II.2. Member State vulnerability to changes in the euro exchange rate ([35])

There have been significant fluctuations in the euro exchange rate since the start of the monetary union. This section assesses Member States' different degrees of vulnerability to changes in the exchange rate. It looks in particular at possible differences in the pass-through of the nominal exchange rate into import and consumer prices, and at differences in the price elasticity of export volumes. Overall, empirical results show a higher sensitivity of Spain's inflation, and export price elasticities, that are significantly higher in Italy, Portugal, Spain, Austria and France. However, in terms of overall impact on activity, differences in export elasticities tend to be offset, at least in part, by differences in trade openness and in integration in global value chains.

Introduction

There have been significant fluctuations in the euro exchange rate since the start of the monetary union. ([36]) Fluctuations in nominal exchange rates affect the economy via various channels. Changes in the nominal exchange rate can affect import prices and inflation. To the extent that it affects the real exchange rate, a change in the euro nominal exchange rate can also affect export volumes. In addition to direct output effects, nominal exchange rates can have an impact on output via changes in domestic income and through import substitution. If vulnerability to euro fluctuations varies across Member States, changes in the euro exchange rate could constitute a common shock with asymmetric effects that could complicate macroeconomic policy in the euro area. Therefore this section explores various dimensions of the impact of euro exchange rate fluctuations in order to assess whether some Member States are more vulnerable than others.

Impact of exchange rate fluctuations on inflation

A change in the nominal exchange rate can lead to a change in import prices in euro terms and may therefore have an impact on consumer price inflation. Furthermore, it can affect the competitiveness of domestic goods relative to foreign ones and the cost of intermediate inputs. This may lead to changes in domestic production costs, mark-ups and producer prices and thereby to second-round effects on domestic consumer prices.

Econometric results show that in all euro area Member States import prices react relatively fast and strongly to a permanent change in the nominal effective exchange rate (NEER) (Box II.2.1). ([37]) Most of the response of import prices occurs immediately (during the same quarter). ([38]) However, it takes around three quarters after a shock before these price changes are passed on to consumer prices and there are some differences across Member States in the reaction of consumer prices which are partly explained by the different compositions of consumption baskets (high proportion of services in some countries). ([39]) For example, in Spain, where the pass-through is the highest, a 1 % depreciation of the NEER would lead to a rise of about 0.15 pp in the inflation rate in the following four quarters. ([40]) ([41])

([35]) Section prepared by Narcissa Balta, Karin Fischer, Plamen Nikolov and Lauri Vilmi.

([36]) For example, the aggregate nominal effective exchange rate (NEER) in the euro area appreciated by more than 12% between August 2012 and March 2014, although this appreciation has been partly reversed since then. There are a number of factors behind nominal euro exchange rate movements, including investors' risk perceptions, differences in monetary policy strategies and the euro's status as a reserve currency.

([37]) The econometric exercises presented in this section cover the following countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal and Spain. The response of import and consumer prices to exchange rate fluctuations is calculated for the period from 1 January 2002. When studying the response of import prices, the currency in which products are priced is important; see discussion in Campa, J.M. and L. Goldberg, (2002), 'Exchange rate pass-through into import prices: a macro or micro phenomenon?', *NBER Working Paper*, 8934. The adoption of physical notes may have changed pricing of imports from producer currency pricing into local currency pricing (i.e. into euro, and making the two equivalent for imports within the euro area), which may have had an impact on pass-through rates.

([38]) For individual Member States, import prices for extra-euro area trade are used as an import price index.

([39]) The differences in pass-through rates into import and consumption prices can also be partly explained by the different compositions of trade and by different trade partners across Member States. For example, Di Mauro *et al.* (2008) find that pass-through rates differ significantly across sectors; see Di Mauro, F., R. Rüffer and I. Bunda, (2008) 'The changing role of the exchange rate in a globalised economy', *Occasional Paper Series,* 94, European Central Bank.

([40]) Pass-through rates are also low in France and Italy, but these results are partly explained by tax changes which bias estimations. If rates for these countries are estimated using the HICP index with constant taxes, the pass-through rises to 0.05 for France and

Box II.2.1: Estimating exchange rate pass-through rates into prices

Exchange rate pass-through rates are estimated by using a vector autoregression (VAR) methodology with quarterly data for the period 2002Q1-2014Q1. By using the VAR with exogenous variables, some second-round effects on consumer prices can also be taken into account. Previously, An and Wang (2012), *inter alia*, have used VAR methods to study exchange rate pass-through. In our pass-through estimations, we estimate the following reduced form VAR(χ, λ) with exogenous variables: $Y_t = \sum_{i=1}^{\chi} A_{t-i} Y_{t-i} + \sum_{j=0}^{\lambda} B_{t-j} X_{t-j} + E_t$

Here the vector of endogenous variables, Y, consists of the output gap, the nominal effective exchange rate, consumer, producer and import price indexes and the EONIA rate. Exogenous variables X are oil prices, a foreign cost measure, calculated as (nominal effective exchange rate *unit labour costs)/real effective exchange rate) and domestic unit labour costs. Treating unit labour costs as an endogenous variable does not change results. Lag lengths χ, λ are chosen based on the model selection criteria and are typically two or three quarters for endogenous variables and one quarter for exogenous variables. The model is estimated by using either HICP or core HICP as a measure for changes in consumer prices. Error terms, E, are assumed to be serially uncorrelated and to follow a normal distribution. The exchange rate shock is identified by the Cholesky decomposition, using the ordering of endogenous variables described above.

Results of 1% depreciation of the euro area NEER on price indexes

	Import prices		HICP		HICP core	
	Short-run(1)	Long-run(2)	Short-run	Long-run	Short-run	Long-run
Euro area	0.55*	1.05*	0.01	0.05	0.00	-0.01
Spain	0.74*	1.23*	0.00	0.15*	0.00	0.13*
Portugal	0.86*	0.93	0.05	0.10	0.04	0.09
Ireland	0.63*	0.83	0.01	0.09	0.00	0.03
Netherlands	0.68*	0.41	0.03	0.08	0.01	0.05
Finland	0.58*	1.05*	0.00	0.08	0.00	0.02
Belgium	1.09*	0.78*	0.05*	0.06	0.00	-0.03
Austria	0.33*	0.82*	-0.03*	0.05	-0.04	-0.01
Germany	0.35*	0.72*	0.04*	0.03	0.01*	-0.20
France	0.86*	1.11*	0.00	0.03	-0.03	-0.06
Italy	0.78*	1.30*	-0.01	0.01	-0.03	-0.06

Note: Short-run pass-through rate measures initial response during the same quarter. Long-term response stands for the cumulative response four quarters after a shock.
* Significantly different from zero at 5 % level.

References:

An L. and J. Wang (2012), 'Exchange Rate Pass-Through: Evidence Based on Vector Autoregression with Sign Restrictions', *Open Economy Review* 23, pp. 359-380.

Most of the effect of exchange rate fluctuations on HICP inflation seems to stem from the reaction of energy prices and unprocessed food, whereas in the majority of Member States core inflation does not seem to respond significantly to exchange rate shocks. Estimations find positive and significant long-run exchange rate pass-through rates into core inflation only in Spain. ([42])

In Portugal and Spain, the rates of pass-through into core inflation are of similar magnitude to those of pass-through into the headline index, though they are statistically significant only in Spain. One possible factor explaining the high pass-through rate in Spain could be the higher proportion of energy and food in the HICP basket combined with a higher correlation of prices in all categories

0.08 for Italy. Long-run pass-through rates into the HICP index with constant tax rates are very similar to the results with headline index in other Member States, but slightly lower in Belgium (0.04), Finland (0.03), Portugal (0.03) and Spain (0.12).

([41]) The relatively limited effect of nominal exchange rate changes on consumer prices in the euro area is explained by the fact that imports from the non-euro area countries are only around 25% of euro area GDP.

([42]) Estimated pass-through rates are also positive in Finland, Ireland, the Netherlands and Portugal, but in these countries estimations cannot reject rates being statistically different from zero.

of core inflation with energy and food prices, possibly reflecting, *inter alia*, the prevalence of wage indexation. ([43]) Nevertheless, the indexation clauses of many contracts have recently been significantly relaxed as part of structural reforms, which may in the future dampen the second-round effects of exchange rate changes in Spain.

Overall, nominal exchange rate fluctuations cause relatively large swings in import prices, but have rather a small effect on HICP, especially if energy and food prices are excluded. With the exception of Spain, potential differences among Member States in the inflation response to euro exchange rate fluctuations are small.

Export vulnerability to exchange rate changes

Once nominal exchange rate movements are fed into the real exchange rate, they can also impact sales of domestic goods and services abroad. The econometric estimations of export demand equations presented in Box II.2.2 show that the elasticity of export demand to the real exchange rate is significantly higher in countries such as Italy and Portugal (Table II.2.1). ([44]) To a lesser degree, Austria, France and Spain also post high elasticities.

These differences in the elasticity can, to some extent, be related to differences in the product structure of exports. For instance, exports of differentiated products will tend to be less reactive to exchange rate fluctuations than exports of more homogenous products. Portugal, Spain and, to some extent, Italy have relatively low proportions of capital goods (which tend to have fewer close substitutes) in total exports (Table II.2.1). Conversely, Ireland, where the proportion of exported services (which tend to be more differentiated than goods) is high, has lower export price elasticity than is suggested just by looking at the structure of its goods exports. Export price elasticities are high in Austria and France, which export relatively high proportions both of capital goods and of services, suggesting that other factors also play an important role in the cross-country elasticity differences. These might relate to other aspects of these economies' sectoral specialisation (beyond the importance of capital goods or services), but also to the quality of the products and services exported.

The estimated country elasticities should be treated with some caution. Estimates for the euro area as a whole indicate that the responsiveness of export demand to changes in the real exchange rate and foreign demand may have increased since the start of the global financial crisis in 2008 (see Box II.2.2). ([45]) At this stage, it is impossible to say whether such a change is cyclical (reflecting, for instance, a higher sensitivity of foreign demand to prices due to depressed cyclical conditions) or of a more lasting nature.

Table II.2.1: **Estimated exchange rate impact on export volumes**

	REER elasticity	Share of capital goods(1)	Share of services in exports(2)
BE	-0.40	8.9	21.2
DE	-0.81	21.1	14.6
IE	-0.76	13.8	38.4
ES	-1.61	10.6	32.3
FR	-1.44	19.2	21.7
IT	-2.56	17.4	19.3
NL	-0.47	17.3	21.5
AT	-1.67	19.6	27.7
PT	-2.14	9.4	24.8

(1) Average as a proportion of total goods exports in 2000M1-2014M5.
(2) Total exports, average 1999-2012.
Source: Eurostat, DG ECFIN calculations.

The effect of the real exchange rate on a country's GDP depends not only on the degree of export price elasticity, and the resulting changes in export market shares, but also on the size of the import substitution effect, ([46]) and the extent to which

([43]) Du Caju *et al.* (2008) find that in Spain a large proportion of workers were covered by wage indexation clauses; see Du Caju, P. Gautier, E. Momferatou. D. and Ward-Warmedinger, M., 'Institutional features of wage bargaining in 23 European countries, the US and Japan', *ECB Working Paper Series,* No 974.

([44]) The export volume elasticities are estimated for the period starting in the first quarter of 1994 (to coincide with the start of the second stage of the EMU), when the nominal exchange rates of the Member States became effectively fixed to each other (only Italy and Finland were briefly outside the Exchange Rate Mechanism after 1994). It should be stressed that the estimated export price elasticities measure the reaction of export volumes to changes in real exchange rates (and thus the reaction to both nominal exchange rates and relative prices). For example, when trade within the euro area is considered, it is only the movement of relative prices that affects export volumes.

([45]) Data limitations only allow the estimation of a pre-crisis export equation for the euro area as a whole. Available samples are too short for such an exercise in the case of estimations for individual countries.

([46]) Attempts to estimate import demand equations based on the same econometric method, countries and time period as the export equations produced disappointing results. However, the available empirical literature (based on alternative econometric methods) suggests that import price elasticities in European countries are significantly lower than the export price elasticities

rising or falling exports affect domestic demand and thereby imports. The overall effect on activity therefore depends on assumptions, notably regarding domestic demand behaviour. In general, GDP will be more sensitive to real exchange rate fluctuations in countries that are more open to trade and comparatively more protected from these fluctuations in countries that are well integrated in global value chains. For the latter, a high degree of integration means that the activity effect of any shock to exports (notably due to exchange rate fluctuations or relative prices) will be partly transmitted to other countries via changes in imported inputs, reducing the effect on activity.

Table II.2.2: **Additional factors behind the exchange rate impact on output**

	REER elasticity	Exports of goods and services to GDP(1)	Foreign value added content of exports to exports(2)
BE	-0.40	79.3	35.0
DE	-0.81	42.0	26.6
IE	-0.76	82.0	42.3
ES	-1.61	27.0	20.7
FR	-1.44	26.4	24.7
IT	-2.56	26.5	20.1
NL	-0.47	70.9	35.9
AT	-1.67	52.4	31.6
PT	-2.14	29.8	32.4

(1) Average 1999Q1-2013Q4, except IE and PT 1999Q1-2013Q3.
(2) Data on the foreign value added of exports are for 2009.
Source: Eurostat, OECD, DG ECFIN calculations.

The share of exports of goods and services to GDP in the different Member States shown in the second column of Table II.2.2 suggests that, with the exception of Austria, countries that have high price elasticity of export demand also tend to export relatively less as a share of GDP. This is likely to mitigate country differences in vulnerability to the exchange rate that can be assumed from the estimated export price elasticities.

For Ireland, Belgium and the Netherlands, the effect of low export elasticities is counterbalanced by very high export-to-GDP ratios, but somewhat further dampened by a stronger integration in global value chains. Portuguese exports also contain a relatively high proportion of foreign value added, which, together with its low degree of openness to trade, mitigates the output effect of its high export price elasticity (third column of Table II.2.2). Overall, large asymmetric effects on output through export volumes are unlikely.

The degree of vulnerability to the euro exchange rate also depends on export price behaviour

When assessing vulnerability to nominal exchange rate fluctuations, the above estimates of price elasticity of exports are subject to an important caveat. The effect of a nominal exchange rate shock on exports and growth depends not only on the elasticity of exports to the real exchange rate, but also on the extent to which fluctuations in the nominal exchange rate are transmitted to the real exchange rate. The greater the pass-through from nominal to real exchange rates, the bigger the impact of a given nominal exchange rate shock on exports and output.

Table II.2.3: **Potential asymmetric response to exchange rate shocks**

	Pass-through to real exchange rates(1)	Extra-euro area VA in exports as a share of total exports(2)	REER elasticity
IT	97.5	12.5	-2.56
PT	89.6	14.8	-2.14
AT	95.3	15.5	-1.67
ES	89.6	12.8	-1.61
FR	98.4	14.5	-1.44
DE	96.5	16.9	-0.81
IE	78.7	31.0	-0.76
NL	81.2	24.7	-0.47
BE	91.3	17.6	-0.40

(1) Correlation between the quarterly contemporaneous change in nominal and real effective exchange rates, export price deflator, 1999Q1-2014Q2.
(2) Data on the extra-euro area value added of exports are for 2009.
Source: Eurostat, OECD, DG ECFIN calculations.

In general, the pass-through from nominal to real exchange rate (based on export price deflators) in the euro area is high (Table II.2.3). There are some differences among Member States – for example, since 1999, the correlation between the quarterly contemporaneous change in nominal and real effective exchange rates has been quite high in France (98.4 %) and Italy (97.5 %) and lower in Ireland (78.7 %), the Netherlands (81.2 %), Spain (89.6 %) and Portugal (89.6 %). This means that, except in Ireland and the Netherlands, a very large part of nominal exchange rate shocks tends to be passed through to the real exchange rate and export prices are

presented here (they vary between -0.38 and -0.06) and the cross-country dispersion is smaller; see Senhadji, A., (1998), 'Time-series estimation of structural import demand equations: a cross-country analysis', *IMF Staff Papers*, Vol.45, No 2. Moreover, countries with high export price elasticities, according to the estimates presented in this chapter, tend to be those with high import price elasticities in Senhadji (1998).

Box II.2.2: Export demand equations for the euro area Member States

Standard export demand equations are estimated in a fractionally cointegrated vector autoregressive model, applying recent concepts of inference for non-stationary time series developed by Johansen and Nielsen (2012). The methodology offers a unified framework for cross-country comparison of estimated export demand elasticities allowing at the same time for country-specific degrees of persistence in the data.

Though the original idea of cointegration in time series as presented by Engle and Granger (1987) allows for fractional orders of cointegration, most of the subsequent empirical work has focused on integer degrees of differentiation of non-stationary time series (ARIMA models). Such models have been widely used to analyse long-run economic relations and short-run adjustments following an over-shooting or under-shooting of the long-run equilibrium conditions. Only in recent years have fractional values for the order of integration also been taken into account (ARFIMA models).

Fractional processes are useful for describing time series with slowly decaying autocorrelation functions, i.e. long memory processes and/or processes for which shocks can have very long but not permanent effects. Long memory processes imply different long-run predictions and effects of shocks. The higher the value of the memory parameter (d), the higher the persistence of the process: i) for d = 0, the process X_t is stationary, with a short memory (i.e. the autocorrelation functions are decaying very fast); ii) for d ϵ (0, 0.5), the process X_t is stationary, with a long memory (i.e. the autocorrelation functions take far long to decay); iii) for d ϵ (0.5, 1), the process X_t is non-stationary and mean-reverting, but shocks do not have a permanent effect (long lasting but not permanent); and iv) for d $\geq$ 1, the process X_t is non-stationary and shocks have a permanent effect.

The long-run equilibrium relations are identified as a fractionally cointegrated (or cofractional) vector, while the short-run dynamic correlations and the speed of adjustment towards the long-run are given by a fractionally cointegrated vector autoregressive model (i.e. a fractional VECM). On the basis of this unified framework that nests the more commonly used case of integration of order one, estimates of long-run export price and income elasticities for selected euro area countries are presented below, using quarterly data between 1994Q1-2014Q1. Exports are defined as total exports of final and intermediate goods and services, deflated by export price indices. Foreign income is defined as the average of imports by major trading partners, weighted with the proportion of the Member State's exports going to a particular importing country in 2005. The choice of weightings for a single year avoids the possible endogeneity problem inherent to using standard export shares as weightings, as in the literature. Finally, relative export prices are measured by the real effective exchange rate (REER). An export prices-based REERs is used, computed by DG ECFIN vis-à-vis 37 main trading countries.

The resulting baseline specification is: $$\Delta^d X_t = \Delta^{d-b} L_b \alpha\beta' X_t + \sum_{i=1}^{k} \Gamma_i \Delta^d L_b^i X_t + \varepsilon_t,$$

where t indexes time and the usual lag operator, L=1-Δ and the difference operator Δ have been replaced by the fractional lag and difference operators, L_b=1-Δ^b, and Δ^b=(1-L)^b. X_t is a multivariate time series vector, including real exports, foreign income and REER (in natural logarithm) and ε_t is an i.i.d. vector of disturbances with positive definite variance covariance matrix. X_t is fractional of order d, and cofractional of order d-b (i.e. $\beta'X_t$ is fractional of order d-b, with d-b<0.5, so $\beta'X_t$ is stationary). The estimated vector of coefficients of β have the usual interpretation of the long-run elasticities, while α describes the adjustment towards the long-run equilibria and the common stochastic trends, which are fractional of order d. Matrices Γ_i give the short-run dynamic correlations. For the special case of d=b=1, the specification gives the usual cointegrating vector autoregressive model (VECM), where $\beta'X_t$ is the I(0) error correction term (i.e. d-b =0).

Results

Results show that for total exports long-run elasticities to the REER range between 0.4 to 2.6 in absolute value and the elasticity of exports to changes in foreign income is closer to 1 in most countries (with the exception of FR and IE). The euro area average export price elasticity is close to 0.8 in absolute value, while the elasticity of exports to changes in foreign income is close to 1, indicating a rather high degree of

(Continued on the next page)

Box (continued)

heterogeneity among euro area countries in terms of exports' response to exchange rate fluctuations. For most euro area countries, except for DE, ES and IT, shocks seem to have long-lasting rather than permanent (i.e. 0.5 < d < 1) effects. Results should be interpreted with care for the countries for which there are some data limitations, such as IE.

Export demand elasticities, euro area exports, 1994q1-2014q1

Country	REER (export prices)	foreign demand	d	b
DE	-0.81	1.18	1.02	1.02
FR	-1.44	0.37	0.99	d=b
BE	-0.40	0.73	0.99	0.95
AT	-1.67	0.66	0.97	0.95
NL	-0.47	0.94	0.99	d=b
ES*	-1.61	1.22	1.01	1.01
IT	-2.56	1.18	1.01	0.99
IE**	-0.76	0.41	0.79	d=b
PT*	-2.14	0.92	0.99	d=b
EA	-0.77	0.91	1.02	d=b
EA pre-crisis (1994q1- 2008q4)	-0.52	0.84	0.995	d=b

Note:
*1995q1-2013q3; ** 1997q1-2013q3;
Inference based on Johansen and Nielsen (2012), and MacKinnon and Nielsen (2014).

References:

Johansen S. and M.O. Nielsen (2012). 'Likelihood inference for a fractionally cointegrated vector autoregressive model', *Econometrica*, Vol. 80, Issue 6, pp. 2 667-2 732.

MacKinnon, J.G. and M.O. Nielsen (2014), 'Numerical distribution functions of fractional unit root and cointegrations tests', *Journal of Applied Econometrics*, Vol. 29, Issue 1, pp. 161-171.

adjusted only to a limited degree when the euro exchange rate fluctuates.

The extent of the pass-through from nominal to real exchange rates can be explained by a range of factors, including pricing-to-market behaviour by firms, local-currency pricing strategies, use of financial hedging instruments, changes in the sectoral composition of exports and integration in global value chains. ([47])

This section looks into the particular role of global value chains. Country differences in the pass-through from nominal to real euro rates can be attributed partly to the effect of the nominal exchange rate on the prices of imported inputs. To give an example, currency appreciation need not be fully reflected in higher export prices (quoted in the currency of the buying country) when prices of imported inputs fall with the cheaper foreign currency. In such situations, profit margins can be kept even if the final price of the exported good (quoted in the currency of the exporting country) is lowered. ([48]) All else being equal, a country with a

([47]) See, for instance, Dong (2012) and Di Mauro *et al.* for a discussion. There is empirical evidence that the pass-through of exchange rates to export prices may have declined in recent decades. However, the decline seems to have been more pronounced in the United States than in the euro area.

Dong, W., (2012) 'The role of expenditure switching in the global imbalance adjustment', *Journal of International Economics,* Vol. 86, pp. 237-251.

Di Mauro, F., R. Rüffer and I. Bunda, (2008), 'The changing role of the exchange rate in a globalised economy', *Occasional Paper Series*, 94, European Central Bank.

([48]) See, for example, Amiti, M., O. Itskhoki, and J. Konings, (2014), 'Importers, Exporters, and Exchange Rate Disconnect', *American Economic Review,* Vol. 104(7), pp. 1942-1978, who highlight the importance of intermediate inputs for explaining the incomplete pass-through of exchange rate changes to international prices.

larger proportion of intermediate inputs in exports coming from outside the euro area will tend to be more sheltered from nominal exchange rate fluctuations and to experience lower pass-through from nominal to real exchange rates. ([49])

In general, imported inputs from non-euro area countries represent about 15 % of exports (second column of Table II.2.3). For Ireland and the Netherlands, the proportion is considerably higher, at 31.0 % and 24.7 % respectively. All else being equal, the higher proportion allows these two countries to benefit from a lower pass-through from nominal to real exchange rates; the lower pass-through between the real and the nominal exchange rate is confirmed by the simple correlations in the first column of Table II.2.3.

Conclusion

Since the inception of the euro in 1999, its nominal effective exchange rate has been subject to large fluctuations. This section has provided a quantitative assessment of differences in the extent to which Member States are vulnerable to changes in the euro exchange rate. It has looked in particular at possible differences in the pass-through of the nominal exchange rate into import and consumer prices, and at differences in the price elasticity of export volumes.

The pass-through of nominal exchange rate into core inflation is found to be very low. Pass-through into the headline index is somewhat higher but, except for Spain, differences among Member States are generally small.

In line with the previous literature, estimates of the elasticity of export volumes to the real exchange rate tend to vary significantly across countries. Among the countries analysed in this section, estimates appear comparatively high in Italy and Portugal and, to a lesser degree, in Austria, France and Spain. Nevertheless, in terms of output effect, these differences tend to be offset, at least in part, by differences in trade openness (Italy, Portugal, France and Spain). The cases of Ireland, the Netherlands and Belgium are less clear-cut, as low export elasticities and comparatively closer integration in global value chains should dampen the output effect of exchange rate fluctuations, but these countries also post much higher trade openness than the rest of the euro area, which has the opposite effect. Overall, the output impact of exchange rate shocks through export volumes is unlikely to be strongly asymmetric across the euro area.

They show that large exporting firms also tend to be the largest importers, which reduces the proportion of the exchange rate change that is passed on to export prices.

([49]) The potential effect of imported inputs on the export price pass-through also depends on the invoicing currency. Previous research has shown that industry structure, macroeconomic volatility and the bargaining strength of the importing firm affect invoicing choices, see Tille, C. and Goldberg, L., (2009), 'What drives the invoicing of international trade?', *VOX EU*.