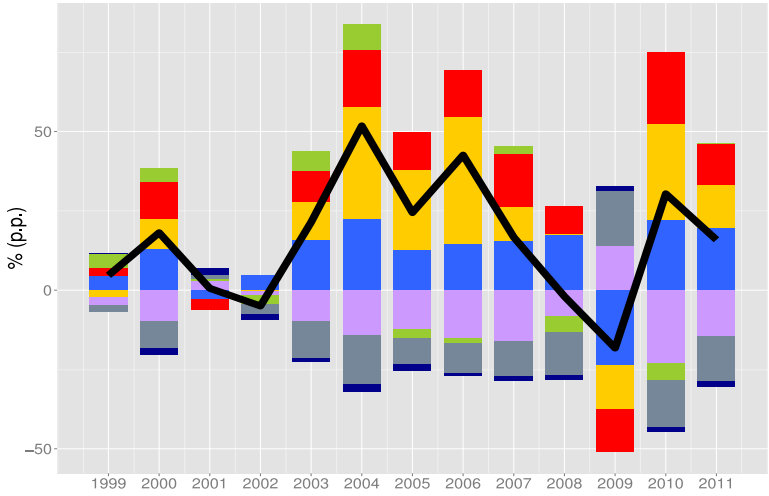
Canada



Chile



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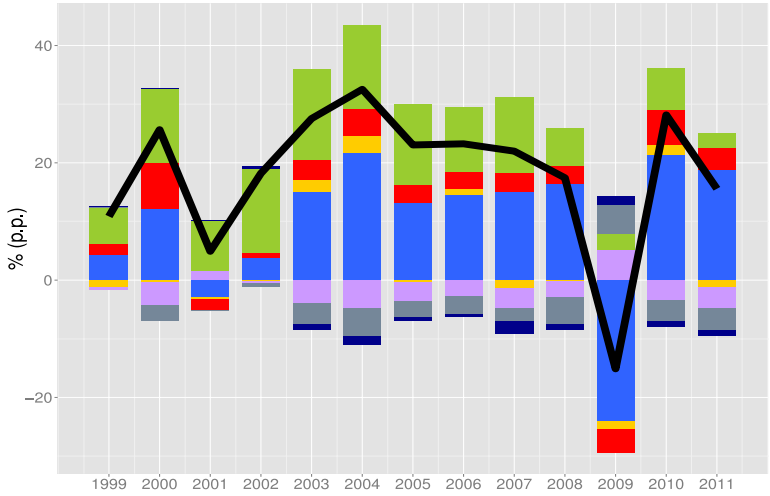
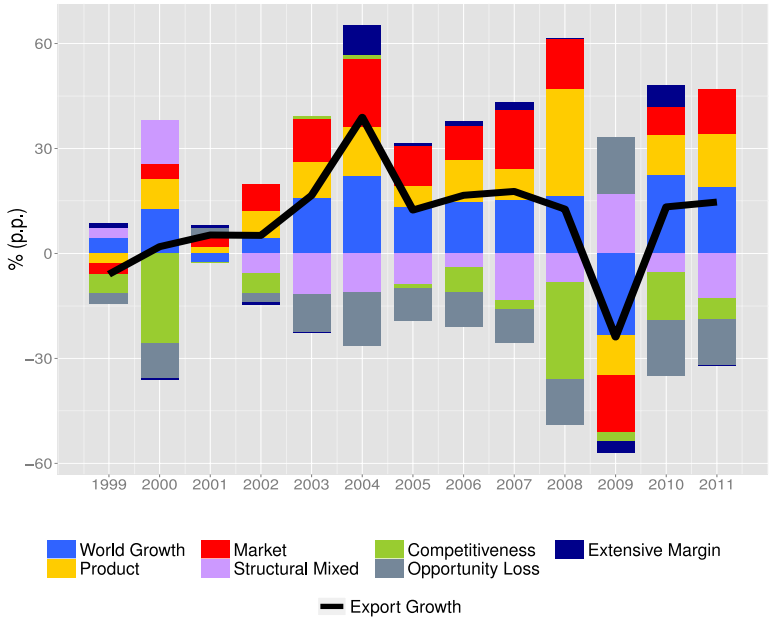
China



Croatia



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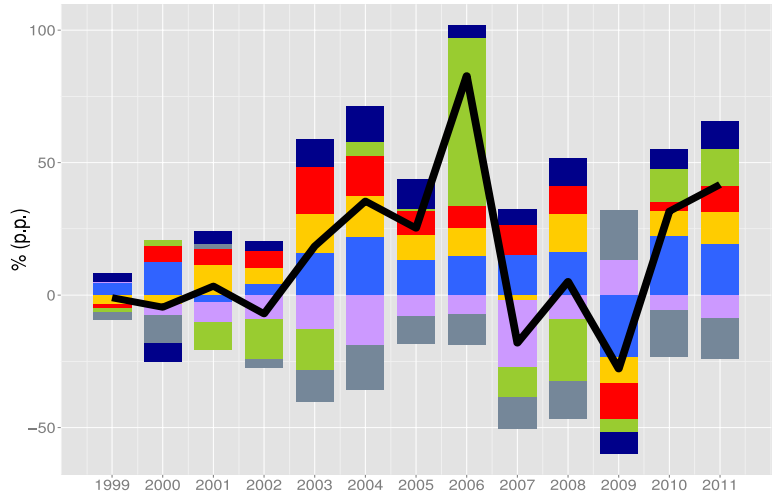
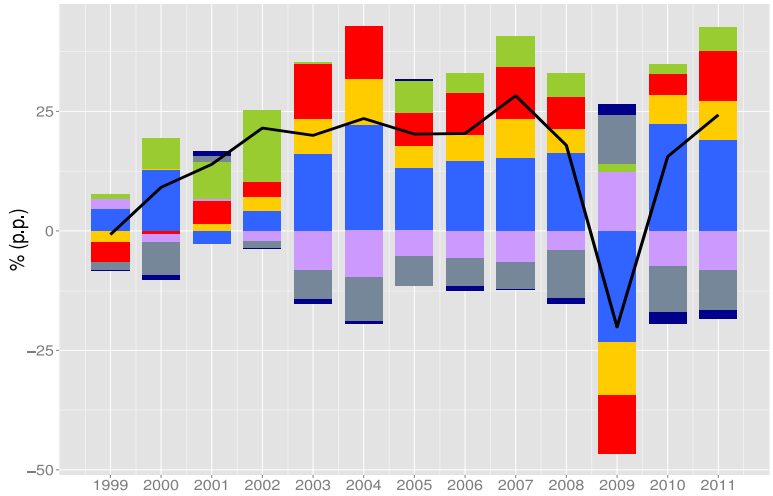
Cyprus



Czech Rep.



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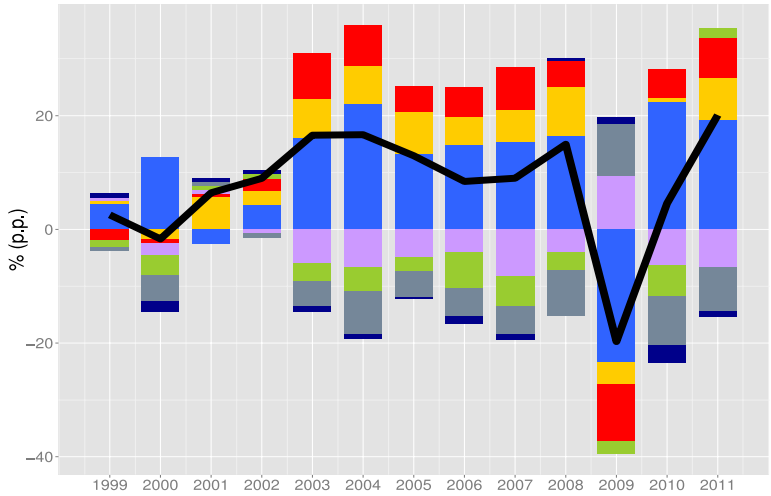
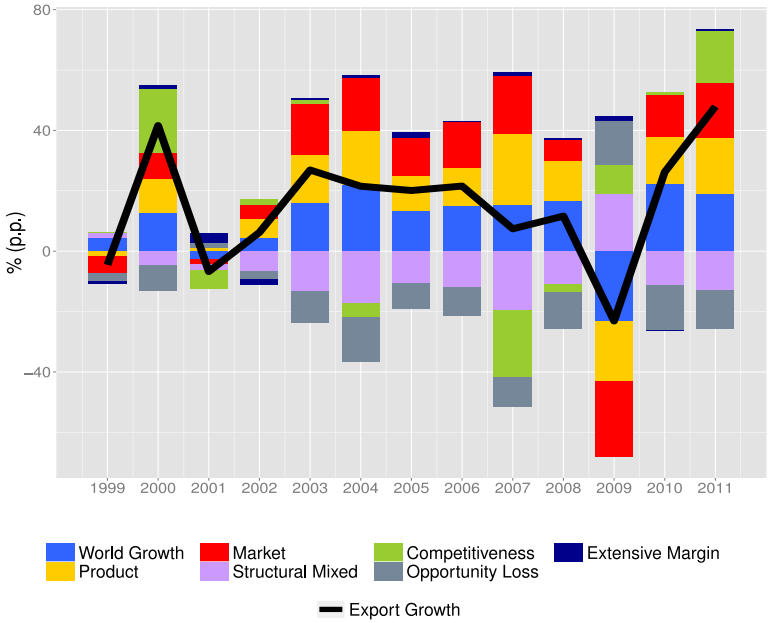
Denmark



Estonia



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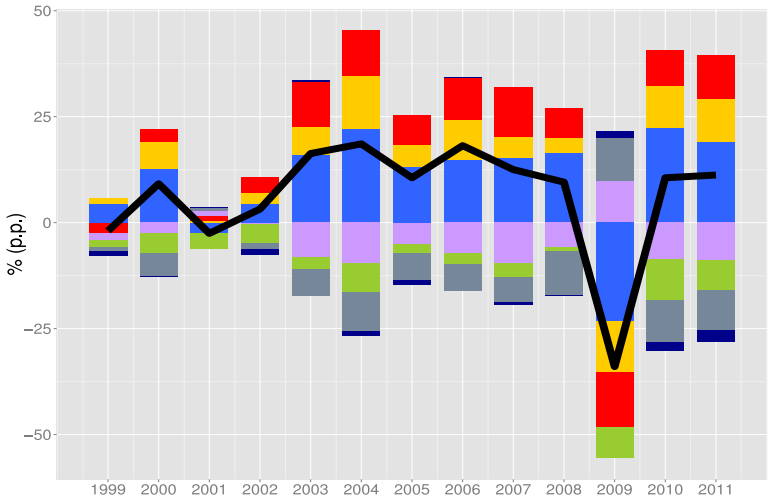
Finland



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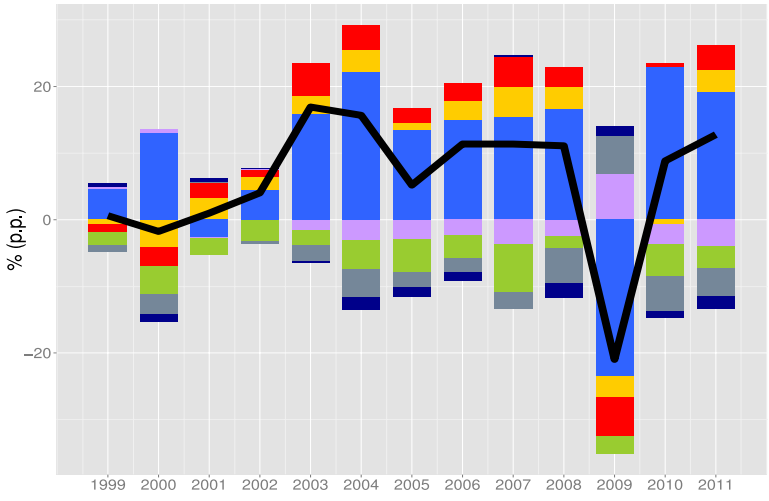

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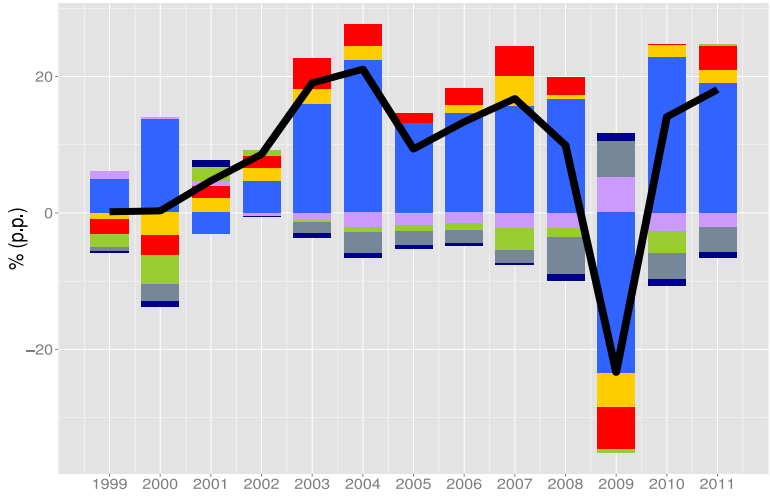
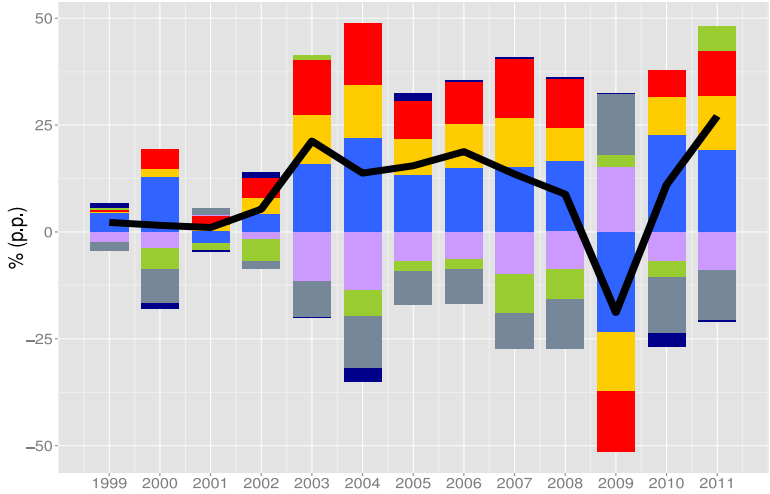
Germany



Greece



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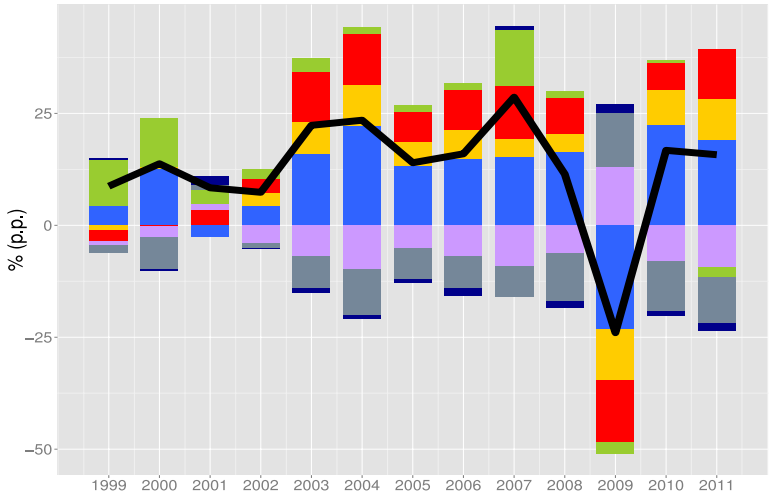
Hungary



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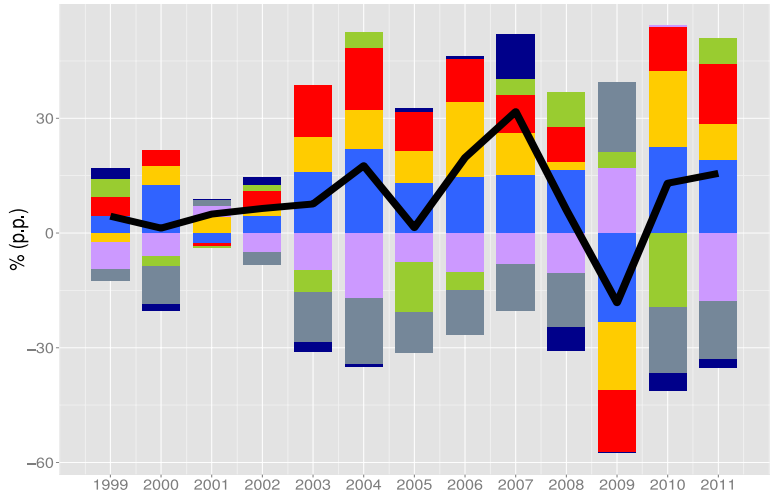

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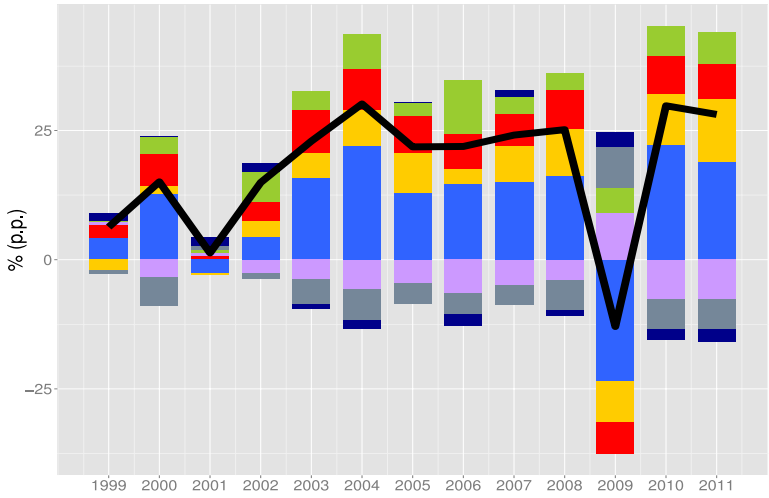
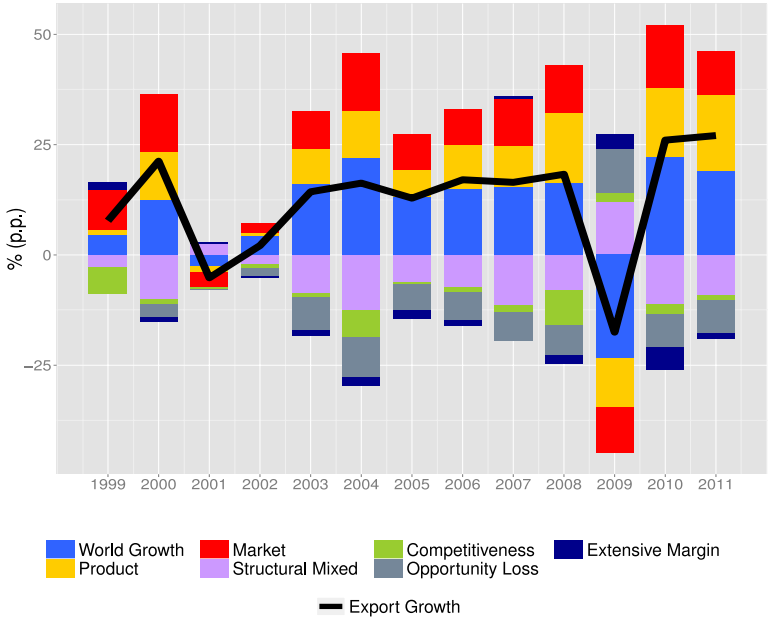
India



Indonesia



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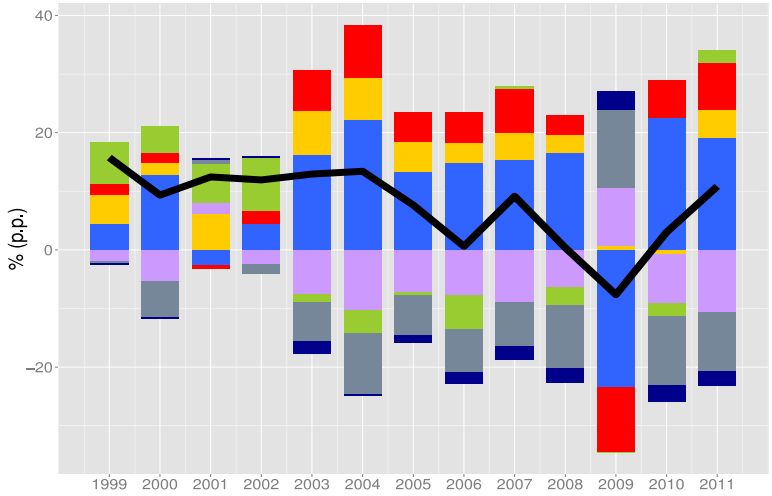
Ireland



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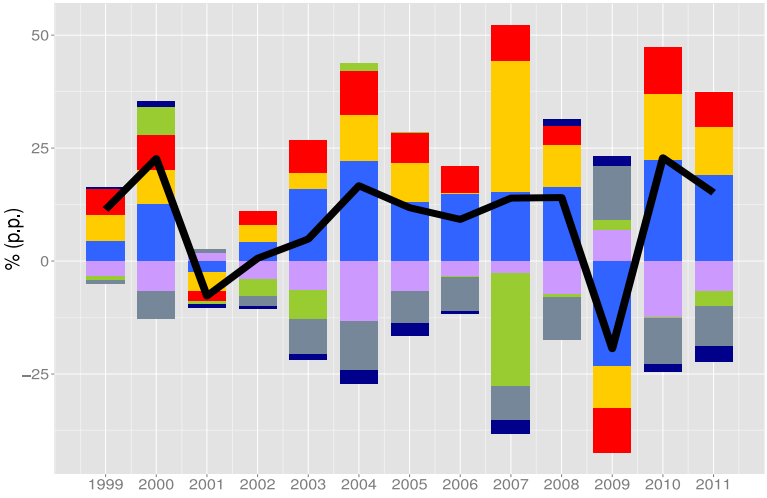

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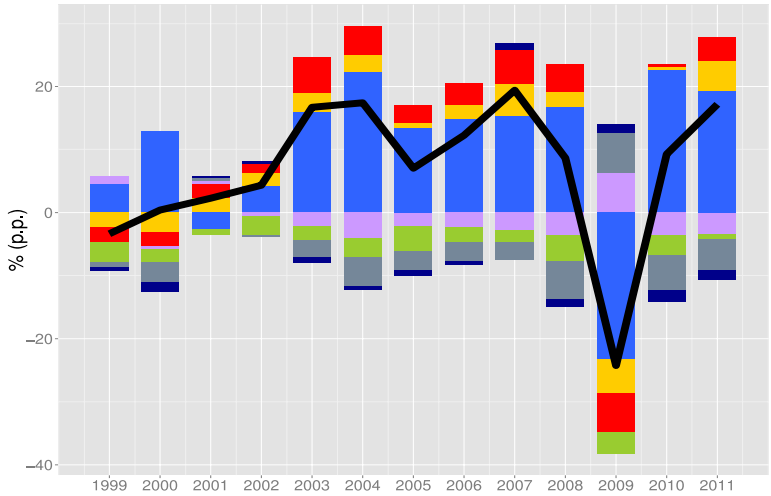
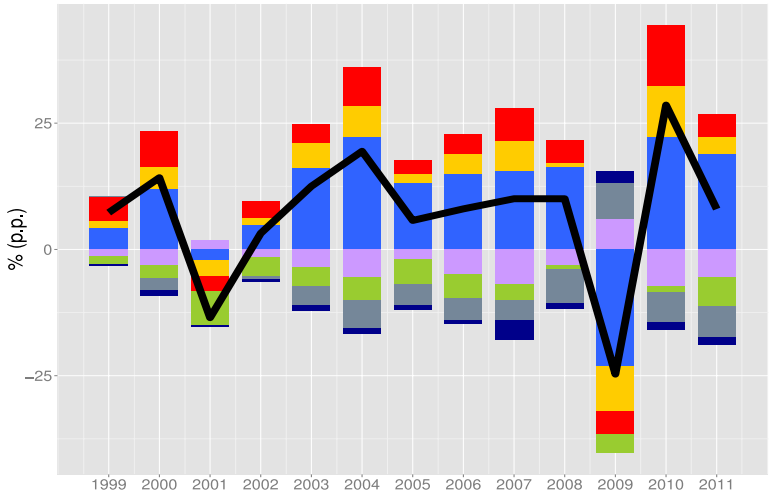
Italy



Japan



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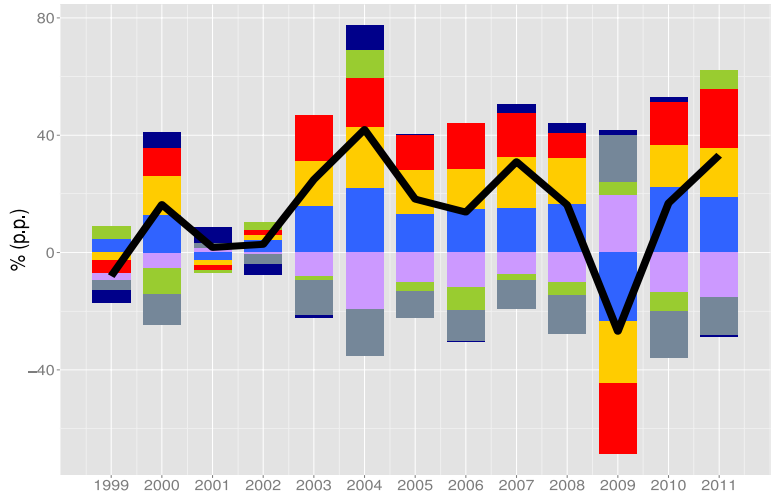
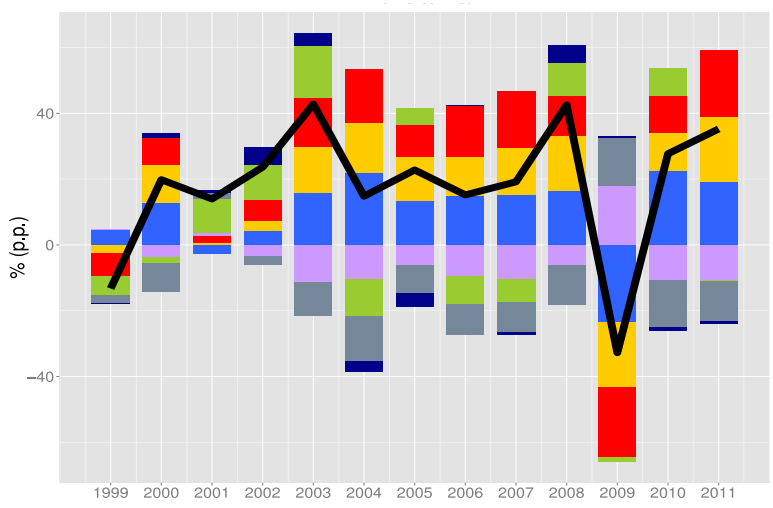
Latvia

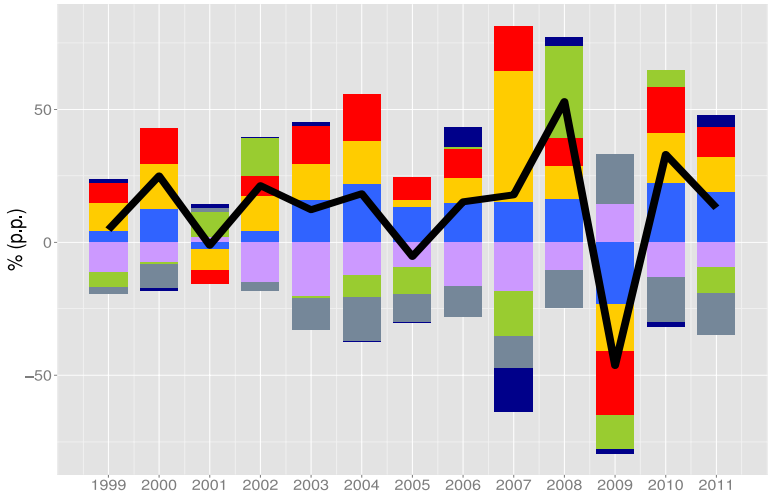


Lithuania

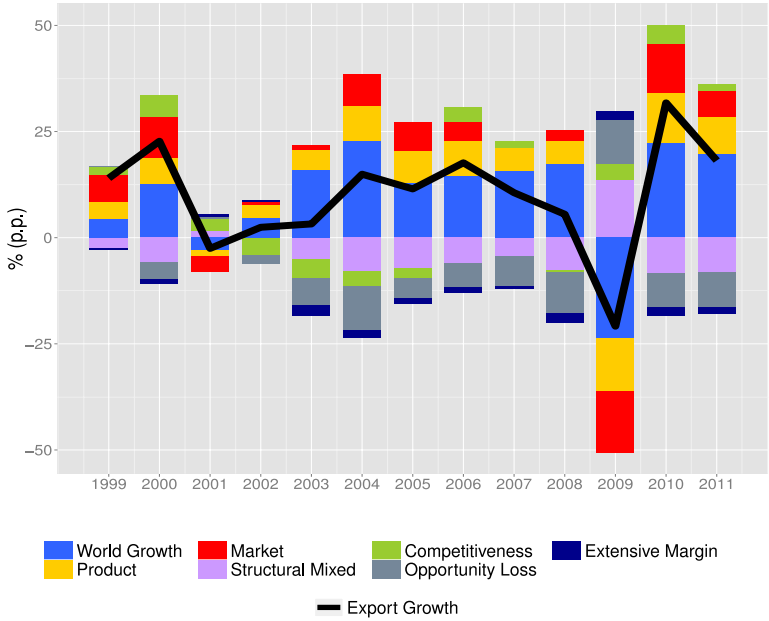


CONTRIBUTIONS TO EXPORTS' GROWTH RATE (BACI, HS6)

Malta



Mexico



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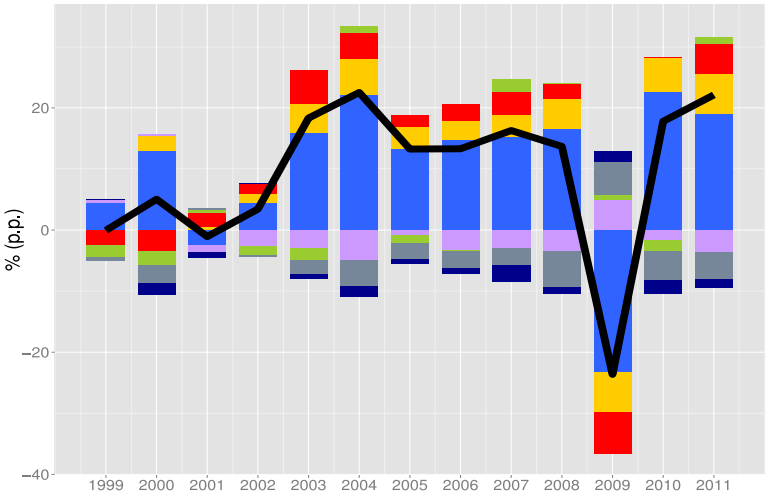
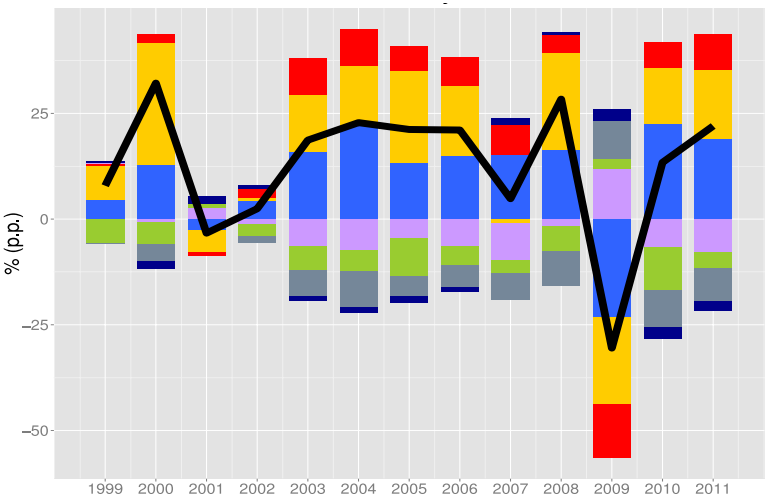
Netherlands

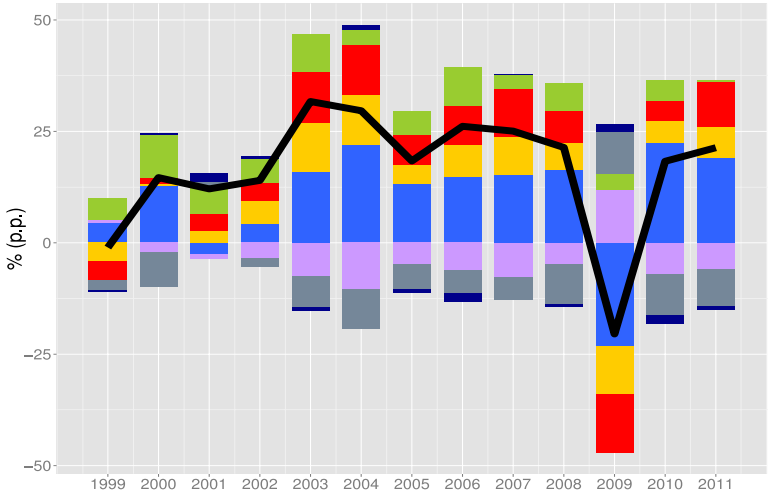


Norway

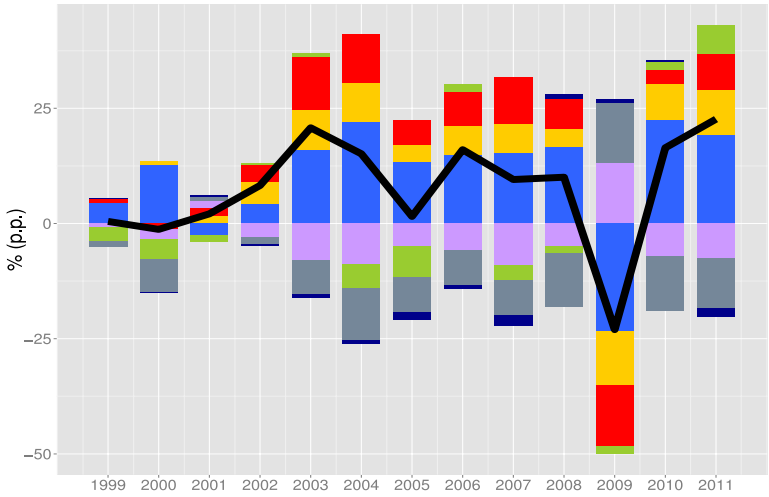


CONTRIBUTIONS TO EXPORTS' GROWTH RATE (BACI, HS6)

Poland



Portugal



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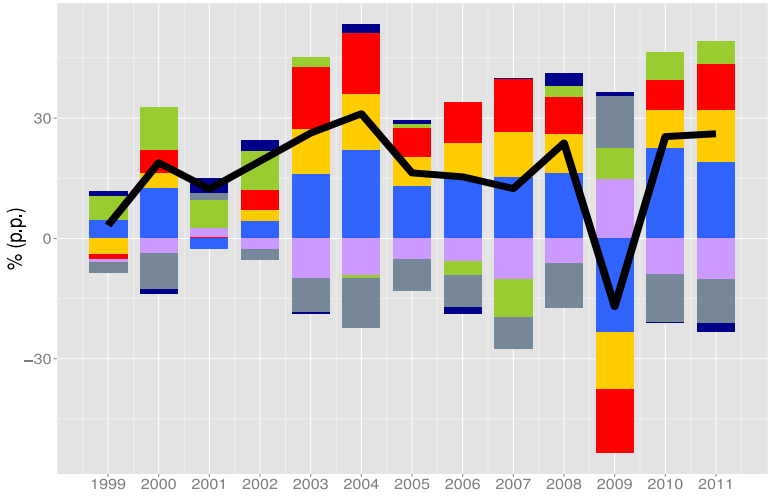
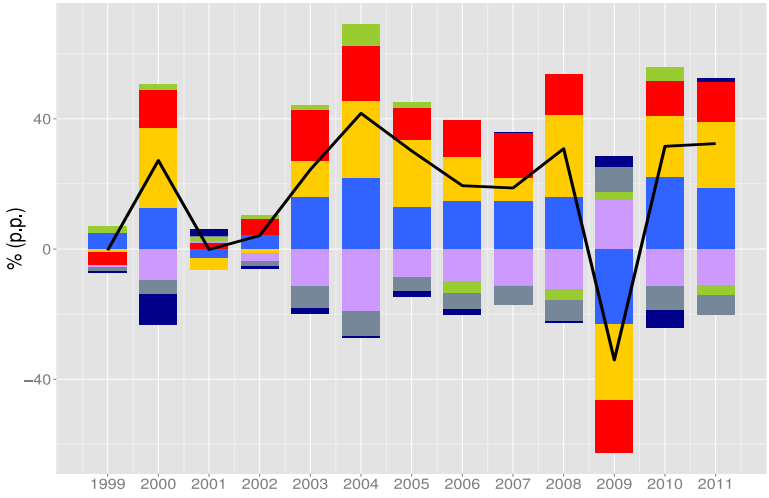
Romania

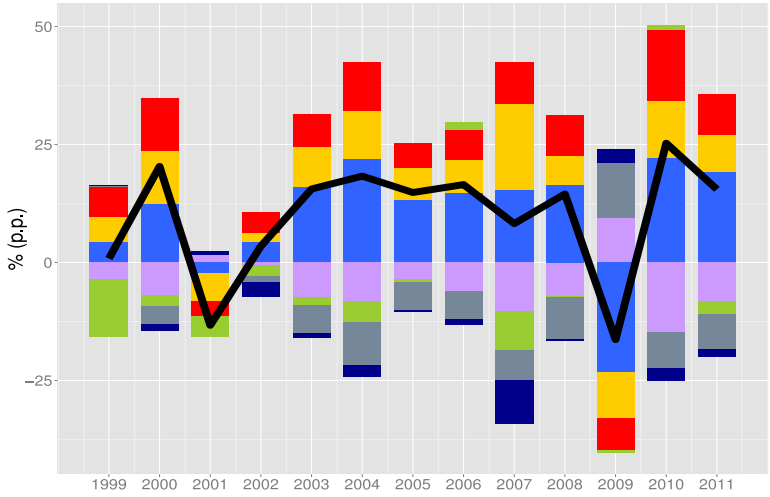


Russian Federation

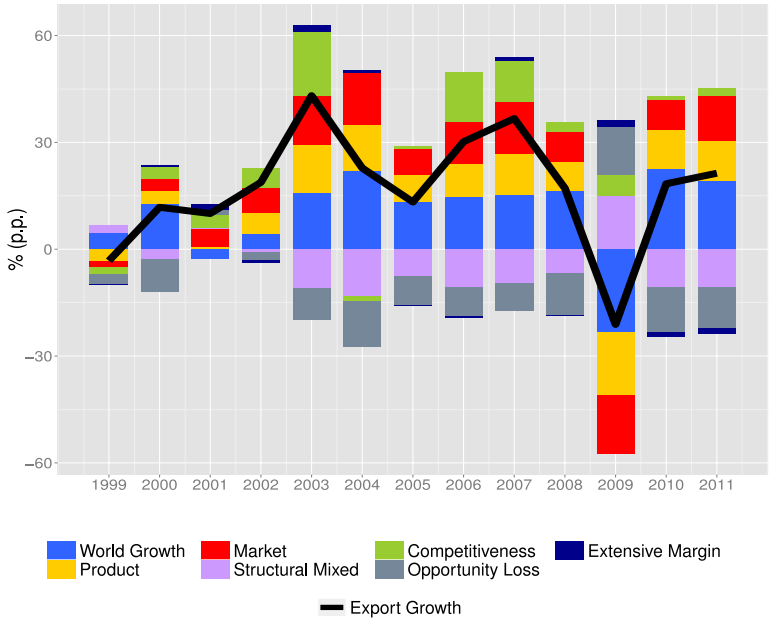


CONTRIBUTIONS TO EXPORTS' GROWTH RATE (BACI, HS6)

Singapore

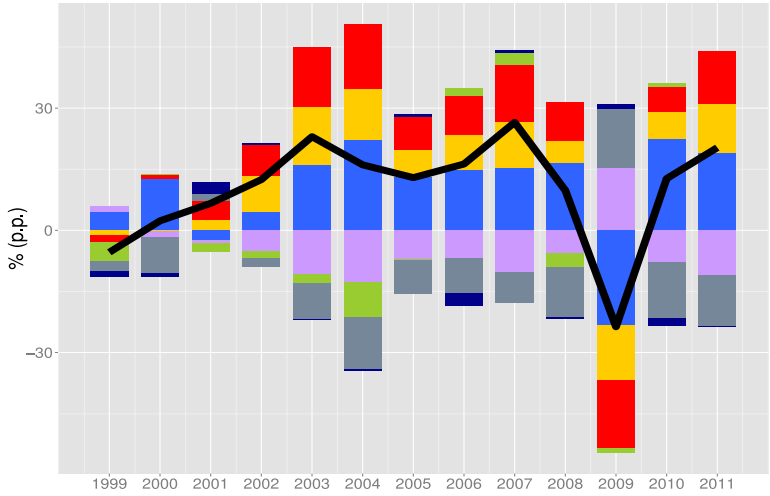


Slovakia

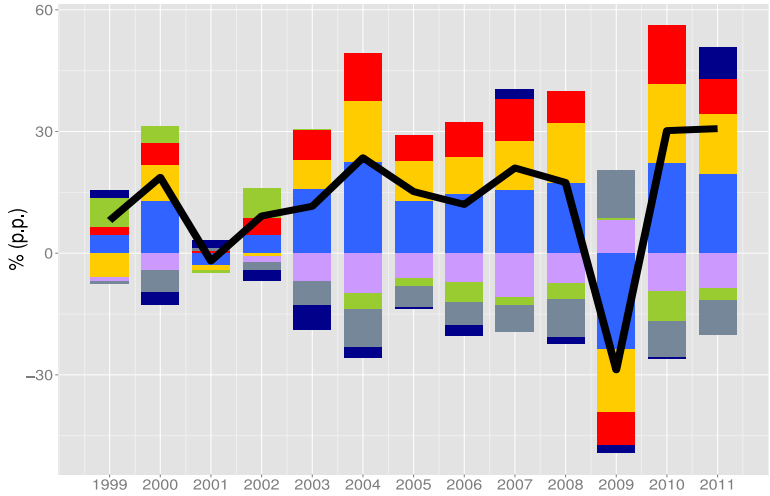


CONTRIBUTIONS TO EXPORTS' GROWTH RATE (BACI, HS6)

Slovenia

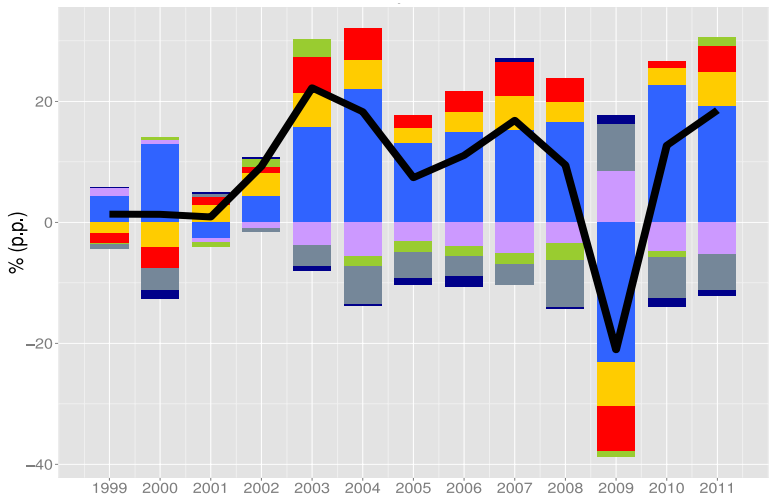


South Africa

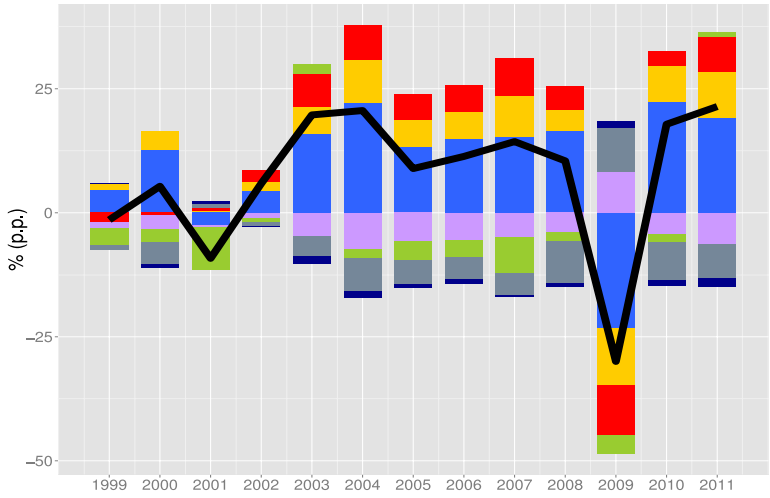


CONTRIBUTIONS TO EXPORTS' GROWTH RATE (BACI, HS6)

Spain

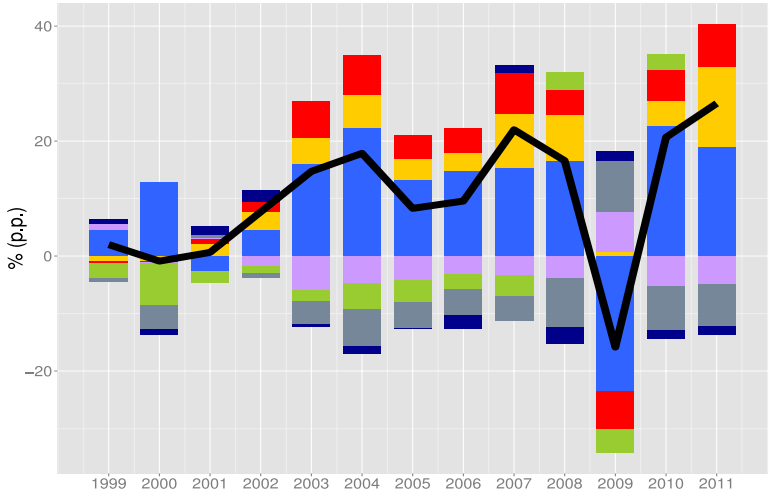


Sweden

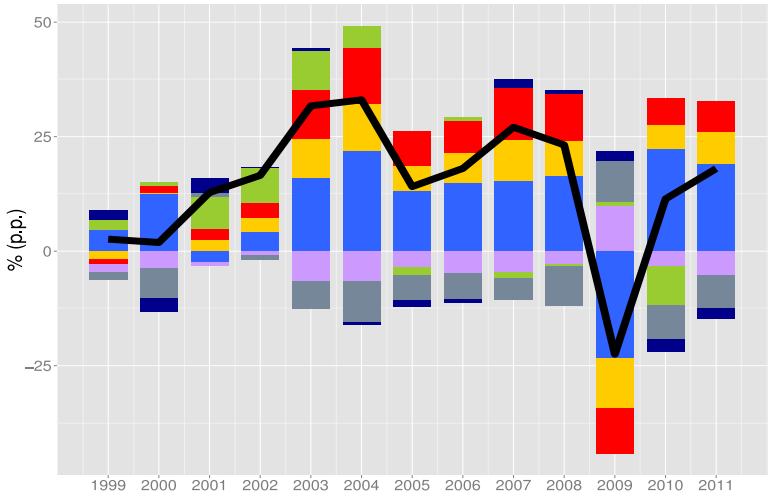


CONTRIBUTIONS TO EXPORTS' GROWTH RATE (BACI, HS6)

Switzerland



Turkey



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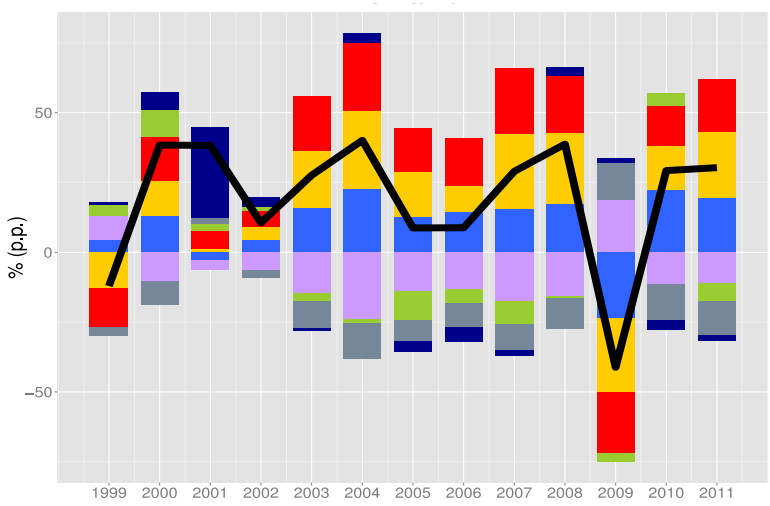
Ukraine



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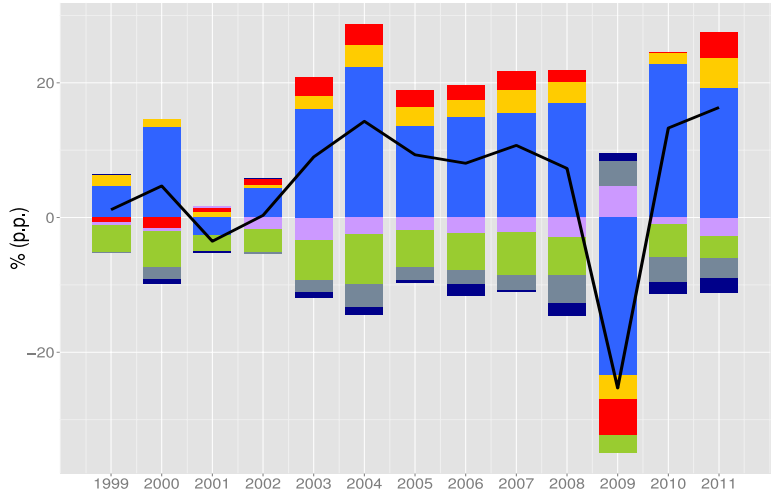

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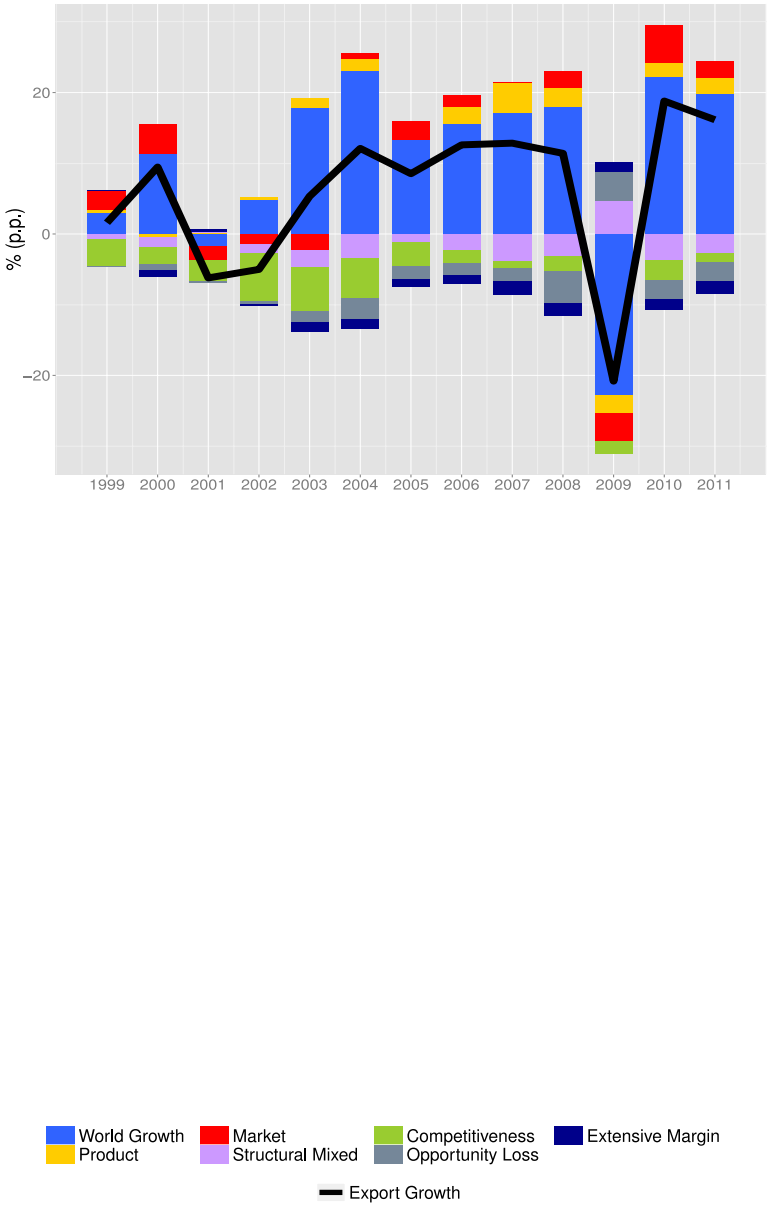
USA



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