**Structural Breaks in Volatility:
Evidence from the OECD Real Exchange Rates
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Abstract

This paper analyses whether volatility changes in the real exchange rates (RERs) of the OECD industrial countries are associated with a specific nominal exchange rate regime. To that end, we examine RER behaviour during the period 1960-2003, thereby covering both the Bretton Woods system of fixed exchange rates and the adoption of generalised floating exchange rates from 1973. We make use of an econometric methodology based on Hansen's (1997) approximation to the p -values of the supreme, exponential and average statistics developed by Andrews (1993) and Andrews and Ploberger (1994). This methodology allows us to obtain a profile of p -values and to delimit periods of stability and instability in the variance of real exchange rates. For most countries in our sample, there is evidence in favour of the non-neutrality of the nominal exchange rate regime regarding real exchange rate volatility.

JEL Classification Numbers: F31, F33, F41

Keywords: Exchange rate regimes, real exchange rate, volatility

1. Introduction

An important empirical question in international finance concerns the stability of real exchange rate (RER) volatility. In particular, it is of interest to investigate the behaviour of RER volatility under different nominal exchange rate arrangements. There is much academic debate on this issue and the previous empirical evidence has been mixed. On the one hand, Mussa (1986), Baxter and Stockman (1989), Flood and Rose (1995), Rogers (1995), Liang (1998) and Carrera and Vuletin (2002), among others, find a positive relationship between RER volatility and the degree of flexibility of the nominal exchange rate regime. However, on the other hand, Grilly and Kaminsky (1991) find that the distribution of the monthly rate of change of the RER is the same under fixed and floating regimes for the pre-World War II data, but different for the post-World War II data. Thus, they conclude that RER behaviour depends on the particular historical period, rather than upon the nominal exchange rate regime. Moreover, Kent and Naja (1998) examine the relationship between the short-term volatility of the effective RER and the degree of flexibility of the nominal exchange rate. Based on pooled results across a set of countries, they find that the effective RER is only twice as volatile under floating regimes than under fixed regimes. Results within countries show that for most countries there is no significant increase in volatility when moving to more flexible exchange rate regimes and, indeed, there are even some countries in which volatility is lower under more flexible exchange rate regimes.

This paper tries to shed some light on RER behaviour using an alternative data set and a new econometric methodology. To that end, a sample of twenty OECD industrial countries for the period 1960-2003 is considered, thereby covering both the Bretton Woods system of fixed exchange rates and the adoption of generalised floating exchange rates from 1973.

The approach taken here marks a departure from the traditional literature on the non-neutrality of nominal exchange rate regimes regarding real exchange rate volatility. Specifically, we sequentially apply tests for a structural change in variance to a range of possible break-points, thus avoiding an assumption of prior knowledge of their location. Our strategy for monitoring a structural change in variance is based on Hansen's (1997) approximation to the p-values of the supreme, exponential and average statistics developed by Andrews (1993) and Andrews and Ploberger (1994). We will apply this methodology following the approach proposed by McConnell and Pérez-Quirós (2000) and Camacho (2004). This approach allows us to obtain a profile of p-values and to delimit periods of stability and instability in the variance of real exchange rates.

For most countries in our sample, our results identify a first period of stability in the variance of the RER until the early/mid 1970s, followed by a period characterised by strong evidence of instability in the variance. Therefore, the results for this group of countries suggest that changes in RER volatility would have been linked to a specific nominal exchange rate regime, lending support to the non-neutrality hypothesis of nominal exchange rate regimes regarding real exchange rate volatility. Nevertheless, we find a second group of countries, for which RER volatility is affected by other factors in addition to nominal exchange rate flexibility.

The paper is organised as follows. Section 2 presents the econometric methodology used for testing structural breaks in RER volatility. Section 3 describes the data set. Section 4 reports our empirical results. Finally, Section 5 provides some concluding remarks.

2. Econometric Methodology: Testing for Structural Breaks in Volatility

Our analysis to detect structural breaks in volatility is based on univariate autoregressive models for first differences (growth rates) of the real exchange rate series, which we denote as q_t . Following McConnell and Pérez-Quirós (2000) and Camacho (2004), we compute, at any quarter t , the GMM estimates of the specification

$$q_t = \mu + \phi q_{t-1} + \varepsilon_{1s} \quad (1)$$

$$\sqrt{\frac{\pi}{2}} |\hat{\varepsilon}_{1s}| = \alpha_1 D_{1s} + \alpha_2 D_{2s} + \varepsilon_{2s} \quad (2)$$

where the dummies are

$$D_{1s} = \begin{cases} 0 & \text{if } s \leq T \\ 1 & \text{if } s > T \end{cases}$$

$$D_{2s} = \begin{cases} 1 & \text{if } s \leq T \\ 0 & \text{if } s > T \end{cases}$$

and where s refers to data of the period from 1960.I to s . The instruments for each period s are constant, q_t , D_{1s} and D_{2s} , T is the estimated break-point and α_1 and α_2 are the estimators of the standard deviation¹.

Andrews (1993) and Andrews and Ploberger (1994) develop statistics for cases similar to this, where the parameter T appears under the alternative hypothesis but not under the null of constant conditional standard deviation ($\alpha_1 = \alpha_2$). They define the function $F_n(T)$ as the Wald (W), Likelihood Ratio (LR) or Lagrange Multiplier (LM) statistic of the hypothesis that $\alpha_1 = \alpha_2$, for break date T , where n is the number of observations. We assume that T lies in a range T_1, T_2 ². Specifically, Andrews (1993) considers the supreme statistic:

$$Sup F = \sup_{T_1 \leq T \leq T_2} F_n(T) \quad (3)$$

where $F=W$, LR or LM.

¹ If ε_t follows a normal distribution, $\sqrt{\frac{\pi}{2}} |\hat{\varepsilon}_t|$ is an unbiased estimator of the standard deviation of ε_t .

² We set $T_1=.15n$ and $T_2=.85n$ [see Andrews (1993) and Andrews and Ploberger (1994)].

On the other hand, Andrews and Ploberger (1994) consider the exponential and average statistics, given by the following expressions: where $F=W$, LR or LM.

$$ExpF = \ln \left(\frac{1}{T_2 - T_1 + 1} \sum_{T=T_1}^{T_2} \exp\left(\frac{1}{2} F_n(T)\right) \right) \quad (4)$$

$$AveF = \frac{1}{T_2 - T_1 + 1} \sum_{T=T_1}^{T_2} F_n(T) \quad (5)$$

The asymptotic distributions of these statistics are non-standard and have been obtained by Andrews (1993) and Andrews and Ploberger (1994), together with their asymptotic critical values. In this paper we apply these statistics, using the associated p-values obtained from the approximation developed by Hansen (1997). In particular, we will perform an out-sample test, compute the p-values associated with the supreme, exponential and average statistics for any quarter, and obtain a profile of p-values to be plotted. In doing so, we will have numerical and graphical information that will be used to delimit periods of stability and instability of real exchange rate volatility.

3. Data

In the empirical analysis, we use quarterly data of the consumer price index and end of quarter nominal exchange rates (expressed as foreign currency against the United States Dollar), for twenty OECD industrial countries, covering the period 1960.I-2003.IV³. These countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Luxembourg, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom. For each country, we compute the real exchange rate using the consumer price index. The source of data used are the IMF *International Financial Statistics* of the International Monetary Fund and the OECD *Main Economic Indicators*.

Figure 1 plots the evolution of our quarterly RERs against the United States Dollar during the period 1960.I-2003.IV. At a glance, Figure 1 shows the differences in RER volatility during and after the Bretton Woods periods. In particular, during the Bretton Woods fixed exchange period (1960.I to 1973.IV), RER volatility is much smaller than in the post-Bretton Woods, flexible exchange rate period.

³ With the beginning of Economic and Monetary Union (EMU) in 1999, the currencies of Austria, Belgium, France, Germany, Ireland, Italy, Luxembourg, The Netherlands, Portugal and Spain disappeared, being replaced by the euro. Therefore, the sample period for these countries only covers the 1960.I-1998.IV period.

4. Empirical Results

Empirical results on changes in real exchange rate volatility are shown in Table 1 and Panels (a) to (c) of Figure 2.

Table 1 reports the periods of stability/instability detected for the variance of real exchange rates for our set of OECD industrial countries. The first column indicates the country and the sample period⁴, and columns three to five offer a summary of results regarding the p-values. In particular, they indicate whether the p-values from the supreme (pvsup), the exponential (pvexp) and the average (pvave) statistics are above or below the standard 0.05 critical value. In several cases, we indicate whether the p-values are in the interval [0.05, 0.10]. The last column indicates whether or not there is any evidence in favour of instability in the variance of real exchange rates during the sub-period indicated in column two. In general, we conclude that there is evidence of instability in the variance of the series when at least two out of the three statistics are below the 0.05 critical value. In addition, we conclude that there is marginal evidence of instability when the p-values are in the interval [0.05, 0.10]. Figure 2 shows the results regarding the p-values graphically.

From Table 1 and Figure 2, we can identify two potential groups of countries with different RER volatility characteristics:

- A first group of countries, with successive sub-periods of RER stability and RER instability, with the break-point located around 1973.IV. This group is formed by Canada, Denmark, France, Ireland, Italy, Japan, Luxembourg, The Netherlands, Portugal, Sweden and Switzerland.
- A second group of countries, with an initial period of stability, followed by a period of instability, then a period of renewed stability and finally a further period of instability. In addition to 1973.IV, two new break-points are found around 1963.IV and 1967.IV. This group includes Australia, Austria, Belgium, Finland, Germany, New Zealand, Norway, Spain, and the United Kingdom.

The 1973.IV break-point could be associated with the breakdown of the Bretton Woods system and the advent of floating exchange rates (see, e.g., Cooper, 1999) .

The structural break in volatility detected in RER in 1963.IV could be associated with the shrinkage in the reserve of convertible currencies and the concurrent decline in the international value of the pound after unfavourable foreign trade figures. These developments pushed the dollar's exchange rate in

⁴ The sample starts at 1963.I instead of 1960.I, because we compute the p-values starting from a sample of twelve observations.

1964 to its upper limit for the first time since 1955, notwithstanding supporting measures by the Bank of England (see, Eichengreen, 1994).

Finally, the break-point detected in 1967.IV could be associated with the devaluation of the pound on 18th November after a rapid worsening of the UK economic climate as well as a series of heavy blows to confidence in sterling, some of them due to political events abroad (unfavourable reaction of the French Government to the UK application to the European Community, the outbreak of war in the Middle East, etc.) (see Bank of England, 1968). A number of currencies were also devaluated (New Zealand dollar, Finnish mark, etc.).

5. Concluding Remarks

In this paper we have attempted to contribute to the wide and active research programme on the behaviour of real exchange rate (RER) volatility under different nominal exchange rate regimes. This is an important question given the strong effect of RER volatility on several macroeconomic variables such as consumption, investment and trade flows (see, e.g., Frankel and Rose, 1995) or even on the long-term growth path (Rodrik, 2000). In particular we have examined the changes in RER volatility registered in twenty OECD industrial countries during the period 1960-2003, thereby covering both the Bretton Woods system of fixed exchange rates and the adoption of generalised floating exchange rates from 1973. To that end, we depart from previous research in this area by using an econometric methodology based on Hansen's (1997) approximation to the p -values of the supreme, exponential and average statistics developed by Andrews (1993) and Andrews and Ploberger (1994). This methodology allows us to obtain a profile of p -values and to delimit periods of stability and instability in the variance of real exchange rates.

The main results are as follows. First, we find a group of eleven out of the twenty OECD industrial countries examined where the profile of the p -values exhibits an initial period of stability in RER volatility followed by a period of instability. The remaining nine countries form a second group which present a very similar profile of p -values: an initial period of stability, followed by a period of instability, then a period of renewed stability and finally a further period of instability in the variance of the RER.

Second, the break-point between stability and instability is located (mostly) around 1973 for the first group of countries, when the practice of fixing exchange was generally abandoned by the major countries. This break-point also appears in the change of RER volatility in the second group of countries between the third (stability) and fourth (instability) periods. Our results suggest that these countries would have also experienced a previous RER volatility break-point either in 1963 or 1967, associated with a deterioration in expectations triggered by balance of payment crises.

We could interpret the result obtained for the first group of countries as evidence in favour of the non-neutrality hypothesis of nominal exchange rate regimes regarding real exchange rate volatility, since the period of stability is detected until the early/mid 1970s and was followed by a new period exhibiting strong evidence of instability in RER variance. This in turn could suggest that the change in the RER volatility would have be linked to a specific nominal exchange rate: the transition from a fixed nominal exchange rate regime to a flexible nominal exchange rate regime after the collapse of the Bretton Woods

system. In the case of the second group of countries, that experienced a break-point in RER volatility before the abandonment of fixed exchange rates, it seems that the volatility would also have been affected by other factors (such as credibility and reputation problems arising from recurrent trade crises) in addition to nominal exchange rate flexibility.

From a theoretical standpoint, our findings for the first, more numerous group of countries seem to support the sticky price models in which the prices of non-traded goods are sticky and there are important deviations of the purchasing power parity for traded goods.

Finally, the results of this paper also could also be used to suggest the need for a generalised adoption of target zones for exchange rates as a compromise between fixed and flexible exchange rate regimes. This would imply co-ordinated monetary and fiscal policies and joint foreign exchange intervention, leading to a restoration of certain beneficial aspects of the Bretton Woods system. In particular, RER fluctuations would decline as countries intervened to smooth exchange rate movements. Furthermore, a target zone system would also enhance the role of economic fundamentals in determining exchange rate movements.

References

- Andrews, D. (1993): “Test for Parameter Instability and Structural Change with Unknown Change Point”, *Econometrica*, Vol. 61, pp. 821-856.
- Andrews, D. and W. Ploberger (1994): “Optimal Tests When a Nuisance Parameter is Present Only Under the Alternative”, *Econometrica*, Vol. 62, pp. 1383-1414.
- Bank of England (1968): *Report for the year ended 29th February 1968* (London: Bank of England)
- Baxter, M. and A. Stockman (1989): “Business Cycles and the Exchange-Rate Regime: Some International Evidence”, *Journal of Monetary Economics*, Vol. 23, pp. 377-400.
- Camacho, M. (2004): “Vector Smooth Transition Regresion Models for the US GDP and the Composite Index of Leading Indicators”, *Journal of Forecasting*, Vol. 23, No. 3, pp. 173-196.
- Carrera, J. and G. Vuletin (2002): “The Effects of Exchange Rate Regimes on Real Exchange Rate Volatility. A Dynamic Panel Data Approach”, mimeo.
- Cooper, R. N. (1999): "Exchange Rate Choices", in J. S. Little and G. P. Olivei (eds.): *Rethinking the International Monetary System*, Federal Reserve Bank of Boston, Conference Series 43, pp. 99-123.
- Eichengreen, B. (1994): “History of the International Monetary System: Implications for Research” F. Van der Ploeg (ed.) *International Macroeconomics* (Cambridge: Basil Blackwell), pp. 151-191.
- Flood, R. and A. Rose (1995): “Fixing Exchange Rates: A Virtual Quest for Fundamentals”, *Journal of Monetary Economics*, Vol. 36, pp. 3-37.
- Frankel, J. and A. Rose (1995), "Empirical Research on Nominal Exchange Rates", in G. Grossman and K. Rogoff (eds.) *Handbook of International Economics*, Vol. 3 (Amsterdam: New Holland), pp. 1689-1729.
- Grilli, V. And G. Kaminsky (1991): “Nominal Exchange Rate Regimes and Real Exchange Rate: Evidence from the United States and Britain, 1885-86”, *Journal of Monetary Economics*, Vol. 27, pp. 191-212.

- Hansen, B.E. (1997): “Approximate Asymptotic P Values for Structural-Change Tests”, *Journal of Business and Economic Statistics*, Vol. 15, pp.60-67.
- Kent, C. and R. Naja (1998): “Effective Exchange Rates and Irrelevant Nominal Exchnage-Rate Regime”, Reserve Bank of Australia Research Discussion Paper, No. 9811.
- Liang, H. (1998): “Real Exchange Rate Volatility: Does the Nominal Exchange Rate Regime Matter?”, IMF Working Paper, No. 98147.
- McConnell, M.M. and Pérez-Quirós, G. (2000): “Output Fluctuations in the United States: What has Changed Since the Early 1980s?”, *American Economic Review*, Vol. 90, pp. 1464-1476.
- Mussa, M. (1986): “Nominal Exchange Rate Regimes and the Behavior of the Real Exchange Rates: Evidence and Implications”, *Carnegie-Rochester Conference Series on Public Policy*, Vol. 25, pp. 117-214.
- Rodrik, D. (2000): “Exchange Rate Regimes and Institutional Arrangements in the Shadow of Capital Flows”, mimeo (available at <http://ksghome.harvard.edu/~drodrik/Malaysia%20conference%20paper.PDF>).
- Rogers, J.H. (1995): “Real Shocks and Real Exchange Rates in Really Long-Term Data”, International Finance Discussion Papers, No. 493, Board of Governors of the Federal Reserve System,.

Table 1. Hansen's (1997) P-values of the Supreme, Exponential and Average Tests

RER ^a	Periods	Pvsup ^b	Pvexp	Pvave	Instability ^c
AUSL 1963.I- 2003.IV	From 1963.I to 1963.IV	<0.05	<0.05	<0.05	YES
	From 1964.I to 1973.III	>0.05	>0.05	>0.05	NO
	From 1973.IV to 1976.III	>0.05	[0.05, 0.10]	<0.05	YES*
	From 19 76.IV to 1982.IV	>0.05	<0.05	<0.05	YES
	From Q1 83 to Q4 03	<0.05	<0.05	<0.05	YES
AUST 1963.I-1998.IV	From 1963.I to 1970.IV	>0.05	>0.05	>0.05	NO
	From 1970.IV to 1971.II	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1971.II to 1977.III	>0.05	>0.05	>0.05	NO
	From 1977.IV to 1979.II	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1979.III to 1980.IV	>0.05	<0.05	<0.05	YES
	From 1981.I to 1998.IV	<0.05	<0.05	<0.05	YES
BEL 1963.I-1998.IV	From 1963.I to 1966.IV	>0.05	>0.05	>0.05	NO
	From 1967.I to 1970.IV	<0.05	<0.05	<0.05	YES
	From 1971.I to 1971.II	>0.05	<0.05	<0.05	YES
	From 1971.III to 1973.II	>0.05	>0.05	>0.05	NO
	From 1973.III to 1974.III	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1974.IV to 1978.II	>0.05	<0.05	<0.05	YES
CAN 1963.I-2003.IV	From 1978.III to 1998.IV	<0.05	<0.05	<0.05	YES
	From 1963.I to 1980.I	>0.05	>0.05	>0.05	NO
	From 1980.II to 1982.II	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1982.III to 1988.III	>0.05	<0.05	<0.05	YES
DEN 1963.I-2003.IV	From 1988.IV to 2003.IV	<0.05	<0.05	<0.05	YES
	From 1963.I to 1975.II	>0.05	>0.05	>0.05	NO
	From 1975.III to 1978.III	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1978.IV to 1979.IV	>0.05	<0.05	<0.05	YES
	From 1980.I to 2003.IV	<0.05	<0.05	<0.05	YES

Notes

a. RER: real exchange rate. AUSL: Australia, AUST: Austria, BEL: Belgium, CAN: Canada, DEN: Denmark.

b. Pvsup, Pvexp and Pvave are the p-values of the supreme test developed by Andrews (1993) and the exponential and average tests developed by Andrews and Ploberger (1994).

c. YES: evidence of instability in the variance of the real exchange rate at 5% significant level, YES*: evidence of instability in the variance of the real exchange rate at 10% significant level, NO: no evidence of instability in the variance of the real exchange rate at 5% significant level.

Table 1 (cont.). Hansen's (1997) P-values of the Supreme, Exponential and Average Tests

RER ^a	Periods	Pvsup ^b	Pvexp	Pvave	Instability ^c
FIN	From 1963.I to 1963.IV	>0.05	>0.05	>0.05	NO
1963.I-	From 1964.I to 1964.III	>0.05	<0.05	<0.05	YES
1998.IV	From 1964.IV to 1967.III	>0.05	>0.05	>0.05	NO
	From 1967.IV to 1969.II	>0.05	<0.05	<0.05	YES
	From 1970.IV to 1974.III	>0.05	>0.05	>0.05	NO
	From 1974.IV to 1975.III	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1975.IV to 1979.IV	>0.05	<0.05	<0.05	YES
	From 1980.I to 1998.IV	<0.05	<0.05	<0.05	YES
FRA	From 1963.I to 1973.IV	>0.05	>0.05	>0.05	NO
1963.I-	From 1974.I to 1975.II	>0.05	[0.05, 0.10]	<0.05	YES*
1998.IV	From 1975.III to 1979.IV	>0.05	<0.05	<0.05	YES
	From 1980.I to 1998.IV	<0.05	<0.05	<0.05	YES
GER	From 1963.I to 1963.II	<0.05	<0.05	<0.05	YES
1963.I-	From 1963.III to 1974.I	>0.05	>0.05	>0.05	NO
1998.IV	From 1974.II to 1974.III	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1974.IV to 1980.III	>0.05	<0.05	<0.05	YES
	From 1980.IV to 1998.IV	<0.05	<0.05	<0.05	YES
IRE	From 1963.I to 1973.III	>0.05	>0.05	>0.05	NO
1963.I-	From 1973.IV to 1976.I	>0.05	>0.05	<0.05	NO
1998.IV	From 1976.II to 1976.IV	>0.05	<0.05	<0.05	YES
	From 1977.I to 1979.IV	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1980.I to 1981.II	>0.05	<0.05	<0.05	YES
	From 1981.III to 1998.IV	<0.05	<0.05	<0.05	YES
ITA	From 1963.I to 1975.II	>0.05	>0.05	>0.05	NO
1963.I-	From 1975.III to 1975.IV	>0.05	[0.05, 0.10]	<0.05	YES*
1998.IV	From 1976.I to 1980.III	>0.05	<0.05	<0.05	YES
	From 1980.IV to 1998.IV	<0.05	<0.05	<0.05	YES

Notes

a. RER: real exchange rate. FIN: Finland, FRA: France, GER: Germany, IRE: Ireland, ITA: Italy.

b. Pvsup, Pvexp and Pvave are the p-values of the supreme test developed by Andrews (1993) and the exponential and average tests developed by Andrews and Ploberger (1994).

c. YES: evidence of instability in the variance of the real exchange rate at 5% significant level, YES*: evidence of instability in the variance of the real exchange rate at 10% significant level, NO: no evidence of instability in the variance of the real exchange rate at 5% significant level

Table 1 (cont.). Hansen's (1997) P-values of the Supreme, Exponential and Average Tests

RER	Periods	Pvsup	Pvexp	Pvave	Instability
JAP 1963.I- 2003.IV	From 1963.I to 1972.IV	>0.05	>0.05	>0.05	NO
	From 1973.I to 1973.IV	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1974.I to 1980.I	>0.05	<0.05	<0.05	YES
	From 1980.II to 2003.IV	<0.05	<0.05	<0.05	YES
LUX 1963.I- 1998.IV	From 1963.I to 1971.II	>0.05	>0.05	>0.05	NO
	From 1971.III to 1971.IV	>0.05	>0.05	<0.05	NO
	From 1972.I to 1973.I	>0.05	<0.05	<0.05	YES
	From 1973.II to 1974.II	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1974.III to 1975.II	>0.05	<0.05	<0.05	YES
	From 1975.III to 1998.IV	<0.05	<0.05	<0.05	YES
NET 1963.I- 1998.IV	From 1963.I to 1978.III	>0.05	>0.05	>0.05	NO
	From 1978.IV to 1979.I	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1979.II to 1980.III	>0.05	<0.05	<0.05	YES
	From 1980.IV to 1998.IV	<0.05	<0.05	<0.05	YES
NZ 1963.I- 2003.IV	From 1963.I to 1967.II	>0.05	>0.05	>0.05	NO
	From 1967.III to 1967.IV	<0.05	<0.05	<0.05	YES
	From 1968.I to 1968.IV	>0.05	<0.05	<0.05	YES
	From 1969.I to 1969.III	<0.05	<0.05	<0.05	YES
	From 1969.IV to 1972.I	>0.05	<0.05	<0.05	YES
	From 1972.II to 1972.IV	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1973.I to 1975.II	>0.05	>0.05	>0.05	NO
	From 1975.III to 1976.I	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1976.II to 1983.IV	>0.05	<0.05	<0.05	YES
NOR 1963.I- 2003.IV	From 1963.I to 1963.II	>0.05	>0.05	>0.05	NO
	1963.III	<0.05	<0.05	<0.05	YES
	From 1963.IV to 1972.IV	>0.05	>0.05	>0.05	NO
	From 1973.I to 1974.IV	>0.05	<0.05	<0.05	YES
	From 1975.I to 1975.II	<0.05	<0.05	<0.05	YES
	From 1975.III to 1979.IV	>0.05	<0.05	<0.05	YES
	From 1980.I to 2003.IV	<0.05	<0.05	<0.05	YES

Notes

a. RER: real exchange rate. JAP: Japan, LUX: Luxembourg, NET: The Netherlands, NZ: New Zealand, NOR: Norway.

b. Pvsup, Pvexp and Pvave are the p-values of the supreme test developed by Andrews (1993) and the exponential and average tests developed by Andrews and Ploberger (1994).

c. YES: evidence of instability in the variance of the real exchange rate at 5% significant level, YES*: evidence of instability in the variance of the real exchange rate at 10% significant level, NO: no evidence of instability in the variance of the real exchange rate at 5% significant level.

Table 1 (cont.). Hansen's (1997) P-values of the Supreme, Exponential and Average Tests

RER	Periods	Pvsup	Pvexp	Pvave	Instability
POR	From 1963.I to 1973.IV	>0.05	>0.05	>0.05	NO
1963.I-1998.IV	From 1974.I to 1976.IV	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1977.I to 1981.I	>0.05	<0.05	<0.05	YES
	From 1981.II to 1998.IV	<0.05	<0.05	<0.05	YES
SPA	From 1963.I to 1963.II	>0.05	>0.05	>0.05	NO
1963.I-1998.IV	From 1963.III to 1965.IV	<0.05	<0.05	>0.05	YES
	From 1966.I to 1977.II	>0.05	>0.05	>0.05	NO
	From 1977.III to 1980.III	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1980.IV to 1983.IV	>0.05	<0.05	<0.05	YES
	From 1984.I to 1998.IV	<0.05	<0.05	<0.05	YES
SWE	From 1963.I to 1973.II	>0.05	>0.05	>0.05	NO
1963.I-2003.IV	From 1973.III to 1974.II	>0.05	[0.05, 0.10]	<0.05	YES*
	From 1974.III to 1979.IV	>0.05	<0.05	<0.05	YES
	From 1980.I to 2003.IV	<0.05	<0.05	<0.05	YES
SWI	From 1963.I to 1973.IV	>0.05	>0.05	>0.05	NO
1963.I-2003.IV	From 1974.I to 1978.III	>0.05	<0.05	<0.05	YES
	From 1978.IV to 2003.IV	<0.05	<0.05	<0.05	YES
UK	From 1963.I to 1967.IV	>0.05	>0.05	>0.05	NO
1963.I-2003.IV	From 1968.I to 1970.I	>0.05	<0.05	<0.05	YES
	From 1970.II to 1971.II	>0.05	>0.05	<0.05	NO
	From 1971.III to 1972.I	>0.05	>0.05	>0.05	NO
	From 1972.II to 1976.I	>0.05	<0.05	<0.05	YES
	From 1976.II to 2003.IV	<0.05	<0.05	<0.05	YES

Notes

a. RER: real exchange rate. POR: Portugal, SPA: Spain, SWE: Sweden, SWI: Switzerland, UK: United Kingdom.

b. Pvsup, Pvexp and Pvave are the p-values of the supreme test developed by Andrews (1993) and the exponential and average tests developed by Andrews and Ploberger (1994).

c. YES: evidence of instability in the variance of the real exchange rate at 5% significant level, YES*: evidence of instability in the variance of the real exchange rate at 10% significant level, NO: no evidence of instability in the variance of the real exchange rate at 5% significant level.

Figure 1. Quarterly Rate of Change in OECD Industrial Countries RER's Against The United States Dollar, 1960.I-2003.IV

Figure 2 (a). P-values of the supreme (pvsup) test developed by Andrews (1993) and the exponential (pvexp) and average (pvave) tests developed by Andrews and Ploberger (1994), 1963.I-2003.IV.

Figure 2 (b). P-values of the supreme (pvsup) test developed by Andrews (1993) and the exponential (pvexp) and average (pvave) tests developed by Andrews and Ploberger (1994), 1963.I-2003.IV.

Figure 2 (c). P-values of the supreme (pvsup) test developed by Andrews (1993) and the exponential (pvexp) and average (pvave) tests developed by Andrews and Ploberger (1994), 1960.I-2003.IV.

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