Real Exchange Rates and Unemployment Within the Euro Area

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The purpose of this research effort is to examine the factors determining the real exchange rates of individual Euro-Area countries with respect to the remaining Euro-Area countries in the group considered. The reason for doing this is that under circumstances where the nominal exchange rate is fixed, as is obviously the case where countries have a common currency, movements in the equilibrium real exchange rates within the area can only occur through relative price changes which may be temporarily moderated by changes in the level of unemployment, a situation that will be prevented if there is sufficient labour mobility or price level flexibility within the currency union. A fundamental question is whether unemployment generated in this fashion presents a problem for the Euro Area.

1. Basic Theoretical Framework

The basic theory, which is developed in the author's recent book and in a subsequent paper, need only be briefly reviewed here.[1] The real exchange rate is the relative price of domestic output in terms of foreign output and can be expressed as

$$Q = \frac{\Pi P}{\tilde{P}} \tag{1}$$

where Q is the real exchange rate, Π is the nominal exchange rate defined as the foreign currency price of domestic currency, P is the domestic price

[1]See John E. Floyd, *Interest Rates, Exchange Rates and World Monetary Policy*, Springer 2010, Chapter 7, and John E. Floyd, "Canadian Monetary Policy and Real and Nominal Exchange Rates," Department of Economics Working Paper No. 435, University of Toronto, June 15, 2011.

level and $\tilde{P}$ is the foreign price level. Ideally, we should use the implicit GDP deflators as the respective price levels, but the consumer price indexes move basically the same through time and are a bit smoother on a quarter-to-quarter basis, possibly due to measurement issues. At a given level of the real exchange rate, the nominal exchange rate will be inversely related to the ratio of the domestic over the foreign price levels as determined by past domestic relative to foreign price inflation. The domestic and foreign price levels can be expressed as geometrically weighted averages of the prices of the traded and non-traded components of the domestic and foreign outputs:

$$P = P_N^{\theta} P_T^{1-\theta} \tag{2}$$

and

$$\tilde{P} = \tilde{P}_N^{\tilde{\theta}} \tilde{P}_T^{1-\tilde{\theta}} \tag{3}$$

where $1 > \theta > 0$ and $1 > \tilde{\theta} > 0$ are the fractions of domestic and foreign output consisting of non-traded components. It is here assumed that all goods have traded and non-traded components. Substituting (2) and (3) into (1), we obtain

$$\begin{aligned} Q &= \frac{\Pi\, P_N^{\theta} P_T^{1-\theta}}{\tilde{P}_N^{\tilde{\theta}} \tilde{P}_T^{1-\tilde{\theta}}} = \frac{\Pi\, P_N^{\theta} (\tilde{P}_{T_D}/\Pi)^{1-\theta}}{\tilde{P}_N^{\tilde{\theta}} \tilde{P}_T^{1-\tilde{\theta}}} \\ &= \frac{(\Pi/\Pi^{1-\theta})\, P_N^{\theta} \tilde{P}_{T_D}^{1-\theta}}{\tilde{P}_N^{\tilde{\theta}} \tilde{P}_T^{1-\tilde{\theta}}} = \left[\frac{(\Pi P_N)^{\theta}}{\tilde{P}_N^{\tilde{\theta}}}\right] \left[\frac{\tilde{P}_{T_D}^{1-\theta}}{\tilde{P}_T^{1-\tilde{\theta}}}\right] \end{aligned} \tag{4}$$

where $\tilde{P}_{T_D}$ is the foreign currency price of the domestic traded componont of output. The real exchange rate of a country with respect to another country or to the remaining group of countries in a monetary union will thus depend on the ratio of domestic relative to foreign prices of the non-traded components of domestic and foreign output and on the world prices of the domestic traded components relative to the world prices of the foreign traded output components.

The above principles suggest that a rise in a country's terms of trade relative to that of the remaining countries in the currency union will cause its real exchange rate with respect to those countries to rise. Alsp, according to the Balassa-Samuelson hypothesis, the real exchange rate will rise in

response to an increase in domestic relative to foreign full-employment income.[2] As full-employment income rises so do real wages, increasing the cost of producing the non-traded components of home output relative to the cost of producing foreign non-traded output components. A further obvious factor causing the real exchange rate to rise will be shifts of demand of home residents from goods with low non-traded components to those with high non-traded components. One measurable cause of this might well be an increased share of government expenditure on domestic output relative to the corresponding shares of foreign government expenditures on those countries' outputs, since there are obvious political pressures on governments to channel their spending as directly as possible to their home residents. And finally, a decision of international investors, in response to new technological developments in, or to better goverment management of, the home economy as compared to other countries in the currency area, to shift their investment towards the domestic economy from abroad will produce an increased demand for the non-traded components of the domestic as compared to foreign output, requiring a higher real exchange rate to achieve equilibrium.

As demonstrated in the earlier work cited above, this increased capital inflow will necessarily be accompanied by an equivalent reduction in the receiving country's current account surplus or increase in its current account deficit and by an equivalent opposite effect in the area losing capital. This follows directly from the equilibrium condition determining home output, which can be conveniently expressed as

$$I - S + DSB = - B_T(Q, Y, \tilde{Y}) \tag{5}$$

where I and S are investment and savings, DSB is the debt service balance and $B_T(Q, Y, \tilde{Y})$ is the balance of trade in goods and services.[3] This states simply that the net capital inflow plus debt service balance must be equal to the negative of the balance of trade in goods and services. When capital flows in, a rise in the real exchange rate will be required to increase imports relative to exports and thereby decrease the balance of trade surplus or increase the balance of trade deficit to create a flow of goods into the country

[2]B. Balassa, "The Purchasing Power Parity Doctrine: A Reappraisal," *Journal of Political Economy*, Vol. 72, No. 6, 1964, 584-96, and Paul A. Samuelson, "Theoretical Notes on Trade Problems," *Review of Economics and Statistics*, Vol. 46, No. 2, 1964, 145-154.

[3]This relationship follows from the facts that Income equals the sum of consumption, investment and net exports and savings equal the excess of income over consumption.

equal to the inflow of ownership claims to capital. In addition, a short-run increase in domestic income will cause imports to increase at any given real exchange rate, reducing the balance of trade, and an increase in foreign income will raise exports, thereby increasing it. These income changes must necessarily be accompanied by corresponding adjustments of savings relative to investment for goods market equilibrium to be maintained.

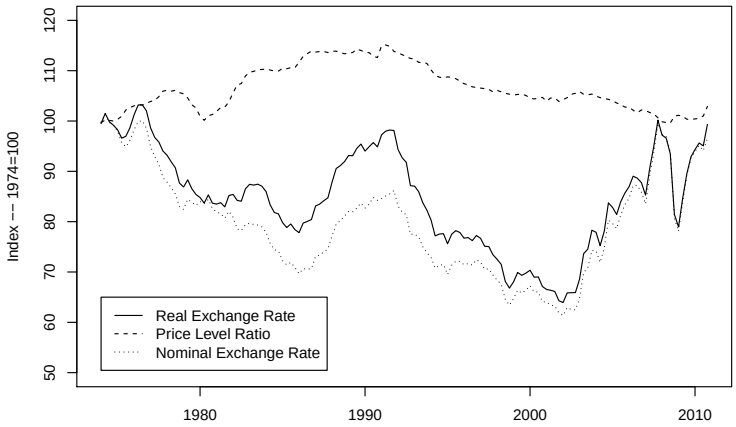

Figure 1: Canadian real and nominal exchange rates and price level ratio with respect to the United States.

Under flexible exchange rates with given domestic and foreign monetary policies, all adjustments to the real exchange rate will occur through corresponding adjustments of the nominal exchange rate. When the nominal exchange rate is fixed, however, all real exchange rate adjustments must occur through changes in the domestic relative to foreign price levels. A classic example of this result would be the obvious consequences of a controversial decision by Canada to adopt the U.S. dollar as its currency.[4] As can be seen from Figure 1 above, Canada's real exchange rate with respect to the

[4]For arguments in favour, see Thomas J. Courchene and Richard G. Harris, *From Fixing to Monetary Union: Options for North American Currency Integration*, C.D. Howe Institute, 1999 and "North American Monetary Union: Analytical Principles and Guidelines," *North American Journal of Economics and Finance*, Vol. 11, No. 1, August 2000, 1-18 and Herbert G. Grubel, "The Case for the Amero: The Economics and Politics of a North American Monetary Union," *Critical Issues Bulletin*, the Fraser Institute, 1999 and "The Merit of a Canada-U.S. Monetary Union," *North American Journal of Economics and Finance, Vol. 11, No. 1, August 2000, 19-40.* For contrary arguments, the second of

United States fell about 20 percent between the mid-1970s and the late-1980s. It then rose by about 20 percent of its mid-1980s level by the early 1990s and declined about 30 percent by the early 2000s and, finally, rose all way back up to its 1974 level by the end of 2010. Had Canada simply adopted the U.S. dollar as its currency, the Canadian price level would have had to move up and down by these percentages for the level of employment to have remained unaffected. Obviously, drastic changes in the Canadian unemployment rate would have resulted had the Canadians adopted the U.S. dollar as their currency.

The only way for Canada to avoid this problem while adopting the U.S. dollar as its currency would be to form a full economic union with the United States, making Canadian Provinces economically equivalent to U.S. States. This would required complete labour mobility between the two countries and, as a result, identical policies with respect to immigration and border control. And, given the relative sizes of the two countries, as Canadian and U.S. citizens redistribute themselves between the two countries over time the fraction of Canadian residents holding U.S. citizenship would quite likely eventually exceed one-half. A currency union obviously requires political as well as economic union to a substantial degree.

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which formally develops the argument presented here, see John Murray, "Why Canada Needs a Flexible Exchange Rate," *North American Journal of Economics and Finance*, Vol. 11, No. 1, 41-60, and Jack L. Carr and John E. Floyd, "Real and Monetary Shocks to the Canadian Dollar: Do Canada and the U.S. Form an Optimal Currency Area," *North American Journal of Economics an Finance*, Vol. 13, 2002, No. 13, Vol. 1, May 2002, 21-39.

2. Euro-Area Real Exchange Rate Evidence

An important degree of political union obviously occurred with the establishment of the European Union and was an important motivation for the large number of countries that joined. And for those who adopted the Euro as their currency, the real exchange rate movements among them have turned out to be very much less than have occurred for Canada with respect to the United States.[5] Because of the continual increase in the number of countries involved it is necessary to focus attention on the initial twelve Euro-Area countries, from which Luxembourg had to be dropped for want of sufficient data. The real exchange rates of three of the eleven countries, each with respect to the other ten which were aggregated using their shares in 2005 GDP, are shown in Figure 2 below. This Figure compares the CPI-based real exchange rates with those based on the implicit GDP deflators in the selected cases of France, Germany and Ireland in which substantial differences between these alternative real exchange rate measures occurred. Figure 3 on the following page plots the real exchange rates of all eleven countries, each with respect to the remaining ten, in three groups with CPI-based real exchange rates used in every case but Greece where the CPI-based series suffered from a distracting level of seasonality while being otherwise consistent with the series based on the implicit GDP deflator.[6]

The maxima, minima and ranges for the individual Euro-Area countries, based alternatively on the consumer price indexes and implicit GDP deflators, are presented in Table 1 following the figures. The overall maximum, minimum, and range of 109, 93 and 16 compare with a maximum of 123.60, a minimum of 76.58 and a range of 47.02 for the Canada vs. United States real exchange rate plotted in Figure 1, converted to a 2005 = 100 base for comparability with Euro Area series.[7]

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[5]For an excellent basic discussion of the issues and circumstances surrounding the development of the Euro, see Chris Mulhearn and Howard R. Vane, *The Euro: Its Origins, Development and Prospects*, Edward Elgar Publishing, 2008.

[6]The sources of the data are the International Monetary Fund, *International Financial Statistics* for all individual countries and *CANSIM* for the Canadian Provinces, whose real exchange rates with respect to each other are discussed below. These sources as well as the statistical computations in the freely available programs `R` and `XLispStat` are fully described in an Appendix available, along with files containing the data, statistical code and resulting output, from the author's website `www.chass.utoronto.ca/~floyd`.

[7]This Canadian real exchange rate is CPI-based. The comparable numbers for the Canada vs. U.S. real exchange rate based on the implicit GDP deflators are 123.30, 74.02 and 49.28.

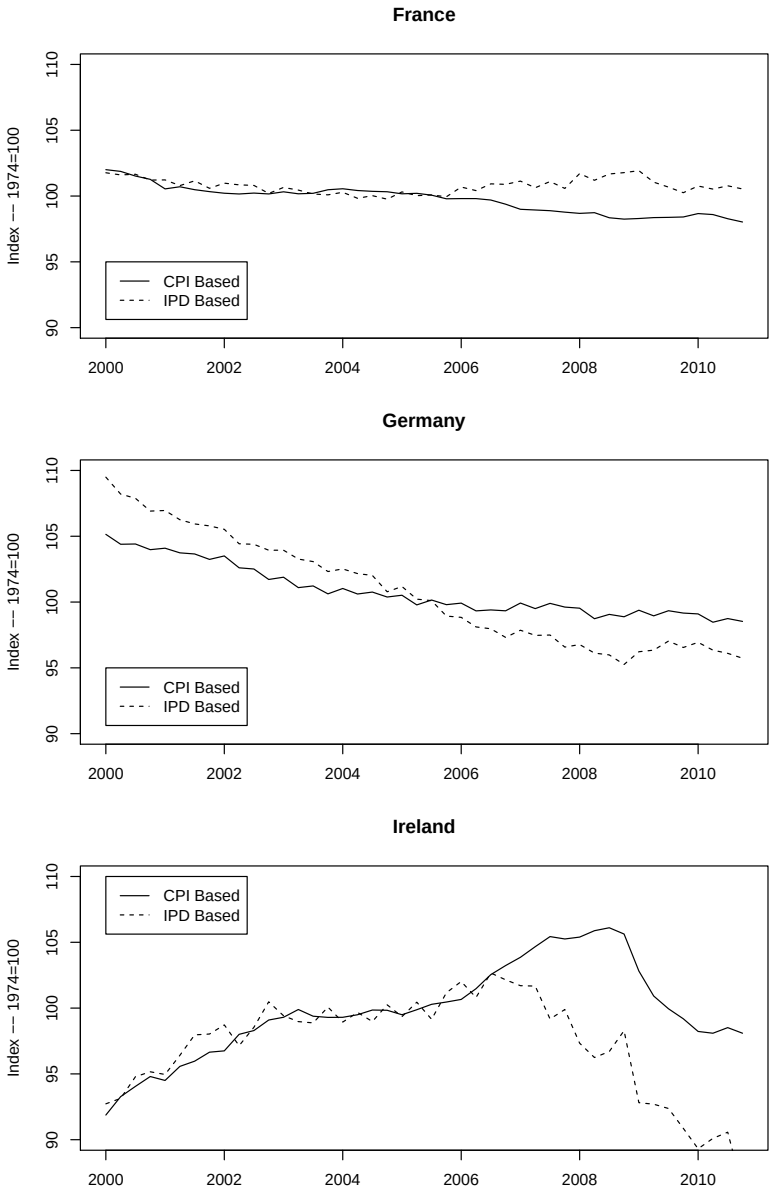


Figure 2: French, German and Irish real exchange rates, each with respect to the group of 10 other Euro Area countries here analyzed weighted by their shares in year 2005 GDP, calculated alternatively on the basis of consumer price indexes and implicit GDP deflators.

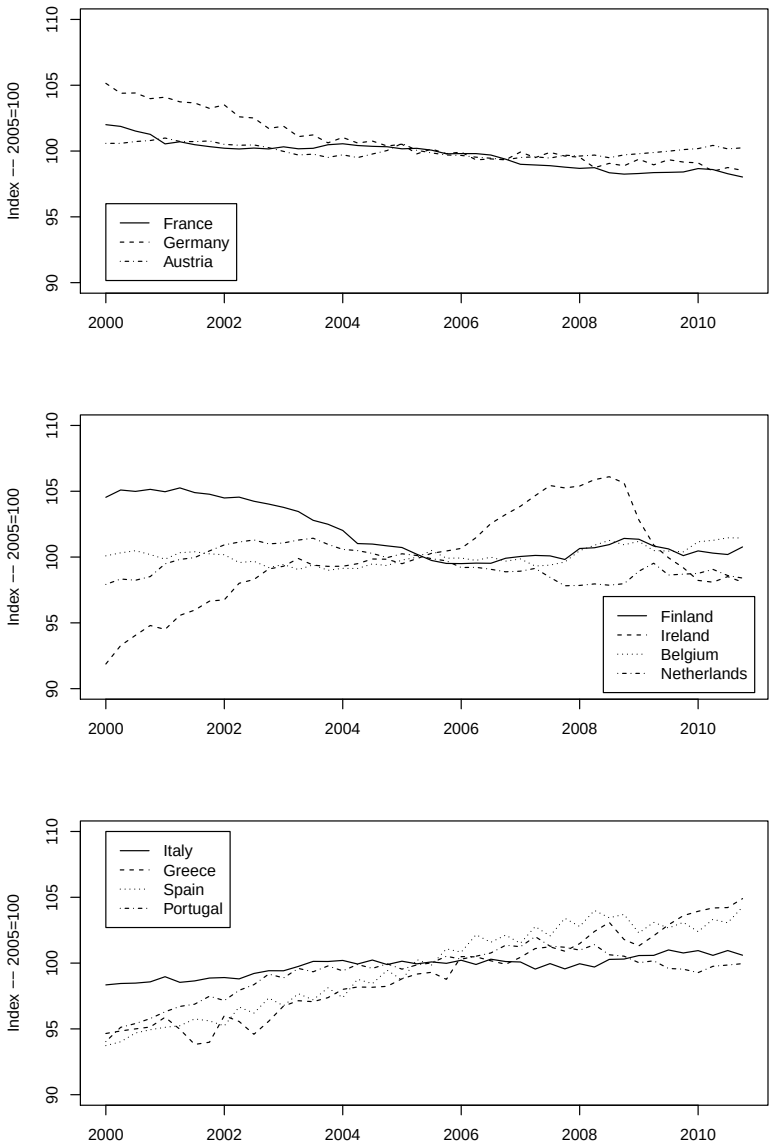


Figure 3: Real Exchange rates of each of eleven Euro-Area countrties with respect to the 10 other Euro-Area countries here analyzed, weighted by their shares in 2005 GDP. CPI-based real exchange rates are used in every case but Greece.

Based on —	Consumer Price Indexes			Implicit GDP Deflators		
	Max	Min	Range	Max	Min	Range
Austria	100.99	99.34	1.65	103.45	98.85	4.60
Belgium	101.46	98.99	2.47	106.83	96.52	10.31
Finland	105.25	99.50	5.75	108.08	98.77	9.31
France	102.00	98.03	3.97	101.93	99.76	2.17
Germany	105.15	98.47	6.68	109.49	95.25	14.24
Greece	108.76	93.01	15.75	104.90	93.82	11.08
Ireland	106.10	91.87	14.23	102.67	86.26	16.41
Italy	101.00	98.34	2.66	102.96	96.37	6.59
Netherlands	101.43	97.82	3.61	101.34	95.87	5.47
Portugal	102.01	94.04	7.97	103.38	93.53	9.85
Spain	104.27	93.73	10.54	104.48	89.00	15.48
Average			6.84			9.59

Table 1: Summary statistics for real exchange rates of eleven countries, each with respect to a 2005-GDP weighted average of the remaining ten, based alternatively on consumer price indexes and implicit GDP deflators.

The real exchange rates with respect to the eleven Euro-Area countries of the United Kingdom, Sweden and Denmark, which are in the European Union but have not adopted the Euro, are plotted along with the United States real exchange rate with respect to the Euro group in Figure 4 and summarized in Table 2 below.

	Based on Implicit GDP Deflators		
	Maximum	Minimum	Range
United States	141.50	80.86	60.64
United Kingdom	111.40	77.60	33.80
Sweden	116.00	86.71	29.29
Denmark	104.10	98.58	5.52

Table 2: Summary statistics for real exchange rates with respect to eleven Euro-Area countries of the United States and three European Union countries that have not joined the Euro Area.

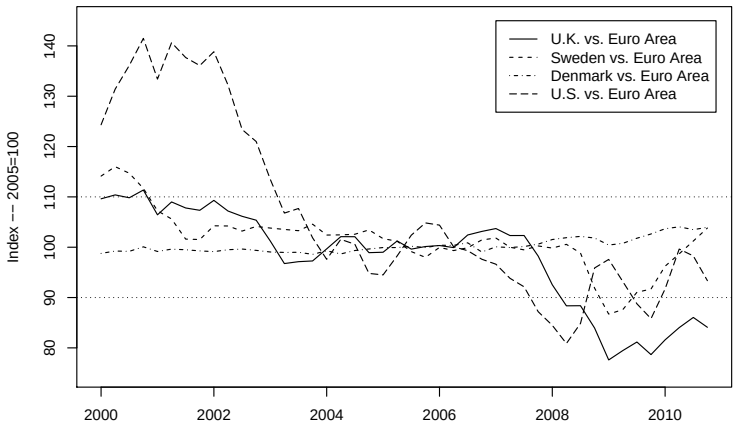


Figure 4: Real exchange rates of non-Euro Area countries with respect to the eleven Euro Area countries studied. The horizonal lines at 90 and 110 on the vertical axis give the upper and lower limits of the within-Euro Area real exchange rate plots in Figure 3.

Only Denmark experienced a range of variation of its real exchange rate with respect to the eleven Euro-Area countries comparable to those countries with respect to each other. The British and Swedish real exchange rates with respect to the eleven Euro-Area countries ranged outside the limits of the graphs on which those latter countries' real exchange rates were plotted. Since membership in the Union was accompanied by free labour migration into and out of the United Kingdom and Sweden, the possibility arises that the greater stability of the within-Euro-Area real exchange rates is due to the fact that underlying full-employment equilibrium real exchange rate movements comparable to those of the U.K. and Sweden were masked by fluctuations in unemployment rates. Another possibility, however, is that permitted movements of the nominal exchange rates and thereby the real exchange rates of Sweden and the U.K. made it unnecessary for unemployment-motivated labour migration to occur to produce the relative price level changes that would otherwise be required.

3. Canadian Inter-Provincial Real Exchange Rate Movements

As a basis for comparison, it is useful to examine movements in the real exchange rates of each of the Provinces of Canada with respect to the remaining Provinces to see if the real exchange rates within that long-standing currency union were less variable than those within the eleven Euro-Area countries. These movements are summarized in the Table 3 below and plotted in Figure 5 on the next page using the same scale on the vertical axis as used in the case of the Euro-Area countries.

	Maximum	Minimum	Range
Newfoundland	102.3	98.8	3.5
Prince Edward Island	103.5	98.4	5.1
Nova Scotia	101.8	98.9	2.9
New Brunswick	101.2	97.5	3.6
Quebec	101.2	97.0	4.1
Ontario	101.3	97.5	3.8
Manitoba	101.3	97.7	3.6
Saskatchewan	102.5	98.6	3.9
Alberta	108.4	96.2	12.2
British Columbia	101.4	96.5	4.8
Average			4.75

Table 3: Real exchange rates of the ten Canadian Provinces with respect to the remaining nine aggregated using 2007-GDP weights, all based on consumer price indexes.

The range of variation of the real exchange rates of the ten individual Canadian Provinces with respect to the other nine averages about 70% of the average range of the within-Euro-Area real exchange rates and the average range of variation for the provinces other than Alberta is about 64% of the average within-Euro-Area range.

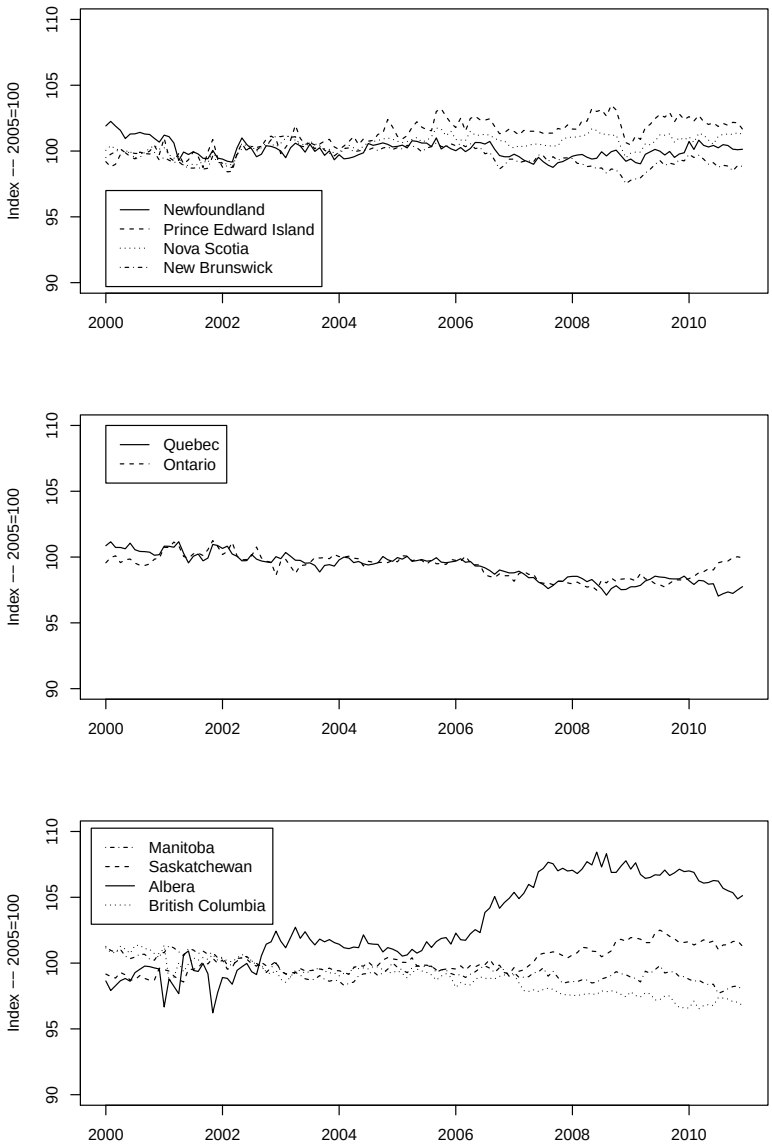


Figure 5: Real exchange rates of each of the ten Canadian provinces with respect to a weighted average the other nine, with the weights being the shares in 2007 GDP. All the real exchange rates are CPI-based.

4. Real Exchange Rate Variations and Unemployment Rates: The Evidence

The next step is to empirically investigate the possibility of a relationship between movements in the underlying full-employment levels of the real exchange rates and the unemployment rates as prices and real exchange rates adjust to their full-employment levels. This involves an extension of the previous work on the determination of real exchange rate movements noted above, with the addition of the lagged unemployment rate as a determinant. A panel data set is brought together consisting of eleven years of quarterly data, running from 2000Q1 to 2010Q4, for the eleven Euro-Area countries considered above. As noted, Luxembourg was dropped from the original twelve because of insufficient data. The full panel is unbalanced because some variables were available for Greece only from 20001Q1 onward and some variables for Portugal ended in 2009Q4. Since the real exchange rates and current and lagged unemployment rates were available for all countries for the entire period, these variables alone can produce a balanced panel which is comparable to the monthly panel that can be put together for the ten Canadian Provinces for the period 2000M1 through 2010M12.

The following OLS regression model was used as the basis for the Euro-Area analysis.

$$\begin{aligned} \text{REX} &= \beta_0 + \beta_1\,\text{TOT} + \beta_2\,\text{CONY} + \beta_3\,\text{NCIY} + \beta_4\,\text{RGDP} \\ &\quad + \beta_5\,\text{UEMPR} + \beta_6\,\text{UEMPRL4} + \epsilon_t \end{aligned} \tag{6}$$

where REX is the real exchange rate with respect to the GDP-weighted average of the remaining ten countries in the group. Two versions of this variable will be used, REXCPI and REXPID according to whether the real exchange rate variables are the ratios of consumer price indexes or implicit GDP deflators. The other variables are as follows:

TOT is the countries' terms of trade with respect to the rest of the world.

GCONY is the countries' government consumption expenditures as a percentage of their GDPs.

NCIY is the countries' net capital inflows plus debt-service balances—that is, the negatives of their balances of trade in goods and services—with respect to the rest of the world, as percentages of their GDPs.

RGDP is the countries' real GDPs obtained by deflating nominal GDPs by the implicit GDP deflators.

UEMPR is the excess of the countries' unemployment rates over the average of the unemployment rates of the remaining ten countries.

UEMPRL4 is the unemployment rates variable above lagged four quarters.

In the regression results presented in Table 4 below, the net capital inflow variable, as defined above, was statistically insignificant and therefore omitted from the regressions in columns 1 and 4 from the left. Then the net capital inflows for countries in which a rather obvious positive relationship is not evident in the plot of the series in Figure 6 following the Table were removed from the panel by setting them equal to zero. This adjusted net capital inflow variable, denoted as NCIYA, contains the series for Belgium, Germany, Ireland, Italy and Spain and is statistically significant with the expected positive sign. It turns out that the real GDP variable was never statistically significant with the correct sign and was therefore omitted from all the regressions shown. The data period was probably too short for sufficient permanent income differences to have occurred to appropriately test the Balassa-Samuelson hypothesis. The terms of trade and government consumption expenditure variables have positive signs as expected.[8]

[8]In two cases the GCONY variable was statistically significant only at the 10% level after the coefficient standard errors were adjusted for heteroskedasticity and autocorrelation. Such adjustments were made throughout using calculations performed in R using Newey-West adjustments with zero lags. When the adjusted coefficient standard errors were calculated in XLispStat using the procedure recommended by Halbert White and programmed by the present author based on the exposition found in James Hamilton's book on time series analysis, these coefficient standard errors were small enough to render the GCONY variable statistically significant at the 5 percent level or better. See Halbert White, "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity," *Econometrica*, Vol. 48, 1980, pp. 827-838, and James D. Hamilton, *Time Series Analysis*, Princeton University Press, 1994, p. 283.

	REXCPI	REXCPI	REXCPI	REXIPD	REXIPD	REXIPD
CONST	82.624	83.919	99.982	68.322	69.638	99.941
	(2.971)***	(2.644)***	(0.332)***	(3.733)***	(3.473)***	(0.419)***
	[8.339]***	[5.833)***	[0.581]***	[7.362]***	[6.134]***	[0.737)***
TOT	10.677	10.836		27.690	27.852	
	(2.424)***	(2.155)***		(3.045)***	(2.830)***	
	[8.454]*	[5.622]**		[7.303]***	[5.920]***	
GCONY	0.360	0.307		0.223	0.169	
	(0.065)***	(0.058)***		(0.081)***	(0.076)**	
	[0.126]***	[0.124]***		[0.150]*	[0.132]*	
NCIYA		0.633			0.643	
		(0.057)***			(0.075)***	
		[0.106]***			[0.127)***	
UEMPR	0.600	0.642	0.641	0.264	0.307	0.258
	(0.079)***	(0.070)***	(0.078)***	(0.099)***	(0.092)***	(0.099)***
	[0.168]***	[0.153]***	[0.172]***	[0.224]	[0.126]***	[0.229]
UEMPRL4	-0.684	-0.506	-0.658	-0.666	-0.485	-0.493
	(0.084)***	(0.076)***	(0.084)***	(0.106)***	(0.100)***	(0.106)***
	[0.279]***	[0.227]**	[0.278]***	[0.245]***	[0.187]***	[0.278]**
NOBS	476	476	484	476	476	484
DF	461	460	471	461	460	471
RSQ	0.302	0.449	0.210	0.328	0.421	0.207

Table 4: Factors determining real exchange rates within the Euro Area. Numbers within brackets are standard errors with those in square brackets being HAC-adjusted. The superscripts ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. Columns 3 and 6 from the left give balanced panel results. Entity but not time fixed effects were included because only the former were statistically significant.

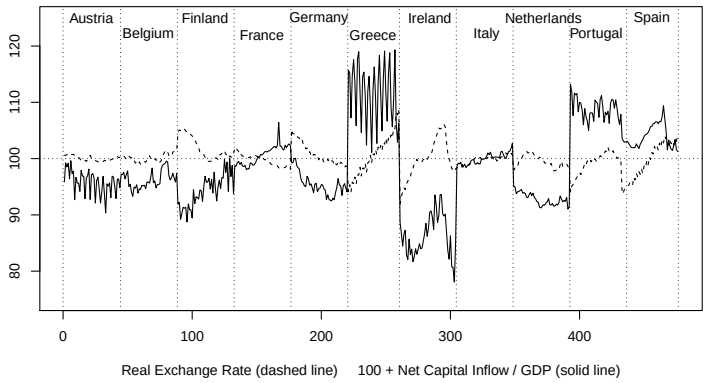


Figure 6: Panel CPI-based real exchange rates (2000 = 100) and net capital inflows as percentages of GDPs with latter are scaled up by adding 100. The time series for all countries but Greece and Portugal run from the first quarter of 2000 to the last quarter of 2010. For Greece they start with the first quarter of 2001 and for Portugal they end with the last quarter of 2009.

The positive signs of the unemployment rate variable in all the regressions reflect the fact that a temporary reduction in output reduces the short-run supply of the domestic output and thereby raises its price. The fact that the unemployment rate lagged four quarters has a negative sign is consistent with the view that increases (declines) in the full-employment equilibrium level of the real exchange rate are associated with reductions (increases) in the unemployment rate rather than immediate increases (declines) in the price level, with adjustments of the price level and real exchange rate toward their long-run equilibrium levels occurring over the subsequent year. The statistically significant negative effect of the lagged unemployment rate variable thus confirms the possibility that the lower observed within-Euro-Area real exchange rate movements in part reflect adjustments of the countries' unemployment rates.

It is tempting to argue that the variations of the full-employment equilibrium within-Euro-Area real exchange rates are comparable to those of the U.K. and Sweden with respect to the eleven Euro-Area countries since

labour can migrate freely between all EU countries, treating this as evidence of a smoothing effect of unemployment rate changes in the Euro Area. This temptation must be resisted for two reasons. First, one cannot rule out the possibility that Denmark is much more comparable, with regard to equilibrium real exchange rate movements, to the eleven EURO-Area countries than are Sweden and the United Kingdom. Second, the fact that the nominal exchange rate rather than the price level can adjust to real exchange rate movements in the EU countries that are not in the Euro-Area may make equilibrating cross-country labour migrations much less important for them.

The question arises as to whether unemployment rate adjustments are important short-run equilibrating factors in long-established within-country currency areas like Canada. A balanced panel regression comparable to the balanced panel regression for the Euro-Area countries in the third column from the left in Table 4 yields the following result.

```
REX = 100.199  + .035 UEMPR  - .053 UEMPRL12
      (19.41)   (0.052)       (0.051)

RSQ = 0.417   NOBS = 1320   DF = 1308
```

where, as in the Euro-Area case, only entity-fixed-effects were statistically significant and therefore included. The HAC-adjusted coefficient standard errors were, of course, much higher than those shown in the brackets, further weakening the result. Separate regressions for individual provinces yield statistically significant results with the correct signs only in the case of Albera and significant results with wrong signs in the cases of Newfoundland and Saskatchewan. One cannot conclude that relative equilbrium real exchange rate variations among the Canadian provinces were moderated by changes in unemployment levels.

How much, then, did the within-Euro-Area real exchange rates observed here differ from their full-employment equilibrium levels? Unfortunately, adjustment of the fitted real exchange rate levels to remove the observed effects of the lagged unemployment rates in the Euro-Area panel regressions cannot correctly answer this question since the observed degrees of unemployment may have resulted from changes in the institutional provision of worker-compensation for unemployment, affecting the normal or equilibrium unemployment level quite independently of equilibrium real exchange rate movements. The differences in unionization and the fraction of employment contracts that are of limited duration, along with the inflation rates, are presented in the table below.

	Percentage of Employees		Inflation
	Unionized	Limited Contracts	Rate
Finland	74	13	1.75
Belgium	54	9	2.29
Ireland	34	9	2.89
Italy	33	12	2.36
Austria	32	9	2.11
Greece	23	12	3.96
Netherlands	22	18	2.20
Germany	20	13	1.64
Portugal	20	22	2.84
Spain	16	29	3.28
France	8	13	1.80

Table 5: Percentages of employees unionized, percentages with employment contracts of limited duration, and average inflation rates. Data are from the European Trade Union Institute, *Eurostat Yearbook 2010* and International Monetary Fund, *International Financial Statistics*.

The degree of unionization is not large in the eleven countries being examined and this, together with the facts that inflation rates are substantial and that the percentage of labour contracts that are of limited duration is more than ten in eight of the eleven cases and for some countries exceeds twenty, suggests that there is substantial room for real wage rate adjustments that reduce pressure on employment rates but quite different adjuswtment

pressures are likely across countries.

These different underlying possibilities for equiibrating real wage rate adjustment suggest that the magnitude of the coefficient of the lagged unemployment rate will be biased downward if only some portion of the variability of the observed unemployment rate variable represents a smoothing effect on the real exchange rate. Accordingly, the implied movement of the unemployment rate in response to a given deviation of the actual exchange rate from its full-employment equilibrium level will be biased upward. Moreover, adjustment of the fitted values to remove the effects of lagged unemployment will distribute the impact of the unemployment changes across countries based on the actual changes in their unemployment rates relative to the other ten countries rather than on the amount of those changes in unemployment rates due to changes in the equilibrium real exchange rates.

In an attempt to deal with the above problems individual-country lagged-unemployment-rate dummy variables are introduced. These dummy variables are assigned to ten of the eleven countries, with the exclusion of Austria, whose lagged-unemployment rate coefficient then becomes that of the panel lagged-unemployment-rate variable, with the coefficients for the other countries being this Austrian coefficient plus the coefficient of the respective country's lagged-unemployment-rate dummy variable. The calculations of the individual country coefficients are illustrated in the Table below. The P-Values refer to the coefficient in the column immediately to the left.

In cases where the country-dummy is not statistically significant it is assumed that the coeffient of the variable for the panel as a whole represents the relevant country-coefficient. Also, in a number of cases the panel dummy coefficient is positive and bigger in absolute value than the negative panel coefficient so that the country-effect of a change in the lagged unemployment rate on the real exchange rate is positive implying that greater unemployment implies a future rise in the real exchange rate rather than a fall. In these cases no value is assigned to the country coefficient. In general, it seems reasonable to think of the effect of a change in employment on the future real exchange rate to be an average of the effects on the CPI- and GDP-Deflator-based real exchange rates if values of both coefficients have been assigned and equal to the effect on whichever of the two alternative measures of the real exchange rate is assigned a coefficient value, if only one of them is. Accordingly, an increase in the real exchange rate over the subsequent four quarters will have an immediate effect on the country's current unemployment rate relative to the average unemployment rates of the remaining ten countries equal to the

Country Country	REX-Base	Panel Coeff.	Coeff. P-Val.	Dummy Coeff.	Coeff. P-Val.	Country Coeff.
Austria	CPI	-0.659	0.000			-0.659
Austria	IPD	-0.737	0.000			-0.737
Belgium	CPI	-0.659	0.000	0.428	.126	-0.659
Belgium	IPD	-0.737	0.000	0.669	.130	-0.737
Finland	CPI	-0.659	0.000	0.984	.000	
Finland	IPD	-0.737	0.000	1.238	.000	
France	CPI	-0.659	0.000	1.147	.000	
France	IPD	-0.737	0.000	0.954	.078	-0.737
Germany	CPI	-0.659	0.000	0.028	.789	-0.659
Germany	IPD	-0.737	0.000	-0.380	.000	-1.117
Greece	CPI	-0.659	0.000	-2.792	.000	-3.451
Greece	IPD	-0.737	0.000	-2.366	.000	-3.103
Ireland	CPI	-0.659	0.000	-0.091	.574	-0.659
Ireland	IPD	-0.737	0.000	-0.954	.000	-1.691
Italy	CPI	-0.659	0.000	0.153	.194	-0.659
Italy	IPD	-0.737	0.000	-0.549	.128	-0.737
Netherlands	CPI	-0.659	0.000	-0.032	.808	
Netherlands	IPD	-0.737	0.000	0.611	.095	-0.737
Portugal	CPI	-0.659	0.000	0.779	.000	
Portugal	IPD	-0.737	0.000	0.611	.095	-0.737
Spain	CPI	-0.659	0.000	0.042	.775	-0.659
Spain	IPD	-0.737	0.000	0.283	.134	-0.737

Table 6: Response of Real Exchange Rates to lagged unemployment rates by country based on individual country dummies for the varable in question in the unbalanced panel data set are the sums of the panel coefficient and country dummy coefficient if the latter is statistically significant and does not render the overall coefficfient positive. When the dummy coefficient is not statistically significant the panel coefficient is used for the country in question. When the overall coefficient is positive no value is assigned to the country coefficient.

reciprocal of the coefficient assigned above. The effects on the countrites for

which coefficient values can be assigned are thus as follows:

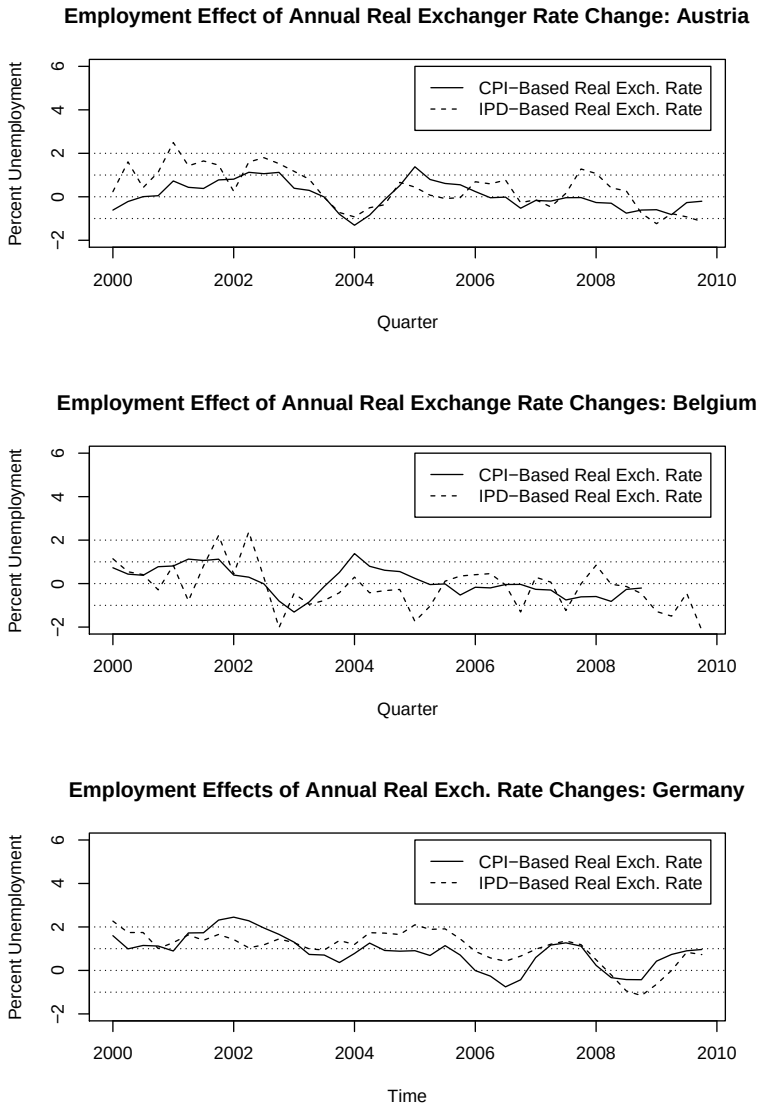


Figure 7: Effects on unemployment rates of current-to-next-year changes in real exchange rates. Continued on next page.

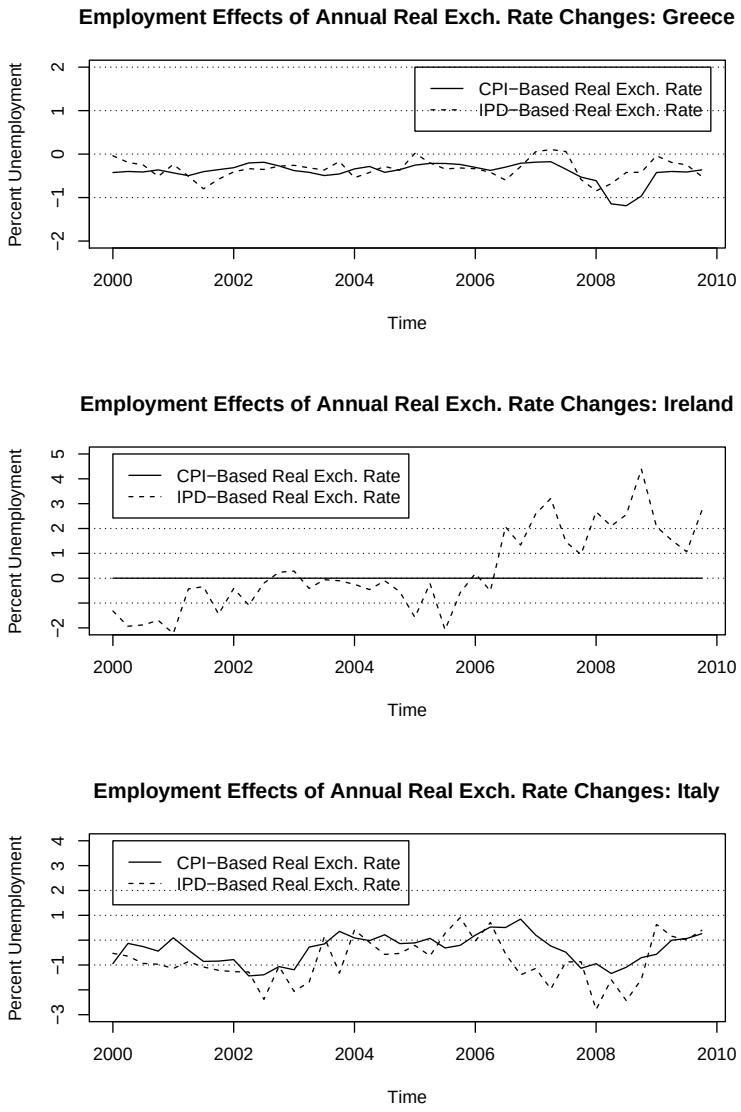
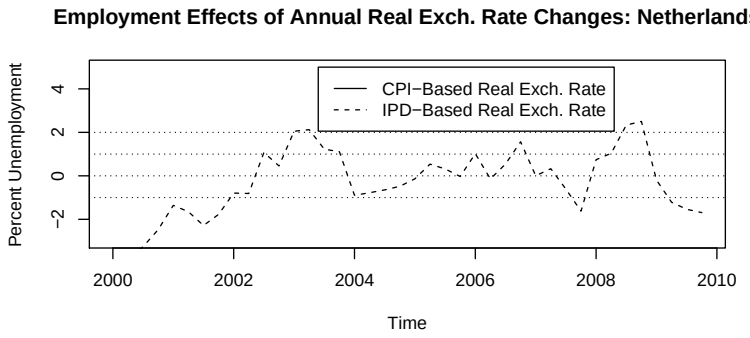


Figure 7: (Cont.) Effects on unemployment rates of current-to-next-year changes in real exchange rates. Continued on next page.



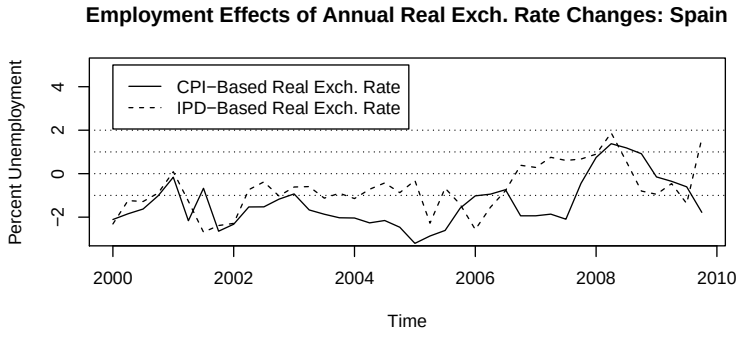


Figure 7: (Cont.) Effects on unemployment rates of current-to-next-year changes in real exchange rates.

In the case of Austria, the evidence suggests that increases in the unemployment rate relative to the other ten countries as a result of observed year-to-year real exchange rate changes were as much as one percentage point in the years 2001, 2002, 2005, 2006 late 2007 and most of 2008. In 2004 and 2009 the unemployment rate was below that in the other ten countries by as much as one percentage point. Similar results appear in the case of Belgium with higher unemployment rates appearing prior to 2002 and in 2004 and lower unemployment rates than in the other ten countries occurring in 2003 and from the beginning of 2005 onward. The maximum employment effect, up or down, was as much as two percentage points on occassion. Germany experienced higher unemployment rates than the other ten countries as a result of observed year-over-year real exchange rate movements for all years prior to 2006 and again inhj 2007 and 2009 with the magnitude of the effect frequentlty being nearly two percentage points. Slightly lower unemployment rates compared to the other ten countries appeared only in 2006 and 2008. The effects of the observed real exchange rate movements for Greece on that country's unemployment rate were everywhere negative, reflecting the fact that the real exchange rate for that country tended to rise throughout the period, quite possibly on account of persistent net capital inflows consequent on government borrowing, which lead to different kinds of trouble later on. One certainly cannot argue that the recent problems Greece has been experiencing were in any way consequent on declines in that country's real exchange rate relative to other countries in the Euro-area. Italy and Spain experienced unemployment-rate consequences of real exchange rate changes similar to Greece although the Italian unemployment rate increased very slightly relative to that of the other ten countries during the years 2003 through 2006 and the Spanish unemployment rate was positively affected only in 2008. The Netherlands experienced very substantial unemployment rate variations relative to the other ten countriesw associated with real exchange rate variations with the maximum effects being as large as three percentage points. Finally, Ireland experienced unemployment rate increases of as much as three percentage points during the years 2007 and 2008 as a result of real exchange rate declines associated with its banking crises and the associated recession. Prior to 2006, Irelands unemploymment rate was smaller than that of the other ten countries as a result of increases in its real exchange rate during those years.

5. Conclusions

Overall, one must conclude that significant unemployment changes were associated with real exchange rate changes in all the countries examined and that these surely must have reduced the economic benefits of Euro-Area membership in every case but Greece and, to a lesser extent, Italy and Spain. Yet, these effects were not a factor in the current crises being experienced by currency union.