Revised competitiveness indicators for Austria reflect a comparatively stable competitiveness development of the Austrian economy over the longer horizon

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The effect of price/cost competitiveness on national exports and imports, and hence on the current account, is especially important for open economies, in particular for small open economies. In Europe the issue of short-term price/cost competitiveness gained specific prominence after the onset of the global crisis in 2008, although large external imbalances had been identified even before 2008. Across the Eurosystem, various (harmonized) indicators are used to monitor and assess national short-term price/cost competitiveness performance. In Austria, these indicators are compiled by the OeNB in cooperation with WIFO, the Austrian Institute of Economic Research. National competitiveness indicators need to be revised regularly to ensure that they adequately reflect changing country-specific trade patterns, as the reliability of these indicators crucially depends on the weights of individual trading partners. In the current release for Austria, which reflects external trade data for the period from 2010 to 2012, the basic conceptual framework was left unchanged. A comparison of the country weights for six consecutive three-year periods, starting in 1995, that underly the current release highlights the re-orientation of trade flows towards countries that joined the EU in 2004 and 2007 as well as the rising importance of China as a destination for Austrian exports. The current revision of the competitiveness indicators for Austria, as described here, indicates only small variations in Austria's international competitiveness since 2008. Another purpose of this article is to establish which of the various price/cost competitiveness indicators best reflects our country's short-term price competitiveness. This is done by estimating standard export and import regressions and comparing the in-sample and out-of-sample fit of models that differ only with respect to the respective real effective exchange rate index. Performance indicators show that models including real effective exchange rates deflated by unit labor costs or by producer prices create comparatively smaller estimation and forecast errors than those using the HICP/CPI.

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The role of price competitiveness for exports and imports and therefore for the external balance of an economy has long been acknowledged in both theoretical and empirical studies of international trade. In Europe, the topic took on a new urgency after the outbreak of the global financial and economic crisis, since many euro area countries had experienced rising current account deficits, following their accession to monetary union, before the global crisis emerged. Improving price competitiveness, in particular in countries with substantial current account deficits, was seen as a crucial precondition for unwinding external imbalances accrued before the crisis and for ensuring sustainable growth in the euro area. Moreover, to prevent the buildup of unsustainable current account imbalances in the future, the EU developed a new alert mechanism for identifying and correcting macroeconomic imbalances at the national level, consisting of a scoreboard of macroeconomic indica-

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tors. Having been designed to pay particular attention to competitiveness developments, this framework contains, among others, five indicators measuring changes in external positions. One of these indicators, namely the real effective exchange rate, reflects the changes in the price competitiveness of each EU country. It is based on the insight that in the short run competitiveness basically burns down to the price competitiveness of the external sector, which is driven by relative price changes reflecting the development of labor and capital costs, productivity gains or losses, and exchange rate changes.[2]

Unlike other euro area countries, Austria had performed comparatively well in terms of short-term price/cost competitiveness before the global crisis hit.[3] Moreover, Austria had benefited from rising cross-border demand for goods and increasingly also for services following the accession to the EU/European Monetary Union. On the back of these developments Austria started to run consistent current account surpluses in 2002. Although the global crisis took its toll on the Austrian economy as well, the output setbacks were followed by a comparatively fast recovery in 2010 and 2011. However, as the recovery lost momentum in 2012 and Austria's economy grew by less than 1% per year on average from 2012 to 2015, the issue of competitiveness and of losing export market shares gained more prominence in Austria.

The usual approach to assessing a country's short-term (price and cost) competitiveness is to analyze how its bilateral exchange rates, domestic prices or cost indices have changed in relation to those of its trading partners. From a macro perspective it is the aggregate effect of all bilateral exchange rate changes that counts rather than individual changes of a parity, as individual changes may offset each other. Therefore the *nominal effective exchange rate index* of a currency (say the euro) – which is calculated as the weighted average of bilateral exchange rates – is a much more meaningful indicator for the economic impact of exchange rate changes on indicators of international trading activity. In order to arrive at a comprehensive indicator of competitiveness, movements in relative prices or costs between the home market and each external market have to be combined with the nominal effective exchange rate index. For this purpose, policymakers rely on *real effective exchange rate indices,* which adequately reflect country-specific trade patterns and build on meaningful and internationally comparable price and cost indices.

For the euro area as a whole, the ECB calculates real effective exchange rate indices of the euro as aggregate price/cost indicators. Thus, these indices by definition mask differences in the price/cost competitiveness of individual euro area countries.[4] Yet from a national perspective, such differences are, of course, a major yardstick for the trade performance of individual member countries. This is why individual euro area members continue to calculate and publish *national price/cost competitiveness indicators* (i.e. *national real effective exchange rate indices*). The euro

[2] *In sum, the EU scoreboard includes 14 main indicators. Violations of multiple thresholds would trigger an in-depth review by the European Commission.*

[3] *See Köhler-Töglhofer and Magerl (2013).*

[4] *See ECB (2000, 2003), Buldorini et al. (2002), and Schmitz et al. (2012) on calculating the nominal and real effective exchange rates for the euro.*

area members committed themselves in 1999 to use a harmonized methodology for this purpose and to revise their indicators at regular intervals to catch up with changes in trade patterns. The most recent revision took place in 2013. Now that a comparable external trade dataset has become available for the three-year period from 2010 to 2012, a new revision was possible.[5]

In Austria, these indicators are compiled by the OeNB in cooperation with the Austrian Institute of Economic Research (WIFO). While based on the harmonized methodology, the Austrian aggregate competitiveness indicator is much broader than the competitiveness indicators calculated by other international institutions since the Austrian indicator consists of four subindices: a subindex for manufactured goods, a subindex for food, a subindex for raw materials and energy products, and a subindex for services.

Regular revisions are meant to ensure that the indicators adequately reflect changing country-specific trade patterns, remain meaningful measures and continue to be internationally comparable. The current revision of the set of indicators shows that Austria's aggregate price competitiveness has improved – although not continually – from the onset of monetary union until 2012, with manufacturing exporters as well as service providers experiencing marked gains in price competitiveness. The aggregate cost competitiveness indicator confirms this picture. However, the strong competitiveness gains observed in the first years of monetary union were lost completely until mid-2013 and regained only partly in 2015 and 2016. Following the onset of the global crisis, in particular in the years 2012–2014, Austrian producers faced a comparatively challenging environment.

With regard to the various price and cost competitiveness indicators calculated by the OeNB in collaboration with WIFO, there is no agreement on which of these indicators better reflect our country's external price competitiveness, thus measuring its effects on foreign trade more appropriately. In the following, we estimate standard export and import regressions for quarterly data and compare the in-sample fit of models differing only with respect to the respective effective exchange rate index. We also compare the out-of-sample performance of these models by comparing recursive prediction errors at 1- to 4-step ahead forecast horizons. This comparison seeks to establish the relevance of alternative relative price or cost measures on Austria's foreign trade performance.

The following section reviews the main characteristics of the price/cost competitiveness indicators. Section 2 addresses the calculation of the country weights based on the trade relations prevailing in the period from 2010 to 2012. Section 3 provides a snapshot of the competitiveness development of the Austrian economy based on the updated price and cost competitiveness indicators with a specific focus on changes observed since the onset of the global crisis. Section 4 focuses on the question which of the various indicators are better reflections of Austria's short-term competitiveness.

[5] *Other institutions like the European Commission, the Bank for International Settlements or the International Monetary Fund also calculate national competitiveness indicators for individual countries, however, based on their own methodologies.*

1 Main characteristics of the competitiveness indicators for Austria remain unchanged

As mentioned above, the euro area countries committed themselves in 1999 to use a harmonized methodology for calculating their national competitiveness indicators and to revise the indicators at regular intervals. Hence past releases of the competitiveness indicator for Austria have been consistent with the harmonized Eurosystem methodology. Now that a comparable external trade dataset has become available for the three-year period from 2010 to 2012, a new revision was possible. In this new revision the basic conceptual framework was left unchanged and the typical building blocks as well as all the innovations implemented in the previous revision of 2013 have been retained (Köhler-Töglhofer and Magerl, 2013 and Hahn et al., 2001). The *main characteristics* of the harmonized competitiveness indicators compiled by the OeNB and WIFO are as follows:

- The aggregate index consists of four subindices calculated for manufactured goods, food, raw materials/energy products and services.
- The index is based on geometric weighting, i.e. it represents the weighted geometric average of a basket of bilateral exchange rates, which yields the price or cost competitiveness indicator when adjusted for the respective relative price or cost indices.
- The individual country weights in the *subindex for manufactured goods* continue to be calculated on the basis of *single (bilateral) import and double (multilateral) export weights*. While direct (or bilateral) export weights are easy to calculate and intuitive, they neglect third-market effects. The method of choice to catch third-market effects are "double export weights," as they are more comprehensive: They reflect both home and external market competition with individual competitors (depicted in competition matrices; see table A2 in the annex). The drawback of double export weights is that they are more difficult to calculate[6] and less intuitive.
- The *index base period* has been left unchanged at the first-quarter average (arithmetic mean) of 1999 (i.e. Q1 99 = 100), which is the base period established by the harmonized Eurosystem framework.
- The revision of 2013 introduced *chain-linking,* replacing fixed weights[7] with a series of weights for consecu-

[6] *Double export weights are calculated on the basis of complex competition matrices. These matrices also track any goods sold on the domestic market that were manufactured domestically and thus compete with imports from other countries. While the ECB takes net manufacturing output (gross manufacturing output less intermediate consumption by manufacturers) as the starting point for building the competition matrix for manufactured goods, the OeNB and WIFO use gross manufacturing output. The rationale behind this approach is that the OeNB considers only gross manufacturing output to be consistent with the foreign trade statistics derived from gross flows. Moreover, intermediate goods and services do affect competitiveness. All other calculation steps are the same for both indicators. Given that gross manufacturing output exceeds net manufacturing output, the OeNB/WIFO indicator yields a higher share of domestic producers in a given market than the ECB indicator. See box 1 in Köhler-Töglhofer et al. (2006).*

[7] *The underlying country weights were fixed over the entire calculation period, starting from 1999, with revised trade weights established during successive rounds of revision (three-year averages for external trade shares). However, in some respects, the price competitiveness index was a chain-linked index even before the revision of 2013, as the index for the period up to 1999 remained based on the sample of trading partners and competing countries underlying the revision of 2001, using weights from the 1995–1997 period. This procedure was chosen because it ensured a more adequate reflection of Austria's trade relations, and thus of its competitiveness situation in the 1993–1998 period.*

tive three-year periods. With the 2016 revision, country weights are now available for six consecutive three-year periods, namely for 1995–1997, 1998–2000, 2001–2003, 2004–2006, 2007–2009 and 2010–2012. The effective exchange rate indices are obtained by chainlinking the indicators based on each of these six sets of trade weights at the end of each three-year period. Looking ahead, the country weights relating to the most recent period (2010–2012) will be used to evaluate price and cost competitiveness until the next full three-year dataset (2013–2015) becomes available.

– We use *three deflators* to calculate the Austrian competitiveness indicators, namely the *HICP/CPI, producer prices, and total unit labor costs (ULC) of the economy*. Specifically, the subindex for the manufacturing sector is calculated on the basis of the HICP/CPI as well as producer prices.[8] The subindex for the service sector and the index for the competitiveness of the Austrian producers and service providers are based on the HICP/CPI as well as on total unit labor costs of the economy.[9] The subindices for food and for raw materials/energy are derived solely on the basis of the HICP/CPI.

– The choice of three different deflators is motivated by their underlying merits and drawbacks: The HICP/CPI deflator is the most widely used variable for calculating real effective exchange rate indices and national competitiveness indicators, given the *timely availability* and the *international comparability* of data. Yet the goods baskets underlying consumer price indices include large numbers of nontradable goods, which makes them an imperfect proxy for changes in tradable goods prices. Hence the rationale for also using producer prices, which have the advantage of being focused more strongly on tradable goods – subject to the disadvantage that internationally comparable producer prices are not available for all relevant trading partners of Austria, but only for 26 competing countries. Total unit labor costs, finally, are the deflator of choice for calculating an indicator of cost competitiveness. This deflator relates to the *economy as a whole*[10], which is a crucial drawback insofar as total unit labor costs also reflect the development of wages and productivity in the nontradable sector of production.[11] Moreover, internationally comparable total unit labor costs are also not available for all relevant trading partners of Austria, limit-

[8] *Until 2013 unit labor costs of the manufacturing sector were used as the deflator since they are a key determinant of manufactured goods sales prices and thus a key indicator of the short-term competitiveness of an economy. However, retaining this cost competitiveness indicator was not on option, as the data on unit labor costs of the manufacturing sector were derived from the OECD, which stopped updating the calculation of comparable unit labor costs for the manufacturing sector in 2012.*

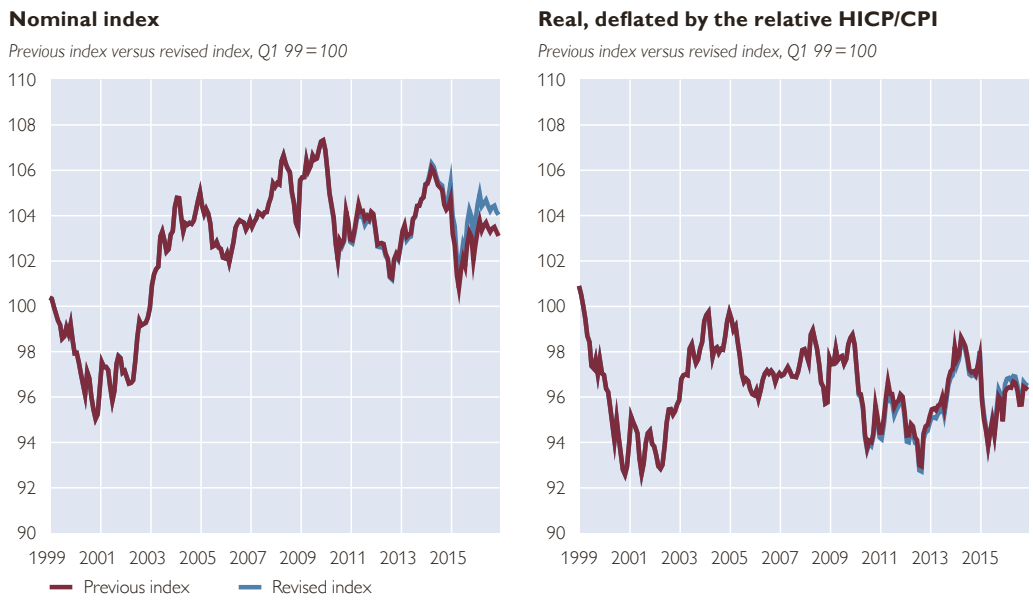
[9] *Unit labor costs for the whole economy are defined as compensation per employee divided by real gross domestic product per employed person.*

[10] *If we assume that labor costs for nontradable goods and personal services rise faster than labor costs in the tradable sector, cost competitiveness indicators based on this deflator must be subject to a certain bias. However, if these nontradables are used as inputs in the tradable sector they exert a significant influence on price competitiveness.*

[11] *For a thorough discussion of the merits and demerits of each deflator, see Köhler-Töglhofer (1999).*

Chart 1

Chained aggregate index of Austria's price competitiveness since 1999



Source: OeNB, WIFO.

ing the respective calculation to just 31 competing countries.[12]

– The regular revisions of the harmonized competitiveness indicators generally provide room for any necessary adjustment in the *sample of trading and competing countries*. The *sample of trading and competing countries* should reflect the patterns of a country's exports. Since the current sample of trading and competing countries still reflects Austrian exports adequately, it remains unchanged, i.e. the index is still based on a sample of 56 countries. As mentioned above, the country sample for the PPI-deflated index and for the ULC-deflated indices due to data restrictions are based on smaller country samples.

2 Country weights – comparatively stable ranking of Austria's trading partners

The assessment of the changes in the country weights – not only for the three-year period under scrutiny but also during the last decade and a half or so – shows that the "ranking" of Austria's main trading partners has in essence remained unchanged, as nearly 75% of the Austrian exports and imports continued to be exchanged with other European countries; at the same time, there have been changes in the *relative* importance of individual trading partners, such as China in particular, whose share in Austria's trade has been rising sharply.

Based on the weighting for the 2010–2012 period, the *aggregate index*

[12] *France, Belgium, Luxembourg, the Netherlands, Germany, Italy, Ireland, Portugal, Spain, Finland, Greece, the Czech Republic, Denmark, Estonia, Hungary, Latvia, Lithuania, Poland, Sweden, Slovenia, Slovakia, the United Kingdom, Australia, Canada, Japan, Norway, Switzerland, the U.S.A., South Korea, New Zealand and Israel. These 31 countries, however, account for more than 80% of domestic foreign trade in goods and services.*

(export- and import-weighted across all subindices) continues to be characterized by a high foreign trade share of the countries that joined the EU before 2004 (57%), which is less than during the period 2007–2009 (60%), whereas the countries that acceded the EU in 2004 and 2007 now account for a share of 13.4% (increase by 0.7 percentage points compared to the previous period).[13] Germany continues to be the country with the largest country weight (33.1%), followed by Italy (7.2%) and the U.S.A. (7.1%).[14] China's trade weight of 4.7% (slightly above the previous period's value of 3.8%) is now even higher than that of France (3.7%) and Switzerland (4.1%). The Czech Republic (3.3%) gained in relative importance, outperforming the Netherlands (2.9%) and the U.K. (2.6%). The Russian Federation's weight comes to 2.5%. The high weight of the U.S.A. – i.e. of the U.S. dollar – results above all from the raw materials and energy products subindex, as imports in this category are mostly denominated in U.S. dollars (see table A1 in the annex).

As outlined above, the export weights for the *manufacturing goods subindex* are calculated as *double export weights* reflecting third-market effects. An analysis of both double export weights and single export weights across the three-year periods produces some interesting insights: Germany's double export weight has shrunk significantly over time (from nearly 30% in 1998–2000 to 24% in 2010–2012). Similarly, the weights of Italy, France, the U.K., Japan and the U.S.A. have gone down during the periods covered by the indicators. In addition, the weight of Switzerland has dropped markedly since the latter part of the 1990s. At the same time the weights of some of the countries that joined the EU in 2004 or 2007 (such as the Czech Republic, Poland or Slovakia) have increased markedly. Overall, China stands out as the country whose relevance for Austrian manufacturing exporters reflects the largest increases (from 1.7% to 7.8%) since the period 1998–2000 (see table A3 in the annex). Its weight is now 1 percentage point higher than that of the U.S.A. China has also become to be more important for domestic manufacturing exporters than Italy, which is after all Austria's second-largest export trading partner within the EU.

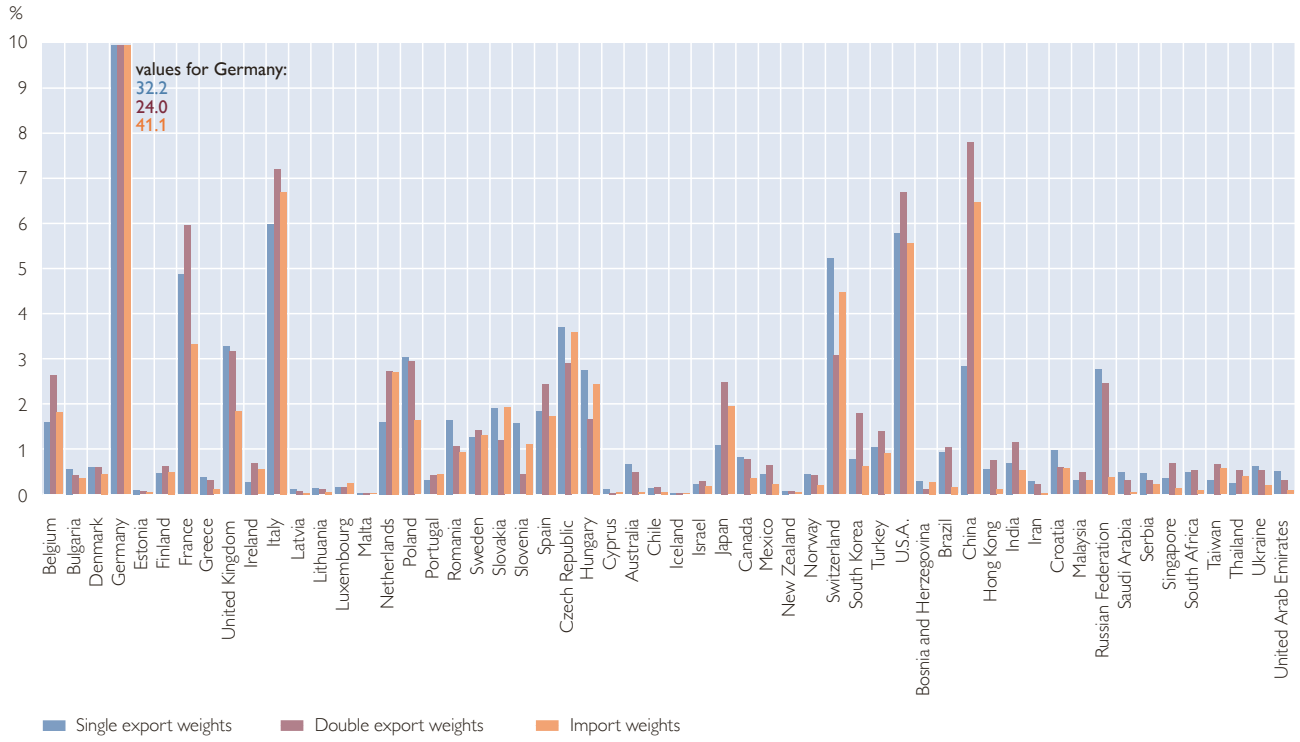
With regard to the impact of foreign competition on domestic industries in third markets, a cross-check of single and double export weights highlights that Austria's single most important trading partner, Germany, continues to show a direct export weight heavily exceeding the export weight that includes competition for domestic exporters in third markets. The same holds true for Switzerland, Belgium and many of the countries that joined the EU in 2004 and later as well as for the Russian Federation (chart 2). The reverse holds for China, Japan, Italy, the Netherlands, the U.S.A., Turkey and most of the Asian emerging markets (e.g. South Korea, India, Hong Kong, Singapore or Taiwan). The latter group of countries and their staple exports constitute ever stronger competition for domestic exporters in third markets. This holds in particular for China, for which the double export weight is 2.7 times its direct weight. Conversely, countries whose double export weight is below their direct export weight are less of a competition

[13] *At the end of the 1990s, the foreign trade share of this country group was only 7%.*

[14] *In the period of 2007–2009, Italy's weight was 7.6% and that of the U.S.A. 9.2%.*

Chart 2

Single and double export weights in the manufactured goods subindex from 2010 to 2012



Source: OeNB, WIFO.

for domestic exporters in third markets. This may be because they are targeting different regions with their exports, or because they export different goods and services.

In the evaluation of the short-term price competitiveness of Austrian manufactured goods exporters, the EU-27 aggregate now accounts for a share of 63.2%. Thus, other EU Member States continue to account for the lion's share of domestic manufacturing exports. At the same time, this share has been going down (in the last decade and a half it shrank by about 10 percentage points). The weight of the euro area (49%) has also been decreasing. While exchange rate uncertainty has disappeared within the euro area, the measure of 49% must not be misinterpreted as the share of Austrian manufactured goods exports that is no longer exposed to exchange rate risks. Competition in non-euro area markets, as reflected by double export weights, causes bilateral exchange rate changes of the euro to other currencies to continue to exert an – indirect – influence on Austrian exports. Of course, the same holds true for Austria's competitors from other euro area countries.[15] In addition, the competitiveness of domestic exporters relative to those in other euro area countries still depends on relative changes in cost and price levels. The aggregate share of those EU Member

[15] *To give an example, the double export weights account for the competition between Austrian and German exports both in the German market and in all other euro area and non-euro area markets. In the case of the latter, exchange rate changes of the euro to the respective national currency matter for Austrian and German exporters alike.*

States that have not yet joined the euro area (14.1%) has decreased slightly over time.[16]

Compared with exports of manufacturing goods, domestic *services exports* continue to be more focused on EU markets (75%). The euro area's share increased by more than 1 percentage point to 61% with the latest update. Again, Germany is Austria's single most important trading partner (with a share of 40% against 38% in the previous period), followed by Italy (5.5%, almost unchanged), the Netherlands (4.2%) and the U.K. (3.6%). The shares of the U.S.A. and Switzerland are 7.5% and 6.9%, respectively.[17]

In the *subindices for raw materials and energy, food and services,* the U.S.A. stand out. Its share appears to be astonishingly high at first glance. This accounts for the fact that additional to Austria's exports to and imports from the U.S.A., corresponding trade flows to and from countries not specified in the index[18] are also invoiced in U.S. dollars, thus adding to the weight of the U.S. dollar.

3 Price competitiveness after the global crisis 2008

3.1 The "post-crisis period" – challenging times for Austrian manufacturing exporters

Between January 1999, when the European monetary union was established, and November 2016, *domestic manufacturing exporters* improved their price competitiveness by more than 5% in real terms, judging from the export-weighted competitiveness index *deflated by the HICP/CPI*. When also taking into account the underlying nominal effective appreciation by nearly 5%, the relative improvement that is attributable solely to changes in price patterns was close to 10%. A cross-check with the competitiveness indicator based on *the producer price index* confirms this trend over the long term. In real terms this indicator dropped by 6% in the period from the first quarter of 1999 up to the third quarter of 2016; the underlying nominal effective depreciation contributed 1 percentage point to the improvement of the PPI-based indicator. The difference in the nominal effective exchange rate developments is due to deviating country samples used for computing each weighting matrix.

As the Austrian economy was characterised by a protracted period of low GDP growth and – by historical standards – weak export growth between 2012 and 2015, a closer inspection of the more recent changes in price competitiveness is required. Indeed, we find the two indicators to have diverged after the onset of the global crisis in 2008, between autumn 2008 and November 2016. Assessed on the basis of the HICP/CPI-deflated indicator, the price competitiveness of the Austrian manufacturing sector improved slightly by about 2%, fluctuating, however, within a band between 92 and 99 (with Q1 99 = 100). This development was, more or less, determined by exchange rate variations. Yet according to

[16] *However, this aggregate figure masks a comparatively strong decline in the share of the U.K. and a rising importance of Poland, the Czech Republic and Romania for Austrian manufacturing exports. In addition, the weight of Switzerland has dropped markedly since the later part of the 1990s, and so have the shares of the U.S.A. and Japan. Conversely, China has gained tremendous importance for domestic manufacturing exporters over the past 1 ½ decade.*

[17] *A comparison over the whole range of periods is not possible since the service subindex was newly implemented in the previous revision of 2013.*

[18] *Rest of the world.*

the PPI-deflated index, calculated for just 26 competing countries, Austria's competitive performance worsened by ½% over this period, with the nominal effective exchange rate depreciating by 1¾%. This implies that the producer prices of Austrian manufacturing exporters rose comparatively stronger than those of their foreign competitors (chart 3A, left panel).

Given the large current account imbalances accumulated by some euro members up to 2008, a regional decomposition of changes in price competitiveness reveals a few quite diverging patterns for the period after 2008 (chart 3A, right panel). Domestic manufacturing exporters made no headway in becoming more competitive in intra-euro area trade. With respect to the euro area they exhibited a marked loss of about 4¾% since mid-2008. Moreover, against those EU Member States which have not yet introduced the euro, Austria experienced even more substantial losses in price competitiveness, of more than 10%. This unfavorable development was partly offset by price competitiveness gains of nearly 30% against U.S. producers. This improvement was, however, completely due to the depreciation of the euro against the U.S. dollar, which also amounted to about 30% since mid-2008. The competitiveness gains vis-à-vis Japan of about 20% also go hand in hand with a depreciation of the euro against the Japanese yen by about 30%.

3.2 Loss of cost competitiveness following the onset of the global crisis

The (import- and export-weighted) index measuring the *cost competitiveness of Austrian producers and service providers* uses *total unit labor costs as the deflator* instead of prices. This indicator shows that competitiveness has improved by about 1% since the launch of the euro, with the entire gain being attributable to nominal effective exchange rate developments. Specifically, this indicator shows an initial improvement of about 7%[19] in Austrian exporters' competitiveness in the first two years of monetary union. While nearly all of this competitiveness gain was gone by mid-2009, the subsequent quarters show another slight competitiveness gain until mid-2012, another reversal until the end of 2014, and a renewed marginal improvement since then. However, the slight worsening of Austria's cost competitiveness from the outbreak of the crisis up to mid-2016 (1%) was driven completely by unit labor costs, which developed less favorably in Austria than abroad. This becomes obvious when taking into account the nominal effective depreciation of about 3% since the third quarter of 2008.[20]

When we compare the cost-based index with the *HICP/CPI-deflated price competitiveness indicator*, the results do not match (chart 3B, left panel). The HICP/CPI-deflated indicator signals an improvement in competitiveness by almost 4% in the long run since the start of European monetary union. This improvement resulted from gains in relative prices of about 8% partially corrected by a nominal effective appreciation. Over the period since the onset of the crisis to mid-2016 the price competitiveness of Austrian producers and service providers improved slightly by about 2%, driven by the nominal exchange rate.

[19] *More than one-third of this improvement was exchange rate-related.*

[20] *Yet, this indicator may very well underestimate the competitiveness of Austrian manufacturers, as total unit labor costs are largely determined by nontradable, low-productivity services.*

3.3 Domestic service providers retained their price competitiveness after the onset of the crisis

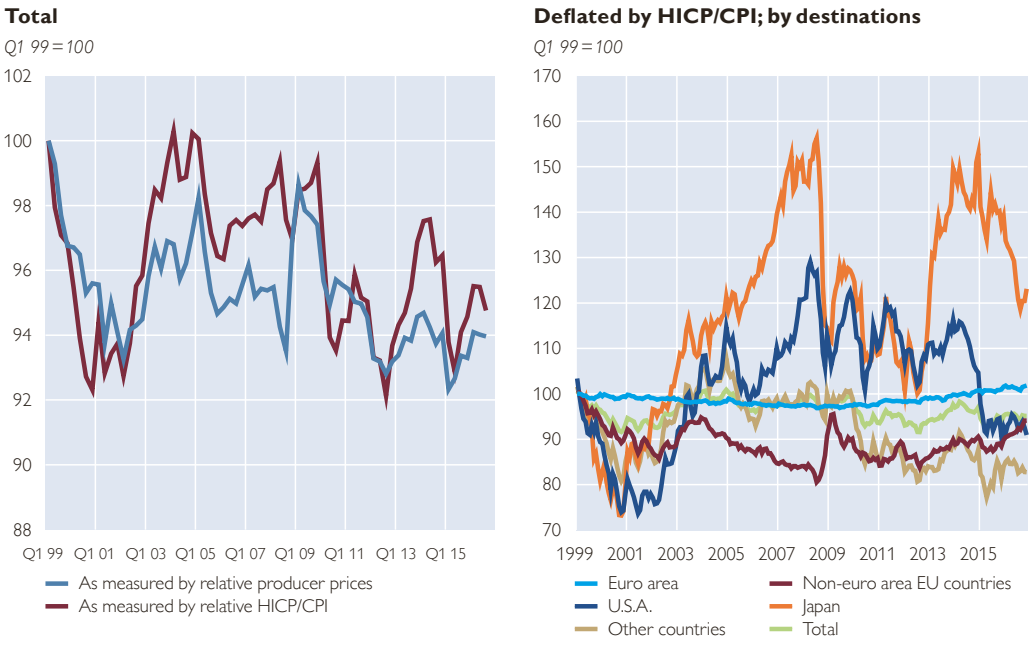
When we look at the (export- and import-weighted) indices designed to reflect the *cost competitiveness of service providers* on the basis of *total unit labor costs*[21] we find competitiveness gains of about 3% since the launch of the euro, half of which stem from a nominal depreciation. The period up to 2008 was characterized by a strong improvement over the first couple of years that was to a large extent compensated in the following years until the onset of the crisis. After the crisis, the services index fluctuated within a narrow range around a mean of 97.

The gains in the period before the crisis hit were partly compensated by a nominal appreciation. In the period after the onset of the crisis we see a diverging pattern featuring a nominal effective depreciation of about 3% which corrected the more than proportional increase of unit labor costs in Austria and resulted in a stable competitive situation.

Over the full sample period, this compares with a real depreciation of more than 3.5% reflecting the relative changes of consumer prices. This overall picture can be decomposed into the pure exchange rate movement, which resulted in an appreciation by 4.8%, and the development in relative prices. Smaller inflation rates in Austria – relative to its competitors – more than compensated for the uptick in nominal exchange rates. Looking only at the development since the onset of the crisis reveals that Austrian service providers, based on the service indicator deflated by the HICP/CPI, faced a worsening of their price competitiveness by more than 2%, half of which was due to the nominal appreciation.

Chart 3A

Export-weighted real effective exchange rate indices for manufactured goods

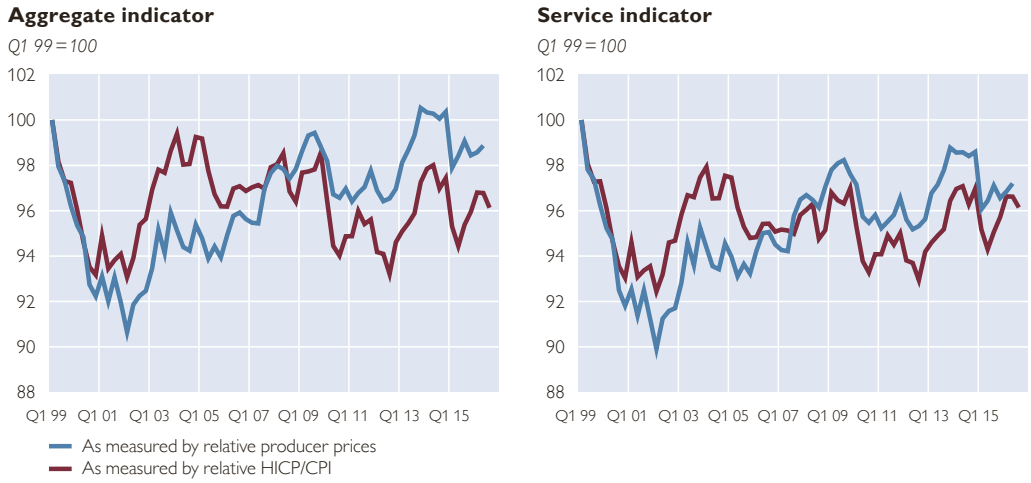


Source: OeNB, WIFO.

[21] *This indicator is based on 31 competing countries.*

Chart 3B

Import- and export-weighted real effective exchange rate indices



Source: OeNB, WIFO.

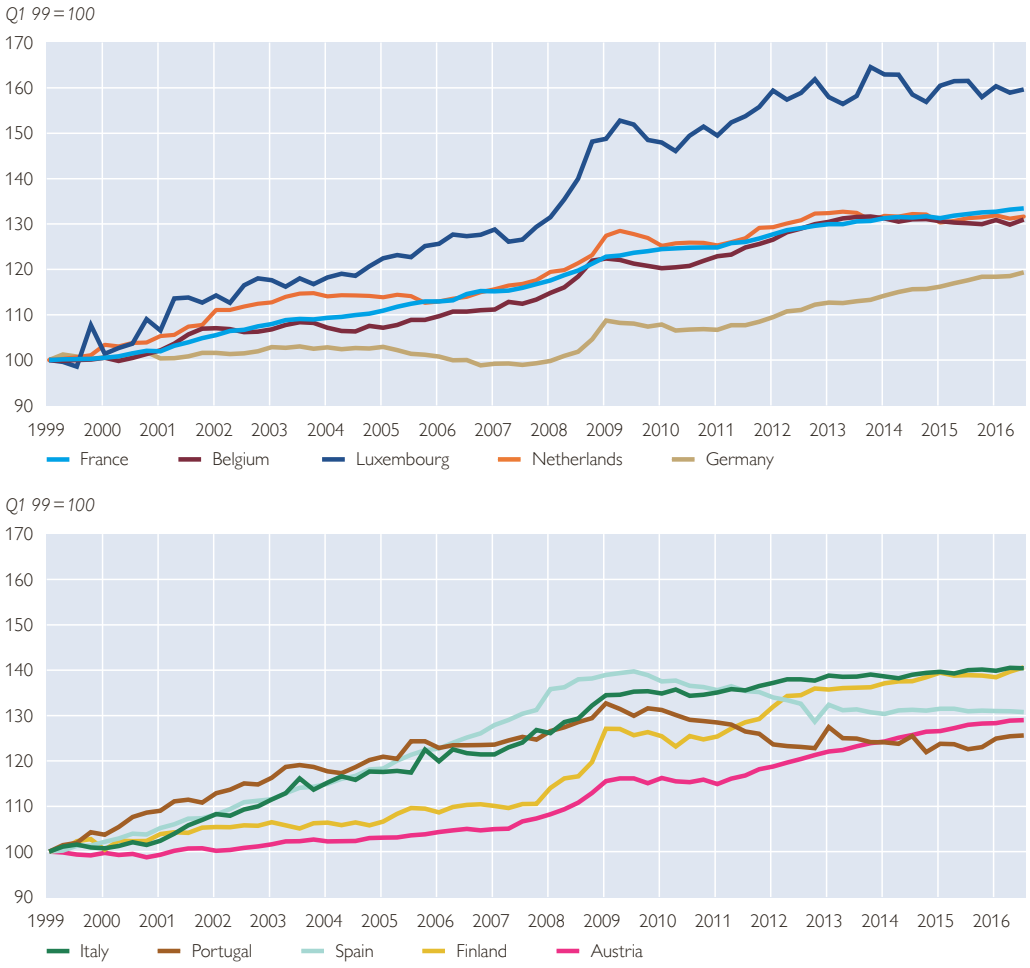
The long-term patterns imply that the gains in competitiveness made by domestic service providers between early 1999 and 2016 amount to roughly 3% both in terms of relative consumer prices and in terms of total unit labor costs. At the same time, the matching headline figures mask highly divergent underlying nominal effective exchange rate movements that result from the fact that the two indicators are based on different country samples and hence on different country weights (chart 3B, right panel).

3.4 Changes in total unit labor costs in Austria relative to changes in other euro area countries

Unit labor costs in the Austrian economy as a whole remained broadly stable from early 1999 until late 2004, thus developing in conformity with total unit labor costs in Germany. The story is different, to some extent, for the period from late 2004 until the third quarter of 2008 when the global economic crisis emerged. In this period, total unit labor costs rose gradually by about 8%, which was still moderate compared with other trading partners (the exception to this observation being Germany, because German unit labor costs decreased by less than 1% in this period). From the third quarter of 2008 until the third quarter of 2016, Austria faced a substantial increase of unit labor costs (16%), which was however more or less on a par with the development of total unit labor costs in Germany (17%). Other euro area countries like France, Belgium, Luxembourg, Netherlands and Italy exhibited more moderate increases, whereas Portugal (–2%) and Spain (–5%) even saw decreasing total unit labor costs. Finland, in comparison, experienced a marked increase of nearly 21%. For the Austrian as well as the German case, the increase can be explained by comparatively higher wage increases agreed between the social partners as well as by productivity losses resulting from the fact that the decline in economic output in 2009 above all led to a reduction in hours worked – partly subsidized – rather than massive layoffs. Those European countries which had built up comparatively high macroeco-

Chart 4

International comparison of total unit labor costs in euro



Source: OeNB, WIFO.

nomic imbalances and/or unsustainable current account deficits were forced to take measures to significantly improve their unit labor cost positions after 2009.

When we look at the period from early 1999 until the third quarter of 2016, total unit labor costs rose by 29% in Austria – compared with 19% for Germany, 40% for Italy, 41% for Finland, some 33% for France and the Netherlands, and 31% for Belgium. Those countries that were hit particularly hard by the global crisis plus, in some countries, the bursting of a real estate bubble – namely Ireland, Spain, Portugal – have seen their unit labor costs rise by between 5% and 30% since 1999.

4 Applying the new effective exchange rate indices in empirical models for foreign trade flows

In this section, we estimate and evaluate empirical models for trade flows based on the newly calculated competitiveness indicators. For the comparison of different models we use their in-sample fit and their predictive power in terms of *h*-step ahead forecast errors. In general, forecasters of international trade flows are interested in two dis-

tinct foreign trade statistics. The first is national accounts data where forecasters concentrate on exports and imports measured at constant prices. The national accounts system includes total exports and two subaggregates: goods and services exports. These categories are also available for imports and allow for an assessment of real effective exchange rate indices.

Alternatively, forecasters may be interested in the future current account balance of a country. In this case, they will concentrate on current account data measured at current prices, which are available on a more disaggregate level. The current account system provides disaggregated data on trade in goods, general merchandise, services, tourism in the broad sense[22] and in the narrow sense, and personal transport. We therefore repeat our evaluation for current account data but use the nominal effective exchange rate indices instead.

The forecasting models are based on the classic design for empirical aggregate foreign trade regressions proposed by Goldstein and Khan (1985). We modify this relation only by analyzing a combination of equations in levels and in first differences to account for possible stochastic trends in the data. In general, the level equation representing the long-run relation between a trade flow and the explanatory variables is:

$$\log(trade_t) = \beta_0 + \beta_1 \log(demand_t) + \\ + \beta_2 \log(competitiveness_t) + u_t$$

where $trade_t$ represents either import or export flows as listed in table A4 in the annex. The associated $demand_t$ is either the Austrian gross domestic product in the case of imports or world output in the case of exports. Quarterly data for world output have been constructed from annual values using the AR(1) maximum likelihood interpolation based on the OECD output series as the quarterly indicator (Chow and Lin, 1971). The effective exchange rate indices indicate changes in the international price $competitiveness_t$ of Austrian goods and services. We use all newly calculated import- and export-weighted effective exchange rate indices as listed in table A4 and re-estimate each equation by replacing the respective indicator for competitiveness. With all variables transformed into logarithms, the parameters of interest are long-run elasticities of trade flows with respect to changes in demand and competitiveness, respectively. Both are given by the coefficients β_1 and β_2. The coefficient β_0 is the regression constant and has no economic interpretation.

This regression gives the long-run relation between the trade flow variable and the associated indicators for demand as well as price competitiveness. The error term u_t can be interpreted as a co-integrating error term, i.e. a deviation from the long-run equilibrium which will push the system back towards the long-run equilibrium position when included into the dynamic equation for growth rates (Engle and Granger, 1987). We test the co-integrating relation between trade flows, demand indicators and price competitiveness using the classic augmented Dickey-Fuller test with automatic lag selection based on the Schwarz criterion. We can reject a unit root in the residual of the co-integrating regression in all but two cases at the 1% significance level; for imports and exports of services at constant prices from the national accounts data we can reject a unit root at the 2% level.

[22] *Tourism including personal transport.*

The dynamic regression equation for seasonally adjusted quarterly data is:

$$\begin{aligned}\text{dlog}(trade_t) &= \alpha_0 + \alpha_1 \text{dlog}(demand_t) + \\ &+ \sum_{i=0}^{8} \left((\alpha_{i+2} \text{dlog}(competitiveness_{t-1}) \right) + \\ &+ \alpha_{11} u_{t-1} + , \alpha_{12} D_t^{EMU} + \alpha_{13} D_t^{MOEL} + \varepsilon_t\end{aligned}$$

where we approximate growth rates over the previous quarter by taking the first difference of the variables in logarithms (dlog). The parameters of interest are the coefficients α_1 and α_2 through α_{10}, now giving the short-run elasticities of trade flows with respect to indicators of demand and competitiveness. We allow for contemporaneous and eight lagged responses of trade flows to changes in the exchange rate indicator. Such a lagged response could emerge if the trade variables' responses to shocks in competitiveness follow the well-known J-curve shape (Rose and Yellen, 1987 and Bahmani-Oskooee and Brooks, 1999). In general, due to dynamic adjustment processes, models estimated at quarterly frequency are likely to have coefficients at higher lags which are still significantly different from zero. We therefore set the lag length uniformly to eight quarters. At the annual frequency this corresponds to models with a contemporaneous term and two lags.

The short-run equation also includes the lagged error correction term from the level equation with α_{11} showing the speed of adjustment to deviations from equilibrium. A negative value of α_{11} close to –1 indicates an extremely fast adjustment process, whereas a negative value close to zero would imply very slow convergence to the new long-run equilibrium relation. On the other hand, positive values imply an explosive process and we eliminate the results of these models from the following presentations. We also include two dummy variables jumping from zero to one in 1999, when the euro area was established, D_t^{EMU}, and in 2004, to reflect the EU's eastern enlargement in that year, D_t^{MOEL}. Finally, the dynamic equation includes an i. i. d. distributed residual, ε_t, with expected value of zero and constant variance.

4.1 The data

The national accounts data on trade flows are available at annual and quarterly frequencies. The annual data series spans as far back as 1954, but in this study we will present only the results based on quarterly data from the first quarter of 1996 through the first quarter of 2016 – the reason for this restriction being the limited range available for effective exchange rate indices based on unit labor costs, which start in 1996. Using the first quarter of 1996 as the starting point, we have fully comparable results for all effective exchange rate indices. Furthermore, models based on quarterly data are more popular among forecasters due to their timely perspective on the most recently published data. The results based on models using world output deviate somehow from models using OECD output, because the catch-up process of emerging markets lifts the average growth rate of world output at constant prices to +3.6% per year (1970 to 2015) compared to +2.6% for industrial countries (OECD). The different dynamics of world output growth not only affect the average growth rate but also change the covariance structure between the demand indicator and the effective exchange rate indices and consequently the estimates for the price elasticity.

The trade flow variables are not perfectly related. Table A5 in the annex shows the correlation coefficients for all export variables from the national

and the current account data. Whereas various definitions of goods exports are almost perfectly correlated, their respective correlations with services exports are considerably smaller, sometimes even zero. Moreover, the correlation among individual categories of services exports is also smaller. This indicates that their respective income and price elasticities may deviate substantially, and consequently, different weighting schemes used for the computation of effective exchange rate indices have the potential to improve the goodness of fit as well as the forecasting performance of empirical models.

At the same time, correlations are quite high among effective exchange rate indices, especially among indices based on relative consumer prices (table A6). Indices based on unit labor costs typically produce lower correlation coefficients in the range between 0.80 and 0.88. As chart 3 shows, most of the variation between different effective exchange rate indices results from more pronounced ups and downs rather than diverging developments over time. The similar behavior of these indices suggests that replacing the exchange rate index in the regression equation of a specific trade flow variable may not create big differences in either the measures for the goodness of fit or the forecasting performance.

4.2 The results

The combination of 9 indicators of each outward and inward trade flow at current and constant prices and 9 different effective exchange rate indices would give rise to 81 co-integrating two-equation systems for both exports and imports, i.e. a total of 162 co-integrating systems. Some of these equations lack direct economic interpretation because they relate a trade flow variable to an effective exchange rate index based on a non-corresponding weighting, e.g. an effective exchange rate index based on service import and export weights to manufacturing exports. While we skip such models for the presentation of income and price elasticities, we avoid prioritizing "reasonable" combinations for the evaluation of the forecasting performance. Consequently, we estimate 9 co-integrating systems for real total export volumes based on national accounts data and all newly calculated real effective exchange rate indices. For goods exports we estimate 21 co-integrating systems based on a mix of national accounts data at constant prices and current account data at current prices and the relevant effective exchange rate indices. Similarly, we estimate 9 co-integrating systems for services exports based on a mix of national and current accounts data. After screening for negative coefficients of the error correction term (α_{11}), we eliminate two models for services exports due to implausibility. We repeat this exercise for all corresponding definitions of imports.

4.2.1 Elasticities and dynamic multipliers

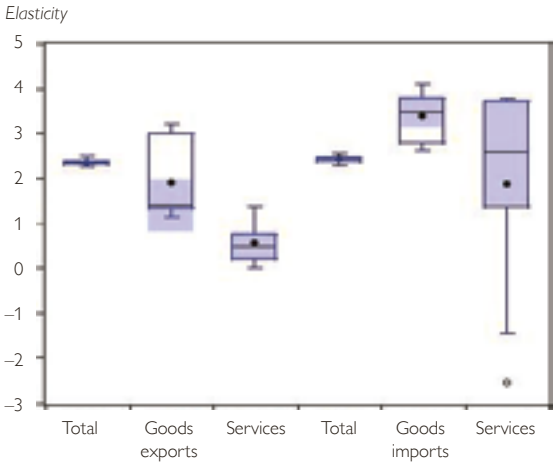
The resulting estimates for the short-run income elasticity of exports and imports are summarized as boxplots in chart 5. For each trade flow, diamonds represent the means of the respective estimates, with the horizontal line within the box showing the median. The variation in the estimates of the income elasticity results from changing the dependent variable in the co-integrating system (e.g. from services exports to tourism exports) and re-estimating each system using appropriate alternative effective exchange rate indices, i.e. in the case of service exports the effective exchange rate indices for services based on consumer prices or alternatively for services based on unit

labor costs. The short-run income elasticity of export regressions shows the instantaneous percentage response of Austrian exports to a 1% quarter-to-quarter increase in world output. The import elasticity indicates the reaction of Austrian imports to a 1% quarter-to-quarter increase in Austria's output. Besides services exports, the estimated values are surprisingly high, indicating demand elasticities between 1 and 3 in both cases (compare the detailed comparison with related empirical studies below). The elasticity for goods exports appears to be higher than the elasticity for services exports because the 95% interval of the boxplot for services does not include the median estimate for goods exports. Estimates for the income elasticity of total exports are almost unaffected by variations in the effective exchange rate index. Both the interquartile range for total exports and the confidence interval of the median are narrow. A similar picture emerges for imports, i.e. the interquartile range widens as we move from total imports to goods and services imports. Finally, the income elasticity for imports of services appears to be somewhat lower than the income elasticity for goods imports, but the precision is low.

Chart 6 shows the dynamic multiplier of trade flows with respect to a 1% increase in the effective exchange rate, i.e. the sum of the coefficients for the contemporaneous competitiveness indicator and all eight lags of the indicator. This value can be interpreted as the accumulated dynamic response to an unexpected increase in price competitiveness. The set-up is identical to the one presented for income elasticities. The price elasticities are similar for exports and imports and only weakly dependent on the exchange rate indicator chosen. Except for the exports and im-

Chart 5

Distribution of estimates for income elasticities[1]

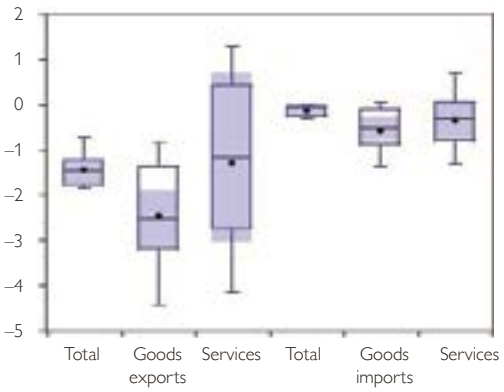


Source: Authors' calculations.

[1] Elasticity of exports with respect to a 1% increase in world GDP and elasticity of imports with respect to a 1% increase in Austrian GDP. The boxplots for total trade volumes are based on 8 models, for goods trade on 18 models, and for services on 10 models. For each trade flow, diamonds represent the means of the respective elasticities, with the horizontal line within the box showing the median. The box itself encloses the interquartile range, i. e. the bottom of the box is the first quartile and the top of the box is the third quartile. Near outliers are shown as circles and far outliers as stars. The staples at the end of each whisker show the last data point within a distance of 1.5 times the interquartile range. The shaded region displays the approximate 95% confidence interval for the median.

Chart 6

Distribution of estimates for dynamic price elasticities[1]



Source: Authors' calculations.

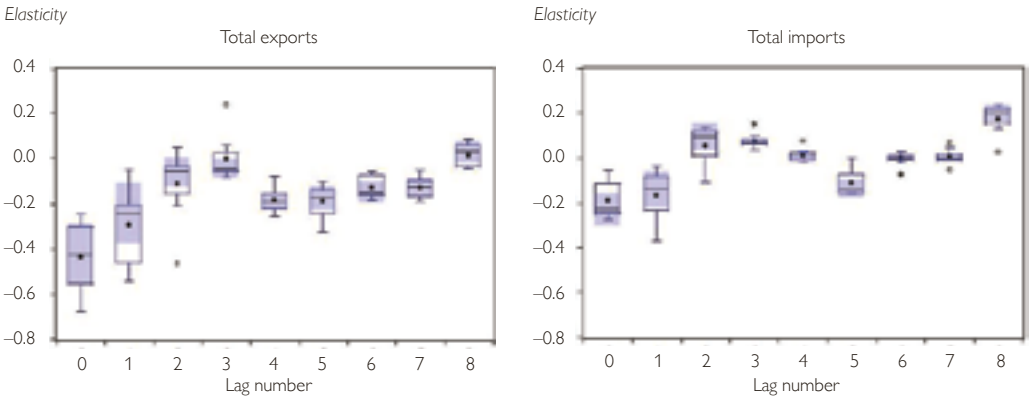
[1] Dynamic elasticities of export and import volumes with respect to a 1% increase of the effective exchange rate index; i.e. the sum over the contemporaneous and all lagged values of the dynamic regression. The boxplots for total trade flows are based on 9 models, for goods trade on 21 models, and for services on 7 models. For each trade flow, diamonds represent the means of the respective dynamic multiplier, with the horizontal line within the box showing the median. The box itself encloses the interquartile range, i. e. the bottom of the box is the first quartile and the top of the box is the third quartile. Near outliers are shown as circles and far outliers as stars. The staples at the end of each whisker show the last data point within a distance of 1.5 times the interquartile range. The shaded region displays the approximate 95% confidence interval for the median.

ports of services, they are less than –1, that is to say, a 1% appreciation is associated with a decline in exports of more than 1%. Surprisingly, imports respond negatively to a 1% appreciation. The variability of estimates for services is much higher than those for total and goods exports. Nevertheless, the negative dynamic multipliers for the elasticity of prices from import regressions contradict theoretical expectations that, in case of an appreciation of the home currency, domestic products and services will be substituted by imports. A possible explanation would be indirect effects resulting from the strong response of exports to an appreciation and the reduction in embodied imported intermediate inputs (Stehrer and Stöllinger, 2013).

Chart 7 disaggregates the dynamic multipliers for total exports and total imports in the national accounts and presents the contemporaneous and lagged responses, i.e. the individual coefficients α_2 through α_{10} in the dynamic regression. In this case, we use all newly calculated export weightings, resulting in 9 estimates at each lag length, which we summarize again as boxplots. The immediate response of exports to a 1% increase in the effective exchange rate is centered around –0.4; it declines quickly towards zero within the next three quarters but rebounds in the fourth quarter to –0.2. Afterwards the elasticity converges slowly to zero. For total imports a similar but subdued picture emerges. Starting with a negative coefficient of –0.2 the elasticity becomes positive already in the second quarter after the exchange rate shock occurred and remains positive or close to zero for most of the following quarters. The first conclusion from chart 7 is that price effects alone will not produce a J-curve effect for Austria because the reduction in exports is immediate and strong, and counterbalancing consequences of rising imports revenues are delayed and small. In order to achieve a J-curve pattern, the indirect effects from reduced exports on domestic output and consequently lower

Chart 7

Distribution of estimates for price elasticities, the dynamic response to an increase in effective exchange rates[1]



Source: Authors' calculations.

[1] *Price elasticities of export and import volumes with respect to a 1% increase of the effective exchange rate index. Each boxplot shows the coefficient at the respective lag length in the dynamic regression model. The boxplots for total trade flows are based on 9 models. Diamonds represent the means of the respective coefficient, with the horizontal line within the box showing the median. The box itself encloses the interquartile range, i. e. the bottom of the box is the first quartile and the top of the box is the third quartile. Near outliers are shown as circles and far outliers as stars. The staples at the end of each whisker show the last data point within a distance of 1.5 times the interquartile range. The shaded region displays the approximate 95% confidence interval for the median.*

import demand will have to be big enough. This result is not surprising because the J-curve effect is based on the invoicing of exports in domestic currency and vice versa. As a great number of contracts is fixed in advance to preempt a surprise appreciation, the currency gain with respect to import payments will create a temporary surplus. Being a small open economy and a founding member of European monetary union, Austria should have seen a decline in its share of foreign currency-denominated invoices. Furthermore, the use of hedging instruments against currency fluctuations and variations in raw material prices has become more widespread over time.

The second conclusion from chart 7 is that choosing a small lag length for the dynamic regression will underestimate the dynamic response of trade flows to exchange rate shocks. Typically, some of the higher order coefficients – at lag lengths between four to seven – turn out to be significant, and a specification search looking for a parsimonious representation of the underlying model is likely to cut at lag lengths of two or three. Zorzi and Schnatz (2007), for example, restrict their dynamic regression for total euro area exports to the contemporaneous competitiveness indicator and present estimates around –0.3, which fits closely into the interquartile range for the contemporaneous coefficient in chart 7. Similarly, Bayoumi et al. (2007) present estimates between –0.5 and –0.7 for the contemporaneous competitiveness indicator, using annual data and a trade-weighted GDP indicator. The Deutsche Bundesbank (2016) only presents long-run elasticities β_2 taking values around –0.35. The corresponding values in our long-run regression for total exports are between –1 and –2.6; but if we chose the Central Planning Bureau volume indicator of world trade as the demand indicator, the estimated long-run elasticities are around –0.4, i.e. quite close to the Deutsche Bundesbank measure (2016). Another effect of choosing world trade as the indicator of foreign demand is a lower income elasticity for total exports in the dynamic regression centered around 0.7, which also corresponds to the value of 0.8 presented by Zorzi and Schnatz (2007).

4.2.2 In-sample fit and out-of-sample forecasting performance

In the next step of our evaluation, we do not restrict our analysis to models that make economic sense but rather include all import-export weighted effective exchange rates in candidate models and search for the combination with the closest in-sample fit and – alternatively – the best ex ante predictive power based on recursive estimations of the co-integrating systems. The comparison of the in-sample fit is based on the coefficient of determination (R^2) resulting from the full sample. The out-of-sample forecasting evaluation starts with a model based on data from Q1 96 through Q4 13. In a recursive procedure we add step by step one quarter to the estimation sample using quarterly data and replacing the effective exchange rate index in the estimation of the co-integrating systems. Because the import elasticities are negative or small, we conclude that Austrian imports do not respond strongly to variations in short-term price/cost competitiveness. Consequently, we can restrict the following presentation to exports only.

We measure the in-sample fit by the coefficient of determination (R^2) in the dynamic regression, which describes the share of the variation in the changes in exports against the previous quarter explained by the regression model. To

assess the out-of-sample predictive power we use the root mean squared forecast error (RMSE) based on forecasts using the realized future values of the explanatory variables. This "perfect foresight" set-up avoids any modeling of the explanatory variables and creates an equivalent and fully reproducible environment for all ex-ante forecasting cycles.

Column three of table 1 shows the label of the effective exchange rate index for which the coefficient of determination is maximized. We can only identify three export variables for which the model with the best in-sample fit actually includes the "theoretically appropriate" effective exchange rate index. We apply the term "theoretically appropriate" for models where the weighting of the effective exchange rate index corresponds broadly to the modeled trade flow variable and for which the dynamic multiplier simultaneously has the expected negative sign. In general, models based on effective exchange rate indices using unit labor costs of the whole economy as the deflator produce the best in-sample fit, and the coefficients of determination do not markedly differ between *the aggregate cost competitiveness indicator* (E_TULC) and *service cost competitiveness indicator* (E_SULC). Furthermore, models based on indices using relative producer prices have on average a distinctly better fit than models using the HICP/CPI deflator. Finally, service exports are harder to explain by our simple co-integration systems than total or goods exports; their R^2 is lower by 20 to 30 percentage points. The ranking provides a clear picture but we want to emphasize that the difference between alternative unit labor cost-based indices in terms of their in-sample fit is small.

The analysis of ex ante prediction errors in table 1 gives a more diverse impression about the usefulness of individual indicators of competitiveness. The models for total and goods exports

Table 1

Comparison of regression results for trade flow variables using different indicators of competitiveness with respect to in-sample fit and out-of-sample forecasting performance

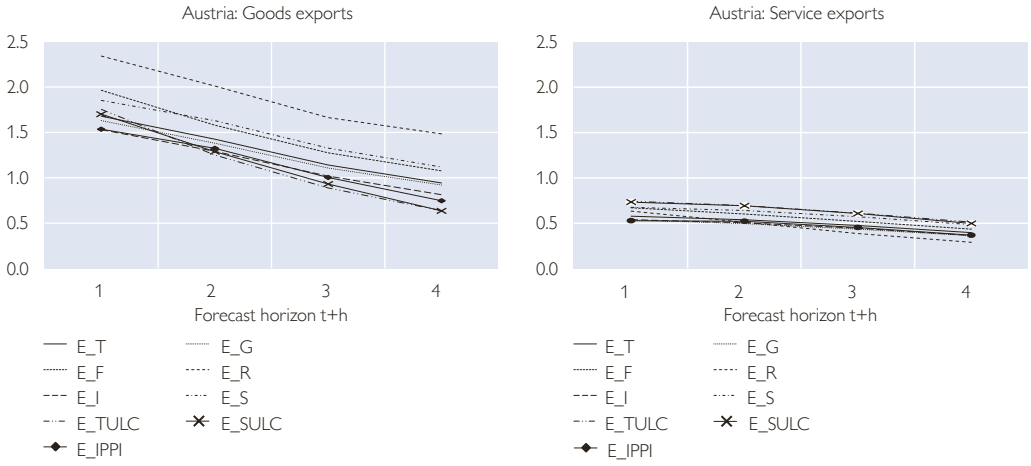
		Model including effective exchange rate "E_.." as the competitiveness indicator producing the best fit in terms of				
		in-sample fit	ex ante predictive power			
Trade flow variable	Price elasticity	R^2	RMSE			
			1-step	2-step	3-step	4-step
Trade flows at constant prices						
NA_X	–1.44	E_SULC	E_IPPI	E_IPPI	E_TULC	E_TULC
NA_XG	–1.60	E_SULC	E_I	E_TULC	E_TULC	E_SULC
NA_XS	–1.01	E_TULC	E_IPPI	E_G	E_R	E_R
Trade flows at current prices						
CA_XGN	–3.00	E_SULCN	E_IPPIN	E_IPPIN	E_IPPIN	E_IPPIN
CA_XSN	–2.18	E_SULCN	E_FN	E_SN	E_SN	E_SN

Source: Authors' calculations.

Note: Compare table A4 for a definition of labels. Models for export flows are based on world output and the respective effective exchange rate indicator. Price elasticity is the average elasticity across the nine effective exchange rate indices. The in-sample fit is measured by the coefficient of determination (R^2) based on quarterly data from Q1 95 through Q1 16. The first out-of-sample forecast is based on quarterly data and the estimation sample runs from Q1 95 through Q4 13. We expand the window of the estimation sample by adding one quarter after another to this sample. This gives us nine 1-step ahead forecast errors, eight 2-step ahead forecasting errors, seven 3-step ahead forecasting errors, and six 4-step ahead forecasting errors for computing the root mean squared errors (RMSE).

Chart 8

Quality of model forecast for exports for various indicators of competitiveness relative to random walk forecast



Source: Authors' calculations.

Note: Compare table A4 for a definition of labels. RMSE for 1- to 4-step-ahead recursive predictions under perfect foresight of model forecasts relative to RMSE of naive random walk forecasts. Estimation sample from Q1 96 through Q4 13 and forecast period from Q1 14 through Q1 16.

data from the national accounts including the unit labor cost-based indicators dominate at the 3- and 4-step ahead forecast horizons, while models including the producer price-based indicator dominate at short-run forecast horizons. At the 1-step ahead horizon the HICP/CPI-based effective exchange rate using the weights from trade in industrial goods has the lowest RMSE. While we cannot find a clear and reasonable picture for real service exports, the best model for nominal service exports includes the HICP/CPI-based index using the service's weight (compare the lower panel of table 1). Chart 8 provides a more informative ranking of competitiveness indicators for real goods and service exports, respectively. The lines in chart 8 are ratios of the RMSE from forecasts based on the dynamic model to the RMSE from a naïve random walk forecast. A value above one indicates that random walk forecasts at this horizon have a lower prediction error than model-based forecasts. A value below one shows that model-based prediction using short- and long-run information about demand and competitiveness have the potential to outperform the random walk approach. At short forecasting horizons, the random walk model beats all model-based forecasts for real goods exports. Starting with the 3-step ahead horizon, models based on indicators using total unit labor costs as the deflator produce lower recursive prediction errors; although the effects of the weighting scheme (aggregate versus service sector based on total unit labor costs) are not distinguishable. Contrary to goods exports, the outflow of services is clearly better predicted by models using demand and competitiveness indicators. Interestingly, the models' performance becomes better with increasing forecast horizons. Models using service-related weighting schemes, however, do not perform better in terms of a lower RMSE. On the contrary, at the 1- and 2-step horizons indices based on goods related weightings dominate and at the 3- to 4-step hori-

zons the raw material-based weighting produces lower prediction errors. One explanation for this may be the high U.S. dollar weighting in the index based on raw materials – but we emphasize that due to the small sample size we have only six 4-step ahead forecasts available to compute the RMSE; moreover, only two of them are from non-overlapping forecast horizons and model-based forecasts certainly benefit from using realized values of explanatory variables.

Similar to Zorzi and Schnatz (2007) we confirm that unit labor cost-based indicators have a better forecasting performance at longer forecast horizons. Using a cross validation approach Deutsche Bundesbank (2016) also identifies models including the effective real exchange rate based on total unit labor costs as the ones producing the lowest prediction error.

5 Conclusions

The relation between price competitiveness and foreign trade imbalances regained attention after the global crisis 2008 hit the world economy. Specifically, within the euro area imbalances had emerged in the years before the onset of the crisis which had to be unwound afterwards. Improving the price competitiveness in those countries that faced substantial current account deficits was seen as a crucial precondition for unwinding the imbalances within the euro area. In general, small open economies have to pursue policies that allow them to remain competitive. In the short run, competitiveness burns down to the price competitiveness of the external sector, which is driven by relative price changes reflecting the level of labor and capital costs, productivity gains or losses, and exchange rates. Thus, any assessment of the price competitiveness of a country starts by analyzing how its exchange rates, domestic price and cost indices have changed compared with those of its trading partners. Across the Eurosystem, various (harmonized) indicators are used to monitor and assess the national short-term price/cost competitiveness performance of individual member countries. They are calculated on the basis of weighted averages of bilateral exchange rates vis-à-vis the currencies of the trading partners of each euro area country and are deflated by appropriate cost and price indices.

The Austrian competitiveness indicator, which is based on the Eurosystem-wide harmonized methodology, is compiled by the OeNB in cooperation with WIFO, the Austrian Institute of Economic Research. It includes Austria's 56 most important trading partners. The aggregate indicator is composed of four subindices for manufactured goods, food, raw materials and energy products, and services. The individual country weights in the subindex for manufactured goods continue to be calculated on the basis of single (bilateral) import and double (multilateral) export weights. The remaining subindices use only single (bilateral) import and export weights. Three different deflators are used for the calculation of the harmonized competitiveness indicator, each having its own pros and cons in terms of timely availability across countries, international comparability, and the degree of focus on tradable goods. The three deflators are the HICP/CPI, producer prices, and unit labor costs of the total economy.

The harmonized competitiveness indicator is obtained by chain linking. The latest revision takes into account the most up-to-date set of comparable external trade data for the period from 2010 to 2012, bringing the series of country weights used to compute effec-

tive exchange rates up to six consecutive three-year periods, starting in 1995. The comparison of these six sets of country weights highlights the re-orientation of trade flows from previous target markets towards countries that joined the EU in 2004 and 2007 as well as the rising importance of China as a destination for Austrian exporters. Based on the weighting for the 2010–2012 period, the aggregate index (export- and import-weighted across all subindices) continues to be characterized by a high foreign trade share of the countries that joined the EU before 2004 (57%), slightly down from its previous period's share. Countries that acceeded the EU in 2004 and 2007 now account for a weight of 13.4% – nearly double the share they had at the turn of the millennium. On an individual country basis, Germany continues to have the largest weight (33.1%), followed by Italy (7.2%) and the U.S.A. (7.1%). With a trade weight of 4.7% China not only gained in importance, it also surpassed traditional Austrian export destinations like France and Switzerland (3.7% and 4.1%, respectively).

In general, Austria's competitiveness remained fairly stable after 2008, with the competitivenesss indices fluctuating within a narrow band. Most of the variation was due to bilateral exchange rate movements of the U.S. dollar and the Japanese yen rather than deviating developments of the respective price and cost indicators. With respect to the members of the Eurosystem, adjustments of bilateral exchange rates vis-à-vis Austria are no longer possible, the burden of adjustment fully applies to relative changes of deflators, i.e. the HICP, the producer prices or unit labor costs. Therefore, those European countries that had built up comparatively high macroeconomic imbalances and/or unsustainable current account deficits by the time the economic crisis hit, were forced to take measures to significantly improve their unit labor cost positions, i.e. moderate their wage increases or even cut wages and improve productivity. Vis-à-vis these countries, Austria has seen comparatively stronger increases in total unit labor costs, implying a loss of cost competitiveness since 2008.

Empirical models of aggregate trade flows usually include indicators of demand, like foreign or domestic output, as well as indicators of competitiveness, like real effective exchange rates, as explanatory variables. In this study, we compare the predictive power of all newly calculated effective exchange rate indices with respect to total foreign trade flows and subgroups like manufactured goods and services. While an appreciation of the real effective exchange rate on average yields a drop in Austrian export activity, import substitution appears to be very weak, and some models even show reversed signs. Out of the nine available real effective exchange rates, the models using deflators based on total unit labor costs have the best in-sample fit and in most cases they also have the lowest prediction errors for longer forecast horizons. Although our results suffer from the small sample available, we conclude that the imprecise measurement of unit labor costs (total economy) and the comparatively small country sample for which unit labor cost-based indices can be constructed do not dampen their empirical success, although models using producer price-based indices perform well at shorter forecast horizons.

With respect to the opportunities of improving data collection, we expect that concentrating efforts on more narrowly defined unit labor cost measures (as is the case with the manufac-

turing index) could significantly improve the explanatory power of empirical trade models and consequently their forecasting performance. With Austria being a small open economy, enhanced competitiveness indicators may also improve the overall precision of macroeconomic forecasts.

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Annex

Table A1

Weighting scheme of the new exchange rate index

Competing countries	Austrian exports						Austrian imports					
	Manufactured goods	Raw materials, energy products	Food	Goods	Services	Total	Manufactured goods	Raw materials, energy products	Food	Goods	Services	Total
	Country weights in %, calculated for the period from 2010 to 2012											
Belgium	2.63	0.42	0.74	2.35	1.61	2.16	1.81	0.52	1.78	1.58	1.45	1.56
Bulgaria	0.41	0.35	0.53	0.41	0.51	0.44	0.35	0.07	0.30	0.29	1.02	0.44
Denmark	0.59	0.25	0.59	0.56	0.75	0.61	0.45	0.11	0.67	0.41	0.38	0.40
Germany	23.95	31.18	32.83	25.05	40.43	29.11	41.11	29.62	39.35	38.97	30.23	37.20
Estonia	0.06	0.05	0.08	0.06	0.06	0.06	0.03	0.03	0.04	0.03	0.14	0.06
Finland	0.61	0.13	0.27	0.56	0.47	0.53	0.49	0.16	0.06	0.40	0.97	0.52
France	5.96	1.53	2.16	5.40	2.42	4.61	3.32	0.77	3.64	2.90	2.54	2.82
Greece	0.32	0.16	0.74	0.34	0.28	0.32	0.10	0.07	0.61	0.13	1.06	0.32
United Kingdom	3.16	1.12	1.94	2.94	3.62	3.12	1.83	0.85	1.02	1.60	4.34	2.16
Ireland	0.69	0.02	0.09	0.61	0.42	0.56	0.55	0.04	0.36	0.45	0.94	0.55
Italy	7.20	22.42	14.16	8.72	5.48	7.87	6.70	4.29	11.39	6.59	6.29	6.53
Latvia	0.07	0.03	0.09	0.07	0.09	0.08	0.02	0.03	0.04	0.02	0.12	0.04
Lithuania	0.11	0.04	0.13	0.10	0.08	0.10	0.05	0.04	0.16	0.06	0.33	0.11
Luxembourg	0.15	0.03	0.05	0.14	0.77	0.30	0.24	0.00	0.02	0.18	1.04	0.35
Malta	0.02	0.03	0.08	0.02	0.13	0.05	0.01	0.00	0.00	0.01	0.17	0.04
Netherlands	2.73	0.92	2.28	2.57	4.18	3.00	2.71	2.00	6.43	2.83	2.34	2.73
Poland	2.95	0.84	1.69	2.72	1.54	2.41	1.63	2.02	4.15	1.87	2.29	1.95
Portugal	0.42	0.13	0.15	0.39	0.24	0.35	0.45	0.10	0.17	0.37	0.48	0.39
Romania	1.05	1.33	1.41	1.09	1.73	1.26	0.93	0.64	0.54	0.85	1.86	1.06
Sweden	1.42	0.11	0.82	1.29	1.28	1.29	1.31	0.48	0.20	1.09	1.43	1.16
Slovakia	1.20	5.40	1.81	1.53	1.71	1.58	1.93	5.01	1.45	2.44	2.94	2.54
Slovenia	0.44	5.01	3.65	0.98	1.14	1.02	1.11	1.95	0.95	1.24	1.72	1.34
Spain	2.44	0.57	1.40	2.24	0.81	1.86	1.73	0.25	3.26	1.57	2.17	1.69
Czech Republic	2.91	6.18	3.05	3.14	2.40	2.95	3.58	4.79	2.67	3.74	3.43	3.67
Hungary	1.66	6.86	4.43	2.21	2.77	2.36	2.44	3.69	4.82	2.82	3.87	3.03
Cyprus	0.02	0.01	0.12	0.03	0.31	0.10	0.04	0.01	0.06	0.04	0.41	0.11
Australia	0.49	0.10	0.57	0.47	0.25	0.41	0.04	0.07	0.11	0.05	0.28	0.10
Chile	0.15	0.00	0.09	0.14	0.05	0.11	0.05	0.27	0.29	0.10	0.05	0.09
Iceland	0.02	0.00	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01	0.08	0.02
Israel	0.28	0.22	0.17	0.27	0.23	0.26	0.17	0.02	0.16	0.15	0.20	0.16
Japan	2.49	1.19	0.76	2.29	0.54	1.83	1.95	0.04	0.05	1.49	0.36	1.26
Canada	0.78	0.03	0.10	0.68	0.33	0.59	0.34	0.16	0.08	0.29	0.44	0.32
Mexico	0.65	0.01	0.03	0.56	0.11	0.44	0.23	0.04	0.15	0.19	0.11	0.18
New Zealand	0.06	0.00	0.07	0.06	0.06	0.06	0.03	0.02	0.29	0.05	0.10	0.06
Norway	0.42	0.04	0.20	0.38	0.38	0.38	0.19	2.01	0.24	0.51	0.38	0.48
Switzerland	3.07	4.44	3.72	3.21	6.89	4.18	4.47	1.39	3.15	3.84	4.39	3.95
South Korea	1.79	0.75	0.68	1.64	0.27	1.28	0.63	0.01	0.02	0.48	0.14	0.41
Turkey	1.40	1.28	0.93	1.36	1.12	1.29	0.90	0.28	1.28	0.82	1.29	0.91
U.S.A.	6.68	2.02	10.32	6.61	7.47	6.83	5.56	15.73	5.30	7.33	7.02	7.27
Bosnia and Herzegovina	0.11	0.15	0.44	0.13	0.25	0.16	0.27	0.32	0.05	0.26	0.30	0.27
Brazil	1.04	0.10	0.60	0.94	0.21	0.75	0.16	1.07	1.54	0.41	0.26	0.38
China	7.80	1.74	0.18	6.87	0.81	5.27	6.47	0.37	0.80	5.02	0.84	4.17
Hong Kong	0.76	0.05	0.15	0.67	0.18	0.54	0.11	0.00	0.00	0.08	0.28	0.12
India	1.14	0.28	0.06	1.01	0.25	0.81	0.53	0.06	0.30	0.43	0.32	0.41
Iran	0.23	0.02	0.09	0.20	0.09	0.17	0.02	0.59	0.09	0.13	0.10	0.12
Croatia	0.60	1.14	1.17	0.68	0.97	0.76	0.57	0.23	0.31	0.49	2.72	0.94
Malaysia	0.48	0.01	0.02	0.42	0.06	0.32	0.30	0.04	0.04	0.24	0.39	0.27
Russian Federation	2.46	0.32	2.25	2.30	2.14	2.26	0.38	13.28	0.06	2.63	2.73	2.65
Saudi Arabia	0.32	0.06	0.30	0.30	0.17	0.27	0.03	1.53	0.00	0.29	0.13	0.26
Serbia	0.31	0.38	0.43	0.33	0.48	0.37	0.21	0.19	0.56	0.23	0.50	0.28
Singapore	0.69	0.00	0.08	0.60	0.12	0.47	0.14	0.00	0.01	0.11	0.17	0.12
South Africa	0.54	0.02	0.31	0.49	0.11	0.39	0.08	1.73	0.42	0.40	0.37	0.39
Taiwan	0.67	0.17	0.06	0.60	0.12	0.47	0.57	0.01	0.01	0.43	0.16	0.37
Thailand	0.53	0.04	0.02	0.46	0.11	0.37	0.39	0.07	0.32	0.33	0.42	0.35
Ukraine	0.54	0.22	0.52	0.52	0.51	0.51	0.20	2.88	0.19	0.67	0.93	0.72
United Arab Emirates	0.30	0.10	0.35	0.29	0.49	0.34	0.08	0.03	0.00	0.06	0.57	0.17
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: OeNB, WIFO.

Table A1 (continued)

Weighting scheme of the new exchange rate index

Competing countries	Exports and imports					
	Manu-factured goods	Raw materi-als, energy products	Food	Goods	Services	Total
	Country weights in %, calculated for the period from 2010 to 2012					
Belgium	2.24	0.49	1.27	1.96	1.54	1.86
Bulgaria	0.38	0.15	0.41	0.35	0.73	0.44
Denmark	0.52	0.15	0.63	0.48	0.59	0.51
Germany	32.19	30.05	36.15	32.19	36.05	33.12
Estonia	0.05	0.03	0.06	0.05	0.09	0.06
Finland	0.55	0.16	0.16	0.48	0.69	0.53
France	4.69	0.98	2.92	4.11	2.47	3.73
Greece	0.22	0.09	0.68	0.23	0.62	0.32
United Kingdom	2.52	0.92	1.47	2.25	3.93	2.64
Ireland	0.63	0.04	0.23	0.53	0.64	0.55
Italy	6.96	9.20	12.75	7.63	5.83	7.21
Latvia	0.04	0.03	0.07	0.04	0.11	0.06
Lithuania	0.08	0.04	0.15	0.08	0.19	0.10
Luxembourg	0.19	0.01	0.04	0.16	0.88	0.33
Malta	0.01	0.01	0.04	0.01	0.15	0.05
Netherlands	2.72	1.71	4.39	2.71	3.39	2.87
Poland	2.32	1.70	2.94	2.28	1.86	2.18
Portugal	0.44	0.10	0.16	0.38	0.34	0.37
Romania	0.99	0.83	0.97	0.97	1.79	1.16
Sweden	1.37	0.38	0.51	1.19	1.35	1.22
Slovakia	1.55	5.12	1.63	2.00	2.23	2.05
Slovenia	0.76	2.78	2.28	1.11	1.39	1.18
Spain	2.10	0.34	2.34	1.90	1.39	1.78
Czech Republic	3.23	5.17	2.86	3.45	2.84	3.31
Hungary	2.03	4.55	4.63	2.52	3.24	2.69
Cyprus	0.03	0.01	0.09	0.03	0.35	0.11
Australia	0.28	0.08	0.34	0.26	0.27	0.26
Chile	0.10	0.20	0.19	0.12	0.05	0.10
Iceland	0.02	0.00	0.01	0.02	0.04	0.02
Israel	0.23	0.08	0.16	0.21	0.22	0.21
Japan	2.23	0.35	0.40	1.88	0.47	1.55
Canada	0.57	0.12	0.09	0.48	0.37	0.46
Mexico	0.45	0.03	0.09	0.37	0.11	0.31
New Zealand	0.05	0.01	0.18	0.05	0.08	0.06
Norway	0.31	1.48	0.22	0.45	0.38	0.43
Switzerland	3.74	2.22	3.43	3.53	5.82	4.07
South Korea	1.24	0.21	0.34	1.05	0.21	0.85
Turkey	1.16	0.55	1.10	1.08	1.19	1.10
U.S.A.	6.14	12.02	7.77	6.98	7.27	7.05
Bosnia and Herzegovina	0.18	0.27	0.24	0.20	0.27	0.22
Brazil	0.61	0.81	1.08	0.67	0.23	0.57
China	7.16	0.74	0.50	5.92	0.82	4.72
Hong Kong	0.45	0.01	0.07	0.37	0.22	0.33
India	0.84	0.12	0.18	0.71	0.28	0.61
Iran	0.13	0.44	0.09	0.16	0.09	0.15
Croatia	0.59	0.47	0.73	0.58	1.72	0.85
Malaysia	0.39	0.03	0.03	0.32	0.20	0.30
Russian Federation	1.46	9.77	1.14	2.47	2.39	2.45
Saudi Arabia	0.18	1.13	0.15	0.30	0.15	0.26
Serbia	0.26	0.24	0.50	0.28	0.49	0.32
Singapore	0.43	0.00	0.04	0.35	0.14	0.30
South Africa	0.32	1.27	0.37	0.44	0.22	0.39
Taiwan	0.62	0.05	0.03	0.51	0.14	0.42
Thailand	0.46	0.06	0.17	0.39	0.25	0.36
Ukraine	0.38	2.16	0.36	0.60	0.69	0.62
United Arab Emirates	0.19	0.05	0.18	0.17	0.52	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: OeNB, WIFO.

Table A2

Competition matrix for manufactured goods exports

Competing countries	Destinations													
	Belgium	Bulgaria	Denmark	Germany	Estonia	Finland	France	Greece	United Kingdom	Ireland	Italy	Latvia	Lithuania	Luxembourg
	Market shares in %, calculated for the period from 2010 to 2012													
Belgium	10.26	1.47	3.16	3.76	2.38	1.57	4.84	2.23	3.65	2.20	1.84	1.85	5.08	16.45
Bulgaria	0.23	47.29	0.11	0.15	0.09	0.02	0.07	1.22	0.06	0.02	0.20	0.19	0.17	0.07
Denmark	0.34	0.22	27.41	0.57	1.38	1.29	0.24	0.29	0.67	0.88	0.16	1.60	1.92	0.20
Germany	16.69	9.03	16.83	54.52	13.47	6.74	10.55	7.24	10.79	6.48	6.88	10.29	14.40	18.52
Estonia	0.05	0.02	0.24	0.03	4.29	1.17	0.01	0.01	0.03	0.01	0.02	5.03	2.50	0.00
Finland	0.44	0.21	1.12	0.34	9.81	60.70	0.16	0.19	0.39	0.17	0.15	2.18	1.76	0.08
France	9.43	2.39	2.97	4.61	2.00	1.39	57.26	3.03	4.06	2.43	3.21	1.64	2.89	7.03
Greece	0.07	3.13	0.15	0.09	0.05	0.02	0.05	54.07	0.11	0.03	0.14	0.05	0.09	0.03
United Kingdom	5.11	1.19	3.48	2.17	2.04	1.47	1.95	1.78	41.93	20.05	1.28	1.50	2.26	1.40
Ireland	5.88	0.21	0.56	0.47	0.14	0.19	0.45	0.47	1.72	43.78	0.33	0.27	0.30	0.30
Italy	3.58	6.03	2.77	3.24	3.59	1.35	4.43	6.67	2.90	1.38	68.09	3.26	5.08	2.25
Latvia	0.02	0.05	0.30	0.03	7.59	0.14	0.01	0.01	0.02	0.01	0.01	21.10	6.93	0.01
Lithuania	0.07	0.14	0.54	0.09	4.17	0.16	0.05	0.02	0.07	0.07	0.03	7.95	7.05	0.03
Luxembourg	0.48	0.05	0.13	0.18	0.07	0.04	0.18	0.03	0.07	0.04	0.06	0.05	0.08	31.45
Malta	0.01	0.02	0.02	0.03	0.00	0.01	0.02	0.03	0.03	0.01	0.02	0.00	0.01	0.00
Netherlands	10.53	1.76	4.98	4.14	3.31	2.34	2.66	2.26	3.79	2.64	1.75	2.38	3.77	4.29
Poland	1.13	1.31	2.65	2.26	5.44	0.69	0.87	0.83	1.40	0.44	0.86	6.15	10.45	0.82
Portugal	0.36	0.13	0.35	0.41	0.18	0.09	0.55	0.17	0.36	0.19	0.17	0.13	0.14	0.16
Romania	0.31	3.32	0.22	0.59	0.32	0.10	0.37	0.62	0.26	0.13	0.66	0.20	0.27	0.05
Sweden	2.06	0.41	9.21	0.80	10.52	5.83	0.55	0.46	1.03	0.52	0.39	2.74	3.35	0.45
Slovakia	0.37	1.20	0.63	0.87	0.40	0.16	0.41	0.28	0.39	0.11	0.36	1.22	0.90	0.29
Slovenia	0.10	0.69	0.29	0.32	0.32	0.05	0.17	0.10	0.09	0.03	0.23	0.29	0.49	0.13
Spain	1.93	0.90	1.11	1.39	0.74	0.48	3.50	2.21	1.74	0.99	1.68	0.65	1.01	0.86
Czech Republic	1.16	1.66	1.27	2.61	1.71	0.57	0.71	0.45	0.98	0.44	0.56	1.60	2.53	0.58
Hungary	0.43	2.39	0.70	1.39	1.07	0.19	0.41	0.38	0.64	0.25	0.41	1.14	1.07	0.34
Cyprus	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.41	0.01	0.00	0.00	0.02	0.03	0.00
Australia	0.10	0.03	0.09	0.04	0.02	0.03	0.03	0.02	0.21	0.08	0.03	0.03	0.01	0.01
Chile	0.37	0.00	0.02	0.01	0.00	0.00	0.09	0.43	0.01	0.00	0.20	0.00	0.00	0.00
Iceland	0.00	0.00	0.03	0.04	0.02	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.07
Israel	1.05	0.45	0.09	0.10	0.10	0.10	0.12	0.25	0.42	0.09	0.12	0.31	0.20	0.06
Japan	2.09	0.22	0.45	1.20	1.14	0.65	0.62	0.42	1.64	1.03	0.49	0.35	0.26	0.92
Canada	0.51	0.04	0.17	0.13	0.35	0.18	0.18	0.07	0.76	0.36	0.08	0.67	0.29	0.44
Mexico	0.24	0.01	0.15	0.24	0.02	0.05	0.07	0.02	0.14	0.30	0.09	0.02	0.32	0.03
New Zealand	0.01	0.00	0.03	0.01	0.01	0.01	0.01	0.00	0.03	0.02	0.01	0.01	0.01	0.00
Norway	0.26	0.03	1.55	0.21	1.39	0.61	0.09	0.14	0.34	0.37	0.06	0.35	0.62	0.13
Switzerland	1.41	0.91	1.15	2.17	0.83	0.63	1.29	1.56	1.64	0.98	1.40	1.41	0.82	1.13
South Korea	0.65	0.46	0.52	0.55	0.76	0.45	0.34	2.07	0.70	0.48	0.38	1.31	0.72	0.27
Turkey	0.61	4.42	0.93	0.68	1.03	0.18	0.54	1.46	1.02	0.41	0.64	0.65	1.42	0.17
U.S.A.	8.02	0.54	1.94	2.21	1.49	1.52	1.56	0.88	4.68	7.07	1.13	2.25	3.93	2.70
Bosnia and Herzegovina	0.01	0.03	0.00	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.06	0.00	0.01	0.13
Brazil	0.37	0.15	0.33	0.19	0.32	0.08	0.09	0.04	0.20	0.17	0.18	0.07	0.06	0.06
China	5.30	2.94	6.90	4.15	8.26	4.79	2.57	5.10	6.09	2.69	3.14	8.38	7.97	6.29
Hong Kong	0.86	0.14	0.84	0.64	0.96	0.76	0.44	0.23	1.08	0.37	0.38	1.10	0.51	0.37
India	1.60	0.29	0.79	0.38	0.59	0.19	0.27	0.32	0.95	0.40	0.41	0.65	0.50	0.03
Iran	0.12	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00
Croatia	0.03	0.11	0.04	0.07	0.04	0.02	0.02	0.03	0.02	0.02	0.15	0.05	0.06	1.05
Malaysia	0.20	0.09	0.18	0.29	0.23	0.15	0.19	0.08	0.29	0.23	0.08	0.34	0.19	0.01
Russian Federation	1.17	1.36	0.97	0.27	4.33	1.75	0.04	0.35	0.17	0.22	0.48	6.09	4.69	0.02
Saudi Arabia	0.47	0.07	0.00	0.02	0.06	0.01	0.03	0.20	0.08	0.01	0.12	0.00	0.10	0.02
Serbia	0.02	0.49	0.02	0.06	0.01	0.01	0.02	0.11	0.02	0.01	0.11	0.03	0.19	0.00
Singapore	1.26	0.05	0.27	0.33	0.09	0.12	0.51	0.06	0.70	0.70	0.05	0.14	0.08	0.03
South Africa	0.49	0.05	0.02	0.25	0.20	0.04	0.06	0.05	0.39	0.09	0.08	0.02	0.07	0.04
Taiwan	0.37	0.31	0.42	0.37	1.04	0.56	0.15	0.21	0.63	0.23	0.23	0.91	0.82	0.17
Thailand	0.48	0.06	0.70	0.17	0.45	0.26	0.13	0.24	0.38	0.33	0.12	0.27	0.35	0.04
Ukraine	0.05	1.42	0.14	0.08	1.12	0.03	0.02	0.18	0.05	0.00	0.21	1.03	1.11	0.01
United Arab Emirates	0.84	0.05	0.02	0.03	0.04	0.08	0.04	0.03	0.15	0.01	0.04	0.08	0.16	0.02
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Single export weights	1.53	0.54	0.57	30.84	0.08	0.45	4.69	0.37	3.14	0.26	5.76	0.11	0.14	0.15

Source: OeNB, WIFO.

Table A2 (continued)

Competition matrix for manufactured goods exports

Competing countries	Destinations													
	Malta	Neth-erlands	Poland	Portu-gal	Roma-nia	Swe-den	Slova-kia	Slove-nia	Spain	Czech Repub-lic	Hun-gary	Cyprus	Aus-tralia	Chile
	Market shares in %, calculated for the period from 2010 to 2012													
Belgium	1.13	8.74	2.22	2.16	1.56	2.29	1.56	2.62	1.75	2.05	2.23	1.71	0.52	0.47
Bulgaria	0.06	0.07	0.13	0.02	1.77	0.04	0.20	0.31	0.05	0.13	0.25	0.29	0.00	0.01
Denmark	0.28	0.76	0.57	0.23	0.36	3.12	0.43	0.32	0.26	0.32	0.56	0.58	0.18	0.15
Germany	4.48	18.58	16.57	8.70	12.83	10.51	18.52	19.70	6.99	21.55	20.64	6.65	2.54	2.97
Estonia	0.02	0.03	0.07	0.01	0.01	0.84	0.04	0.03	0.02	0.04	0.03	0.06	0.00	0.00
Finland	0.23	1.10	0.60	0.13	0.23	2.32	0.21	0.44	0.18	0.21	0.42	0.12	0.17	0.28
France	4.94	4.34	2.83	4.35	4.69	2.66	3.94	5.58	5.22	2.51	3.86	2.27	0.99	0.99
Greece	0.31	0.09	0.08	0.12	0.77	0.04	0.06	0.15	0.06	0.06	0.09	9.53	0.02	0.02
United Kingdom	5.16	4.54	1.81	1.68	1.63	2.85	1.20	1.47	1.89	1.76	1.75	4.79	1.32	0.55
Ireland	0.18	0.96	0.27	0.50	0.53	0.31	0.11	0.16	0.65	0.33	0.30	0.26	0.20	0.07
Italy	7.84	2.78	4.19	4.40	9.20	1.82	4.43	15.43	3.65	3.09	4.47	6.30	0.89	1.09
Latvia	0.02	0.03	0.15	0.00	0.04	0.14	0.04	0.03	0.00	0.03	0.02	0.37	0.00	0.00
Lithuania	0.02	0.08	0.26	0.06	0.06	0.31	0.07	0.05	0.03	0.09	0.11	0.03	0.00	0.00
Luxembourg	0.05	0.19	0.11	0.04	0.06	0.08	0.08	0.21	0.04	0.09	0.06	0.20	0.01	0.02
Malta	3.23	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.00	0.01	0.03	0.00	0.00
Netherlands	2.09	3.23	3.06	2.78	2.00	2.81	2.11	3.21	1.94	4.34	2.95	2.36	0.46	0.42
Poland	0.52	1.70	46.33	0.61	2.53	1.81	5.15	2.20	0.66	5.27	4.34	1.64	0.08	0.06
Portugal	0.21	0.42	0.16	47.40	0.39	0.17	0.18	0.18	1.75	0.23	0.19	0.32	0.02	0.12
Romania	0.08	0.38	0.49	0.18	36.40	0.19	1.23	1.03	0.20	0.58	2.46	0.70	0.01	0.02
Sweden	0.13	1.61	1.26	0.49	0.37	54.73	0.48	0.56	0.41	0.69	0.76	0.31	0.50	0.42
Slovakia	0.18	0.52	1.73	0.20	1.60	0.54	20.65	2.24	0.28	5.14	3.64	0.54	0.03	0.02
Slovenia	0.06	0.15	0.31	0.07	0.54	0.11	0.54	8.65	0.05	0.41	0.70	0.11	0.01	0.01
Spain	1.29	1.45	1.27	16.66	1.78	0.79	1.00	2.14	63.78	1.15	1.65	2.39	0.43	1.18
Czech Republic	0.44	1.47	2.87	0.53	2.02	1.00	14.88	2.74	0.57	34.99	3.37	0.90	0.09	0.06
Hungary	0.12	0.64	1.23	0.36	4.83	0.40	6.49	3.04	0.46	2.13	23.82	0.17	0.06	0.03
Cyprus	0.06	0.00	0.00	0.00	0.02	0.00	0.01	0.02	0.00	0.01	0.00	18.72	0.00	0.00
Australia	0.05	0.12	0.01	0.01	0.02	0.04	0.00	0.03	0.02	0.01	0.01	0.04	64.33	0.18
Chile	0.00	0.51	0.00	0.01	0.00	0.01	0.00	0.00	0.08	0.00	0.00	0.01	0.19	57.69
Iceland	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Israel	1.90	0.48	0.08	0.13	0.24	0.06	0.04	0.31	0.17	0.10	0.17	7.44	0.13	0.14
Japan	4.38	4.64	0.81	0.45	0.46	0.63	0.75	0.40	0.51	1.08	1.82	1.98	3.66	1.86
Canada	0.84	0.55	0.10	0.10	0.09	0.14	0.10	0.16	0.08	0.06	0.28	0.18	0.33	0.49
Mexico	0.01	0.41	0.04	0.09	0.15	0.03	0.03	0.05	0.09	0.09	0.59	0.06	0.14	2.05
New Zealand	0.02	0.03	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.79	0.03
Norway	0.11	0.74	0.26	0.13	0.24	1.48	0.03	0.06	0.12	0.14	0.07	0.42	0.05	0.12
Switzerland	0.56	1.47	0.74	0.92	1.04	0.66	0.75	1.53	1.02	1.06	1.11	0.57	0.57	0.25
South Korea	25.60	0.91	1.52	0.73	0.60	0.35	7.08	5.16	0.30	1.04	1.92	5.50	1.42	2.28
Turkey	3.25	0.65	0.57	0.47	3.21	0.42	0.63	2.25	0.61	0.47	0.53	4.97	0.07	0.13
U.S.A.	0.82	7.30	0.72	0.64	0.66	1.73	0.32	0.87	1.14	0.86	1.50	0.80	5.20	9.35
Bosnia and Herzegovina	0.01	0.02	0.02	0.01	0.05	0.01	0.07	1.50	0.01	0.02	0.08	0.01	0.00	0.00
Brazil	0.03	1.16	0.09	0.35	0.06	0.08	0.04	0.07	0.18	0.02	0.11	0.03	0.09	2.97
China	22.91	15.82	4.01	2.72	3.99	2.63	3.70	7.20	3.22	4.65	7.28	9.51	7.65	11.06
Hong Kong	0.24	1.59	0.28	0.25	0.39	0.45	0.30	0.27	0.34	0.47	1.41	0.22	1.20	0.53
India	1.07	0.96	0.23	0.48	0.39	0.28	0.13	0.85	0.42	0.16	0.31	0.36	0.43	0.57
Iran	0.32	0.06	0.00	0.01	0.02	0.01	0.00	0.19	0.01	0.00	0.00	0.00	0.00	0.00
Croatia	0.58	0.05	0.04	0.01	0.12	0.02	0.14	3.13	0.01	0.07	0.15	0.25	0.00	0.00
Malaysia	0.32	1.26	0.11	0.07	0.07	0.13	0.15	0.11	0.07	0.22	0.30	0.23	0.91	0.11
Russian Federation	0.82	2.24	0.51	0.04	0.30	0.17	0.63	0.36	0.05	0.50	0.57	4.06	0.02	0.02
Saudi Arabia	0.09	0.20	0.09	0.12	0.02	0.05	0.01	0.09	0.09	0.01	0.00	0.06	0.05	0.06
Serbia	0.01	0.03	0.05	0.01	0.42	0.02	0.29	1.65	0.01	0.09	0.21	0.37	0.00	0.00
Singapore	1.30	1.73	0.10	0.08	0.09	0.10	0.08	0.16	0.06	0.48	0.73	0.08	1.53	0.05
South Africa	0.05	0.29	0.09	0.06	0.03	0.07	0.00	0.09	0.09	0.08	0.09	0.04	0.18	0.08
Taiwan	0.50	1.23	0.27	0.24	0.16	0.27	0.44	0.79	0.21	0.34	0.59	0.32	0.74	0.40
Thailand	0.18	0.99	0.16	0.15	0.13	0.21	0.23	0.12	0.13	0.61	0.42	0.22	1.72	0.54
Ukraine	0.07	0.08	0.49	0.02	0.72	0.02	0.43	0.04	0.03	0.16	1.03	0.55	0.01	0.01
United Arab Emirates	0.84	0.14	0.02	0.03	0.06	0.01	0.00	0.02	0.02	0.02	0.02	0.34	0.06	0.04
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Single export weights	0.02	1.54	2.93	0.29	1.57	1.21	1.84	1.51	1.76	3.55	2.64	0.10	0.63	0.13

Source: OeNB, WIFO.

Table A2 (continued)

Competition matrix for manufactured goods exports

Competing countries	Destinations													
	Iceland	Israel	Japan	Canada	Mexico	New Zealand	Norway	Switzerland	South Korea	Turkey	U.S.A.	Bosnia and Herzegovina	Brazil	China
	Market shares in %, calculated for the period from 2010 to 2012													
Belgium	2.30	3.49	0.15	0.36	0.28	0.47	1.30	2.23	0.12	1.22	0.45	0.96	0.31	0.08
Bulgaria	0.02	0.05	0.00	0.00	0.00	0.01	0.02	0.07	0.00	0.28	0.00	0.71	0.00	0.00
Denmark	9.06	0.15	0.03	0.12	0.07	0.24	3.47	0.32	0.04	0.12	0.10	0.23	0.06	0.02
Germany	10.78	5.14	0.72	1.51	2.23	2.17	6.82	20.93	1.22	5.90	1.97	15.63	1.51	0.83
Estonia	0.33	0.02	0.00	0.00	0.01	0.00	0.30	0.01	0.00	0.01	0.01	0.01	0.01	0.00
Finland	0.98	0.15	0.03	0.07	0.06	0.15	1.30	0.27	0.06	0.22	0.08	0.05	0.08	0.03
France	1.65	1.67	0.26	0.43	0.53	0.83	1.14	5.40	0.36	2.08	0.55	1.65	0.53	0.16
Greece	0.06	0.19	0.00	0.01	0.01	0.03	0.02	0.05	0.00	0.17	0.01	0.45	0.00	0.00
United Kingdom	5.48	2.65	0.24	0.77	0.29	1.38	2.94	3.49	0.25	1.09	0.94	0.56	0.35	0.11
Ireland	0.47	0.65	0.09	0.12	0.15	0.18	0.18	2.30	0.03	0.14	0.53	0.29	0.04	0.02
Italy	2.95	2.96	0.21	0.42	0.78	0.85	1.12	7.82	0.30	2.59	0.54	11.07	0.61	0.12
Latvia	0.34	0.02	0.00	0.00	0.00	0.00	0.16	0.02	0.00	0.01	0.00	0.01	0.00	0.00
Lithuania	0.52	0.01	0.00	0.01	0.00	0.00	0.33	0.02	0.00	0.01	0.01	0.02	0.00	0.00
Luxembourg	0.05	0.02	0.00	0.02	0.02	0.01	0.05	0.07	0.00	0.04	0.01	0.02	0.00	0.00
Malta	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	9.39	1.79	0.11	0.19	0.21	0.36	2.24	2.05	0.32	1.18	0.30	1.41	0.19	0.06
Poland	1.00	0.35	0.02	0.12	0.08	0.10	2.06	0.60	0.03	0.66	0.06	2.11	0.04	0.02
Portugal	0.19	0.12	0.01	0.02	0.06	0.02	0.08	0.18	0.01	0.08	0.03	0.06	0.04	0.00
Romania	0.04	0.14	0.00	0.02	0.01	0.01	0.34	0.13	0.02	0.56	0.02	1.44	0.02	0.00
Sweden	6.19	0.46	0.07	0.20	0.17	0.28	9.71	0.58	0.10	0.41	0.19	0.63	0.18	0.05
Slovakia	0.23	0.08	0.00	0.03	0.02	0.03	0.13	0.35	0.01	0.27	0.03	1.23	0.01	0.02
Slovenia	0.08	0.05	0.00	0.01	0.01	0.01	0.04	0.12	0.00	0.07	0.01	10.80	0.01	0.00
Spain	0.68	1.37	0.06	0.16	0.76	0.26	0.67	1.50	0.06	1.28	0.14	1.46	0.31	0.03
Czech Republic	0.89	0.81	0.02	0.03	0.08	0.09	0.55	1.03	0.03	0.34	0.06	2.40	0.04	0.01
Hungary	0.21	0.44	0.02	0.04	0.09	0.08	0.15	0.35	0.02	0.38	0.04	4.08	0.03	0.02
Cyprus	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Australia	0.09	0.12	0.09	0.06	0.07	10.68	0.02	0.14	0.18	0.03	0.09	0.01	0.02	0.04
Chile	0.43	0.00	0.02	0.08	0.20	0.05	0.02	0.08	0.19	0.09	0.09	0.00	0.31	0.12
Iceland	22.94	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Israel	0.14	39.06	0.03	0.12	0.08	0.14	0.04	0.50	0.06	0.35	0.38	0.03	0.10	0.03
Japan	1.47	2.10	86.91	1.45	2.18	3.33	0.88	1.02	4.71	0.67	2.53	0.01	0.64	1.47
Canada	0.68	0.35	0.06	51.04	0.74	0.50	0.35	0.22	0.09	0.08	3.58	0.02	0.22	0.04
Mexico	0.01	0.11	0.05	1.34	48.60	0.12	0.03	0.19	0.04	0.04	4.20	0.01	0.50	0.02
New Zealand	0.02	0.01	0.04	0.02	0.01	58.26	0.01	0.00	0.02	0.00	0.02	0.00	0.00	0.00
Norway	7.12	0.03	0.03	0.03	0.01	0.03	55.94	0.12	0.14	0.06	0.05	0.04	0.04	0.02
Switzerland	0.69	1.13	0.25	0.46	0.29	0.42	0.59	36.03	0.20	0.48	0.45	1.08	0.25	0.09
South Korea	4.11	1.79	0.96	0.71	2.01	1.36	1.08	0.27	79.21	1.11	1.06	0.31	0.99	1.24
Turkey	0.29	2.49	0.01	0.08	0.03	0.09	0.25	0.30	0.01	68.91	0.08	3.97	0.08	0.01
U.S.A.	2.72	14.06	1.50	34.31	31.82	3.62	1.53	4.31	2.30	1.14	71.14	0.24	3.02	0.59
Bosnia and Herzegovina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	13.44	0.00	0.00
Brazil	0.01	0.13	0.06	0.10	0.81	0.05	0.04	0.29	0.09	0.10	0.28	0.03	84.87	0.03
China	2.57	7.57	4.73	3.83	4.99	6.69	2.25	1.44	6.09	3.57	6.45	0.74	3.17	90.55
Hong Kong	0.33	2.10	0.65	0.48	0.45	1.04	0.24	1.23	0.61	0.21	0.89	0.09	0.21	2.32
India	1.53	2.43	0.08	0.23	0.25	0.42	0.16	0.36	0.16	0.59	0.53	0.08	0.24	0.08
Iran	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.24	0.00	0.00	0.00	0.03
Croatia	0.04	0.01	0.00	0.00	0.00	0.01	0.07	0.04	0.00	0.03	0.01	9.85	0.00	0.00
Malaysia	0.05	0.00	0.41	0.14	0.34	0.91	0.07	0.08	0.31	0.15	0.35	0.02	0.08	0.21
Russian Federation	0.21	0.79	0.07	0.03	0.09	0.01	0.27	1.11	0.10	1.17	0.10	0.33	0.18	0.04
Saudi Arabia	0.02	0.00	0.02	0.00	0.01	0.35	0.03	0.06	0.08	0.45	0.02	0.08	0.01	0.09
Serbia	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.02	0.00	11.67	0.00	0.00
Singapore	0.05	0.67	0.57	0.19	0.35	1.87	0.26	0.34	1.15	0.10	0.44	0.03	0.14	0.35
South Africa	0.02	0.52	0.19	0.05	0.04	0.13	0.03	0.93	0.06	0.06	0.14	0.00	0.06	0.02
Taiwan	0.18	0.68	0.63	0.35	0.35	0.68	0.27	0.18	0.93	0.38	0.67	0.02	0.20	0.83
Thailand	0.06	0.73	0.61	0.13	0.28	1.53	0.16	0.43	0.21	0.22	0.34	0.09	0.19	0.18
Ukraine	0.19	0.28	0.00	0.01	0.05	0.01	0.05	0.02	0.03	0.56	0.02	0.43	0.04	0.00
United Arab Emirates	0.05	0.00	0.01	0.05	0.01	0.13	0.19	0.34	0.01	0.11	0.03	0.02	0.05	0.01
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Single export weights	0.02	0.21	1.04	0.78	0.43	0.07	0.43	5.02	0.74	0.99	5.56	0.27	0.89	2.73

Source: OeNB, WIFO.

Table A2 (continued)

Competition matrix for manufactured goods exports

Competing countries	Destinations															
	Hong Kong	India	Iran	Croatia	Malaysia	Russian Federation	Saudi Arabia	Serbia	Singapore	South Africa	Taiwan	Thailand	Ukraine	United Arab Emirates	Rest of the world	Double export weight
	Market shares in %, calculated for the period from 2010 to 2012															
Belgium	0.58	0.89	0.26	0.84	0.18	0.61	0.84	1.12	0.40	1.00	0.23	0.32	0.84	1.48	1.37	2.63
Bulgaria	0.01	0.00	0.03	0.23	0.01	0.07	0.05	2.32	0.01	0.01	0.01	0.01	0.15	0.02	0.13	0.41
Denmark	0.05	0.03	0.07	0.39	0.04	0.13	0.16	0.40	0.24	0.13	0.04	0.06	0.24	0.16	0.43	0.59
Germany	1.32	1.12	2.25	9.79	1.99	4.93	4.65	10.28	2.92	6.15	2.01	1.23	6.67	5.80	8.63	23.95
Estonia	0.00	0.00	0.00	0.02	0.00	0.26	0.00	0.02	0.00	0.01	0.00	0.00	0.13	0.00	0.03	0.06
Finland	0.03	0.06	0.04	0.32	0.07	0.71	0.17	0.22	0.12	0.27	0.06	0.06	0.46	0.21	0.49	0.61
France	1.09	0.32	1.10	1.53	0.89	1.11	2.22	1.70	2.25	1.41	0.52	0.56	1.06	2.28	3.78	5.96
Greece	0.01	0.00	0.01	0.15	0.00	0.04	0.05	1.01	0.02	0.02	0.00	0.00	0.06	0.14	0.18	0.32
United Kingdom	1.31	0.52	0.17	0.80	0.68	0.80	2.21	0.81	1.93	2.47	0.36	0.60	0.75	3.73	1.84	3.16
Ireland	0.16	0.02	0.04	0.18	0.20	0.05	0.34	0.36	0.26	0.19	0.06	0.05	0.06	0.21	0.17	0.69
Italy	1.00	0.38	1.42	8.14	0.39	1.39	2.29	7.96	0.75	1.08	0.33	0.44	2.11	3.02	3.65	7.20
Latvia	0.00	0.00	0.00	0.02	0.00	0.09	0.00	0.02	0.00	0.00	0.00	0.00	0.11	0.01	0.04	0.07
Lithuania	0.00	0.01	0.00	0.05	0.00	0.38	0.01	0.09	0.00	0.00	0.00	0.00	0.27	0.01	0.16	0.11
Luxembourg	0.02	0.01	0.01	0.02	0.00	0.02	0.03	0.04	0.02	0.03	0.00	0.00	0.02	0.05	0.04	0.15
Malta	0.07	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.11	0.00	0.00	0.00	0.00	0.01	0.02	0.02
Netherlands	0.25	0.16	0.34	1.49	0.27	0.78	0.98	1.67	0.92	1.13	0.78	0.27	1.23	1.30	1.52	2.73
Poland	0.05	0.03	0.05	1.13	0.06	0.87	0.10	1.87	0.17	0.28	0.04	0.04	4.15	0.16	0.59	2.95
Portugal	0.02	0.01	0.02	0.07	0.01	0.02	0.07	0.04	0.03	0.06	0.01	0.01	0.03	0.06	0.44	0.42
Romania	0.02	0.02	0.14	0.35	0.01	0.15	0.08	2.67	0.02	0.09	0.00	0.00	0.56	0.12	0.29	1.05
Sweden	0.12	0.14	0.38	0.61	0.17	0.40	0.65	0.71	0.39	0.68	0.12	0.20	0.39	0.33	0.71	1.42
Slovakia	0.01	0.01	0.01	0.94	0.01	0.36	0.03	2.18	0.01	0.05	0.01	0.01	0.55	0.06	0.35	1.20
Slovenia	0.01	0.01	0.03	4.83	0.00	0.12	0.02	4.64	0.01	0.02	0.01	0.01	0.28	0.04	0.21	0.44
Spain	0.17	0.13	0.41	0.82	0.12	0.29	0.84	0.81	0.27	0.59	0.11	0.12	0.36	0.71	1.91	2.44
Czech Republic	0.07	0.07	0.04	1.52	0.04	0.59	0.15	1.84	0.06	0.28	0.03	0.04	1.41	0.32	0.67	2.91
Hungary	0.05	0.03	0.01	2.90	0.06	0.38	0.11	4.15	0.23	0.41	0.02	0.04	2.08	0.76	0.44	1.66
Cyprus	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02
Australia	0.25	0.07	0.02	0.00	0.64	0.01	0.53	0.01	0.52	0.38	0.44	0.48	0.01	0.32	0.52	0.49
Chile	0.01	0.01	0.00	0.00	0.05	0.00	0.04	0.06	0.00	0.05	0.43	0.04	0.00	0.01	0.46	0.15
Iceland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Israel	0.92	0.25	0.00	0.09	0.27	0.08	0.00	0.07	0.21	0.24	0.19	0.16	0.18	0.01	0.42	0.28
Japan	6.44	0.85	0.88	0.14	5.73	1.31	4.07	0.12	6.82	2.37	12.13	10.79	0.59	4.35	6.92	2.49
Canada	0.19	0.12	0.04	0.16	0.21	0.11	0.37	0.04	0.27	0.24	0.16	0.12	0.11	0.38	0.53	0.78
Mexico	0.07	0.03	0.00	0.01	0.04	0.03	0.07	0.00	0.21	0.12	0.07	0.07	0.04	0.16	1.32	0.65
New Zealand	0.03	0.01	0.00	0.00	0.03	0.00	0.02	0.00	0.05	0.03	0.02	0.02	0.00	0.03	0.08	0.06
Norway	0.02	0.02	0.02	0.17	0.06	0.04	0.04	0.05	0.38	0.06	0.05	0.02	0.02	0.15	0.18	0.42
Switzerland	1.54	0.25	0.35	0.79	0.24	0.34	0.96	0.98	1.21	0.44	0.45	0.35	0.48	1.51	1.24	3.07
South Korea	4.92	0.98	3.37	0.32	2.00	1.14	3.94	0.19	5.01	1.09	3.58	2.07	1.03	3.54	5.97	1.79
Turkey	0.05	0.03	1.77	0.82	0.03	0.55	1.38	2.94	0.14	0.18	0.02	0.04	1.33	1.40	2.26	1.40
U.S.A.	4.33	1.30	0.06	0.52	3.80	0.73	7.06	0.46	7.98	2.97	4.91	2.06	0.87	6.17	8.40	6.68
Bosnia and Herzegovina	0.00	0.00	0.00	1.72	0.00	0.00	0.00	1.17	0.00	0.00	0.00	0.00	0.01	0.00	0.05	0.11
Brazil	0.08	0.06	0.06	0.01	0.06	0.02	0.18	0.02	0.43	0.57	0.13	0.16	0.06	0.16	2.76	1.04
China	50.34	4.08	7.48	5.40	9.47	4.36	8.31	2.05	12.65	7.63	8.36	7.09	7.12	14.25	19.69	7.80
Hong Kong	3.97	0.95	0.09	0.14	1.24	0.22	0.38	0.15	2.59	0.45	2.51	1.52	0.21	1.95	1.65	0.76
India	2.16	82.91	0.76	0.31	0.76	0.17	1.58	0.21	1.90	1.61	0.21	0.63	0.42	14.26	2.78	1.14
Iran	0.00	0.14	68.53	0.01	0.03	0.00	0.03	0.00	0.02	0.01	0.08	0.02	0.02	1.13	0.50	0.23
Croatia	0.00	0.00	0.01	50.00	0.00	0.04	0.01	1.89	0.00	0.02	0.00	0.00	0.05	0.02	0.12	0.60
Malaysia	1.83	0.37	0.22	0.04	54.54	0.06	0.53	0.03	7.33	0.36	1.03	2.53	0.07	1.91	1.22	0.48
Russian Federation	0.09	0.38	1.29	0.36	0.10	74.23	0.14	1.52	0.04	0.04	0.38	0.16	8.78	0.27	1.26	2.46
Saudi Arabia	0.12	0.24	0.09	0.21	0.10	0.02	48.74	0.04	1.24	0.34	0.43	0.28	0.10	1.56	0.64	0.32
Serbia	0.00	0.00	0.02	1.08	0.00	0.07	0.00	40.51	0.00	0.00	0.00	0.00	0.11	0.00	0.10	0.31
Singapore	6.47	0.89	0.15	0.12	10.31	0.05	0.43	0.03	32.06	0.40	3.41	3.78	0.02	2.07	3.78	0.69
South Africa	0.14	0.07	0.03	0.01	0.10	0.01	0.10	0.01	0.09	62.44	0.14	0.08	0.02	0.31	1.59	0.54
Taiwan	6.74	0.32	0.45	0.18	2.05	0.17	0.66	0.04	4.94	0.47	55.29	1.66	0.18	0.83	1.73	0.67
Thailand	2.34	0.39	0.29	0.06	2.83	0.10	1.23	0.02	2.36	0.94	0.73	61.60	0.12	1.45	2.51	0.53
Ukraine	0.00	0.08	0.29	0.13	0.04	1.53	0.13	0.35	0.06	0.01	0.02	0.08	53.95	0.15	0.85	0.54
United Arab Emirates	0.50	1.22	6.90	0.02	0.07	0.05	3.00	0.03	0.33	0.18	0.04	0.12	0.11	20.66	2.35	0.30
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Single export weights	0.53	0.66	0.27	0.93	0.29	2.65	0.47	0.45	0.33	0.47	0.30	0.24	0.60	0.49	3.79	100.00

Source: OeNB, WIFO.

Table A3

Comparison of weights for manufactured goods across different calculation periods

Competing countries	1998 to 2000				2001 to 2003				2004 to 2006			
	Austrian exports (single weights)	Austrian exports (double weights)	Austrian imports	Total	Austrian exports (single weights)	Austrian exports (double weights)	Austrian imports	Total	Austrian exports (single weights)	Austrian exports (double weights)	Austrian imports	Total
	%											
Belgium	1.82	2.77	2.21	2.48	1.72	2.88	1.89	2.38	1.73	2.96	1.71	2.35
Bulgaria	0.34	0.19	0.11	0.15	0.38	0.20	0.17	0.18	0.52	0.28	0.28	0.28
Denmark	0.86	0.80	0.64	0.72	0.77	0.76	0.59	0.68	0.74	0.69	0.55	0.63
Germany	36.82	29.95	43.28	36.86	33.43	27.23	42.28	34.85	31.93	25.25	43.07	33.89
Estonia	0.05	0.04	0.03	0.03	0.08	0.06	0.03	0.04	0.18	0.09	0.03	0.06
Finland	0.62	0.91	1.12	1.02	0.59	0.86	1.11	0.99	0.58	0.81	1.06	0.93
France	4.75	6.61	5.22	5.89	4.69	6.52	4.23	5.36	4.12	5.87	4.17	5.04
Greece	0.45	0.34	0.15	0.24	0.59	0.41	0.13	0.27	0.52	0.38	0.12	0.25
United Kingdom	4.71	5.47	3.37	4.38	4.95	5.16	2.67	3.90	4.43	4.51	2.28	3.43
Ireland	0.32	0.82	0.75	0.78	0.31	0.90	1.27	1.08	0.48	0.80	0.86	0.83
Italy	6.85	8.74	7.80	8.25	6.93	8.83	7.22	8.02	7.15	8.60	7.07	7.85
Latvia	0.06	0.03	0.02	0.03	0.10	0.05	0.03	0.04	0.13	0.07	0.02	0.05
Lithuania	0.08	0.06	0.04	0.05	0.11	0.09	0.04	0.06	0.15	0.12	0.04	0.08
Luxembourg	0.20	0.18	0.17	0.18	0.19	0.18	0.17	0.17	0.23	0.19	0.23	0.21
Malta	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.11	0.02	0.01	0.02
Netherlands	2.45	2.40	2.95	2.68	2.26	2.46	2.78	2.62	1.83	2.52	2.74	2.62
Poland	1.69	1.61	0.76	1.17	1.80	1.82	0.96	1.39	2.24	2.21	1.12	1.68
Portugal	0.49	0.58	0.56	0.57	0.50	0.57	0.61	0.59	0.45	0.48	0.49	0.48
Romania	0.68	0.50	0.42	0.46	1.24	0.69	0.74	0.72	1.79	0.96	0.94	0.95
Sweden	1.22	1.58	1.49	1.53	1.12	1.44	1.42	1.43	1.10	1.42	1.46	1.44
Slovakia	1.11	0.78	1.07	0.93	1.45	0.90	1.46	1.18	1.67	1.00	1.46	1.22
Slovenia	1.68	0.93	1.00	0.97	1.74	0.98	1.19	1.09	1.79	0.89	1.19	1.04
Spain	3.06	3.15	1.41	2.25	2.87	3.15	1.53	2.33	2.99	3.15	1.57	2.38
Czech Republic	2.78	2.14	2.13	2.14	3.12	2.39	2.72	2.56	3.22	2.63	3.11	2.86
Hungary	4.93	2.50	3.02	2.77	4.46	2.22	3.24	2.74	3.62	1.93	2.38	2.15
Cyprus	0.05	0.02	0.00	0.01	0.09	0.02	0.00	0.01	0.04	0.01	0.01	0.01
Australia	0.50	0.41	0.03	0.22	0.54	0.44	0.05	0.24	0.67	0.52	0.07	0.30
Chile	0.05	0.07	0.01	0.04	0.05	0.07	0.01	0.04	0.08	0.11	0.01	0.06
Iceland	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.02	0.04	0.03	0.00	0.02
Israel	0.23	0.29	0.15	0.22	0.17	0.26	0.12	0.19	0.13	0.23	0.09	0.16
Japan	1.03	3.14	2.97	3.05	1.02	2.88	2.66	2.77	1.07	2.87	2.52	2.70
Canada	0.76	0.68	0.55	0.61	0.85	0.78	0.47	0.62	1.00	0.91	0.43	0.68
Mexico	0.23	0.41	0.14	0.27	0.21	0.44	0.19	0.31	0.24	0.49	0.16	0.33
New Zealand	0.07	0.05	0.01	0.03	0.08	0.06	0.01	0.04	0.09	0.07	0.02	0.05
Norway	0.47	0.44	0.15	0.29	0.40	0.40	0.12	0.26	0.42	0.41	0.18	0.30
Switzerland	6.24	3.68	3.39	3.53	6.04	3.34	3.61	3.47	5.26	2.72	3.69	3.19
South Korea	0.34	0.96	0.51	0.73	0.41	1.12	0.73	0.92	0.49	1.44	1.02	1.24
Turkey	0.78	0.94	0.54	0.73	0.73	1.01	0.78	0.89	0.86	1.23	0.88	1.06
U.S.A.	4.93	7.32	6.86	7.08	5.71	7.67	6.72	7.19	6.28	7.63	5.60	6.65
Bosnia and Herzegovina	–	–	–	–	0.21	0.10	0.04	0.07	0.24	0.12	0.12	0.12
Brazil	0.42	0.55	0.13	0.33	0.31	0.46	0.10	0.28	0.30	0.58	0.18	0.39
China	0.74	1.71	1.66	1.68	1.41	2.99	2.26	2.62	1.42	4.27	3.65	3.97
Hong Kong	0.57	0.88	0.34	0.60	0.70	0.88	0.34	0.61	0.52	0.83	0.21	0.53
India	0.17	0.38	0.24	0.30	0.22	0.48	0.27	0.37	0.37	0.67	0.34	0.51
Iran	0.32	0.30	0.03	0.16	0.37	0.30	0.02	0.16	0.37	0.27	0.02	0.14
Croatia	0.98	0.51	0.34	0.42	1.26	0.62	0.50	0.56	1.35	0.66	0.65	0.65
Malaysia	0.13	0.35	0.31	0.33	0.13	0.37	0.62	0.50	0.25	0.43	0.33	0.38
Russian Federation	0.92	1.03	0.29	0.64	1.45	1.35	0.28	0.81	2.08	1.95	0.27	1.13
Saudi Arabia	0.27	0.17	0.01	0.09	0.25	0.18	0.01	0.10	0.36	0.26	0.01	0.14
Serbia	–	–	–	–	–	–	–	–	0.17	0.16	0.05	0.11
Singapore	0.28	0.54	0.20	0.37	0.29	0.61	0.27	0.44	0.27	0.75	0.17	0.47
South Africa	0.38	0.41	0.07	0.23	0.47	0.50	0.07	0.28	0.56	0.59	0.10	0.35
Taiwan	0.37	0.90	0.94	0.92	0.31	0.84	0.82	0.83	0.33	0.78	0.70	0.74
Thailand	0.20	0.31	0.26	0.28	0.15	0.35	0.28	0.32	0.15	0.39	0.37	0.38
Ukraine	0.29	0.32	0.12	0.22	0.41	0.43	0.17	0.30	0.55	0.54	0.20	0.37
United Arab Emirates	0.22	0.10	0.01	0.05	0.32	0.23	0.01	0.12	0.34	0.24	0.03	0.14
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: OeNB, WIFO.

Table A3 (continued)

Comparison of weights for manufactured goods across different calculation periods

Competing countries	2007 to 2009				2010 to 2012			
	Austrian exports (single weights)	Austrian exports (double weights)	Austrian imports	Total	Austrian exports (single weights)	Austrian exports (double weights)	Austrian imports	Total
	%							
Belgium	1.67	3.04	1.79	2.43	1.59	2.63	1.81	2.24
Bulgaria	0.68	0.38	0.29	0.34	0.56	0.41	0.35	0.38
Denmark	0.73	0.70	0.48	0.59	0.59	0.59	0.45	0.52
Germany	31.65	23.97	42.72	33.00	32.06	23.95	41.11	32.19
Estonia	0.11	0.07	0.03	0.05	0.09	0.06	0.03	0.05
Finland	0.57	0.79	0.60	0.70	0.46	0.61	0.49	0.55
France	4.07	5.59	3.59	4.63	4.87	5.96	3.32	4.69
Greece	0.58	0.41	0.10	0.26	0.38	0.32	0.10	0.22
United Kingdom	3.57	3.57	2.16	2.89	3.27	3.16	1.83	2.52
Ireland	0.26	0.69	0.54	0.62	0.27	0.69	0.55	0.63
Italy	6.80	8.23	7.08	7.67	5.99	7.20	6.70	6.96
Latvia	0.15	0.07	0.02	0.05	0.11	0.07	0.02	0.04
Lithuania	0.14	0.13	0.05	0.09	0.14	0.11	0.05	0.08
Luxembourg	0.13	0.16	0.17	0.17	0.15	0.15	0.24	0.19
Malta	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01
Netherlands	1.78	2.64	2.72	2.68	1.60	2.73	2.71	2.72
Poland	2.86	2.61	1.35	2.00	3.04	2.95	1.63	2.32
Portugal	0.41	0.46	0.37	0.42	0.31	0.42	0.45	0.44
Romania	2.04	1.15	0.72	0.95	1.64	1.05	0.93	0.99
Sweden	1.21	1.44	1.44	1.44	1.26	1.42	1.31	1.37
Slovakia	1.87	1.13	1.64	1.38	1.91	1.20	1.93	1.55
Slovenia	1.90	0.84	1.10	0.96	1.57	0.44	1.11	0.76
Spain	2.73	2.99	1.63	2.33	1.83	2.44	1.73	2.10
Czech Republic	3.63	2.86	3.31	3.08	3.69	2.91	3.58	3.23
Hungary	3.25	1.85	2.21	2.02	2.74	1.66	2.44	2.03
Cyprus	0.06	0.01	0.02	0.02	0.10	0.02	0.04	0.03
Australia	0.70	0.51	0.06	0.29	0.66	0.49	0.04	0.28
Chile	0.10	0.13	0.01	0.07	0.14	0.15	0.05	0.10
Iceland	0.03	0.03	0.01	0.02	0.02	0.02	0.01	0.02
Israel	0.18	0.26	0.09	0.18	0.22	0.28	0.17	0.23
Japan	0.82	2.57	2.05	2.32	1.08	2.49	1.95	2.23
Canada	0.85	0.78	0.45	0.62	0.81	0.78	0.34	0.57
Mexico	0.35	0.56	0.19	0.38	0.44	0.65	0.23	0.45
New Zealand	0.08	0.07	0.03	0.05	0.07	0.06	0.03	0.05
Norway	0.60	0.50	0.19	0.35	0.45	0.42	0.19	0.31
Switzerland	5.01	2.55	4.25	3.37	5.22	3.07	4.47	3.74
South Korea	0.54	1.68	0.65	1.19	0.77	1.79	0.63	1.24
Turkey	0.83	1.35	0.86	1.11	1.03	1.40	0.90	1.16
U.S.A.	5.04	6.82	6.11	6.48	5.78	6.68	5.56	6.14
Bosnia and Herzegovina	0.30	0.14	0.19	0.17	0.28	0.11	0.27	0.18
Brazil	0.64	0.88	0.18	0.55	0.93	1.04	0.16	0.61
China	1.96	6.16	4.99	5.60	2.84	7.80	6.47	7.16
Hong Kong	0.41	0.81	0.15	0.50	0.55	0.76	0.11	0.45
India	0.59	0.96	0.43	0.71	0.69	1.14	0.53	0.84
Iran	0.34	0.25	0.01	0.13	0.28	0.23	0.02	0.13
Croatia	1.34	0.63	0.61	0.62	0.97	0.60	0.57	0.59
Malaysia	0.28	0.42	0.25	0.34	0.30	0.48	0.30	0.39
Russian Federation	2.65	2.22	0.31	1.30	2.76	2.46	0.38	1.46
Saudi Arabia	0.47	0.22	0.02	0.12	0.48	0.32	0.03	0.18
Serbia	0.53	0.32	0.22	0.27	0.47	0.31	0.21	0.26
Singapore	0.32	0.72	0.13	0.43	0.34	0.69	0.14	0.43
South Africa	0.53	0.57	0.10	0.34	0.49	0.54	0.08	0.32
Taiwan	0.23	0.70	0.63	0.66	0.31	0.67	0.57	0.62
Thailand	0.18	0.48	0.41	0.45	0.25	0.53	0.39	0.46
Ukraine	0.72	0.62	0.21	0.42	0.63	0.54	0.20	0.38
United Arab Emirates	0.52	0.31	0.02	0.17	0.51	0.30	0.08	0.19
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: OeNB, WIFO.

Table A4

Variable list

Definition	Label	Growth rate (mean)
NA: Total exports, nominal	na_xn	5.72
NA: Exports of goods, nominal	na_xgn	5.96
NA: Exports of services, nominal	na_xsn	5.29
NA: Total imports, nominal	na_mn	5.16
NA: Imports of goods, nominal	na_mgn	5.13
NA: Imports of services, nominal	na_msn	5.42
NA: Austrian GDP, nominal	yn_a	3.36
NA: Total exports, real with irregular component	na_x	4.75
NA: Exports of goods, real with irregular component	na_xg	5.21
NA: Exports of services, real with irregular component	na_xs	3.71
NA: Total imports, real with irregular component	na_m	3.84
NA: Imports of goods, real with irregular component	na_mg	4.16
NA: Imports of services, real with irregular component	na_ms	2.87
NA: Austrian GDP, real with irregular component	y_a	1.79
World GDP, nominal	yn_world	4.59
World GDP, real	y_world	3.77
Exchange rate	e_usea	–0.24
CA: Exports of goods	ca_xgn	6.09
CA: Exports of general merchandise	ca_xcn	6.14
CA: Exports of general services	ca_xsn	5.65
CA: Exports of tourism in broader sense	ca_xten	2.64
CA: Exports of tourism in narrower sense	ca_xtnn	2.53
CA: Exports of international passenger transport	ca_xptn	5.10
CA: Imports of goods	ca_mgn	5.33
CA: Imports of general merchandise	ca_mcn	5.36
CA: Imports of general services	ca_msn	5.59
CA: Imports of tourism in broader sense	ca_mten	3.21
CA: Imports of tourism in narrower sense	ca_mtnn	2.95
CA: Imports of international passenger transport	ca_mptn	6.46
Nominal effective exchange rate, total	e_tn	0.38
Nominal effective exchange rate, goods	e_gn	0.36
Nominal effective exchange rate, food	e_fn	0.55
Nominal effective exchange rate, raw materials	e_rn	1.05
Nominal effective exchange rate, industrial goods	e_in	0.26
Nominal effective exchange rate, services	e_sn	0.47
Real effective exchange rate, total	e_t	–0.45
Real effective exchange rate, goods	e_g	–0.46
Real effective exchange rate, food	e_f	–0.47
Real effective exchange rate, raw materials	e_r	–0.64
Real effective exchange rate, industrial goods	e_i	–0.46
Real effective exchange rate, services	e_s	–0.52
Nominal effective exchange rate, total ULC	e_tulcn	–0.13
Nominal effective exchange rate, services ULC	e_sulcn	–0.18
Real effective exchange rate, total ULC	e_tulc	–0.30
Real effective exchange rate, services ULC	e_sulc	–0.46
Nominal effective exchange rate, total PPI	e_ippin	–0.21
Real effective exchange rate, total PPI	e_ippi	–0.62

Source: OeNB, Statistics Austria, authors' calculations. Quarterly data rates of change against previous year based on data from Q1 96 to Q2 16. NA: national accounts, CA: current account, ULC: unit labor costs, PPI: producer price index.

Table A5

Correlation between pairs of trade flow variables (rate of change with respect to the previous year's quarter)

	NA_X	NA_XG	NA_XS	CA_XGN	CA_XCN	CA_XSN	CA_XTEN	CA_XTNN	CA_XPTN
NA_X	1.00								
NA_XG	0.97	1.00							
NA_XS	0.58	0.38	1.00						
CA_XGN	0.96	0.95	0.54	1.00					
CA_XCN	0.97	0.96	0.53	1.00	1.00				
CA_XSN	0.54	0.41	0.84	0.50	0.50	1.00			
CA_XTEN	0.28	0.15	0.55	0.26	0.27	0.64	1.00		
CA_XTNN	0.13	0.01	0.48	0.04	0.05	0.55	0.99	1.00	
CA_XPTN	0.60	0.62	0.22	0.68	0.66	0.35	0.43	0.31	1.00

Source: OeNB, Statistics Austria. Authors' calculations based on pairwise maximum samples. Compare table A4 for a definition of labels.

Table A6

Correlation between pairs of real effective exchange rate indices (rate of change the with respect to the previous year's quarter)

	E_T	E_G	E_F	E_R	E_I	E_S	E_TULC	E_SULC	E_IPPI
E_T	1.00								
E_G	1.00	1.00							
E_F	0.95	0.95	1.00						
E_R	0.86	0.87	0.87	1.00					
E_I	0.99	1.00	0.93	0.83	1.00				
E_S	0.98	0.97	0.98	0.89	0.96	1.00			
E_TULC	0.86	0.85	0.84	0.81	0.85	0.88	1.00		
E_SULC	0.85	0.83	0.85	0.81	0.83	0.88	0.99	1.00	
E_IPPI	0.74	0.74	0.78	0.64	0.73	0.78	0.75	0.76	1.00

Source: OeNB, Statistics Austria. Authors' calculations based on pairwise maximum samples. Compare table A4 for a definition of labels.