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## *How Volatile Are Exchange Rates?*

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## How volatile are exchange rates?\*

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### Abstract

This paper briefly describes the broad features of major exchange rates since the early 1970s, and compares these features with those of the 1960s. Also included is a brief analysis of whether these features are manifested in real interest rates and in commodity prices, with seemingly curious results.

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## 1. Introduction

Exchange rates have been notoriously volatile since switching to floating rates by major currencies in the early 1970s (Manzur, 2003; Manzur & Chan, 2010). Increased exchange rate volatility means increased uncertainty for international business, which can be enormously costly. To cope with this volatility, economic managers have been constantly looking for alternative arrangements. The best example of a potential solution is the European Union whose member countries suspended use of their national currencies and adopted a single currency (the euro). A number of emerging economies have struggled with variants of managed exchanged rate regimes. Smaller countries like Panama and Ecuador have gone for dollarization, and other high-inflation countries like Mexico and Argentina are viewed as likely candidates for this extreme option. Consequently, exchange rate volatility is a major concern for policy makers and business.

How volatile have real exchange rates been since return to the float by the major currencies? We provide a brief description of the broad features of major exchange rates since the early 1970s, and compare these features with those of the 1960s. Also included is a brief analysis of whether these features are manifested in real interest rates and in commodity prices. The purpose is to describe the features rather than to analyse them. Such a descriptive historical study is important because it presents a set of stylized facts and useful insights that are fundamental to appropriate exchange rate modelling.

## 2. Basic Statistics<sup>1</sup>

We focus on the log-changes (or return) of real rather than nominal exchange rates involving four major currencies, namely, the Australian dollar, the Canadian dollar, the Japanese yen and the British pound sterling. Real exchange rates are calculated as the nominal rates (expressed as domestic currency costs of \$US1) multiplied by the ratio of the domestic price level to the US price level. The consumer price index (CPI) is used for prices. All data are from Datastream, and are quarterly, starting from 1960:Q1 to 2010:Q3, which is as recent as available at the time of writing. For our purpose, the data for the 1960s represent the experience of the fixed- exchange rate period. The sample for the flexible regime is

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<sup>1</sup> All data used in this paper are contained in a separate appendix, available on request.

further truncated into three sub-periods to allow for possible world shocks that might have introduced structural breaks into the series. The first sub-period 1973:Q1–1986:Q2 witnessed a set of common shocks associated with sharp fluctuations in the price of oil and contractionary monetary policy in major industrial economies. The second sub-period, 1986:Q3–2003:Q4 represents the globalization period characterised by dramatic increases in the volume of cross-border trade in both goods and assets. The third sub-period 2004:Q1–2010:Q3 covers recent developments including the global financial crisis and sovereign debt problems in the Euro zone.

**Table 1 Quarterly Real Exchange Rates (log-change x 100): 1960s vs 1973-2010**

Statistics	Australia	Canada	Japan	UK	Mean
<b>1960s:</b>					
Mean	0.49	0.30	0.70	0.70	0.55
Standard deviation	2.91	0.89	1.24	1.89	1.73
<b>1973 – 2010:</b>					
Mean	0.27	0.04	-1.26	0.72	-0.06
Standard deviation	5.47	2.77	5.05	5.05	4.59
<b>1973 – 1986:</b>					
Mean	2.93	0.86	-1.18	1.81	1.11
Standard deviation	5.43	1.69	5.41	5.38	4.48
<b>1986-2003:</b>					
Mean	0.15	-0.17	-1.22	-0.03	-0.32
Standard deviation	4.19	2.06	5.31	4.38	3.99
<b>2004-2010:</b>					
Mean	-0.77	-1.03	-1.53	0.47	-0.72
Standard deviation	7.78	4.96	3.55	5.74	5.51

Note: As the Australian dollar was floated in 1983, the data for Australia are adjusted accordingly for the sub-samples. The last column gives the means across the rows.

Table 1 contains the means and standard deviations of quarterly log change of real exchange rates for the Australian dollar, the Canadian dollar, the Japanese yen, and British pound sterling. A positive change is a real depreciation of the domestic currency. Looking at the mean changes for 1960s and 1973-2010, these are comparable across the two periods, except for the Japanese yen which experienced an appreciation against the US dollar in the latter period. But the standard deviations are several times larger in 1973-2010 period than in

the 1960s. As can be seen, the Australian dollar has become almost twice as volatile as before, the Canadian dollar and the British pound volatility is almost three times larger, and Japanese yen has been more than four times as volatile during the floating exchange rate system as in the 1960s under the Bretton-Woods system. When looking into the three sub-periods of the floating exchange rate system, the standard deviations for the first two sub-periods are more or less comparable, but these numbers have increased for each of these currencies except for the Japanese yen in the last sub-period. Overall, the results indicate that the variability of real exchange rates has increased since the exchange rates were set to float. This is consistent with the literature (see Mussa, 1987 and Manzur, 2003) as well as with the asset approach to exchange rates, whereby the exchange rate being an asset price adjusts instantaneously to ‘news’ (see Mussa 1982). Interestingly, the mean change for each of the four currencies for 1973-2010 is close to zero (-0.06, see the last column of Table 1). This is encouraging for the long-run stationarity of real exchange rates.

For comparison purposes, we now turn to the properties of other financial prices such as commodity prices and real interest rates. For commodity prices, we use the Commodity Research Bureau (CRB) spot world commodity price index. Except for Japan during the 1960s, long-term government bond rates are used for nominal interest rates for the entire sample. For Japan, because of data unavailability, quarterly treasury bill rates are used for the 1960s. The real interest rates are the nominal rates adjusted for inflation (ex-post). Again, the CPI is used to measure inflation.

Table 2 is the real interest counterpart of Table 1. As can be seen across the 1960s and the 1973-2010 period, the mean changes are somewhat comparable, but there are wide divergences in the standard deviations. The standard deviation of the Australian real interest rate in the floating period has increased about ten times compared to what it was in the 1960s. On the other hand, this measure has declined for Japan, the UK and the USA, with Canada having a slight increase. Comparing the last column in Table 2 with the last column in Table 1, it can be seen, that on average, the volatility of interest rates tends to exceed that of exchange rates both under fixed and flexible exchange rate systems. Table 3 shows that commodity prices have been no less volatile than the real exchange rates in both 1960s and 1973-2010.

**Table 2 Quarterly Real Interest Rates: 1960s vs 1973-2010**

Statistics	Australia	Canada	Japan	UK	US	Mean
<b>1960s:</b>						
Mean	-0.27	-1.38	2.33	-2.45	-0.91	-0.54
Standard deviation	1.79	6.28	20.44	14.90	6.79	10.04
<b>1973 - 2010:</b>						
Mean	0.44	-0.11	1.22	-0.29	-0.02	-0.25
Std deviation	17.65	6.65	14.47	5.98	3.79	9.71
<b>1973-1986:</b>						
Mean	0.29	0.18	-0.11	-0.55	-0.06	-0.05
Std deviation	1.54	9.85	2.65	6.36	1.38	4.36
<b>1986-2003:</b>						
Mean	0.6	-0.08	3.13	0.31	0.66	0.92
Standard deviation	22.24	2.12	20.75	6.33	4.63	11.21
<b>2004-2010:</b>						
Mean	0.27	-0.78	-1.1	-1.33	-1.66	-0.92
Standard deviation	2.05	6.7	5.69	3.93	4.24	4.52

**Table 3 Quarterly change in Commodity Price Index, 1960s vs 1973-2010**

<u>Period</u>	<u>Mean</u>	<u>Standard Deviation</u>
1960s:	0.34	2.72
1973-2010:	0.82	5.70
1973-1986:	1.04	6.22
1986-2003:	0.61	3.84
2004-2010:	1.67	8.24

### 3. Correlations

Do major currencies move together? How proportionate are the currency co-movements with interest rates and commodity prices? Table 4 shows that the correlations across the four currencies are either negative or close to zero in the 1960s. In 1973-2010, these numbers have improved in a positive direction, except for the Japanese yen. Table 5 gives the correlations of changes in real exchange rates, real interest rates and commodity prices for 1973-2010. In each of the four countries, the real exchange rate tends to be either uncorrelated or negatively correlated with both real interest rates and commodity prices.

**Table 4 Correlation among the currencies: 1960s vs 1973-2010**

<u>1960s:</u>					<u>1973-2010:</u>				
	Australia	Canada	Japan	UK		Australia	Canada	Japan	UK
Australia	1.00				Australia	1.00			
Canada	-0.02	1.00			Canada	0.70	1.00		
Japan	0.06	-0.15	1.00		Japan	0.05	-0.01	1.00	
UK	-0.11	0.06	0.07	1.00	UK	0.50	0.47	0.29	1.00

However, the correlation coefficients of both the Australian and the Canadian dollars with the world commodity prices tend to be reasonable and encouraging for the commodity currency literature (see Chen and Rogoff, 2004).

**Table 5 Correlations of exchange rates, interest rates and commodity prices, 1973 - 2010**

	Australia				Canada		
	Dollar	Interest rate	Commodity price		Dollar	Interest rate	Commodity price
Dollar	1.00			Dollar	1.00		
Interest rate	0.01	1.00		Interest rate	-0.22	1.00	
Commodity price	-0.31	0.02	1.00	Commodity price	-0.31	0.03	1.00
	Japan				UK		
	Yen	Interest rate	Commodity price		Pound	Interest rate	Commodity price
Yen	1.00			Pound	1.00		
Interest rate	-0.08	1.00		Interest rate	-0.11	1.00	
Commodity price	0.07	-0.01	1.00	Commodity price	-0.25	-0.10	1.00

Note: Australian data starts from 1983.

#### 4. Conclusions

Based on the first and second-order moments of real exchange rates, real interest rates and commodity prices, our findings indicate that exchange rates may not be as volatile as they are generally viewed. There is a tendency for the changes in real exchange rates to wash away in the long run. Curiously, real exchange rates have tended to be either uncorrelated or negatively correlated with real interest rates; however, the correlations of both the Australian and the Canadian dollars with the world commodity prices tend to provide support to the concept of commodity currency. These results have useful implications for further research in exchange rate economics.

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