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Aggregate and sector-specific exchange rate indexes for the Portuguese economy

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Abstract

Economic theory and empirical evidence suggest that fluctuations in exchange rates may have strong reallocation effects. Accession to the Exchange Rate Mechanism in 1992, and then to the European Monetary Union in 1999, implied a drastic change in the behaviour of Portugal's exchange rate indexes. The analysis of those indexes is therefore bound to play an important role in the study of the evolution of the Portuguese economy in the last two decades. However, there are many alternative exchange rate indexes.

In this paper, we compute and compare aggregate and sector-specific exchange rate indexes for the Portuguese economy. We find that alternative effective exchange rate indexes are very similar between them. We also find that sector-specific effective exchange rates are strongly correlated with aggregate indexes. Nevertheless, we show that sector-specific exchange rates are more informative than aggregate exchange rates in explaining changes in employment: whereas aggregate indexes are statistically insignificant in employment equations, regressions using sector-specific exchange rate indexes show a statistically significant and economically large effect of exchange rates on employment.

Keywords: exchange rates, international trade, employment, EMU

JEL-codes: F15, F16, F41

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1 Introduction

The exchange rate is commonly viewed as a policy instrument that governments (or monetary authorities) could use to improve domestic economic conditions. The fierce discussion in recent years about the possible undervaluation of the Chinese Yuan is a prominent example of the importance attached to such matters. The same sort of discussion occurred within euro area countries before they agreed to give up their national currencies and adopt a common currency.

Despite the usual focus, namely in the popular press, on bilateral nominal exchange rates, what should be a cause for concern is the evolution of the effective exchange rate, and particularly of the real effective exchange rate, i.e., a weighted index of relative prices, with weights reflecting trade partners relevance. In fact, upon abandoning their national currencies, countries lose their ability to use nominal devaluations to counteract the loss of international competitiveness stemming from high domestic inflation relative to foreign competitors, and their ability to lower with a stroke of the pen the foreign prices of those domestic goods that compete on price rather than on quality. Indeed, there is evidence that fluctuations in real exchange rates may have strong inter- and within-sector reallocation effects, as they imply changes in the international relative price of goods — see, e.g., Campa and Goldberg (2001) and Klein et al. (2003).

Portugal provides an example of a country that, in the 1970s and in the 1980s, actively tried to manage the exchange rate. Prior to the accession to the European Economic Community (EEC) in 1986, Portugal adopted a crawling peg. Before the launch of the euro, the Portuguese escudo (the Portuguese currency before the euro) tracked movements in the Spanish peseta, in an effort not to lose competitiveness with regard to similar Spanish products. Joining the Exchange Rate Mechanism in 1992, and then the European Monetary Union in 1999, therefore implied a drastic change in the behaviour of Portugal's effective exchange rate, not only because its nominal value with respect to other euro area countries could no longer be adjusted, but also because the evolution of the European Single Market, alongside the common currency, biased Portuguese trade towards European countries, especially Spain.[1]

This change in trade patterns in turn implies that effective exchange rates should be computed on the basis of time-varying weights. This and other issues in the computation of effective exchange rates have been the subject of a vast literature — see, e.g., Goldberg (2004) and references therein. One difficulty with the computation of effective exchange rates is that the choice of the trade weights is not unique. In this paper we shall make use of the three basic sets of weights employed in the literature: export shares, import

[1] See Amador et al. (2007) and Cabral (2008) for detailed analyses of the evolution of Portuguese trade patterns.

shares and total trade shares (exports plus imports).

Another important issue is whether one can use an aggregate exchange rate index to discuss the economic performance, or whether one should use sectoral indexes. According to our computations, between 1988 and 2006, the Portuguese aggregate real effective exchange rate appreciated more than 20%. This appreciation may have had a significant impact on the Portuguese labour market, similarly to what happened in other countries. For example, Gourinchas (1999) estimated that a 1% real appreciation of the French franc eliminated 0.95% of jobs in the tradable sectors in the following two years. Can this sort of result be found in Portuguese data? Studies of Portuguese exports — e.g., Cabral (2004) and Cabral and Esteves (2006) — have found evidence that declining competitiveness of Portuguese firms has contributed to the weak performance of Portuguese exports in recent years. Although other, qualitative, aspects of competitiveness are certainly important, the real exchange rate is a leading candidate to take responsibility for, at least some of, this loss of competitiveness.

The purpose of this text is therefore to compare the evolution and evaluate the usefulness of alternative effective exchange rate indexes for the Portuguese economy. To this end, we begin by describing, in section 2, the main features of Portuguese aggregate exchange rate indexes and international trade patterns in the period 1988-2006. In section 3 we present sector-specific effective exchange rate indexes and compare their behavior with that of aggregate indexes. In section 4 we assess the informative content of sector-specific exchange rate indexes, relative to aggregate indexes, by estimating their effect on employment. Section 5 concludes.

2 Aggregate exchange rate indexes

Aggregate exchange rate indexes synthetise information on bilateral exchange rates and, therefore, may be useful indicators of the competitiveness of domestic production in the international context. In this section, we present several aggregate effective exchange rate indexes for the Portuguese economy and discuss their behaviour.

Our data begins in 1988, two years after Portugal (and Spain) joined the European Economic Community. We construct nominal and real effective exchange rates for Portugal until 2006. Real exchange rates are more informative than nominal exchange rates about trade competitiveness when inflation differentials between trading partners are significant, which was the case for the Portuguese economy in the period of our analysis. Data for nominal exchange rates, defined as national currency per US dollar at the end of the period, and for the consumer price index are from the IMF International Finan-

cial Statistics database.[2] The country weights are based on data from OECD's STAN bilateral trade database (OECD, 2008).[3]

We compute the effective exchange rate indexes as geometrically weighted averages of bilateral exchange rates.[4] The real effective exchange rate index at time t, I_t, is given by the following formula:

$$I_t = \prod_{j=1}^{N(t)} (rer_t)^{w_{j,t}} \tag{1}$$

where

$$rer_t = \frac{e_{j,t} \cdot p_{j,t}}{p_t} \tag{2}$$

is the bilateral real exchange rate between Portugal and country j, $e_{j,t}$ is the price of foreign currency j in terms of escudos[5] at time t, p_t and $p_{j,t}$ are consumer price indexes for the Portuguese economy and for economy j, $N(t)$ is the number of foreign currencies in the index at time t and $w_{j,t}$ is the weight of currency j in the index at time t, with $\sum_j w_{j,t} = 1$. An increase in the value of this index corresponds to a real depreciation of the Portuguese currency. The base of the index is the year 2000.

In the last two decades, Portuguese international trade patterns changed significantly, both in terms of export destinations and import origins. Table 1 shows the percentage change in the shares of a group of countries in Portuguese exports and imports between 1988 and 2006. This group of countries contains Portugal's most important trade partners — accounting for at least 0.5% of Portuguese exports or imports in either 1988 or 2006 — for which individual data is available in OECD's STAN database.[6] The most striking development during this period was the emergence of Spain as the main trade partner: between 1988 and 2006, the share of Portuguese exports to Spain increased from 11.5% to 26.5% and the share of Portuguese imports from Spain increased from 13.1% to 28.9%. Germany and France stand, respectively, as the second and third main trade partners. The decrease of UK export and import shares should also be noticed. The share of exports to the euro area increased from 57.8% to 63.3% and the share of imports from

[2]For Germany the source of the data was OECD.STAT. Data prior to 1991 refering to West Germany have been linked to the data from 1991 onwards covering unified Germany. Nominal exchange rate data for Taiwan was collected from the Statistical Bureau of the Republic of China (http://eng.stat.gov.tw).

[3]For further details and access to the data, consult the webpage at http://www.oecd.org/sti/stan/.

[4]For a detailed explanation on the construction of effective exchange rates see, e.g., Buldorini et al. (2002). For a detailed description of aggregate trade-weighted exchange rates for the US economy constructed by the Board of Governors of the Federal Reserve System go to http://www.federalreserve.gov/releases/h10/summary. The construction of the Bank of Portugal's current effective exchange rate index for Portugal is presented in Gouveia and Reis (2004); the previous index is presented in Vidal and Reis (1994).

[5]In our computations, after 1998, we use the fixed parity relative to the euro: 200.482.

[6]A notable absence from Table 1 is Angola, which has gained importance in the context of Portugal's international trade in recent years.

the euro area increased from 59.5% to 65.1%. Despite this, the share of Portuguese exports to OECD countries decreased from 90.7% in 1998 to 82.2% in 2006, and imports from OECD registered a similar decrease.

Table 1: Trade shares per country

	Exports			Imports		
Partner	1988	2006	$\Delta(pp)$	1988	2006	$\Delta(pp)$
Austria	0.011	0.005	-0.006	0.008	0.006	-0.001
Belgium-Luxembourg	0.032	0.032	0.000	0.041	0.029	-0.012
Czech Republic	0.000	0.004	0.004	0.000	0.005	0.005
Canada	0.009	0.004	-0.005	0.010	0.002	-0.008
Denmark	0.023	0.007	-0.016	0.009	0.006	-0.003
Finland	0.014	0.007	-0.008	0.006	0.004	-0.002
France	0.152	0.119	-0.032	0.117	0.081	-0.036
Germany	0.147	0.128	-0.019	0.147	0.131	-0.016
Iceland	0.001	0.000	0.000	0.007	0.001	-0.006
Ireland	0.005	0.005	0.000	0.003	0.009	0.006
Italy	0.041	0.039	-0.003	0.092	0.056	-0.037
Japan	0.007	0.003	-0.004	0.036	0.010	-0.026
Mexico	0.000	0.004	0.004	0.005	0.005	0.000
Korea	0.002	0.001	-0.001	0.003	0.006	0.002
Netherlands	0.059	0.030	-0.029	0.048	0.044	-0.004
Norway	0.017	0.003	-0.014	0.010	0.013	0.003
Poland	0.000	0.006	0.006	0.001	0.006	0.005
Spain	0.115	0.265	0.150	0.131	0.289	0.158
Sweden	0.040	0.011	-0.029	0.019	0.009	-0.010
Switzerland	0.022	0.008	-0.014	0.024	0.007	-0.017
Turkey	0.001	0.006	0.005	0.002	0.009	0.007
United Kingdom	0.143	0.066	-0.077	0.083	0.040	-0.044
United States	0.059	0.061	0.002	0.043	0.015	-0.028
Argentina	0.000	0.001	0.001	0.008	0.002	-0.007
Brazil	0.002	0.007	0.005	0.016	0.023	0.007
South Africa	0.003	0.002	-0.001	0.006	0.004	-0.003
Thailand	0.001	0.001	0.000	0.006	0.002	-0.004
China	0.003	0.006	0.003	0.004	0.014	0.011
Russia (Federation of)	0.000	0.003	0.003	0.000	0.012	0.012
Singapore	0.001	0.020	0.019	0.001	0.001	0.000
Total	0.910	0.853	-0.057	0.886	0.839	-0.047

Continued on next page...

... table 1 continued

	Exports			Imports		
Partner	1988	2006	$\Delta(pp)$	1988	2006	$\Delta(pp)$
Euro Area (13)	0.578	0.633	0.055	0.595	0.651	0.056
EU 25	0.785	0.733	-0.052	0.707	0.720	0.013
OECD	0.907	0.822	-0.085	0.851	0.785	-0.066

Notes: pp stands for percentage points. These are shares in total exports and imports.

If the weights in the effective exchange rate formulas ideally should reflect the degree to which producers in the countries considered in the index compete with domestic producers, then the changes in the importance of trade partners described above should be taken into account in the computation of effective exchange rate indexes. In addition, although fairly similar in most cases, some countries' export and import shares are very different. For example, in 2006, exports to the US represented 4.3% of Portugal's exports, but imports from that country were only 1.5% of Portugal's imports. Therefore, the computation of the weights, w, associated with each bilateral exchange rate will yield different results according to whether one bases the computation on export shares, on import shares, or on some combination of the two. In this paper we will present effective exchange rate indexes computed using export, import and "trade" weights, i.e., one effective exchange rate index will use weights based on export shares:

$$w_{\text{exp},j,t} = \frac{X_{j,t}}{\sum_{j=1}^{N(t)} X_{j,t}}, \tag{3}$$

another index will use weights based on import shares:

$$w_{\text{imp},j,t} = \frac{M_{j,t}}{\sum_{j=1}^{N(t)} M_{j,t}}, \tag{4}$$

and the trade-weighted index will employ the average of both shares:

$$w_{\text{tra},j,t} = \frac{1}{2}\left(w_{\text{exp},j,t} + w_{\text{imp},j,t}\right) \tag{5}$$

In the formulas, $X_{j,t}$ stands for Portuguese exports to country j and $M_{j,t}$ is imports from country j to Portugal (in year t). The indexes will be denoted $FXExp$, $FX\,\mathrm{Im}\,p$ and $FXTrade$, respectively. Implicitly, these weights assume that exports from one country to another compete only with the importing country's production. By including

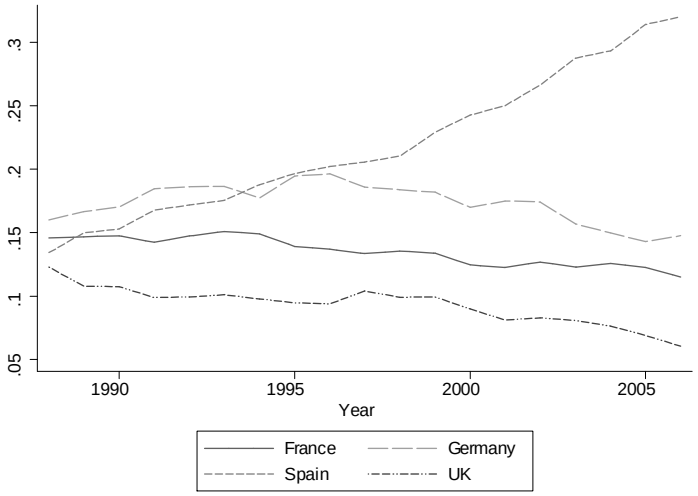

Figure 1: Currency weights in the aggregate exchange rate index (ExRateTrade)

additional information in the computation of the weights, it would be possible to produce effective exchange rate indexes that attempt to take into account the effect of third-party competition. We will not compute such indexes here — for the Portuguese economy they can be found, for instance, in Esteves and Reis (2006).

In Figure 1 we can see the evolution of selected bilateral exchange rate weights used in the computation of the $FXTrade$ exchange rate index (the weights for the other indexes are similar). The four series depicted correspond to Portugal's main trade partners — compare Table 1. The evolution of the weights shows the importance of using time-varying data for currency weights in the construction of exchange rate indexes that aim at measuring the competitiveness of domestic firms in international trade. In fact, in Figure 1 it is clear that the weights can change substantially: we can see the significant and steady increase in the weight of the Spanish currency and the decrease in the weight of the English pound. The weights given to France and Germany have oscillated around a slightly declining trend.

Figure 2 shows the behaviour of different measures of the aggregate effective real exchange rate described above. All four measures display a very similar evolution, suggesting that the choice of weights has little impact in the Portuguese case.

Figure 3 shows the evolution of measures of the aggregate effective real exchange rate computed using different country sets. One measure ($FXTradeBP$) was computed by the Portuguese central bank and is available only since 1999.[7] The other three measures of the real effective exchange rate were computed by us: $FXTradeG$ (using all 29 OECD

[7] Available at http://www.bportugal.pt/EstatisticasWEB.

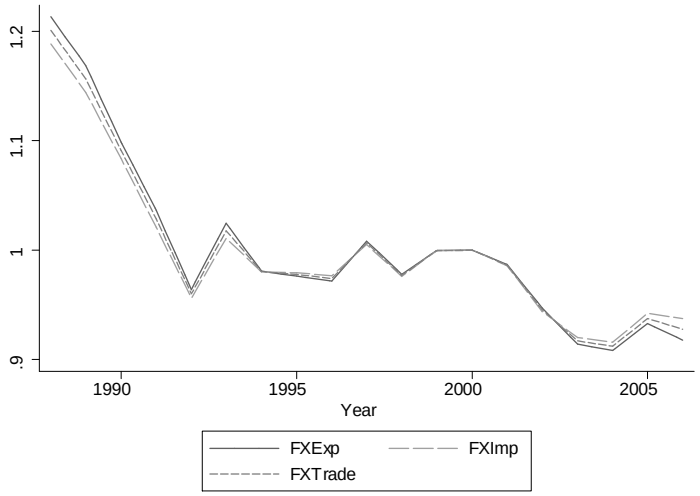

Figure 2: Aggregate real exchange rates: alternative trade weights

and 24 non-OECD trade partners for which there is data in STAN – series already shown in Figure 2), $FXTradeEA$ (using the thirteen first countries that integrated the euro currency) and $FXTradeB$ (using only the group of 30 countries with export or import shares larger than 0.5% in either 1988 or 2006 — recall Table 1).

The three measures computed by us present a broadly similar behaviour. Nevertheless, the global index shows an overall smaller decline than the other indexes. The gap between this and the other two indexes was especially notorious in the early and mid 1990s: the sequence of exchange rate adjustments that followed the ERM crisis appears to have had less impact on the global index than on the indexes that depend more heavily on European countries.

In Figure 4 we compare the evolution of the nominal ($NFXTradeEA$) and real ($RFXTradeEA$) aggregate effective exchange rates of the Portuguese currency against the currencies of the first thirteen countries to adopt the euro. Figure 4 shows that the nominal index has been more stable than the real index. It also shows that the nominal index may present a distorted picture of the evolution of competitiveness. In fact, despite the nominal depreciation before the birth of the euro, in real terms there was a large appreciation of the Portuguese currency. Most of the appreciation occurred between 1988 and 1992. This period was followed by small variations in the real exchange rate until the Portuguese escudo joined the euro. The period since then has again been characterized by a real appreciation, which amounted to approximately 7%. The inflation differential relative to the trade partners is thus an important feature of the Portuguese economy during this period.

Aggregate exchange rate series are presented in Tables 9 and 10 in the Appendix and

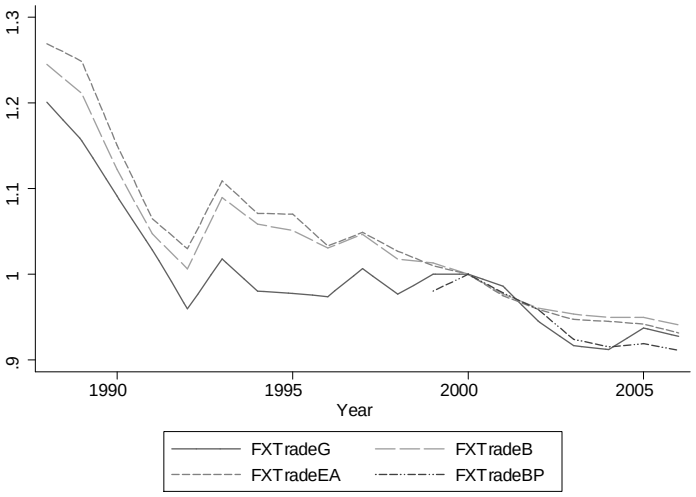

Figure 3: Aggregate real exchange rates: alternative country set

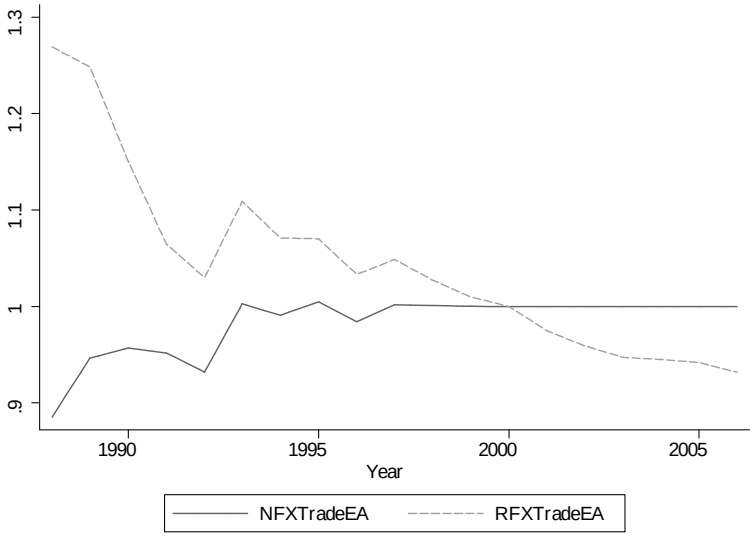

Figure 4: Real and nominal exchange rate against the euro (13)

can be downloaded at http://www3.eeg.uminho.pt/economia/nipe/docs/2009/DATA_NIPE_WP_13_2009.xls.

3 Sector-specific real exchange rates

Aggregate exchange rate indexes such as those analysed in the previous section may be useful summaries of the evolution of domestic firms competitiveness. However, since the importance of trading partners varies across sectors, and the export destinations of an industry may be very different from the import origins of that same sector, sector-specific exchange rate indexes may be more informative than aggregate indexes concerning the evolution of industry competitiveness — see, e.g., Goldberg (2004).

In this section we present sector-specific exchange rates for 28 sectors, classified according to an industry classification based upon ISIC Rev. 3.[8] A complete list of the sectors may be found in Table 6 in the Appendix.

Table 2 shows the share of Portuguese exports (imports) that flow to (from) the countries indicated in the columns, for the most important sectors ranked by weight in total exports (imports) in 2006.[9] In 2006 Spain stands out as an important export destination for all sectors presented, with export shares varying between 8% for "Radio, television and communication equipment", and 25% for "Food products, beverages and tobacco". On the other hand, in 2006 Portugal bought from Spain 35% and 46% of its imports of "Textiles, textile products, leather and footwear" and "Food products, beverages and tobacco", respectively. In 2006 Germany was the most important destination of "Motor vehicles, trailers and semi-trailers", buying 31% of Portugal's exports of these goods. However, for "Food products, beverages and tobacco", Germany was only a residual destination with a 3% share of total exports. Table 2 also shows that the euro area's (13) share in "Radio, television and communication equipment" exports (46%) is much lower than its share in "Motor vehicles, trailers and semi-trailers" exports (79%). Another striking example of the difference in the weight of trade partners across sectors is given by the comparison between the OECD share in "Motor vehicles, trailers and semi-trailers" exports (95%) and its share in "Radio, television and communication equipment" exports (63%) — Singapore, in 2006, accounted for 25% of the exports of that sector. These differences imply that exchange rate movements will affect competitiveness differently in each sector and should, therefore, be weighted differently in the computation of sector-specific exchange rates, to which we now turn.

[8] In this work, as mentioned above, we use the STAN Bilateral Trade Database, which follows an industry classification based upon ISIC Rev. 3.

[9] See Tables 6 and 7 in the Appendix for the ranking of sectors by their weight in exports and in imports, respectively.

Table 2: Sector export share

Sector export share per destination															
		Spain		Germany		France		UK		Euro Area (13)		EU 25		OECD	
Industry	OECD	1988	2006	1988	2006	1988	2006	1988	2006	1988	2006	1988	2006	1988	2006
Textiles, text. prod., leather and footwear	4	3,46	20,89	19,53	12,77	16,31	15,73	17,91	12,48	54,31	64,4	85,04	82,23	97,3	90,73
Motor Vehicles, trailers and semi-trailers	20	31,18	17	1,49	30,56	37,97	20,83	9,84	9,44	86,41	78,59	96,55	92,29	97,69	95,4
Food products, beverages and tobacco	3	10,98	25,24	4,78	2,61	14,5	11,29	9,66	5,87	51,37	59,55	65,29	67,62	82,61	75,81
Radio, television and communication equip.	18	8,96	7,91	44,1	22	16,08	3,88	11,54	2,88	80,89	46	94	50,14	96,94	63,42
Machinery and equipment	15	16,52	20,54	13,8	18,65	8,27	10,58	7,71	4,29	48,2	58,09	57,87	66,32	78,85	75,09
Sector import share per origin															
		Spain		Germany		France		UK		Euro Area (13)		EU 25		OECD	
Industry	OECD	1988	2006	1988	2006	1988	2006	1988	2006	1988	2006	1988	2006	1988	2006
Textiles, text. prod., leather and footwear	4	9,92	35,26	24,09	7,15	14,17	8,63	6,53	2,32	72,61	75,18	82,05	78,89	87,35	81,67
Motor Vehicles, trailers and semi-trailers	20	22,91	27,69	11,12	23,78	23,34	19,61	10,21	4,01	73,86	80,6	87,69	90,98	99,66	98,41
Food products, beverages and tobacco	3	14,01	46,23	2,71	7,71	10,92	8,34	4,88	2,71	42,6	75,04	50,74	81,32	82,98	86,22
Radio, television and communication equip.	18	5,67	18,85	33,33	47,82	5,25	2,83	8,53	1,93	66,1	81,2	75,84	86,88	97,38	94,92
Machinery and equipment	15	10,21	24,61	21,32	16,47	9,64	7,55	7,52	3,21	71,82	74,84	84,96	82,23	97,47	88,58

Notes: pp stands for percentage points. These are shares in total exports and imports. OECD stands for OECD industry classification.

Following the approach used in the computation of aggregate exchange rate indexes, we consider three sector-specific real exchange rate measures which differ in the weights given to bilateral exchange rates. The weights depend on the foreign countries' shares of Portugal's exports and imports for each of the 28 sectors considered in our analysis. The formulas used in computing effective exchange rates for sector i are:

(1) export-weighted:

$$FXExp_t^i = \prod_{j=1}^{N(t)} \left(rer_{j,t}\right)^{w_{j,t}^i} \tag{6}$$

where

$$w_{j,t}^i = \frac{X_{j,t}^i}{\sum_j X_{j,t}^i} \tag{7}$$

(2) import-weighted

$$FXImp_t^i = \prod_{j=1}^{N(t)} \left(rer_{j,t}\right)^{w_{j,t}^i} \tag{8}$$

where

$$w_{j,t}^i = \frac{M_{j,t}^i}{\sum_j M_{j,t}^i} \tag{9}$$

(3) trade-weighted

$$FXTrade_t^i = \prod_{j=1}^{N(t)} \left(rer_{j,t}\right)^{w_{j,t}^i} \tag{10}$$

where

$$w_{j,t}^i = 0.5 \left(\frac{X_{j,t}^i}{\sum_j X_{j,t}^i} + \frac{M_{j,t}^i}{\sum_j M_{j,t}^i} \right) \tag{11}$$

In the formulas above, $rer_{j,t}$ stands for the bilateral real exchange rates of each of Portugal's trading partner (indexed by j). Inflation differentials are accounted for by the consumer price index — see equation (2). It would seem more appropriate to use sectoral price indexes. However, we do not have access to that sort of data. As before, an increase in the value of these indexes implies a real depreciation of the Portuguese currency.

Although the weights of the different currencies vary significantly across sectors, the Portuguese industry-specific effective exchange rates are strongly correlated with aggregate exchange rate indexes. Table 3 shows six sets of correlations of exchange rate indexes – see notes on Table 3 – and the number of sectors for different levels of correlation. In fact, when using trade weights (that is, the average of export and import shares), Table 3 shows that in only 4 of the 28 sectors is the correlation between the industry-specific and the aggregate exchange rate index below 0.9 (column 3). This number increases to 5 (column 1) when exports are used as weights and to 9 in the case of imports (column 3).

Table 3: Correlations between exchange rate indexes

	(1)	(2)	(3)	(4)	(5)	(6)
$Corr \geq 0.90$	23	19	24	16	25	23
$0.90 > corr \geq 0.80$	3	3	2	4	2	3
$0.80 > corr \geq 0.70$	0	1	0	2	0	2
$0.70 > corr$	2	5	2	6	1	0

Notes: number of sectors in each correlation grouping out of 28 sectors. In columns (1), (2), (3), (4), (5) and (6), we have $FXExp_i$ with FXTradeG, $FXImp_i$ with FXTradeG, $FXTrade_i$ with FXTradeG, $FXExp_i$ with $FXImp_i$, $FXExp_i$ with $FXTrade_i$ and $FXImp_i$ with $FXTrade_i$, respectively.

Table 4: Exchange rate indexes percentage change

	$FXExp_i$	$FXImp_i$	$FXTrade_i$
	1988-2006	1988-2006	1988-2006
Food products, beverages and tobacco	-20,8	-18	-19,4
Textiles, textile products, leather and footwear	-24,3	-18,2	-21,3
Chemicals excluding Pharmaceuticals	-21,7	-21,2	-21,4
Machinery and equipment, nec	-20,7	-24,8	-22,8
Motor vehicles, trailers and semi-trailers	-26	-26	-26
Global	-24,3	-21,1	-22,7

The different industry indexes are also highly correlated between them. In 16 of the 28 sectors the correlation between the export-based and the import-based indexes is above 0.9 (column 4). This number increases to 23 when one compares the import- and the trade-based indexes (column 6), and to 25 when comparing the export- and the trade-based indexes (column 5).

The sectors that appear to differ most from the majority are "Aircraft and spacecraft", "Electricity, gas and water supply" and "Scrap metal", followed by "Agriculture, hunting, forestry and fishing" and "Mining and quarrying".

Given the evidence of high correlation presented above, it is not surprising that the change in the exchange rate indexes is broadly similar across industries. Table 4 shows the change in the exchange rate indexes for the 5 most important sectors ("Food products, beverages and tobacco", "Textiles, textile products, leather and footwear", "Chemicals

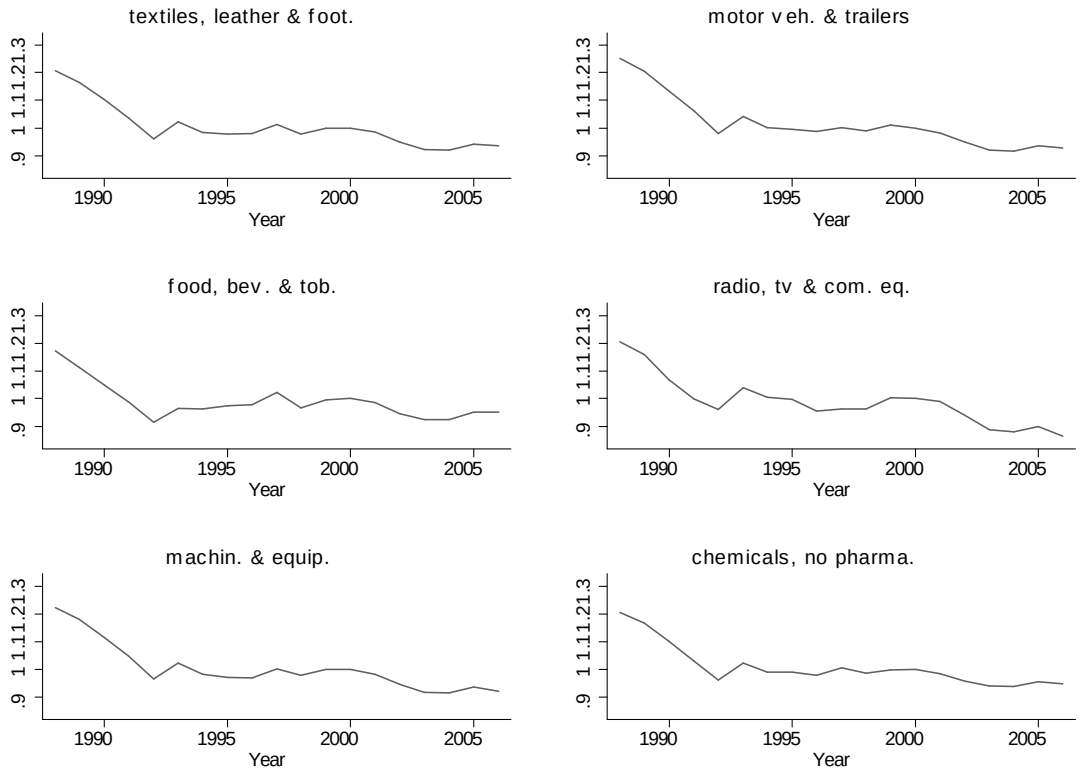

Figure 5: Sector-specific exchange rates

excluding Pharmaceuticals", "Machinery and equipment, n.e.c.", and "Motor vehicles, trailers and semi-trailers") and for the aggregate of 28 sectors. The same conclusion may also be drawn from the analysis of Figure 5 where sector-specific exchange rates show very similar patterns (for the graphs of the remaining sector-specific exchange rates see Figures 6, 7 and 8 in the Appendix).

Sector-specific exchange rate series are presented in Table 11 in the Appendix and can be downloaded at http://www3.eeg.uminho.pt/economia/nipe/docs/2009/DATA_NIPE_WP_13_2009.xls.

4 Aggregate versus sector-specific exchange rates indexes: an application to labour market demand

There is a growing literature on the impact of exchange rate movements on labour markets — see, e.g., Campa and Goldberg (2001) and the references therein. In particular, the wild swings of the US dollar in the 1980s have been a special focus of attention. Branson

and Love (1988) estimate that the appreciation of the US dollar in the first half of the 1980s caused the loss of about 1 million jobs in US manufacturing. Using data for a sub-sample of manufacturing sectors over a similar time-period, Revenga (1992) found evidence that the appreciation of the US dollar had reduced employment in US manufacturing sectors by 4.5-7.5% on average, besides having reduced wages. Campa and Goldberg (2001) add data for the 1990s. They also find an effect of exchange rates on US manufacturing employment. However, their analysis shows that the exchange rate impact is less than previously estimated and that it is concentrated in low price-over-cost-markup industries and in industries with proportionally less college-educated workers. Similar studies have been conducted in other countries. For example, Gourinchas (1999) estimated that a 1% appreciation of the French franc increases tradable employment growth by 0.9% in the following two years. Another recent study is that of Ekholm et al. (2008), who conclude that the sharp appreciation of the Norwegian krone in the early 2000s explains one seventh of the total decline in manufacturing employment in that period.

Here we will perform a similar analysis using Portuguese data. However, the goal here is not to conduct an exhaustive study of the impact of exchange rate movements on Portuguese manufacturing employment, but rather to compare the usefulness of the different exchange rate indexes discussed in the study of the issue. We use employment sector-level data, for the period 1988-2006, from the "Quadros de Pessoal" dataset provided by the Portuguese Ministry of Labour and Social Solidarity (Portugal, 2006). This dataset is based on a compulsory survey that matches all firms and establishments (with at least one employee) with their workers. In 1988, it included 122,774 firms and 1,996,933 workers, covering 43% of total employment. In 2006, it included 344,024 firms and 3,099,513 workers, covering 55% of total employment. We aggregated the firm-level data from Quadros de Pessoal to obtain sector-level data for 21 manufacturing sectors, which were selected to match the International Standard Industrial Classification of all economic activities, Revision 3 (ISIC Rev. 3), as they are more exposed to foreign trade. Of the 28 sectors used in the previous section we exclude non-manufacturing sectors such as "Agriculture, hunting, forestry and fishing", "Mining and quarrying", "Electricity, gas and water supply", "Scrap metal", "Waste" and the residual sector "Other". We also have excluded "Coke, refined petroleum products and nuclear fuel". For a list of the remaining 21 sectors see Table 7 in the appendix.

To evaluate at the sector-level the effect of real aggregate and sector-specific exchange rates on employment growth we use a model based on Gourinchas (1999), specified in

first-differences, with the following form:

$$\Delta l_{jt} = \beta_0 + \beta_1 \Delta ExRate_{j,t-1} + \beta_2 \Delta ShareImp_{j,t-1} + \lambda_t + \theta_j + \boldsymbol{\tau} \mathbf{Z}_{t-1} + \varepsilon_{jt} \qquad (12)$$

The dependent variable, l_{jt}, is employment (in logs), measured as total workers observed for each sector j in year t. $ExRate_{j,t-1}$ is either the lagged real effective aggregate exchange rate or sector j exchange rate (in logs), as defined in the previous section.[10] The exchange rate is smoothed by the Hodrick-Prescott filter, which filters out the transitory component of the exchange rate. In order to account for competition from non-OECD countries (in particular, from emerging countries), we include the variable $ShareImp_{j,t-1}$, which is the share of non-OECD countries in sector j OECD countries' imports. Δ denotes the first difference of the variables. The model also includes a set of time dummies, λ_t, in order to control for common aggregate time variant shocks, such as monetary policy shocks, and a set of sectoral dummies θ_j. Since we specify a model in first-differences, these dummies account for sector-specific trends. Finally, ε_{jt} is a white noise error term. All variables are in real terms. The model is estimated by OLS, with robust standard errors allowing for within-sector correlation.

When the model is estimated using the aggregate real effective exchange rate we cannot control for aggregate shocks using time dummies. As such, we control for aggregate shocks that may affect input prices using changes in oil prices ($\Delta RPOil_{t-1}$), changes in the long-term interest rate ($\Delta LTIR_{t-1}$) and changes in unit labour costs (ΔULC_{t-1}). Additionally, we also control for business cycle effects by including changes in the logarithm of real GDP in the European Union-15 ($\Delta \ln(RGDP_{t-1}) : EU$) or in the logarithm of real Portuguese GDP ($\Delta \ln(RGDP_{t-1}) : PT$). These control variables are included in vector $\mathbf{Z}_{t-1}$ and are lagged one year.

Table 5: Aggregate and sectoral exchange rate: OLS regressions in first-differences

	AGGREGATE		SECTORAL SPECIFIC			
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Log(ExRateAgg_{t-1})$	.610	.446				
	(.578)	(.739)				
$\Delta Log(ExRateSec_{t-1})$			.921*	.810*	2.638**	2.661**
			(.525)	(.489)	(1.213)	(1.127)
$\Delta ShareImp_{t-1}$	-.915***	-.949***	-.920***	-.943***	-.979***	-1.000***
	(.236)	(.240)	(.230)	(.238)	(.173)	(.280)
$\Delta RPOil_{t-1}$	-.006	-.004	-.006	-.006		

Continued on next page...

[10] The exchange rate used in the estimation is computed using the average of export and import shares as bilateral exchange rate weights.

... table 5 continued

	AGGREGATE		SECTORAL SPECIFIC			
	(1)	(2)	(3)	(4)	(5)	(6)
	(.044)	(.031)	(.044)	(.030)		
ΔRI_{t-1}	-.0003	-.001	.0009	.0002		
	(.007)	(.007)	(.007)	(.006)		
$\Delta log(RGDP_{t-1}) : EU$	-.210		-.217			
	(2.109)		(2.136)			
$\Delta log(RGDP_{t-1}) : PT$		-.363		-.299		
		(.935)		(.887)		
ΔULC_{t-1}	.0004	.0009	.002	.002		
	(.005)	(.005)	(.004)	(.005)		
Time dummies	no	no	no	no	yes	yes
Sectoral dummies	no	no	no	no	no	yes
Observations	357	357	357	357	357	357
R^2	.007	.008	.009	.01	.042	.076
LogLikelihood	-4.043	-3.906	-3.723	-3.633	2.309	8.685
RMSE	.247	.247	.247	.247	.247	.25

Notes: Significance levels: $*$: 10% $**$: 5% $***$: 1%. All regressions are estimated by OLS. RMSE is root mean squared error. The exchange rate is the filtered series obtained by the Hodrick-Prescott (1997) filter. Regressions under AGGREGATE are estimated using the aggregate exchange rate, while regressions under SECTORAL SPECIFIC are estimated using the sectoral exchange rate. Regressions (3) and (4) are estimated using sectoral dummies. Regressions (2) and (4) are estimated using time dummies.

Table 5 shows the results of the estimation of equation (12). Our results, using both EU-15 GDP and Portuguese GDP growth as control variables — columns (1) and (2) —, suggest that the aggregate exchange rate does not explain changes in employment. On the contrary, sector-specific exchange rates play an important role in the explanation of movements in employment — columns (3) to (6). Using the sector-specific exchange rate, and GDP growth for EU-15, column (3), the estimated employment-exchange rate elasticity is 0.921. Using the Portuguese GDP growth the elasticity is slightly smaller (0.810). These elasticities are similar to the ones reported by Gourinchas (1999). However, as mentioned in Gourinchas (1999), international comparisons should take into account labour market specificities, so that a comparison of our estimates with those reported in other studies is not straightforward.

In column (5) we combine sector-specific exchange rates with time dummies to control for aggregate shocks. Time dummies are preferred to aggregate controls since we can control for any common aggregate shock which is correlated with changes in sectoral-

specific exchange rates. In this case, there is both an increase in the employment-exchange rate elasticity and in its significance: a 1% depreciation of the real exchange rate implies a 2.64% increase in sectoral employment. This result is robust to the inclusion of sector-specific trends — see column (6). In addition, it is important to note that the inclusion of sector-specific exchange rates increases the precision of the estimates.

Finally, it should be stressed that our results show a negative effect of non-OECD competition on employment, with an implied elasticity in the range 0.92 – 1.00.

5 Conclusion

The integration in the EEC, in 1986, implied structural changes in the behaviour of Portuguese real exchange rate indexes. On the one hand, changes in Portugal's international trade patterns have resulted in a significant variation in bilateral exchange rate weights in effective exchange rate indexes. On the other hand, the participation in the Exchange Rate Mechanism reduced the scope for changes in the nominal value of the escudo. However, even after the accession to the euro area, inflation differentials and fluctuations of the euro vis-à-vis other currencies still had an impact on real effective exchange rates.

These were the motivations for computing exchange rate indexes for the Portuguese economy. Exchange rate indexes depend on the group of trade-partner countries included in exchange rate indexes and on the bilateral exchange rate weights, which depend on whether we consider total trade, exports or imports. For example, between 1988 and 2006, the analysis of bilateral exchange rate weights shows an increasing weight of Spain and a decreasing weight of the United Kingdom in exchange rate indexes. After 1998, aggregate exchange rate indexes based on exports, imports and total trade exhibit very similar patterns. However, between 1988 and 1998, import-weighted and export-weighted exchange rate indexes, although they converge, provide very different pictures for exchange rate movements.

Additionally, exchange rate indexes may be computed for the whole economy and for specific sectors of the economy, as the group of trade-partner countries varies between sectors. For this reason it has been argued that sector-specific exchange rates are more informative on the competitiveness of the economy. We computed exchange rate indexes for 28 sectors and concluded that Portuguese sector-specific effective exchange rates are strongly correlated between them and with aggregate exchange rate indexes.

Finally, following the literature on exchange rates and labour markets, we used employment sector-level data to evaluate the benefits of using sector-specific real exchange rates relative to aggregate exchange rate indexes. Our estimates suggest that sector-specific exchange rates are more informative than aggregate exchange rate indexes in

explaining changes in manufacturing employment. We estimate that, at the sector-level, a 1% real appreciation decreases employment growth by 0.8-2.7%. Our results suggest that more effort should be devoted to the construction and analysis of sector-specific exchange rate indexes.

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A Appendix

Table 6: List of Sectors

Sector	ISIC Rev. 3
agriculture, hunting, forestry and fishing	01 - 05
mining and quarrying	10 - 14
food products, beverages and tobacco	15 - 16
textiles, textile products, leather and footwear	17 - 19
wood and products of wood and cork	20
pulp, paper, paper products, printing and publishing	21 - 22
coke, refined petroleum products and nuclear fuel	23
chemicals excluding pharmaceuticals	24, excl. 2423
pharmaceuticals	2423
rubber and plastics products	25
other non-metallic mineral products	26
iron and steel	271 + 2731
non-ferrous metals	272 + 2732
fabricated metal products, except machinery and equipment	28
machinery and equipment, nec	29
office, accounting and computing machinery	30

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... table 6 continued

Sector	ISIC Rev. 3
electrical machinery and apparatus, nec	31
radio, television and communication equipment	32
medical, precision and optical instruments, watches and clocks	33
motor vehicles, trailers and semi-trailers	34
building and repairing of ships and boats	351
aircraft and spacecraft	353
railroad equipment and transport equipment nec	352 + 359
manufacturing nec	36 - 37
electricity, gas and water supply	40
scrap metal	
waste	
other	

Table 7: Exports by Sector: Total exports (US 10^3 dollars), sector share in total exports and rank

Sector	$Ex88$	$S88$	$R88$	$Ex06$	$S06$	$R06$
pharmaceuticals	88133	0.008	14	453816	0.012	17
office, accounting and computing machinery	66290	0.006	16	748174	0.020	15
radio, television and communication equipment	371430	0.035	8	3039757	0.080	4
medical, precision and opt. inst., watches, clocks	64578	0.006	18	374783	0.010	18
aircraft and spacecraft	38257	0.004	20	99656	0.003	20
chemicals excluding pharmaceuticals	617246	0.059	6	2462823	0.065	6
machinery and equipment, nec	361495	0.035	9	2572785	0.068	5
electrical machinery and apparatus, nec	297018	0.028	10	1678416	0.044	9
motor vehicles, trailers and semi-trailers	721393	0.069	5	5482275	0.144	2
railroad equipment and transport equipment nec	12225	0.001	21	188601	0.005	19
rubber and plastics products	134250	0.013	13	1689521	0.045	8
other non-metallic mineral products	431736	0.041	7	1711633	0.045	7
iron and steel	66259	0.006	17	1084494	0.029	14
non-ferrous metals	75396	0.007	15	633388	0.017	16
fabricated metal products, except mach and equip	239127	0.023	11	1615982	0.043	10
building and repairing of ships and boats	44271	0.004	19	87711	0.002	21
food products, beverages and tobacco	812261	0.078	3	3076193	0.081	3
textiles, textile products, leather and footwear	4245899	0.406	1	6657559	0.175	1

Continued on next page...

... table 7 continued

Sector	$Ex88$	$S88$	$R88$	$Ex06$	$S06$	$R06$
wood and products of wood and cork	731368	0.070	4	1582630	0.042	11
pulp, paper, paper products, printing and pub	853416	0.082	2	1565557	0.041	12
manufacturing nec	194072	0.019	12	1135634	0.030	13
Total exports	10466119			37941388		

Note: in the column title 'Ex' stands for exports, 'S' for share and 'R' for rank; numbers stand for years. Export values are in current values.

Table 8: Imports by Sector: Total imports (US 10^3 dollars), sector share in total imports and rank

Sector	$Im88$	$S88$	$R88$	$Im06$	$S06$	$R06$
pharmaceuticals	288493	0.020	15	2396052	0.046	8
office, accounting and computing machinery	488890	0.033	8	1533581	0.030	13
radio, television and communication equipment	758549	0.051	6	4262404	0.082	6
medical, precision and opt. inst., watches, clocks	352934	0.024	13	1375875	0.027	15
aircraft and spacecraft	55028	0.004	19	703127	0.014	18
chemicals excluding pharmaceuticals	1671470	0.113	3	5196197	0.100	3
machinery and equipment, nec	2312008	0.157	2	4469612	0.086	5
electrical machinery and apparatus, nec	463250	0.031	9	1865671	0.036	10
motor vehicles, trailers and semi-trailers	2706021	0.184	1	7176663	0.139	1
railroad equipment and transport equipment nec	53892	0.004	20	224804	0.004	20
rubber and plastics products	378555	0.026	12	1653024	0.032	12
other non-metallic mineral products	243315	0.017	17	995673	0.019	17
iron and steel	587824	0.040	7	2685929	0.052	7
non-ferrous metals	388547	0.026	10	1895516	0.037	9
fabricated metal products, except mach and equip	298798	0.020	14	1495433	0.029	14
building and repairing of ships and boats	35974	0.002	21	52798	0.001	21
food products, beverages and tobacco	1415829	0.096	5	5478461	0.106	2
textiles, textile products, leather and footwear	1546021	0.105	4	4588713	0.089	4
wood and products of wood and cork	62355	0.004	18	592207	0.011	19
pulp, paper, paper products, printing and pub	385853	0.026	11	1775249	0.034	11
manufacturing nec	251414	0.017	16	1355517	0.026	16
Total imports	14745021			51772504		

Note: in the column title 'Im' stands for imports, 'S' for share and 'R' for rank; numbers stand for years. Import values are in current values.

Table 9: Aggregate real exchange rates: alternative trade weights

Year	FXExp	FXImp	FXTrade
1988	1,213	1,189	1,198
1989	1,169	1,144	1,154
1990	1,099	1,084	1,090
1991	1,037	1,021	1,027
1992	0,964	0,956	0,959
1993	1,025	1,011	1,016
1994	0,981	0,980	0,980
1995	0,976	0,979	0,978
1996	0,972	0,977	0,974
1997	1,008	1,005	1,006
1998	0,978	0,976	0,977
1999	1,000	1,000	1,000
2000	1,000	1,000	1,000
2001	0,987	0,986	0,986
2002	0,947	0,944	0,945
2003	0,914	0,920	0,918
2004	0,909	0,916	0,913
2005	0,933	0,942	0,939
2006	0,918	0,938	0,930

Table 10: Aggregate real exchange rates: alternative country set

Year	FXTradeB	FXTradeEA	FXTradeG
1988	1,213	1,189	1,198
1989	1,169	1,144	1,154
1990	1,099	1,084	1,090
1991	1,037	1,021	1,027
1992	0,964	0,956	0,959
1993	1,025	1,011	1,016
1994	0,981	0,980	0,980
1995	0,976	0,979	0,978
1996	0,972	0,977	0,974
1997	1,008	1,005	1,006
1998	0,978	0,976	0,977
1999	1,000	1,000	1,000
2000	1,000	1,000	1,000
2001	0,987	0,986	0,986
2002	0,947	0,944	0,945
2003	0,914	0,920	0,918
2004	0,909	0,916	0,913
2005	0,933	0,942	0,939
2006	0,918	0,938	0,930

Table 11: Sectoral-specific exchange rates

Year	Sector	ISIC Ver. 3	FXExp	FXImp	FXTrade
1988	food products, beverages and tobacco	15 - 16	1,179	1,172	1,174
1989	food products, beverages and tobacco	15 - 16	1,116	1,114	1,115
1990	food products, beverages and tobacco	15 - 16	1,066	1,043	1,050
1991	food products, beverages and tobacco	15 - 16	1,008	0,978	0,987
1992	food products, beverages and tobacco	15 - 16	0,940	0,904	0,914
1993	food products, beverages and tobacco	15 - 16	0,984	0,955	0,964
1994	food products, beverages and tobacco	15 - 16	0,966	0,961	0,962
1995	food products, beverages and tobacco	15 - 16	0,971	0,975	0,974
1996	food products, beverages and tobacco	15 - 16	0,976	0,978	0,977
1997	food products, beverages and tobacco	15 - 16	1,017	1,024	1,022
1998	food products, beverages and tobacco	15 - 16	0,979	0,961	0,967
1999	food products, beverages and tobacco	15 - 16	0,997	0,993	0,994
2000	food products, beverages and tobacco	15 - 16	1,000	1,000	1,000
2001	food products, beverages and tobacco	15 - 16	0,983	0,988	0,986
2002	food products, beverages and tobacco	15 - 16	0,936	0,951	0,946
2003	food products, beverages and tobacco	15 - 16	0,914	0,928	0,924
2004	food products, beverages and tobacco	15 - 16	0,914	0,930	0,925
2005	food products, beverages and tobacco	15 - 16	0,944	0,956	0,952
2006	food products, beverages and tobacco	15 - 16	0,934	0,960	0,952
1988	textiles, textile products, leather and footwear	17 - 19	1,224	1,160	1,207
1989	textiles, textile products, leather and footwear	17 - 19	1,174	1,135	1,163
1990	textiles, textile products, leather and footwear	17 - 19	1,108	1,090	1,103
1991	textiles, textile products, leather and footwear	17 - 19	1,039	1,030	1,036
1992	textiles, textile products, leather and footwear	17 - 19	0,963	0,953	0,960
1993	textiles, textile products, leather and footwear	17 - 19	1,031	1,006	1,023
1994	textiles, textile products, leather and footwear	17 - 19	0,984	0,985	0,984
1995	textiles, textile products, leather and footwear	17 - 19	0,975	0,984	0,978
1996	textiles, textile products, leather and footwear	17 - 19	0,973	0,993	0,979
1997	textiles, textile products, leather and footwear	17 - 19	1,011	1,015	1,012
1998	textiles, textile products, leather and footwear	17 - 19	0,974	0,987	0,978
1999	textiles, textile products, leather and footwear	17 - 19	1,001	0,998	1,000
2000	textiles, textile products, leather and footwear	17 - 19	1,000	1,000	1,000
2001	textiles, textile products, leather and footwear	17 - 19	0,988	0,980	0,985
2002	textiles, textile products, leather and footwear	17 - 19	0,951	0,947	0,949
2003	textiles, textile products, leather and footwear	17 - 19	0,916	0,934	0,922
2004	textiles, textile products, leather and footwear	17 - 19	0,914	0,933	0,921
2005	textiles, textile products, leather and footwear	17 - 19	0,933	0,957	0,943
2006	textiles, textile products, leather and footwear	17 - 19	0,927	0,949	0,936
1988	wood and products of wood and cork	20	1,174	1,111	1,169
1989	wood and products of wood and cork	20	1,104	1,162	1,107
1990	wood and products of wood and cork	20	1,047	1,076	1,049
1991	wood and products of wood and cork	20	0,987	0,973	0,985
1992	wood and products of wood and cork	20	0,933	0,889	0,926
1993	wood and products of wood and cork	20	1,011	0,900	0,993
1994	wood and products of wood and cork	20	0,959	0,952	0,958
1995	wood and products of wood and cork	20	0,944	1,000	0,953
1996	wood and products of wood and cork	20	0,934	1,000	0,946
1997	wood and products of wood and cork	20	0,994	1,038	1,003
1998	wood and products of wood and cork	20	0,954	0,987	0,961
1999	wood and products of wood and cork	20	0,998	0,990	0,996
2000	wood and products of wood and cork	20	1,000	1,000	1,000
2001	wood and products of wood and cork	20	0,983	0,981	0,983
2002	wood and products of wood and cork	20	0,919	0,902	0,915

Continued on next page...

... table 11 continued

Year	Sector	ISIC Ver. 3	FXExp	FXImp	FXTrade
2003	wood and products of wood and cork	20	0,886	0,882	0,885
2004	wood and products of wood and cork	20	0,878	0,867	0,875
2005	wood and products of wood and cork	20	0,917	0,935	0,922
2006	wood and products of wood and cork	20	0,900	0,931	0,908
1988	pulp, paper, paper products, printing and publishing	21 - 22	1,213	1,194	1,207
1989	pulp, paper, paper products, printing and publishing	21 - 22	1,167	1,188	1,173
1990	pulp, paper, paper products, printing and publishing	21 - 22	1,090	1,128	1,105
1991	pulp, paper, paper products, printing and publishing	21 - 22	1,038	1,067	1,051
1992	pulp, paper, paper products, printing and publishing	21 - 22	0,962	0,969	0,965
1993	pulp, paper, paper products, printing and publishing	21 - 22	1,025	1,012	1,018
1994	pulp, paper, paper products, printing and publishing	21 - 22	0,989	0,998	0,993
1995	pulp, paper, paper products, printing and publishing	21 - 22	0,974	1,005	0,988
1996	pulp, paper, paper products, printing and publishing	21 - 22	0,981	0,991	0,986
1997	pulp, paper, paper products, printing and publishing	21 - 22	1,016	1,019	1,017
1998	pulp, paper, paper products, printing and publishing	21 - 22	0,993	0,989	0,991
1999	pulp, paper, paper products, printing and publishing	21 - 22	1,004	1,000	1,002
2000	pulp, paper, paper products, printing and publishing	21 - 22	1,000	1,000	1,000
2001	pulp, paper, paper products, printing and publishing	21 - 22	0,982	0,984	0,983
2002	pulp, paper, paper products, printing and publishing	21 - 22	0,956	0,962	0,959
2003	pulp, paper, paper products, printing and publishing	21 - 22	0,932	0,950	0,941
2004	pulp, paper, paper products, printing and publishing	21 - 22	0,920	0,946	0,934
2005	pulp, paper, paper products, printing and publishing	21 - 22	0,942	0,963	0,954
2006	pulp, paper, paper products, printing and publishing	21 - 22	0,929	0,964	0,948
1988	chemicals excluding pharmaceuticals	24, excl. 2423	1,216	1,201	1,205
1989	chemicals excluding pharmaceuticals	24, excl. 2423	1,195	1,159	1,168
1990	chemicals excluding pharmaceuticals	24, excl. 2423	1,117	1,097	1,102
1991	chemicals excluding pharmaceuticals	24, excl. 2423	1,066	1,021	1,031
1992	chemicals excluding pharmaceuticals	24, excl. 2423	0,987	0,957	0,963
1993	chemicals excluding pharmaceuticals	24, excl. 2423	1,026	1,022	1,023
1994	chemicals excluding pharmaceuticals	24, excl. 2423	0,975	0,995	0,990
1995	chemicals excluding pharmaceuticals	24, excl. 2423	0,978	0,996	0,992
1996	chemicals excluding pharmaceuticals	24, excl. 2423	0,970	0,982	0,979
1997	chemicals excluding pharmaceuticals	24, excl. 2423	0,998	1,009	1,006
1998	chemicals excluding pharmaceuticals	24, excl. 2423	0,977	0,989	0,987
1999	chemicals excluding pharmaceuticals	24, excl. 2423	0,992	1,000	0,998
2000	chemicals excluding pharmaceuticals	24, excl. 2423	1,000	1,000	1,000
2001	chemicals excluding pharmaceuticals	24, excl. 2423	0,986	0,986	0,986
2002	chemicals excluding pharmaceuticals	24, excl. 2423	0,959	0,957	0,958
2003	chemicals excluding pharmaceuticals	24, excl. 2423	0,945	0,939	0,940
2004	chemicals excluding pharmaceuticals	24, excl. 2423	0,948	0,936	0,939
2005	chemicals excluding pharmaceuticals	24, excl. 2423	0,960	0,954	0,956
2006	chemicals excluding pharmaceuticals	24, excl. 2423	0,953	0,946	0,948
1988	pharmaceuticals	2423	1,169	1,184	1,181
1989	pharmaceuticals	2423	1,107	1,136	1,131
1990	pharmaceuticals	2423	0,993	1,078	1,064
1991	pharmaceuticals	2423	0,966	1,004	0,998
1992	pharmaceuticals	2423	0,938	0,951	0,949
1993	pharmaceuticals	2423	1,022	1,043	1,040
1994	pharmaceuticals	2423	0,948	1,002	0,995
1995	pharmaceuticals	2423	0,947	1,004	0,996
1996	pharmaceuticals	2423	0,941	0,975	0,969
1997	pharmaceuticals	2423	0,982	1,011	1,007
1998	pharmaceuticals	2423	0,965	0,983	0,980

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Year	Sector	ISIC Ver. 3	FXExp	FXImp	FXTrade
1999	pharmaceuticals	2423	0,999	0,995	0,996
2000	pharmaceuticals	2423	1,000	1,000	1,000
2001	pharmaceuticals	2423	0,981	0,991	0,989
2002	pharmaceuticals	2423	0,912	0,960	0,952
2003	pharmaceuticals	2423	0,861	0,929	0,919
2004	pharmaceuticals	2423	0,864	0,927	0,918
2005	pharmaceuticals	2423	0,909	0,936	0,933
2006	pharmaceuticals	2423	0,903	0,925	0,922
1988	rubber and plastics products	25	1,226	1,244	1,240
1989	rubber and plastics products	25	1,183	1,209	1,203
1990	rubber and plastics products	25	1,122	1,132	1,130
1991	rubber and plastics products	25	1,058	1,061	1,061
1992	rubber and plastics products	25	0,934	0,990	0,978
1993	rubber and plastics products	25	1,028	1,043	1,040
1994	rubber and plastics products	25	0,984	1,004	0,998
1995	rubber and plastics products	25	0,984	1,000	0,995
1996	rubber and plastics products	25	0,980	0,981	0,980
1997	rubber and plastics products	25	1,012	0,998	1,002
1998	rubber and plastics products	25	0,992	0,982	0,985
1999	rubber and plastics products	25	1,001	1,003	1,002
2000	rubber and plastics products	25	1,000	1,000	1,000
2001	rubber and plastics products	25	0,987	0,984	0,985
2002	rubber and plastics products	25	0,961	0,961	0,961
2003	rubber and plastics products	25	0,944	0,939	0,941
2004	rubber and plastics products	25	0,941	0,939	0,940
2005	rubber and plastics products	25	0,953	0,956	0,955
2006	rubber and plastics products	25	0,949	0,949	0,949
1988	other non-metallic mineral products	26	1,202	1,259	1,223
1989	other non-metallic mineral products	26	1,160	1,229	1,184
1990	other non-metallic mineral products	26	1,093	1,152	1,112
1991	other non-metallic mineral products	26	1,034	1,084	1,051
1992	other non-metallic mineral products	26	0,966	1,003	0,979
1993	other non-metallic mineral products	26	1,029	1,031	1,029
1994	other non-metallic mineral products	26	0,980	0,988	0,983
1995	other non-metallic mineral products	26	0,970	0,999	0,979
1996	other non-metallic mineral products	26	0,958	0,986	0,968
1997	other non-metallic mineral products	26	0,996	0,998	0,997
1998	other non-metallic mineral products	26	0,964	0,987	0,973
1999	other non-metallic mineral products	26	0,996	0,992	0,995
2000	other non-metallic mineral products	26	1,000	1,000	1,000
2001	other non-metallic mineral products	26	0,990	0,972	0,982
2002	other non-metallic mineral products	26	0,949	0,954	0,951
2003	other non-metallic mineral products	26	0,917	0,955	0,933
2004	other non-metallic mineral products	26	0,916	0,958	0,932
2005	other non-metallic mineral products	26	0,946	0,976	0,958
2006	other non-metallic mineral products	26	0,943	0,971	0,954
1988	iron and steel	271 + 2731	1,232	1,226	1,227
1989	iron and steel	271 + 2731	1,202	1,220	1,218
1990	iron and steel	271 + 2731	1,128	1,134	1,134
1991	iron and steel	271 + 2731	1,049	1,068	1,066
1992	iron and steel	271 + 2731	0,981	0,997	0,995
1993	iron and steel	271 + 2731	0,986	1,037	1,029
1994	iron and steel	271 + 2731	0,940	1,007	0,998

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Year	Sector	ISIC Ver. 3	FXExp	FXImp	FXTrade
1995	iron and steel	271 + 2731	0,977	0,982	0,982
1996	iron and steel	271 + 2731	0,943	0,976	0,972
1997	iron and steel	271 + 2731	1,000	1,018	1,015
1998	iron and steel	271 + 2731	0,979	0,979	0,979
1999	iron and steel	271 + 2731	0,992	0,988	0,989
2000	iron and steel	271 + 2731	1,000	1,000	1,000
2001	iron and steel	271 + 2731	0,987	0,977	0,979
2002	iron and steel	271 + 2731	0,976	0,938	0,946
2003	iron and steel	271 + 2731	0,972	0,926	0,937
2004	iron and steel	271 + 2731	0,978	0,931	0,943
2005	iron and steel	271 + 2731	0,991	0,969	0,975
2006	iron and steel	271 + 2731	0,998	0,967	0,976
1988	non-ferrous metals	272 + 2732	1,268	1,160	1,177
1989	non-ferrous metals	272 + 2732	1,241	1,013	1,040
1990	non-ferrous metals	272 + 2732	1,168	1,074	1,084
1991	non-ferrous metals	272 + 2732	1,118	1,016	1,025
1992	non-ferrous metals	272 + 2732	0,987	0,959	0,961
1993	non-ferrous metals	272 + 2732	1,021	1,031	1,031
1994	non-ferrous metals	272 + 2732	1,009	1,009	1,009
1995	non-ferrous metals	272 + 2732	1,000	1,001	1,001
1996	non-ferrous metals	272 + 2732	0,986	0,983	0,984
1997	non-ferrous metals	272 + 2732	1,007	1,019	1,018
1998	non-ferrous metals	272 + 2732	0,995	0,988	0,989
1999	non-ferrous metals	272 + 2732	0,998	1,005	1,004
2000	non-ferrous metals	272 + 2732	1,000	1,000	1,000
2001	non-ferrous metals	272 + 2732	0,991	0,995	0,994
2002	non-ferrous metals	272 + 2732	0,979	0,999	0,996
2003	non-ferrous metals	272 + 2732	0,968	0,943	0,948
2004	non-ferrous metals	272 + 2732	0,965	0,948	0,951
2005	non-ferrous metals	272 + 2732	0,987	0,959	0,966
2006	non-ferrous metals	272 + 2732	0,989	0,949	0,959
1988	fabricated metal products, except machinery	28	1,207	1,250	1,233
1989	fabricated metal products, except machinery	28	1,163	1,218	1,196
1990	fabricated metal products, except machinery	28	1,109	1,152	1,135
1991	fabricated metal products, except machinery	28	1,057	1,077	1,070
1992	fabricated metal products, except machinery	28	0,973	0,990	0,984
1993	fabricated metal products, except machinery	28	1,020	1,034	1,029
1994	fabricated metal products, except machinery	28	0,979	0,991	0,986
1995	fabricated metal products, except machinery	28	0,981	0,993	0,988
1996	fabricated metal products, except machinery	28	0,965	0,988	0,978
1997	fabricated metal products, except machinery	28	1,010	1,010	1,010
1998	fabricated metal products, except machinery	28	0,971	0,988	0,982
1999	fabricated metal products, except machinery	28	1,000	1,001	1,000
2000	fabricated metal products, except machinery	28	1,000	1,000	1,000
2001	fabricated metal products, except machinery	28	0,987	0,986	0,987
2002	fabricated metal products, except machinery	28	0,946	0,964	0,957
2003	fabricated metal products, except machinery	28	0,923	0,943	0,934
2004	fabricated metal products, except machinery	28	0,923	0,942	0,933
2005	fabricated metal products, except machinery	28	0,951	0,958	0,954
2006	fabricated metal products, except machinery	28	0,946	0,948	0,947
1988	machinery and equipment, nec	29	1,155	1,231	1,222
1989	machinery and equipment, nec	29	1,130	1,189	1,181
1990	machinery and equipment, nec	29	1,071	1,124	1,116

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Year	Sector	ISIC Ver. 3	FXExp	FXImp	FXTrade
1991	machinery and equipment, nec	29	1,015	1,054	1,048
1992	machinery and equipment, nec	29	0,960	0,967	0,966
1993	machinery and equipment, nec	29	1,007	1,027	1,023
1994	machinery and equipment, nec	29	0,956	0,993	0,984
1995	machinery and equipment, nec	29	0,950	0,980	0,973
1996	machinery and equipment, nec	29	0,948	0,978	0,971
1997	machinery and equipment, nec	29	0,996	1,004	1,002
1998	machinery and equipment, nec	29	0,962	0,985	0,980
1999	machinery and equipment, nec	29	0,990	1,003	1,000
2000	machinery and equipment, nec	29	1,000	1,000	1,000
2001	machinery and equipment, nec	29	0,986	0,983	0,984
2002	machinery and equipment, nec	29	0,930	0,954	0,947
2003	machinery and equipment, nec	29	0,901	0,926	0,918
2004	machinery and equipment, nec	29	0,893	0,927	0,916
2005	machinery and equipment, nec	29	0,927	0,942	0,937
2006	machinery and equipment, nec	29	0,916	0,926	0,922
1988	office, accounting and computing machinery	30	1,083	1,169	1,159
1989	office, accounting and computing machinery	30	1,129	1,117	1,119
1990	office, accounting and computing machinery	30	0,954	1,041	1,030
1991	office, accounting and computing machinery	30	0,926	0,972	0,967
1992	office, accounting and computing machinery	30	0,895	0,928	0,926
1993	office, accounting and computing machinery	30	0,993	1,027	1,025
1994	office, accounting and computing machinery	30	0,935	0,969	0,967
1995	office, accounting and computing machinery	30	0,978	0,961	0,962
1996	office, accounting and computing machinery	30	0,958	0,965	0,965
1997	office, accounting and computing machinery	30	1,002	0,992	0,993
1998	office, accounting and computing machinery	30	0,981	0,978	0,978
1999	office, accounting and computing machinery	30	0,993	0,999	0,998
2000	office, accounting and computing machinery	30	1,000	1,000	1,000
2001	office, accounting and computing machinery	30	0,990	0,992	0,991
2002	office, accounting and computing machinery	30	0,919	0,962	0,951
2003	office, accounting and computing machinery	30	0,864	0,935	0,912
2004	office, accounting and computing machinery	30	0,797	0,926	0,881
2005	office, accounting and computing machinery	30	0,831	0,953	0,905
2006	office, accounting and computing machinery	30	0,792	0,945	0,895
1988	electrical machinery and apparatus, nec	31	1,222	1,235	1,230
1989	electrical machinery and apparatus, nec	31	1,180	1,205	1,194
1990	electrical machinery and apparatus, nec	31	1,114	1,119	1,116
1991	electrical machinery and apparatus, nec	31	1,049	1,052	1,051
1992	electrical machinery and apparatus, nec	31	0,981	0,989	0,985
1993	electrical machinery and apparatus, nec	31	1,039	1,057	1,048
1994	electrical machinery and apparatus, nec	31	1,006	1,017	1,011
1995	electrical machinery and apparatus, nec	31	0,985	1,000	0,992
1996	electrical machinery and apparatus, nec	31	0,990	0,980	0,985
1997	electrical machinery and apparatus, nec	31	1,019	1,006	1,013
1998	electrical machinery and apparatus, nec	31	0,984	0,988	0,986
1999	electrical machinery and apparatus, nec	31	1,004	1,003	1,003
2000	electrical machinery and apparatus, nec	31	1,000	1,000	1,000
2001	electrical machinery and apparatus, nec	31	0,986	0,984	0,985
2002	electrical machinery and apparatus, nec	31	0,945	0,957	0,951
2003	electrical machinery and apparatus, nec	31	0,918	0,930	0,924
2004	electrical machinery and apparatus, nec	31	0,917	0,922	0,919
2005	electrical machinery and apparatus, nec	31	0,941	0,944	0,942

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Year	Sector	ISIC Ver. 3	FXExp	FXImp	FXTrade
2006	electrical machinery and apparatus, nec	31	0,942	0,938	0,940
1988	radio, television and communication equipment	32	1,225	1,198	1,207
1989	radio, television and communication equipment	32	1,187	1,144	1,159
1990	radio, television and communication equipment	32	1,111	1,047	1,070
1991	radio, television and communication equipment	32	1,041	0,979	1,000
1992	radio, television and communication equipment	32	0,980	0,951	0,961
1993	radio, television and communication equipment	32	1,045	1,038	1,041
1994	radio, television and communication equipment	32	1,017	0,997	1,005
1995	radio, television and communication equipment	32	1,015	0,983	0,996
1996	radio, television and communication equipment	32	0,947	0,960	0,955
1997	radio, television and communication equipment	32	0,992	0,943	0,963
1998	radio, television and communication equipment	32	0,973	0,956	0,962
1999	radio, television and communication equipment	32	1,002	1,002	1,002
2000	radio, television and communication equipment	32	1,000	1,000	1,000
2001	radio, television and communication equipment	32	0,990	0,987	0,989
2002	radio, television and communication equipment	32	0,931	0,944	0,939
2003	radio, television and communication equipment	32	0,856	0,910	0,888
2004	radio, television and communication equipment	32	0,842	0,904	0,880
2005	radio, television and communication equipment	32	0,858	0,924	0,899
2006	radio, television and communication equipment	32	0,803	0,910	0,864
1988	medical, precision and optical instruments, watches and clocks	33	1,213	1,174	1,179
1989	medical, precision and optical instruments, watches and clocks	33	1,182	1,116	1,126
1990	medical, precision and optical instruments, watches and clocks	33	1,101	1,041	1,050
1991	medical, precision and optical instruments, watches and clocks	33	1,022	0,970	0,977
1992	medical, precision and optical instruments, watches and clocks	33	0,985	0,925	0,934
1993	medical, precision and optical instruments, watches and clocks	33	1,069	1,019	1,028
1994	medical, precision and optical instruments, watches and clocks	33	1,031	0,974	0,987
1995	medical, precision and optical instruments, watches and clocks	33	1,015	0,969	0,982
1996	medical, precision and optical instruments, watches and clocks	33	0,993	0,952	0,962
1997	medical, precision and optical instruments, watches and clocks	33	1,010	0,991	0,995
1998	medical, precision and optical instruments, watches and clocks	33	0,970	0,963	0,965
1999	medical, precision and optical instruments, watches and clocks	33	1,001	0,997	0,997
2000	medical, precision and optical instruments, watches and clocks	33	1,000	1,000	1,000
2001	medical, precision and optical instruments, watches and clocks	33	0,985	0,987	0,987
2002	medical, precision and optical instruments, watches and clocks	33	0,951	0,943	0,945
2003	medical, precision and optical instruments, watches and clocks	33	0,928	0,910	0,914
2004	medical, precision and optical instruments, watches and clocks	33	0,926	0,899	0,905
2005	medical, precision and optical instruments, watches and clocks	33	0,940	0,916	0,920
2006	medical, precision and optical instruments, watches and clocks	33	0,918	0,899	0,902
1988	motor vehicles, trailers and semi-trailers	34	1,266	1,248	1,252
1989	motor vehicles, trailers and semi-trailers	34	1,240	1,194	1,205
1990	motor vehicles, trailers and semi-trailers	34	1,163	1,124	1,134
1991	motor vehicles, trailers and semi-trailers	34	1,086	1,056	1,063
1992	motor vehicles, trailers and semi-trailers	34	0,982	0,979	0,979
1993	motor vehicles, trailers and semi-trailers	34	1,044	1,041	1,041
1994	motor vehicles, trailers and semi-trailers	34	0,997	1,003	1,002
1995	motor vehicles, trailers and semi-trailers	34	1,003	0,991	0,995
1996	motor vehicles, trailers and semi-trailers	34	0,995	0,983	0,988
1997	motor vehicles, trailers and semi-trailers	34	1,020	0,990	1,002
1998	motor vehicles, trailers and semi-trailers	34	1,000	0,983	0,989
1999	motor vehicles, trailers and semi-trailers	34	1,006	1,013	1,011
2000	motor vehicles, trailers and semi-trailers	34	1,000	1,000	1,000
2001	motor vehicles, trailers and semi-trailers	34	0,985	0,980	0,982

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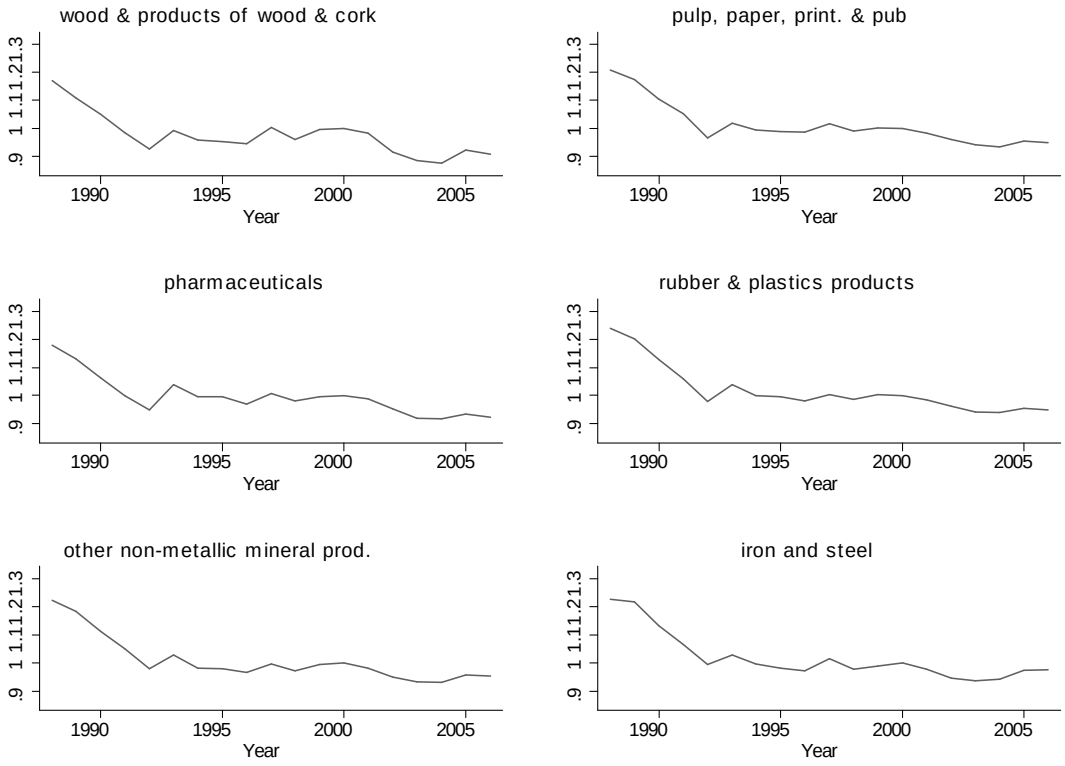
Year	Sector	ISIC Ver. 3	FXExp	FXImp	FXTrade
2002	motor vehicles, trailers and semi-trailers	34	0,957	0,943	0,949
2003	motor vehicles, trailers and semi-trailers	34	0,929	0,914	0,920
2004	motor vehicles, trailers and semi-trailers	34	0,930	0,910	0,918
2005	motor vehicles, trailers and semi-trailers	34	0,945	0,930	0,936
2006	motor vehicles, trailers and semi-trailers	34	0,937	0,923	0,929
1988	building and repairing of ships and boats	351	1,271	1,171	1,201
1989	building and repairing of ships and boats	351	1,273	1,206	1,253
1990	building and repairing of ships and boats	351	1,108	1,099	1,102
1991	building and repairing of ships and boats	351	1,038	1,007	1,022
1992	building and repairing of ships and boats	351	1,046	0,934	0,965
1993	building and repairing of ships and boats	351	1,046	0,932	0,984
1994	building and repairing of ships and boats	351	1,046	0,995	1,011
1995	building and repairing of ships and boats	351	1,075	0,917	0,988
1996	building and repairing of ships and boats	351	1,026	0,935	0,989
1997	building and repairing of ships and boats	351	1,045	0,936	1,026
1998	building and repairing of ships and boats	351	1,027	0,902	0,968
1999	building and repairing of ships and boats	351	0,997	0,990	0,993
2000	building and repairing of ships and boats	351	1,000	1,000	1,000
2001	building and repairing of ships and boats	351	0,983	0,981	0,982
2002	building and repairing of ships and boats	351	0,969	0,950	0,961
2003	building and repairing of ships and boats	351	0,951	0,800	0,861
2004	building and repairing of ships and boats	351	0,906	0,773	0,847
2005	building and repairing of ships and boats	351	0,942	0,948	0,944
2006	building and repairing of ships and boats	351	0,950	0,934	0,943
1988	aircraft and spacecraft	353	1,205	1,019	1,086
1989	aircraft and spacecraft	353	0,998	0,954	0,967
1990	aircraft and spacecraft	353	0,966	0,928	0,938
1991	aircraft and spacecraft	353	0,911	0,876	0,888
1992	aircraft and spacecraft	353	0,925	0,914	0,917
1993	aircraft and spacecraft	353	0,968	1,028	1,007
1994	aircraft and spacecraft	353	0,798	0,944	0,914
1995	aircraft and spacecraft	353	0,783	0,959	0,918
1996	aircraft and spacecraft	353	0,881	0,823	0,840
1997	aircraft and spacecraft	353	0,926	1,050	1,017
1998	aircraft and spacecraft	353	0,937	0,949	0,946
1999	aircraft and spacecraft	353	0,989	0,981	0,983
2000	aircraft and spacecraft	353	1,000	1,000	1,000
2001	aircraft and spacecraft	353	1,015	1,022	1,020
2002	aircraft and spacecraft	353	1,012	0,913	0,951
2003	aircraft and spacecraft	353	0,903	0,837	0,861
2004	aircraft and spacecraft	353	0,735	0,701	0,713
2005	aircraft and spacecraft	353	0,847	0,794	0,808
2006	aircraft and spacecraft	353	0,863	0,850	0,852
1988	railroad equipment and transport equipment nec	352 + 359	1,284	1,253	1,259
1989	railroad equipment and transport equipment nec	352 + 359	1,273	1,216	1,228
1990	railroad equipment and transport equipment nec	352 + 359	1,169	1,131	1,140
1991	railroad equipment and transport equipment nec	352 + 359	1,124	1,033	1,050
1992	railroad equipment and transport equipment nec	352 + 359	1,046	0,973	0,984
1993	railroad equipment and transport equipment nec	352 + 359	1,025	1,053	1,048
1994	railroad equipment and transport equipment nec	352 + 359	0,981	1,026	1,015
1995	railroad equipment and transport equipment nec	352 + 359	0,969	0,993	0,987
1996	railroad equipment and transport equipment nec	352 + 359	0,975	0,925	0,945
1997	railroad equipment and transport equipment nec	352 + 359	1,008	0,974	0,985

Continued on next page...

... table 11 continued

Year	Sector	ISIC Ver. 3	FXExp	FXImp	FXTrade
1998	railroad equipment and transport equipment nec	352 + 359	0,965	0,956	0,959
1999	railroad equipment and transport equipment nec	352 + 359	0,995	1,014	1,009
2000	railroad equipment and transport equipment nec	352 + 359	1,000	1,000	1,000
2001	railroad equipment and transport equipment nec	352 + 359	0,993	0,959	0,970
2002	railroad equipment and transport equipment nec	352 + 359	0,963	0,928	0,938
2003	railroad equipment and transport equipment nec	352 + 359	0,952	0,917	0,929
2004	railroad equipment and transport equipment nec	352 + 359	0,942	0,917	0,927
2005	railroad equipment and transport equipment nec	352 + 359	0,937	0,908	0,921
2006	railroad equipment and transport equipment nec	352 + 359	0,913	0,893	0,902
1988	manufacturing nec	36 - 37	1,217	1,235	1,228
1989	manufacturing nec	36 - 37	1,162	1,204	1,185
1990	manufacturing nec	36 - 37	1,113	1,131	1,123
1991	manufacturing nec	36 - 37	1,050	1,054	1,053
1992	manufacturing nec	36 - 37	1,001	0,968	0,979
1993	manufacturing nec	36 - 37	1,028	1,017	1,021
1994	manufacturing nec	36 - 37	0,979	0,961	0,969
1995	manufacturing nec	36 - 37	0,985	0,959	0,970
1996	manufacturing nec	36 - 37	0,980	0,972	0,975
1997	manufacturing nec	36 - 37	1,017	1,000	1,007
1998	manufacturing nec	36 - 37	0,985	0,981	0,982
1999	manufacturing nec	36 - 37	1,003	0,999	1,000
2000	manufacturing nec	36 - 37	1,000	1,000	1,000
2001	manufacturing nec	36 - 37	0,982	0,988	0,986
2002	manufacturing nec	36 - 37	0,959	0,957	0,958
2003	manufacturing nec	36 - 37	0,946	0,929	0,937
2004	manufacturing nec	36 - 37	0,942	0,920	0,931
2005	manufacturing nec	36 - 37	0,954	0,943	0,948
2006	manufacturing nec	36 - 37	0,960	0,935	0,946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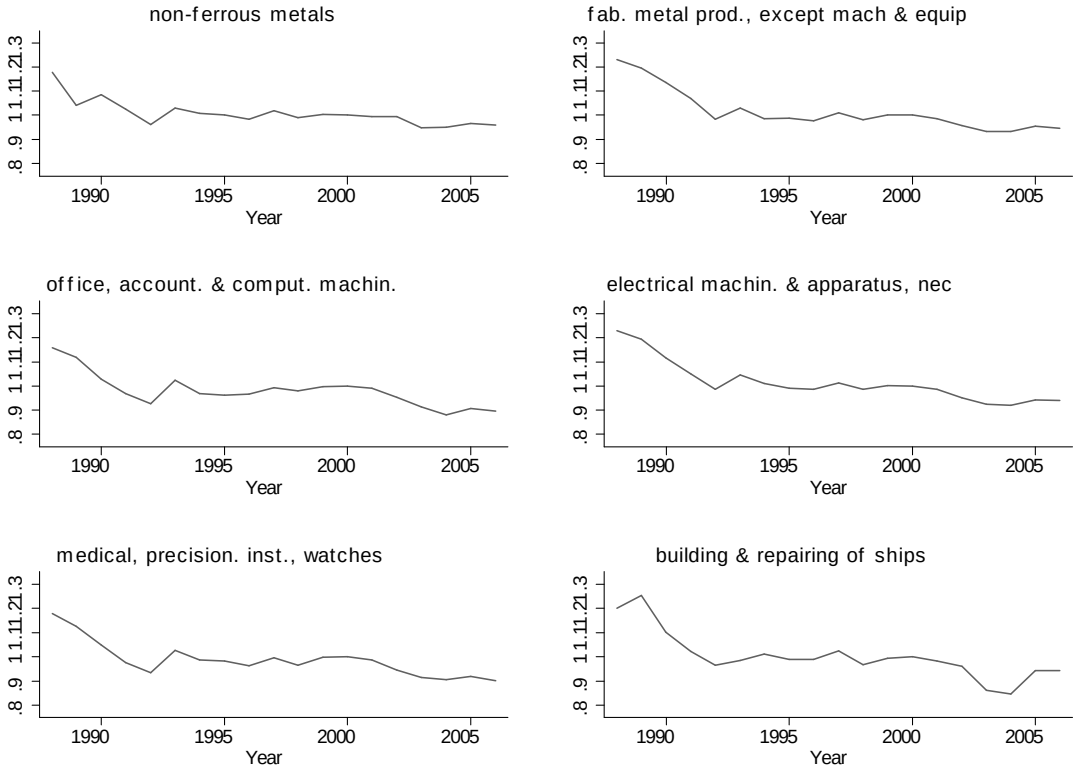

Figure 6: Sector-specific exchange rates

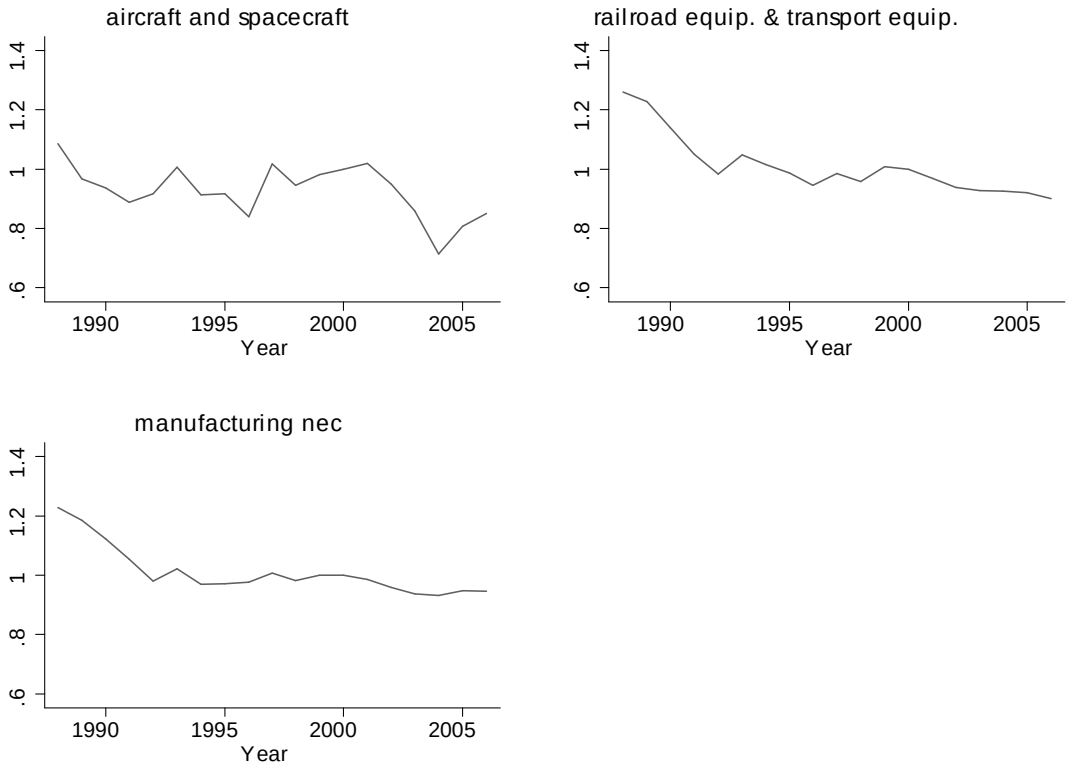

Figure 7: Sector-specific exchange rates

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