

Who Cares About Volatility?

A Tale of Two Exchange-Rate Systems

BY SYLVAIN LEDUC

Currency debacles in Mexico in 1994-95 and in Asia in 1997-98 suggest that exchange-rate policies may be very important for these economies. Some economists go so far as to argue that, for many small countries, the choice of an exchange-rate system may be their single most important macroeconomic policy decision.

The post-World War II experience of industrial countries, however, paints a different picture of the importance of exchange-rate policies for an economy's performance. In fact, the exchange-rate system mattered surprisingly little for the performance of these economies.

The debate over the benefits of different exchange-rate systems goes back a long way. In the 1940s, some economists argued that exchange rates determined by market forces would be very unstable — they would experience wild and erratic movements driven mostly by the speculative motives of investors. Critics of such flexible exchange-rate systems feared that

the uncertainty created by these movements in exchange rates would lead to a fall in trade between nations and, thus, to lower standards of living. Nobel laureate Milton Friedman disagreed forcefully with that view. In an important essay, which influenced the decision to adopt a system of flexible exchange rates in the early 1970s, Friedman argued that as long as underlying economic conditions are stable, there is no presumption that exchange rates will move excessively.

Although much has been written on the subject, the debate is far from settled. Indeed, the sheer number of different exchange-rate systems currently in place in the world demonstrates that policymakers disagree on the merits of different exchange-rate arrangements. For instance, as of June 1999, the International Monetary Fund reported that 67 countries pegged their currency, eight adhered to a currency board arrangement, 37 either used the currency of another country as the sole legal tender or belonged to a monetary union,

and the remaining 73 followed more flexible arrangements, such as managed or independent floating (see *Different Types of Exchange-Rate Regimes* for a short description of the different systems). Even among the more homogeneous group of 29 countries that make up the Organization for Economic Cooperation and Development (OECD), six were pegging their currencies, 12 followed arrangements of independent or managed floating, and 11 had just formed a monetary union in which they adopted a common currency, the euro, which will be the sole legal tender by 2002.

Exchange-rate arrangements vary across time as well as across countries. For instance, at the start of the 20th century, most Western countries' currencies were rigidly fixed to gold, under the system known as the gold standard, which collapsed with the outbreak of World War I. In the 1930s, many countries, facing the hardships of the Great Depression, opted for more flexibility and decided to let market forces determine the value of their currencies.¹ Then, in 1945, the architects of the Bretton Woods system struck a compromise by creating a system of fixed, but adjustable exchange rates, in an attempt to combine the benefits of the gold standard with those of flexible exchange rates (see *The Bretton Woods Exchange-Rate System*).

Countries spend much time and effort devising exchange-rate arrangements. One reason is that policymakers hope that the right exchange-rate system will help stabilize their economies. A stable economic environment decreases the amount of



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¹ For a thorough account of the gold standard and the interwar period, see the book by Barry Eichengreen.

uncertainty people face when they have to make economic decisions such as how much to plant this season, how much to expand a factory, or how much to save for retirement. Is one particular exchange-rate system associated with a more stable economic environment? To shed some light on this question, we will review what happened historically to the volatility of certain macroeconomic variables for some industrial countries under different exchange-rate mechanisms. We will focus our attention on the Bretton Woods system of fixed, but adjustable exchange rates, in place from 1945 to 1971, and on the period since 1973, during which most industrial countries opted for flexible exchange rates.² We will see that, as the critics argued would happen, flexible exchange rates have been extremely volatile, but predictions of lower trade volumes, lower output, and lower standards of living failed to come true. Indeed, the volatility of exchange rates affected economies surprisingly little, whether we look at output, net exports, consumption, or investment.

WHAT ARE THE HISTORICAL FACTS?

Let's begin our investigation of how the exchange-rate mechanism affects macroeconomic variables by looking at some plots describing how those variables moved over time from 1957 to 1999.³ One important variable is the real exchange rate. People usually think about nominal exchange rates, which denote the price of one currency in terms of another. For instance, in January 1999 one U.S. dollar was worth 113 Japanese yen, but in January 2000, the U.S. dollar traded for 105 Japanese yen. Therefore, the dollar lost 7.1 percent of its value against the yen over that year, that is, the *nominal* exchange rate fell 7.1 per-

² This article does not study the period between August 1971 and March 1973 when the major industrial countries' currencies evolved under the Smithsonian Agreement.

³ The sample studied starts in 1957 instead of 1945 because many economic series are unavailable before that date.

cent. The *real* exchange rate, on the other hand, represents the relative prices of goods in two countries. A common measure used to calculate the real exchange rate is the nominal exchange rate multiplied by the ratio of consumer price indexes in the two countries. From January 1999 to January 2000, the consumer price index rose 3 percent more in the United States than in Japan, so the real exchange rate declined only 4.1 percent.⁴ In other words, while \$1.00 could buy 7.1 percent fewer yen in January 2000 than in January 1999,

⁴ In January 1999, the consumer price index in the United States was 164.7, and the consumer price index in Japan was 102, implying a real exchange rate of 182.5: the nominal exchange rate of 113 yen per U.S. dollar times the ratio of U.S. to Japanese price indexes. By January 2000, however, the U.S. consumer price index had risen to 169.1 while that in Japan had fallen to 101.5, resulting in a fall of the real exchange rate to 174.9.

\$1.00 of U.S. goods could be traded for 4.1 percent fewer Japanese goods in January 2000 than a year before.

The real exchange rate's volatility measures the extent to which the relative price of two countries' goods fluctuates over time. Since most countries switched from fixed to flexible nominal exchange rates in the early 1970s, real exchange rates have become much more volatile, as critics of flexible exchange rates predicted (Figure 1).⁵ However, the volatility of many other economic variables has not changed as much (Figure 2).⁶ If an

⁵ All variables have been detrended by taking the first difference of their logarithms; that is, we look at growth rates. For purposes of exposition, in Figures 1 and 2 the period between August 1971 and March 1973 is included with the flexible exchange-rate period.

⁶ See the article by Marianne Baxter and Alan Stockman for a more exhaustive study.

Different Types of Exchange-Rate Regimes

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Exchange-Rate Arrangement with No Separate Legal Tender: Under this arrangement, two possible cases emerge. First, the currency of another country is used as the sole legal tender; for example, Panama uses the U.S. dollar. Second, the country may belong to a monetary union in which members of the union share the same legal tender; for example, the European countries that belong to the European Monetary Union share a common currency, the euro.

Currency Board Arrangement: In this case, the country is bound by law to exchange domestic currency for a particular foreign currency at a fixed exchange rate. Argentina uses this arrangement, exchanging one peso for one U.S. dollar.

Other Conventional Fixed Peg Arrangements: The country pegs its currency to that of another country or to a basket of currencies. Typically, the arrangement allows the exchange rate to fluctuate within a narrow band around a central rate.

Crawling Peg: As in the previous case, the country pegs its currency to that of another country, but it revises the exchange rate periodically at a fixed, pre-announced rate. Costa Rica uses a crawling peg system.

Managed Floating: The monetary authority of the country intervenes actively in the foreign-exchange market to influence the movements of the exchange rate. The monetary authority, however, does not specify or pre-commit to any particular value for the exchange rate.

Independent Floating: For the most part, the market determines the exchange rate of a country. The monetary authority rarely, if ever, intervenes in the foreign exchange market. England has a freely floating exchange rate.

The Bretton Woods Exchange-Rate System

I

n 1944, delegates from 44 countries met at Bretton Woods, New Hampshire, to reform the international monetary system.^a The delegates wanted to design a system that would combine the benefits of both flexible and fixed exchange-rate systems. The result was a system of fixed, but adjustable, nominal exchange rates.

Under the system, the U.S. dollar was fixed in terms of gold (initially at \$35 per ounce), and the U.S. Treasury bought and sold gold to maintain this official price. In turn, every other member country was to fix its currency to the dollar (and indirectly to gold) and keep its exchange rate within a 1 percent range on either side of the parity by buying or selling U.S. dollars in the foreign-exchange market. Only in the face of a significant and long-lasting deficit or surplus in its balance of payments was a country allowed to adjust the parity of its currency. Thus, the goal was to enjoy the stability associated with fixed exchange rates while simultaneously retaining the ability to move the nominal exchange rate when necessary to restore equilibrium in the balance of payments.

The system essentially collapsed in August 1971, when the U.S. suspended its promise to exchange gold for dollars at the official price.^b Many elements contributed to the fall of Bretton Woods, but an important one concerned the liquidity of the system. Under the agreement, the U.S.

Treasury fixed the price of the U.S. dollar in terms of gold by buying and selling gold on the market. In other words, the U.S. promised to exchange U.S. dollars for gold at the official price of \$35 per ounce. The system collapsed when other countries no longer believed that the U.S. could keep its promise to exchange U.S. dollars for gold at the official price. In the 1960s, U.S. reserves of gold steadily declined while the amount of U.S. liabilities to foreigners increased. That is, there were more and more U.S. dollars in circulation for every ounce of gold, putting more strain on the capacity of the United States to honor the agreement. Other countries, which had accumulated U.S. dollars, became afraid that the dollar would be devalued in terms of gold, and they started to convert their holdings of dollars into gold. In August 1971, President Richard Nixon suspended the convertibility of dollars into gold, which essentially ended the Bretton Woods system.

^a A collection of articles on the workings of the Bretton Woods system can be found in the book by Michael Bordo and Barry Eichengreen.

^b In 1971, however, the industrial countries were not yet ready to implement a system of flexible exchange rates. Under the Smithsonian Agreement, signed in December 1971, they adopted a system similar in spirit to that of Bretton Woods, although it allowed the exchange rates to fluctuate more. That system collapsed in March 1973.

observer didn't know the date on which the Bretton Woods system fell, it would be hard to tell from plots of industrial production when these countries switched to a flexible exchange-rate system. The same is true of other macroeconomic variables, including consumption, investment, or net exports.

Although a picture may be worth a thousand words, looking solely at figures like these may be deceiving. Table 1 reports the volatility of the real exchange rate between three countries and the United States, as well as, for each country, the volatility of its industrial production, consumption, investment, and net exports (all in inflation-adjusted terms) in the flexible exchange-rate period relative to their volatility in the Bretton Woods period.⁷ The table demonstrates that except for the real exchange rate, these economic variables are about equally volatile under the two different ex-

change-rate regimes. Certainly, since 1973 no variable has experienced an increase in its volatility similar to that of real exchange rates. Moreover, the increase in exchange-rate volatility did not lead to a fall in international trade and to lower standards of living, as critics of flexible exchange rates feared. In fact, the relationship between exchange-rate regimes and economic growth does not appear to be strong.⁸

SHOULD WE CARE ABOUT THE REAL EXCHANGE RATE?

The increase in the volatility of real exchange rates since 1973,

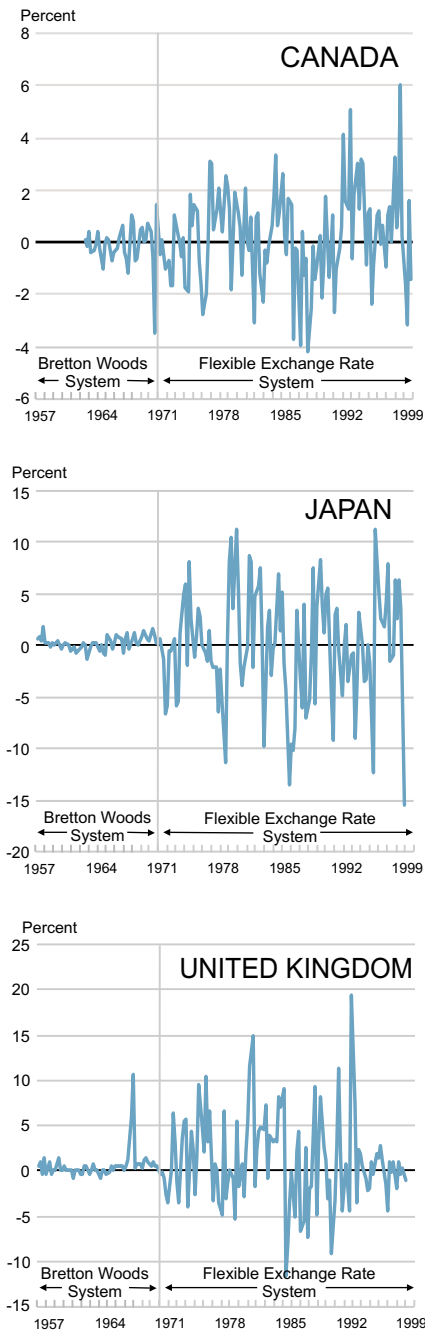
⁷ The results are not affected if we look at the variability of real exchange rates vis-à-vis a currency other than the U.S. dollar.

⁸ See the article by Atish Gosh, Anne-Marie Gulde, Jonathan Ostry, and Holger Wolf.

without similar increases in the volatility of other economic variables and with no adverse effect on trade volumes or standards of living, constitutes an important puzzle in international economics. The reason is that economists generally think that relative prices, like the real exchange rate, matter for allocating scarce resources efficiently.

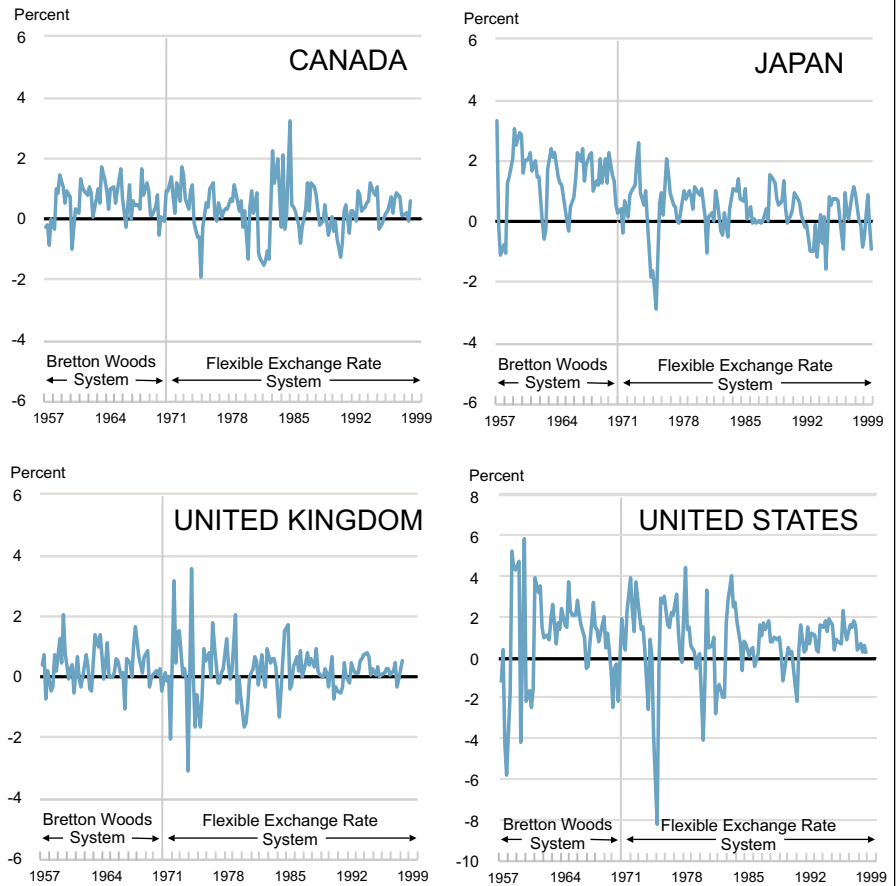
Imagine, for a moment, that the U.S. economy does not trade with any other country and the relative price of cars suddenly increases. This increase would give people an incentive to switch expenditures from cars to other goods in the economy, therefore lowering production and employment in the car industry.

In theory, real exchange rates work just like the relative price of cars in the example above. The only difference is that the real exchange rate represents the relative price of goods between countries. Imagine now that the

FIGURE 1**Quarterly Growth Rates of Real Exchange Rates: Before & After Bretton Woods***

Source: IMF International Finance Statistics and Statistics Canada

* Real exchange rates shown vis-à-vis the United States

FIGURE 2**Quarterly Growth Rates Of Industrial Production: Before & After Bretton Woods**

Source: IMF International Finance Statistics and DRI

U.S. economy opens up to trade, and suppose that the relative price of U.S. goods increases (i.e., the real exchange rate appreciates). Just like the increase in the relative price of cars in the previous example, the appreciation of the real exchange rate for U.S. goods should be associated with a shift in world demand away from U.S. products toward foreign-produced goods and, consequently, production and employment in the United States would fall.

These potentially large movements in production and employment

are what concern international economists and policymakers. According to this simple theory, movements in real exchange rates should coincide with movements in resources in the world economy. So if the volatility of the real exchange rate increases, the volatility of other economic variables, such as output or consumption, should also increase. However, as the discussion above showed, this clearly did not happen after 1973. Economists have been trying to solve this puzzle for some time now. Our search for a solution will be helped by learning whether the

TABLE 1: Ratio of Volatility

Flexible Exchange-Rate Period Relative to Bretton Woods Period

	Real Exchange Rate	Output	Consumption	Investment	Net Exports
Canada	3.42	1.53	1.03	1.18	0.79
Japan	8.84	0.81	1.04	0.74	0.70
United Kingdom	3.03	1.31	0.99	0.94	0.88
United States		0.71	0.95	1.02	0.92

Sources: IMF International Financial Statistics, DRI, and Statistics Canada

The volatility of a variable is measured by the standard deviation of quarter-to-quarter growth rates of that variable. Quarter-to-quarter growth rates are calculated as the change from each quarter to the next in the logarithm of the variable.

The Bretton Woods period covers 1957Q1 to 1970Q4, while the flexible exchange-rate period covers 1973Q1 to 1999Q4.

choice of exchange-rate systems affects the volatility of real exchange rates, or vice versa.

WHAT CAUSES WHAT?

Higher volatility of real exchange rates is associated with a flexible exchange-rate system. But what is cause and what is effect? Could it be that real exchange rates have become more variable since 1973 because the underlying circumstances affecting the economy have also become more variable, and consequently, countries decided to adopt a flexible exchange-rate system to insulate their economies from external shocks? Interestingly, the adoption of a flexible exchange-rate system in the early 1970s coincided with the first OPEC oil-price shock. Thus, real exchange rates may have become more volatile since 1973 because world economies have been subject to more real shocks, of which oil-price shocks are a prime example, and countries responded to these real shocks by moving to a flexible exchange-rate system. Perhaps the more volatile real exchange rate and the adoption of a flexible exchange-rate system resulted from an increase in the size of shocks to the economy. Although we do not have formal statisti-

cal results proving or disproving this case, the historical experience of Canada and Ireland shows that this is unlikely.

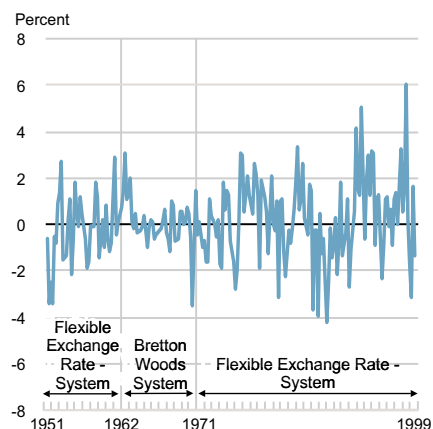
In 1950, Canada decided to leave the Bretton Woods system of fixed, but adjustable, exchange rates because it had difficulty setting a stable and credible exchange rate. The Canadian government had increased the value of the Canadian dollar, relative to other currencies, in 1946 and decreased it in 1949. In October 1950, facing strong market pressures toward an appreciation, Canada decided to let its currency float. The Canadian exchange rate was flexible until early 1962, when Canada rejoined the Bretton Woods system. Comparing the behavior of the Canadian exchange rate during these different periods shows that it is likely that the choice of exchange-rate system influences the behavior of a country's real exchange rate (Figure 3). The volatility of the Canadian real exchange rate was much lower when Canada was part of the Bretton Woods system in the 1960s than it has been under the current regime or than it was in the 1950s. In fact, each time the Canadian currency has been allowed to float, the real exchange rate has been roughly three

times more volatile than it was under the Bretton Woods system (Table 2).

Ireland's experience provides another example of the effects of the exchange-rate system on the economy. Until the end of 1978, the Irish pound was pegged to the British pound. But in January 1979, Ireland joined the European Monetary System (EMS), in which the Irish pound was effectively tied to the German mark. As in the Canadian case, the volatility of the real exchange rate between two countries is closely linked to the type of exchange-rate arrangement these countries follow (Table 3). Since the Irish pound was allowed to float against the British currency in 1979, the real exchange rate between Ireland and the UK has been more than twice as volatile as it was in the period from 1973 to 1978, when the currencies were tied to each other. The opposite pattern emerges between Ireland and Germany: after the Irish pound was essentially tied to the German mark in 1979, the volatility of the real exchange rate between Ireland and Germany fell by nearly one-half.

FIGURE 3

Quarterly Growth Rates of the Canadian Real Exchange Rate



Source: Statistics Canada and DRI

TABLE 2: The Canadian Experience

Standard Deviation of the Real Exchange Rate

	1950 - 1962	1962 - 1970	1971 - 1999
Real Exchange Rate	1.50	0.54	1.83

Source: Statistics Canada and DRI.

TABLE 3: The Irish Experience

Standard Deviation of the Real Exchange Rate

	1973- 1978	1979 - 1999
Irish Pound / UK Pound	1.69	4.21
Irish Pound / German Mark	4.87	2.77

Source: DRI

The numbers reported are the standard deviation of quarter-to-quarter growth rates of the real exchange rate. These quarter-to-quarter growth rates are calculated as the change from each quarter to the next in the logarithm of the real exchange rate.

From the experiences of Canada and Ireland, it's apparent that the change to a flexible exchange-rate system causes increased volatility in the real exchange rate, not vice versa.

WHY DO REAL EXCHANGE RATES EXPERIENCE WILD SWINGS?

One proposed explanation is that market psychology, not economic fundamentals like supply and demand, causes nominal and real exchange rates to move so much in a flexible exchange-rate system. Under this approach, the exchange rate becomes a self-fulfilling prophecy. For instance, suppose that a trader in the foreign-exchange market buys U.S. dollars because he expects the U.S. dollar to appreciate. If all traders have the same expectations and all decide to buy U.S. dollars, their actions push the value of the U.S. dollar up, confirming their

expectations. Thus, market psychology can lead to exchange-rate volatility.

But, in general, people do not like the uncertainty generated by more volatile exchange rates. Some use costly means, like hedging, to protect themselves against it.⁹ Since the rest of the economy behaves similarly un-

⁹ Hedging refers to the means investors and firms take to protect themselves from possible movements in currencies. For instance, suppose an American firm exporting to Canada expects to receive a payment of 100,000 Canadian dollars in three months. To protect itself from the possible depreciation of the Canadian dollar, the American firm could hedge by entering into a contract with a bank stipulating that the firm agrees to sell 100,000 Canadian dollars for U.S. dollars to the bank in three months, at a fixed rate of exchange set at the time the contract is agreed upon. Changes in the exchange rate between the Canadian dollar and the U.S. dollar during the three months will have no effect on the firm's profits.

der fixed or flexible exchange-rate regimes, fixing the nominal exchange rate could thus be beneficial in avoiding wild and irrational movements in exchange rates and their hedging costs. The market-psychology approach says that, left to itself, the market for foreign exchange does not work very well — exchange rates are too volatile, which imposes costs on the economy. Generally, however, economists believe in market forces and prefer explanations based on economic fundamentals rather than psychology. Commenting on the possibility that flexible exchange rates would be extremely unstable, Milton Friedman noted that “[the] advocacy of flexible exchange rates is not equivalent to advocacy of unstable exchange rates. The ultimate objective is a world in which exchange rates, while *free* to vary, are in fact highly stable. Instability of exchange rates is a symptom of instability in the underlying economic structure.”

Are the wild movements in real exchange rates since the early 1970s consistent with theoretical models based on economic fundamentals? The simplest model of exchange-rate determination, known as purchasing power parity, states that nominal exchange rates should move to offset inflation differentials across countries, leaving real exchange rates constant over time. This simple theory cannot explain the high volatility of real exchange rates.

What is happening is that the law of one price fails.¹⁰ The law of one price states that a good should sell for the same price in two different countries, when the prices are expressed in the same currency, after adjusting for tariffs and transport costs. If that were not the case, an individual would have an incentive to buy the good in the country where it is cheaper and sell it in the other country, an action called arbitrage in economic lingo. Such an individual is referred to as an arbitrageur.

¹⁰ See the articles by Charles Engel and by John Rogers and Michael Jenkins.

For instance, imagine that the same computer sells for 2000 Canadian dollars in Canada and for 1000 U.S. dollars in the United States. Moreover, suppose that 1 U.S. dollar can be exchanged for 1.5 Canadian dollars. Therefore, converting the U.S. price of the computer into Canadian dollars using the exchange rate, we find that 1500 Canadian dollars could buy the 1000 U.S. dollars needed to acquire this computer in the United States. To keep the example simple, let's assume there are no transport costs to ship a computer from the United States to Canada. An arbitrageur could make a profit of 500 Canadian dollars (333 U.S. dollars) by buying the computer in the United States and selling it in Canada. With sufficient arbitrage, prices, when expressed in the same currency, should converge, since arbitrageurs would raise the demand for computers in the United States and increase their supply in Canada.

If all sectors in the economy produce freely traded products and sell them in very competitive markets, the law of one price should hold, after adjusting for transport costs, and real exchange rates should not vary much. Rogers and Jenkins, however, found that 81 percent of the movements in real exchange rates are due to a failure of the law of one price. Moreover, Charles Engel and John Rogers showed that, for a wide range of commodities, the presence of transport costs cannot account for failure of the law of one price. This suggests that to better understand movements in real exchange rates, we need to have a better understanding of what causes the law of one price to fail.

THE SEARCH FOR A GOOD MODEL

Economists have been trying to develop a good model to explain the facts about real exchange rates. One important element of an explanation is that prices are slow to adjust to changes in the economy (often referred to as price stickiness). For instance, Figure 4 shows the nominal and the real exchange rates between Canada and the United States, as well

as the ratio of American to Canadian prices (as measured by the consumer price indexes). The high volatility of exchange rates since the early 1970s, combined with the nearly constant ratio of foreign to domestic prices, illustrates that the prices of goods are slow to adjust to changes in the economy, compared with financial variables such as nominal exchange rates.

Many researchers think that any model of exchange rates should include features that allow the prices

associated with highly volatile real exchange rates. While this may explain why real exchange rates are so volatile, it doesn't explain why more volatile real exchange rates aren't associated with more volatile consumption, output, and net exports. Therefore, the sluggishness of prices doesn't provide a full explanation of the puzzle.

It turns out that an explanation for the failure of the law of one price can help us understand why more volatile movements in the real exchange rate are not associated with more volatile economic fundamentals. This explanation, first postulated by Paul Krugman in a 1987 article, relies on what is known as pricing-to-market, which occurs when a firm sells the same product at different prices in different markets, as in our earlier example of computer prices. To determine if a firm set a different price in different markets, we would need to convert the price in one country into the other country's currency, using the exchange rate. A company might set different prices in different countries because of a difference in how strongly quantity demanded reacts to a change in price.

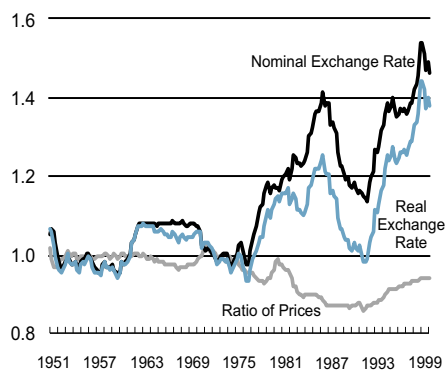
Of course, the extent to which a company can price to market may be limited by the possibility of arbitrage. With sufficient arbitrage, the difference in prices should vanish. Therefore, pricing-to-market is more likely to be found in industries, such as the car industry, in which products are tailored to local requirements.

Paul Froot and Paul

Klemperer provide another explanation for pricing-to-market. Their model relies on the observation that future demand for some firm's product may depend on the firm's current market share. In their framework, the higher the current market share, the higher the future demand will be. Such a relationship between current market share and future demand could arise because it is costly for consumers to switch brands. For example, a consumer may be unwilling to substitute a brand he has little information on for one he has tried and liked.

FIGURE 4

Canadian Exchange Rates and Price Ratio 1951-1999



Source: Statistics Canada and DRI

of goods to respond slowly to changes in the economy. Suppose some change in the economy causes a change in the nominal exchange rate. Since the prices of goods are slow to react (and since the real exchange rate equals the nominal exchange rate times the ratio of price indexes), real and nominal exchange rates should move approximately in line with each other. Therefore, flexible exchange-rate systems, in which nominal exchange rates are highly volatile, should also be

One property of pricing-to-market is that firms do not necessarily pass through movements in nominal exchange rates to the prices they charge in foreign countries, especially if the change in the exchange rate is temporary. Imagine, for example, that a U.S. firm sells its product in the United States and in Canada and that it is able to price to market. Suppose, moreover, that, as Froot and Klemperer argue, the firm's future demand for its product in each country depends on its current share of the market in each country. If the Canadian dollar were to temporarily depreciate vis-à-vis the U.S. dollar, the U.S. firm's profits would fall. The firm would get fewer U.S. dollars in exchange for each Canadian dollar it earns. The firm might react to the depreciation of the Canadian dollar by raising the price it charges Canadian consumers; that is, the U.S. firm might *pass through* the depreciation of the Canadian dollar to Canadian consumers. However, if the firm cares about its market share in Canada, it may prefer to keep constant the price it charges there, resulting in a cut in the firm's current profits.

In other words, pricing-to-market can engender price stickiness in local markets. Because of that stickiness, movements in the nominal exchange rate get translated into movements in the real exchange rate. Thus, pricing-to-market helps account for the high volatility of real exchange rates since 1973. And pricing-to-market can also help explain why the rest of the economy is unaffected by large movements in real exchange rates. Since, under pricing-to-market, movements in nominal exchange rates do not necessarily get passed through to consumer prices, consumers would have no incentives to switch from one good to another. Therefore, we would not expect production, consumption, investment, and net exports to respond strongly to exchange-rate movements if most firms price to market. Consequently, the high volatility of exchange rates would not be transmitted to other variables in the economy. In fact, many studies have uncovered pricing-

to-market in manufacturing industries. For instance, a study by Joseph Gagnon and Michael Knetter found that, instead of changing the price that they charge for their products in the United States, Japanese automobile exporters offset 70 percent of exchange-rate changes by adjusting profits.

Recently, researchers have built numerical models incorporating information on various aspects of the world economy to investigate how much changes in economic fundamentals (for instance, changes in monetary policy or movements in productivity) can account for the movements in exchange rates since 1973. The first wave of such models put the emphasis on perfectly competitive industries and movements in fundamentals driven primarily by changes in productivity across countries.¹¹ These frameworks were only partially successful at explaining the behavior of exchange rates, especially their high volatilities. In particular, they could not explain the large movements in real exchange rates that are due to the failure of the law of one price.

As a result, a second generation of numerical models tries to make sense of the large movements in

building on these previous studies, combined pricing-to-market and price stickiness to study the effects of exchange-rate regimes on the economy and found that these features could explain why the higher variability of real exchange rates since 1973 did not get transmitted to other economic variables. Figure 5, which shows the simulated time series for the real exchange rate, output, and net exports from our model, indicates that the model captures the empirical facts illustrated in Figures 1 and 2. Looking at the movements of the real exchange rate, an observer would be able to easily select the date at which the switch in exchange-rate regime occurred. However, looking only at the simulated series for output and net exports from our model economy, the observer would likely have a more difficult task.

CONCLUSION

Does the exchange-rate system matter? Looking at the Bretton Woods system and the flexible exchange-rate system that followed, this article showed that although real exchange rates have been much more volatile under the current flexible exchange-rate system, this high

Japanese automobile exporters offset 70 percent of exchange-rate changes by adjusting profits.

exchange rates under the current flexible exchange-rate regime by emphasizing imperfectly competitive industries with price stickiness and pricing-to-market, and changes in monetary policy.¹² These models have had relatively more success in explaining exchange-rate movements.

Recently, Luca Dedola and I,

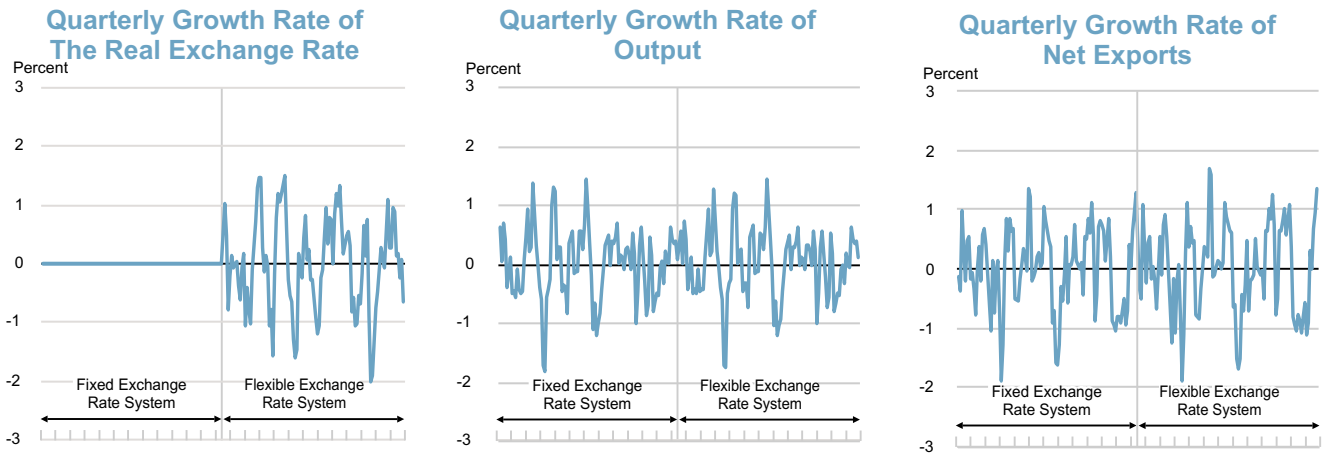
¹¹ See the article by David Backus, Patrick Kehoe, and Finn Kydland.

¹² See the articles by Caroline Betts and Michael Devereux; V.V. Chari, Patrick Kehoe, and Ellen McGrattan; and Robert Kollman.

volatility has not been transmitted to other sectors of the economy, at least not in the world's major industrial countries. In a sense, the early critics of flexible exchange-rate systems were half right. They were correct in predicting that exchange rates would be highly volatile if market forces determined them. However, their prediction of a lower trade volume, lower output, and overall lower standards of living did not materialize after the demise of the Bretton Woods system. In fact, in his 1989 book, Paul Krugman argues that flexible exchange rates "can move so much precisely because they seem to matter so little."

FIGURE 5


Model's Simulated Data Under Fixed & Flexible Exchange-Rate Systems*



* All the variables have been detrended

Does that mean that any type of exchange-rate system would suit any country? Probably not. Depending on the economic situation, a country could be harmed by its choice of an exchange-rate system. For instance, some researchers have shown that countries that left the gold standard in the early years of the Great Depression suffered much less than countries that kept their currency fixed to gold (see the book by Barry Eichengreen). This finding provides some evidence that the exchange-rate system matters, at least in drastic situations, and that the efforts of policymakers and academics to devise and understand different exchange-rate arrangements are important. Moreover, the recent experience of some emerging markets, such as East Asia or Latin America, suggests that exchange-rate volatility may very well matter for small, open economies, even though it does not

seem to matter much for larger, industrial countries. Indeed, a recent study by Shinji Takagi and Yushi Yoshida shows that Japanese firms exporting to East Asia, to a very large extent, do not price to market. As a result, movements in nominal exchange rates get transmitted into local

prices, which then affect consumption, production, and employment. Thus, unlike residents of industrial countries, those in small, open economies may very well care about exchange-rate volatility and which exchange-rate system is in place in their countries. 



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