Why Canada Should Adopt a Hard Fix Exchange Rate with the United States: An Application of the Optimum Currency Area Theory

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Introduction

With the establishment of a monetary union in Europe, and the anticipated prosperity it will bring, there is increasing interest in examining the feasibility of forming monetary unions or adopting single currency regimes elsewhere, including North America.

One way of looking at what type of exchange rate arrangement would best suit a region is to use optimum currency area (OCA) theory (see, for example, Guglielmo et al. 1999, Bayoumi and Eichengreen 1998, and Frankel and Rose 1998).

OCA theory says that a country can make an optimal choice between a hard fix[1] and a flexible exchange rate regime by using criteria[2] to determine from which regime the country's economy would benefit the most.

This paper applies the OCA criteria to the North American context to see whether Canada would benefit from adopting a hard fix exchange rate regime[3] with the United States.

There are varying opinions on the applicability of OCA theory;[4] however, it is, in the author's opinion, a useful tool for assessing whether a currency area is optimal or whether it could be improved. In the Canadian case, would a hard fix with the U.S. currency be advantageous? OCA

[1] Hard fix denotes an irrevocable fix between the currencies of more than one country.
[2] These criteria were developed by Mundell (1961), McKinnon (1963) and Kenen (1969).
[3] This would mean that Canada would adopt the U.S. dollar as its currency.
[4] Tavlas (1993), in support of OCA theory, gives examples of work done to operationalize it. Mélitz (1995), in contrast, suggests that the absence of a welfare function to enable a comprehensive cost-benefit analysis is a deficiency of the theory.

theory provides a framework for assessing a currency area. It looks at an economy's openness, shocks, business cycles, structure, international factor mobility, and whether there exists a system of risk sharing. Conclusions can then be drawn from this assessment as to whether a hard fix or flexible exchange rate regime would be most beneficial.

This paper first reviews the various alternative currency arrangements, and sets out the benefits of monetary unions, along with some of the limitations of a flexible exchange rate arrangement as a public policy instrument and the implications for Canada of abandoning it. Next, the OCA theory is explained and the criteria outlined and applied to the case of Canada and the U.S. This is done by measuring the degree of openness of the Canadian and U.S. economies, measuring the symmetry between the Canadian and the U.S. economies in terms of shocks, business cycles and structure, and looking at factor mobility and risk sharing in the two countries. The paper concludes by using the results of this analysis to make a case for either the adoption or rejection of a hard fixed exchange rate arrangement for Canada and the U.S.

Alternative Currency Arrangements

There are eight models of exchange rate regime operating throughout the world (IMF 2000). These can be characterized according to their degree of fixity or flexibility and by their legal structure. The following lists these regimes in order of increasing flexibility, with brief explanations below:

- monetary union

- currency board
- conventional fixed peg arrangement
- pegged exchange rate within horizontal bands
- crawling peg
- exchange rate within crawling bands
- managed floating with no previous path
- independent floating.

Monetary Union

Visser (1997) defines a monetary union as an area without payments restrictions within which exchange rates are permanently, or hard fixed, and eventually the various currencies are converted into a single currency. As with any currency area, a monetary union needs an institution to conduct monetary policy; hence, it has a central bank. The European Union member countries that have permanently fixed their individual currencies to the new Euro, for example, have formed a monetary union, with a single currency.

Currency Board

A currency board is an arrangement in which an exchange rate is fixed by law. Hong Kong, one of eight currency boards in existence today, can only print its currency when it has been backed by U.S. dollars at the ratio specified by law. Often the incentive for adopting a currency board is that it imposes monetary discipline on the country, bringing credibility to the country's currency. Dollarization is similar to a currency board; however, the U.S. dollar is actually adopted as the official currency. A currency board based on the U.S. dollar anchors a country's currency at a

legislated parity to the U.S. dollar. Recently, Argentina which has a currency board, considered adopting a hard fix exchange rate by adopting the U.S. dollar as its currency. If it were to go this route, Argentina would have its monetary policy tied to that of the U.S. central bank.

Conventional Fixed Peg Arrangement

This involves a country fixing its exchange rate to a foreign currency or basket of foreign currencies and allowing it to move within a narrow band: at most plus or minus one percent of the rate for the foreign currency (IMF 2000, 141). Between 1962 and 1970, the Canadian dollar was pegged to the U.S. dollar and allowed to fluctuate plus or minus one percent around the fixed parity.

Pegged Exchange Rate Within Horizontal Bands

The exchange rate is maintained with margins of fluctuation around the peg of greater than plus or minus one percent, giving the exchange rate greater flexibility than a conventional fixed peg arrangement (IMF 2000, 141).

Crawling Peg

Less rigid than a peg arrangement, a crawling peg allows for the exchange rate to be adjusted periodically in response to changes in particular economic indicators. For example, the exchange rate might be adjusted in response to differentials in the inflation rates between a country and its trading partners (IMF 2000, 141).

Exchange Rate Within Crawling Bands

A variation on the crawling peg regime is one that features an exchange rate within crawling bands. This regime allows the exchange rate to be maintained within a set of bands that are adjusted in response to selective economic indicators (IMF 2000, 141).

Managed Floating With No Previous Path

Under this regime, the monetary authority influences the exchange rate by intervening in the foreign exchange market. This intervention is not based on a previously specified path for the exchange rate (IMF 2000, 141).

Independent Floating

The most flexible of exchange rate regimes is an independent floating exchange rate, which is determined by market forces in the foreign exchange market. Any market intervention by the monetary authority is intended to prevent undue fluctuations of the exchange rate rather than establish a level for it (IMF 2000, 141).

The Limitations of a Flexible Exchange Rate as an Automatic Stabilizer

Canada has followed an independent floating exchange rate regime since 1970, although, as Table 1 shows, the country's exchange rate policy has alternated between flexible and fixed rates throughout its brief history.

Table 1: Canadian Exchange Rate Regimes

Years	Type of Regime
→1914	Fixed
1914–1925	Floating
1925–1929	Fixed
1929–1939	Floating
1939–1950	Fixed
1950–1962	Floating
1962–1970	Fixed
1970→	Floating

One drawback of a flexible exchange rate regime is that exchange rate depreciation, often touted as the economic rationale behind this arrangement, is in fact not an efficient stabilizer against economic shocks. For a depreciation to work, it requires as a precondition money illusion, which is unlikely the more open the economy is, according to Mundell (1961, 663). Even non-traded goods are affected by exchange rate changes, when imported inputs are used in their production.

Other reasons why a depreciation is inefficient as an automatic stabilizer are:

- it is too broad in scope
- it causes inflation
- it leads to trade disputes
- time lags impinge on its ability to stabilize the economy efficiently

- it leads to exchange rate misalignments
- it distorts investment decisions

In order for an exchange rate depreciation to reverse the adverse effects of a shock and bring about economic adjustment, it requires the unlikely precondition that economic agents are subject to "money illusion" (Mundell 1961, 663). For example, Canadian merchants or workers would only agree to receiving a lower "real" payment for their goods or labour (i.e. measured in terms of international buying power) if they were completely unaware of the currency's decreased purchasing power at home and abroad. This is impossible given evidence of relative purchasing power parity[5] and Canada's high level of trade with the United States. Many of the goods Canadians consume or produce contain U.S. inputs: either actual U.S.-based labour, or capital and materials inputs. A depreciation of the Canadian dollar results in a change in the terms of trade between Canada and the U.S. — a result that is transmitted to the domestic economy through "passed on" price increases for goods containing U.S. labour or capital inputs. This erosion of workers purchasing power, in time will lead to demands from workers for higher pay.[6] The price effect raises the price of imports, while the wealth effect reduces the workers' purchasing power — a vexing problem for managers and workers in the domestic economy.

Another problem with using the exchange rate as a stabilizer arises when there is an industry-specific demand shock. Exchange rate depreciation, by adjusting and distorting prices across the entire economy, is an unnecessarily blunt adjustment tool. It stabilizes the affected part of the

[5] Relative purchasing power parity relates the percentage change in price in one country with that of its trading partner, plus the percentage change in the exchange rate.
[6] They will have become aware of the fall of the real value of their wages caused by exchange rate depreciation.

economy (i.e. the sector hit by the asymmetric shock) along with other sectors exposed to the exchange rate adjustment, regardless of whether all sectors require the same adjustment stimulus. This is detrimental to the economy as a whole.

An industry-specific shock is felt across national boundaries when countries have a similar economic structure. When the exchange rate is used as a stabilizer in the event of an industry-specific shock striking both sides of a border, it becomes a competitive devaluation. This type of anti-competitive action leads to counterproductive trade disputes. Flexible exchange rates are effective for facilitating economic adjustment only when applied to regions with different types of economic activity and business cycle (Mundell 1961, 660).

Exchange rate movements intended as economic stabilizers may not work quickly enough. Dion and Jacob (1990) found that there is a lag period before the intended effect of an exchange rate adjustment takes effect. The idea of using exchange rate depreciation as a means of adjustment is linked to the Marshall-Lerner condition. When the sum of the elasticities of imports and exports is greater than one, currency depreciation can facilitate adjustment and avoid unpleasant periods of unemployment. The lag period found between the time of the exchange rate depreciation and its intended effect has been dubbed the J-Curve, because for a period the exchange rate change in fact has the opposite effect. A J-Curve has not been found to be the case for exchange rate depreciation in Canada; however, it would be plausible that it would exist for imported products that are highly inelastic.

Exchange rate depreciation can also lead to exchange rate misalignments, resource misallocations, trade distortions and a loss of real competitiveness and productivity — all of which are threats to Canadians' standard of living.

Exchange rate misalignments, or divergences from relative purchasing power parity, occur when the exchange rate fails to reflect economic fundamentals. To illustrate a misalignment, consider the Ricardian two-country, two-good model. Both countries produce a good for which they have a comparative advantage and trade it for a good for which they have a comparative disadvantage. Trade enables each country to consume a larger basket of the two goods than they otherwise would. An exchange rate misalignment in this model could occur for reasons external to an economy's economic fundamentals. Consider an asymmetric shock. If highly speculative market agents divert investment away from one economy to the other in response to an investment boom, there would be on the first country's currency to depreciate. This price change would change the pattern of production in the two countries so that both countries would produce the two goods less efficiently. This would prevent the countries from attaining the level of utility they had before the price change. Unlike a nominal shock that occurs between regions in a monetary union, an exchange rate depreciation, by affecting the prices of all tradable goods within an economy, can cause a wider rage of trade distortions. Unfortunately, some industries, which have a comparative advantage in terms of productivity or efficiency over their foreign counterparts, may be neglected in favour of other industries that benefit solely from an undervalued or overvalued exchange rate, which creates an artificial competitiveness. Thus, exchange rate misalignment distorts trade and diminishes economic welfare.

There is evidence that firms switch to producing other products in response to exchange rate movements (Bodnar and Gentry 1993, 41), which leads to inefficient allocations of resources. Consider labour-intensive industries such as textiles, which benefit from the declining Canadian dollar. Comparing Canadian labour textile resources with those of the world's leading textile producers shows that Canada does not have a comparative advantage in this product. Canada's textile industry benefits from an undervalued exchange rate. This example confirms that exchange rate misalignments encourage inefficient production processes. Because a misalignment affects the entire economy, it distorts production processes, discouraging production of the goods for which Canada has a comparative advantage and encouraging inefficient production of others.

An undervalued exchange rate deters domestic manufacturers from investing in items such as machinery to enhance productivity and competitiveness (Harris 1993, 36). Consider the following example.

Harris (1999) notes that the 1997–1998 shock to commodities markets affected the same industries on both sides of the Canada-U.S. border simultaneously. In response, the Canadian government chose to rely on exchange rate depreciation to stabilize the Canadian resources sector. This depreciation encouraged inefficient economic activity. After the fall in prices for wood products in the late 1990s, the relatively weak Canadian dollar cushioned Canadian firms from falling world prices, allowing Canadian forestry producers to continue producing without restructuring their operations. U.S. companies, on the other hand, were forced to make substantial cuts to their operations, and take productivity enhancing measures to survive. To

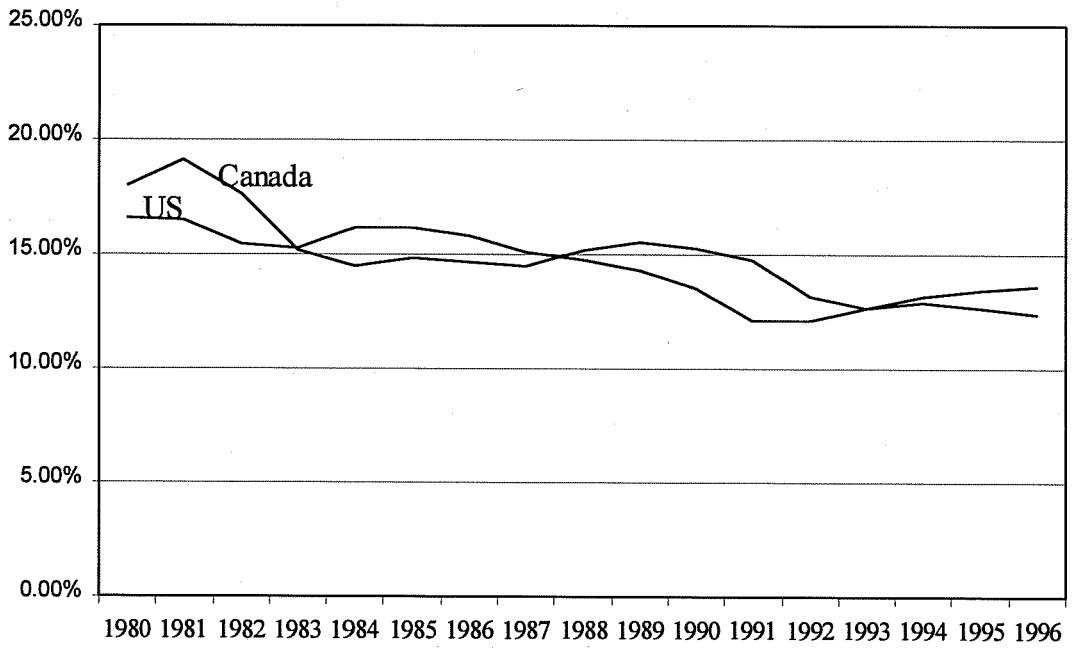
their future detriment Canadian firms were deterred from making productivity-enhancing capital investments. Since the U.S. firms restructured, however, they have become more competitive than Canadian producers, which has led to recent layoffs in the Canadian industry. Efficient U.S. firms have been able to outperform Canadian sawmills, offering more competitive prices for raw timber and selling the finished product at a cheaper price. Canada would be better off making necessary adjustments instead of using currency depreciation to stabilize the sector (Harris 1999, 323).

An interesting recent development in the Canadian lumber industry is the current shortage of raw logs in British Columbia; this is because logs are being sold to U.S. sawmills instead of Canadian sawmills. U.S. sawmills are able to offer Canadian exporters more money for the logs because they have become more efficient than their Canadian counterparts and can process the raw logs at less cost. This deterioration of the Canadian sawmills' productivity relative to that of the U.S. sawmills confirms Harris' argument that exchange rate misalignments lead to inefficient production choices.

Another concern, is the hypothesis that exchange–rate induced price competitiveness is one of several possible factors that contribute to a decline in capital formation, which in turn decreases productivity. Figure 1. which follows, traces the decline of capital formation in Canada. Figure 1 shows the steady downward trend of Canadian gross fixed capital formation as a percentage of GDP, while the U.S. figures have been increasing since 1990. The relationship between a weakening dollar and productivity has been demonstrated by McCalllum (1999, 7) who found a correlation coefficient of 0.86 between labour productivity in Canadian manufacturing and

changes in the Canada-U.S. exchange rate. Dupuis and Tessier (2000, viii) in a study for the Bank of Canada, found that McCallum's bivariate model is incorrectly specified, and that the relationship is not robust. Declining productivity may have other explanations instead. Nevertheless, the logic behind this hypothesized link between the declining exchange rate and productivity is convincing and still may be a factor in the decline in productivity.

Figure 1: Canadian and U.S. Gross Capital Formation as a Percentage of GDP



Source: Statisitics Canada

Benefits of a Hard Fix Exchange Rate

As discussed in the previous section, Canada's independent floating exchange rate regime is not ideal. This paper proposes, then, that Canada look at a adopting a hard fix exchange rate regime with the United States as an alternative. A hard fix exchange rate regime is the logical choice, given the potential of all other alternatives to come under direct destabilizing pressure — either from market forces as has occurred with the various peg arrangements, or from political pressure, as has occurred with currency boards. The presumed benefits for Canada of a hard fix are threefold:

- reduced transactions costs
- no exchange rate risk vis à vis the U.S.
- stronger, deeper financial markets.

Reduced Transaction Costs

Adopting a hard fix exchange rate regime reduces the costs associated with exchanging currencies and facilitates crossborder transactions. Given the large volume of trade that occurs between Canada and the U.S. (trade accounts for 40 percent of Canada's gross domestic product [GDP]), Canada would realize a considerable gain. By way of illustration, it is estimated that the transaction cost savings resulting from the European Monetary Union would amount to between 0.2 and 0.5 percent of annual European Union GDP (Collignon 1999, 8).

An estimate of transaction cost savings for Canada can be made by multiplying the turnover of U.S. dollars exchanged in foreign exchange markets for Canadian dollars by the spread between the "bid" and "ask" prices for U.S. dollars.

The Bank for International Settlements estimates the turnover for 1998 to be US$36.8 billion per day. Multiplied by a "bid-ask" spread of US$0.00015, the transaction costs amount to US$5.5 million for one day, or approximately 0.2 percent of Canada's GDP. Although these costs may seem insignificant, they act as a barrier to trade.

McCallum used a gravity model (a trade model that takes into account distance as an explanatory variable) to examine what the effect on Canada-U.S. trade flows would be if trade barriers were removed, noting that the Canada-U.S. border acts as a barrier to trade even with the removal of tariffs (McCallum 1995, 622). Kenen, referring to McCallum's study, states that "a monetary union can be expected to extend the domain of the typical firm by taking the foreignness out of foreign trade" (Kenen 1997, 212). Grubel observes that "...producers in the currency union consider the enlarged currency area as belonging more effectively to their marketing and factor purchasing area" (Grubel 1970, 320).

It seems, then, that adopting a hard fixed exchange rate regime would reduce transaction costs, which, in turn, would lead to increased trade between Canada and the U.S.

No Exchange Rate Risk

A further gain from adopting a hard fixed exchange rate regime is the elimination of exchange rate risk. This has two benefits:

- reduction of the risk premium embedded in the interest rate
- it promotes a stable investment environment.

Exchange rate risk is a determinant of interest rates (this follows from the assumption that lenders charge rent for the exchange rate risk that they incur when they lend money in a particular foreign currency). Lower risk results in lower risk premiums and interest rates; this increases the capital-labour ratio and, hence, productivity. Conversely, unstable exchange rates lead to higher interest rates as lenders require a higher return to cover exchange rate losses. An argument can be made that uncertainty and unstable exchange rates can be managed in the short term using various hedging devices. However, whether accomplished using a financial instrument or by maintaining balances of foreign funds and speculating, hedging represents a transaction cost to the economy and likely cannot be sustained.

Over the long term, exchange rate risk and exchange rate movements influence investment decisions. Evidence from studies on firms' responses to exchange rate exposure indicates that firms can never fully eliminate it (hedging becomes impractical for very long term investment decisions) and that exchange rate exposure affects an industry's returns (Bodnar and Gentry 1993, 34).

Exchange rate movements cause changes in the price of a firm's inputs and outputs. Firms respond to these movements by altering their production — by making different products, for example. These actions have a distorting effect on trade (Kenen 1997, 212). Thus, the exchange rate may predominate over economic fundamentals such as productivity and the investment environment as a determinant of firms' production process.

Because exchange rate adjustments affect a firm's price schedule, they also influence production decisions, such as where to locate. Just as international firms may locate operations in a foreign country to maximize profits — either by avoiding tariffs or accessing cheaper labour — they avoid locating in an environment subject to exchange rate instability. Stable exchange rates are an incentive to locate in a particular area. International firms make more efficient location choices when they do not have to consider the possibility of exchange rate movements (Collignon 1999, 10).

Courchene and Harris (1999, 21) allude to the concern that workers and other market agents have regarding exchange rate risk, and the measures they take to cover this risk. These authors refer to what they call market dollarization — the use of U.S. dollars in contracts to hedge against currency risk. An example of this practice is a high tech consultant or hockey player working in Canada who signs a U.S. dollar contract to hedge against exchange rate depreciation (Courchene and Harris 1999, 21). This increasingly common practice suggests that exchange rate variability is a deterrent to the crossborder movement of skilled labour.

At the firm level, exchange rate movements can affect the stock value of multinational enterprises, which presents a dilemma for managers trying to maintain profitability. Hedging against exchange rate risk becomes more costly the further into the future the hedging is done. If Bodnar and Gentry's findings are correct that exchange rate exposure is unavoidable (Bodnar and Gentry 1993, 34), exchange rate permanence in the form of a "hard fix" can be expected to stimulate economic activity in sectors in which hedging is costly and difficult.

Stronger, Deeper Financial Markets

Another predicted benefit of a hard fix exchange rate regime lies in the strength a dominant currency has to resist destabilizing market forces.

The increased size of a monetary union makes foreign exchange markets more resilient to currency speculation and makes the valuation of the currency less sensitive to large transactions (Mundell 1968, 183). A strengthened currency makes the financial system more resilient to the vicissitudes of the global economic system, which is of particular benefit to smaller, open countries such as Canada.

Having outlined the benefits of adopting a hard fix exchange rate regime, the next section of this paper looks at the costs to Canada of giving up its flexible exchange rate system.

The Costs of Abandoning a Flexible Exchange Rate (or Adopting a Hard Fix)

There are several costs to consider if Canada were to give up its flexible exchange rate regime and adopt a hard fixed exchange rate:

- loss of the exchange rate as an adjustment mechanism
- loss of an independent monetary policy and restrictions imposed on fiscal policy
- loss of seigniorage
- loss of a national symbol.

Adjustment Mechanism

For an open economy such as Canada's, the effect of short-term demand shocks can be lessened by using a flexible exchange rate as an adjustment mechanism. An illustration of how this works can be drawn from the resources sector. When world demand for commodities falls, affected industries experience less demand for their exports and, as a result, production decreases and job layoffs occur. If prices were flexible, they would adjust and layoffs could be avoided. However, this does not happen because wages and prices are rigid in the short term. This leaves a flexible exchange rate as the only instrument of adjustment to bring market supply and product demand back to a level that would restore employment to the pre-shock level.

The Mundell-Fleming model, using an IS-LM analysis, demonstrates that a fall in world demand (shown by an inward shift of the IS curve) results in an outflow of capital and a downward exchange rate adjustment. The resulting lower exchange rate has a stimulating effect on output,

offsetting the initial inward shift of the IS curve. This result follows from two things: the change in the terms of trade (E (pCAN/pUS)) brought about by a change in the exchange rate E (E = US$/CAN$), and the responsiveness of imports and exports to a change in relative prices. The change in relative prices is a form of price flexibility. The Bank of Canada has measured the responsiveness of imports and exports to a change in relative prices, (a measure of the price elasticity of imports and exports). The study confirmed the shock absorber effect of an exchange rate adjustment, and found that a one percent depreciation of the currency improved the trade balance by CAN$ 2 billion. Incidentally, it took approximately three years to experience 75 percent of this improvement (Dion and Jacob 1990, 10).

Independent Monetary Policy an d Restrictions on Fiscal Policy

Giving up an independent floating exchange rate regime to adopt a hard fix exchange rate arrangement requires careful consideration of the cost of losing monetary policy independence. An independent monetary policy allows the Canadian central bank, in conjunction with the Canadian government, to exercise the monetary policy that is most suited to accomplishing particular macroeconomic objectives.

Consider when the Canadian economy experiences a recession as a result of an external demand shock. With the exchange rate fixed, the Bank of Canada would not be free to exercise discretionary monetary policy to offset the detrimental effects of the shock. Thus, relinquishing monetary policy independence limits the policy options available to manage a shock.

Consider another example. If the U.S., Canada's most important trading partner, were to undergo an increase in inflation[7] while exchange rates were fixed, there would be inflationary pressure on the Canadian economy. This imported inflation is a consequence of a change in the terms of trade causing Canadian goods become relatively cheaper than U.S. goods.

An alternative to fixed exchange rates and imported inflation would be to allow the Canadian currency to appreciate and reverse the inflationary pressure. This would return the terms of trade to their previous level. Thus, a flexible exchange rate, by allowing a country to follow an independent monetary policy, allows a country to insulate itself from inflation generated elsewhere.

Choosing between a fixed and flexible exchange rate becomes a matter of determining whether external or internal control of inflation is preferable (Genberg 1989, 445). Canada's monetary policy follows closely U.S. monetary policy: making the debate over the merits of an independent monetary policy rather hollow in substance. Figures 2 and 3 show this close relationship between Canadian and U.S. monetary policy.

[7] This occurred when the U.S. ran an expansionary monetary policy during the late 1960s and early 1970s to finance increased government expenditures incurred through the war in Viet Nam.

Figure 2: Change of M3 Money Supply in Canada and the U.S.

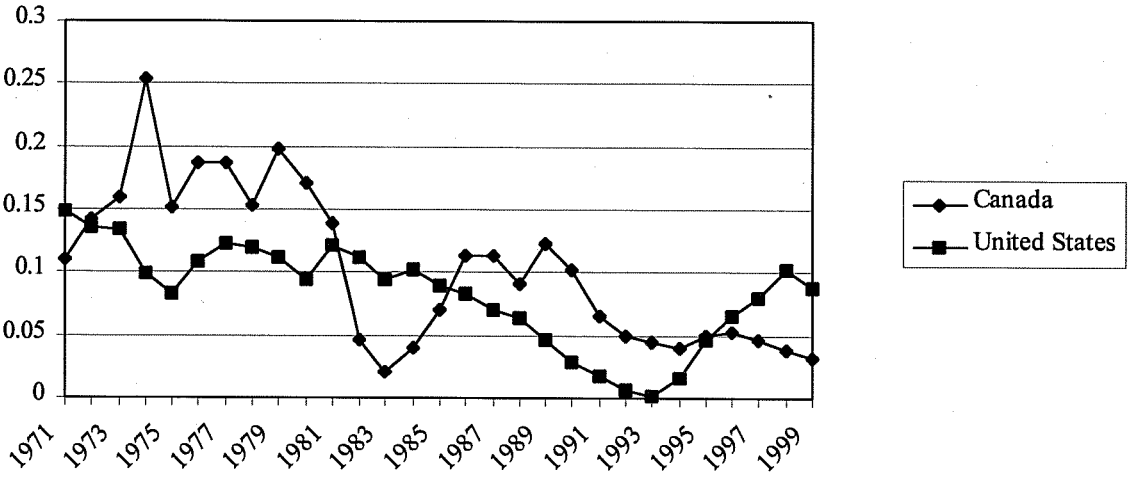
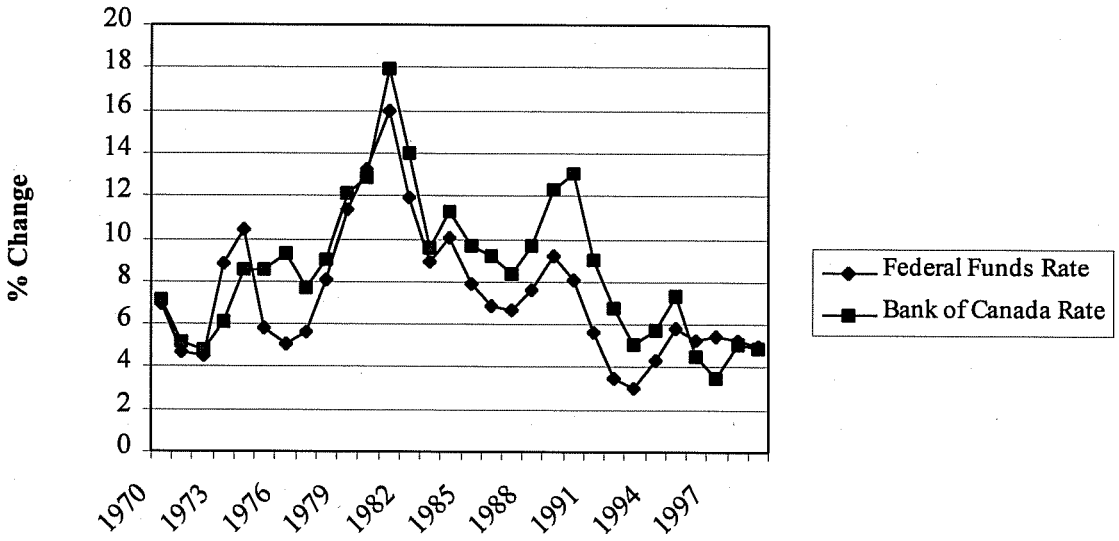


Figure 3: Canadian and U.S. Interest Rates



Another strike against an independent monetary policy is the fact that it does not allow the central bank to exploit an inflation-unemployment Phillips Curve relationship; it only allows the central bank its choice of inflation rates. Once market expectations for inflation correctly match

the actual rate of inflation, monetary policy becomes less effective as an instrument to stimulate economic growth.

Adopting a hard fix regime would impose limitations on the extent of fiscal policy that the government could exercise. Members of the European Union are limited in the fiscal policy they can pursue by Union laws that stipulate a maximum level for their deficit to GDP ratios. This imposed fiscal discipline acts to control inflation, and protect the integrity of the Euro. However, the limits placed on fiscal policy may leave a government with few tools to counteract the effects of a recession. Certainly, the more closely integrated, the member economies within a hard fix regime are, the more likely that the appropriate fiscal policy for one member's economy, will be appropriate for the other member. Thus, ratios that govern fiscal policy in the European Union, are more restrictive for the economies that are different than the average economy than they are for economies that are near the average. This suggests that a loss of fiscal policy freedom is less of an issue, the more closely integrated the Canadian and US economies become.

Seigniorage

The loss of the revenue generated for the Canadian government (called seigniorage) if the Bank of Canada were to lose its right to issue the Canadian dollar has been estimated at CAN$1.5 billion per year.[8] There would also be an initial loss to the government of CAN$31.5 billion (McCallum 1999, 8). There is the possibility that the Canadian government would be compensated for lost seigniorage revenues if it adopts a hard fix exchange rate with the

[8] McCallum uses the 1999 value of outstanding notes in circulation amounting to CAN$ 31.5 billion, to represent the initial lost seigniorage; he calculates yearly interest on this figure to represent foregone seigniorage in future years.

United States. A Florida senator, Connie Mack, has already proposed that governments of countries that officially adopt the U.S. dollar as their principal currency be refunded lost seigniorage revenues (Mack, August 2000, 65).

National Symbol and Economic Sovereignty

The loss of the Canadian dollar as a national symbol and the loss of sovereign economic institutions that this implies, is probably the most controversial aspect of adopting a hard fix exchange rate arrangement. A hard fix regime, would take away the Bank of Canada's role to conduct independent monetary policy, or its ability to act as lender of last resort. It would instead function as a branch of the U.S. central banking system. This loss of sovereignty would be unacceptable to Canadians given present nationalist sentiment (Fortin 2000, 45). However, sovereign states frequently affiliate themselves with supranational institutions to ensure their economic well-being. The merging of the Canadian currency into a hard fix exchange rate regime, if seen as being beneficial, may be a future possibility.

The importance of the Canadian dollar as a symbol, and the sovereignty that a separate currency brings, must be considered within the context of the greater international economic system to which Canada belongs. Thirty years ago, few people would have believed that Canada would become a member of a continent-wide trading bloc. Today, economic and trade links are an essential part of Canada's economic

strategy. In the same way that the Canada-U.S. Free Trade Agreement, the North American Free Trade Agreement and the Free Trade of the Americas have come to be viewed as essential to Canada's economic future, a hard fix exchange rate, with its economic benefits, could possibly be a logical monetary arrangement for Canada within 20 or 30 years. With the continual trend towards Canada's economic integration with the U.S. economy, a hard fix exchange rate becomes more feasible.

With some of the pros and cons for Canada of a monetary union with the United States explored, the next section of this paper introduces the optimum currency area theory, which will be used to see whether such a union is a good fit for the Canadian economy.

Optimum Currency Area Theory

Optimum currency area (OCA) theory is a useful tool for gauging the appropriateness of the currency regime or regimes of an existing or proposed economic region. The region may consist of either multiple currencies with hard fixed exchange rates or a single currency (Mundell 1969, 657). OCA theory describes circumstances under which the union of regions or countries would increase the welfare of the population (Grubel 1970, 319).

Mundell, in his article "A Theory of Optimum Currency Areas," (1961) illustrated OCA theory using a simple model of two countries linked by trade and perfect capital mobility. Countries A and B each have a national currency with fixed exchange rates, and initially have balance of

payments equilibrium and full employment. Prices are rigid and will not facilitate economic adjustment in the event of a shock.

An asymmetric demand shock is introduced: a shift in demand for output from country B to country A, which results in country A incurring current account surpluses, and country B having a current account deficit. With prices rigid, the exchange rate fixed, and no labour mobility between the two countries, there is no mechanism available to facilitate adjustment. Country B will continue to operate below potential, while country A operates above potential. The fixed exchange rate prevents country A from using monetary policy to dampen increased demand, and country B from using monetary policy to stimulate demand. In this example, countries A and B can be defined as being separate economic regions; the economic shock is not symmetrical across both countries, as evidenced by the shift in demand from country B to country A. In this case a fixed exchange rate prevents an automatic adjustment mechanism from stabilizing the two economies in face of this asymmetric shock.

What would happen if the exchange rate between country A and country B were flexible? Given that prices and wages are rigid, an exchange rate adjustment would take the place of actual price adjustment. The current account surplus of country A, and the current account deficit for country B, would lead to a depreciation of country B's exchange rate. This would shift the terms of trade in favour of country A. The resulting change in the terms of trade would reverse the effects of the original demand shock. Thus, in choosing the exchange rate regime, when the countries being considered are areas comprising distinct economic regions receiving asymmetric shocks, a flexible exchange rate is preferred to a fixed exchange rate.

Single Currency Areas

Having demonstrated the effectiveness of a flexible exchange rate regime to stabilize the economy of a country affected by an asymmetric shock, we need to examine whether it is effective in the case of a symmetric shock.

Consider again a simple two-country, two-good model with trade, capital mobility, and rigid prices and wages. Suppose that a symmetric demand shock is experienced, causing demand to shift away from both countries. This would adversely impact their current account balances and cause downward pressure on their currencies. This yields a couple of possible outcomes:

1. If both countries are of the same economic size, both will experience a similar decrease in their current account balances. This will lead to both currencies depreciating the same amount - leaving their bilateral exchange rate, and the terms of trade untouched. Thus the flexible exchange rate regime is ineffective as an adjustment mechanism.

2. If countries A and B are unequal in terms of their economic size, the demand shock will result in disproportionate changes in their current accounts. This results in a depreciation of one country's currency relative to that of the other country. This change in the terms of trade between the two countries stimulates demand for the output of only one of the affected countries, while shifting demand further away from the other, exacerbating the shock.

The model demonstrates that in the event of a demand shock affecting both countries symmetrically, a flexible exchange rate is either ineffective, and may be detrimental. The Separate currency areas linked by a flexible exchange rate, as in the above scenario, are not optimal. Mundell (1961) uses the Canadian and U.S. economies as an illustration to explain the concept of currency area optimality.

At the conceptual level, the currency area is optimal when the region that it defines is homogeneous in the way in which it is affected by a shock. Consider Canada and the U.S., which have a flexible exchange rate. The economies of both countries can be roughly divided into two regions: the industrial east and the commodities, resource-based west. What would happen if demand shifted away from east to west simultaneously in both countries, assuming no labour mobility between east and west in each country?

Initially, the effect of the shift would be to bring inflationary pressures to the west and unemployment to the east (assuming that wages and prices are downwardly rigid). A flexible exchange rate does not serve as an automatic stabilizer since both countries receive the same shock. This would force both countries to make a choice: to do nothing to ease unemployment in the east if they want to halt inflation in the west, or for each to adopt an expansionary monetary policy to ease unemployment in the east. Both countries in this example would experience either inflation in the region that did not experience the shock and recovery in the depressed part, or, if no expansionary monetary policy was followed, no inflation and no immediate recovery.

A more optimal solution would be for the two countries to be reorganized into two single currency areas — industrial east and commodities-based west. An exchange rate movement in response to an asymmetric shock between east and west would stimulate demand in the depressed region while reducing inflationary pressure in the region experiencing the increased demand. Thus Mundell illustrated a key point, that an optimal currency area encompasses a homogeneous economic region. "Today, if the case for flexible exchange rates is a strong one, it is in logic a case for flexible exchange rates based on regional currencies, not on national currencies; the optimum currency area is the region" (Mundell 1961, 660).

Mundell intended OCA theory to be used to examine existing national currencies to see whether a country's geographic boundaries are optimal, and to assess new economic experiments (i.e. exchange rate arrangements) in a world of rapid economic integration (Mundell 1969, 77). Thus, OCA theory is an ideal approach to study the possibility of a hard fix exchange rate between Canada and the U.S. The theory helps the researcher to determine when the geographical boundaries of a currency area have been appropriately made, and are optimal. In turn, flexible exchange rates between one optimum currency area and a different optimum currency area will bring about economic adjustment without having to choose between inflation and unemployment.

The OCA Criteria

The OCA theory includes five criteria to frame the analysis of whether Canada would benefit economically from a monetary union with the United States:

- the degree of openness of each economy (McKinnon 1963, 177)
- the similarity of shocks and business cycles in the economies (Mundell 1968, 180)
- the similarity of economic structure between the economies (Mundell 1961, 660)
- the degree of factor mobility (Mundell 1968, 182)
- the existence of a system of risk sharing in the economies (Kenen 1969, 45).

Each of these criteria is described below and applied to the proposed Canada-U.S. hard fix exchange rate. If Canada and the U.S. satisfy the criteria more completely as a single currency area than as separate currency areas, then the gains for Canada from having a hard fix exchange rate would outweigh the usefulness of a flexible exchange rate.

Degree of Openness

Openness refers to the extent to which trade and the flow of capital is free to occur between Canada and the U.S. In a single currency area, capital moves with complete freedom throughout. Measures of openness between Canada and the U.S. include capital flows and the percentage of GDP that imports and exports comprise.

From a global perspective, international financial markets allow investors to move vast amounts of money in and out of a country very quickly for reasons often exogenous of a central bank's policy. As a result, interest rates in the smaller country must closely follow those of its larger trading partners, or risk destabilizing the exchange rate. Economic size dictates that small, open countries rely more on international trade and investment for economic growth than do larger countries. This hampers smaller countries' ability to pursue an independent monetary policy.[9] Smaller countries cannot make decisions that affect investment flows without having a proportionately larger effect on their economies than would be the case for larger countries. A large country such as the United States profits more from having an independent monetary policy than does a smaller country.

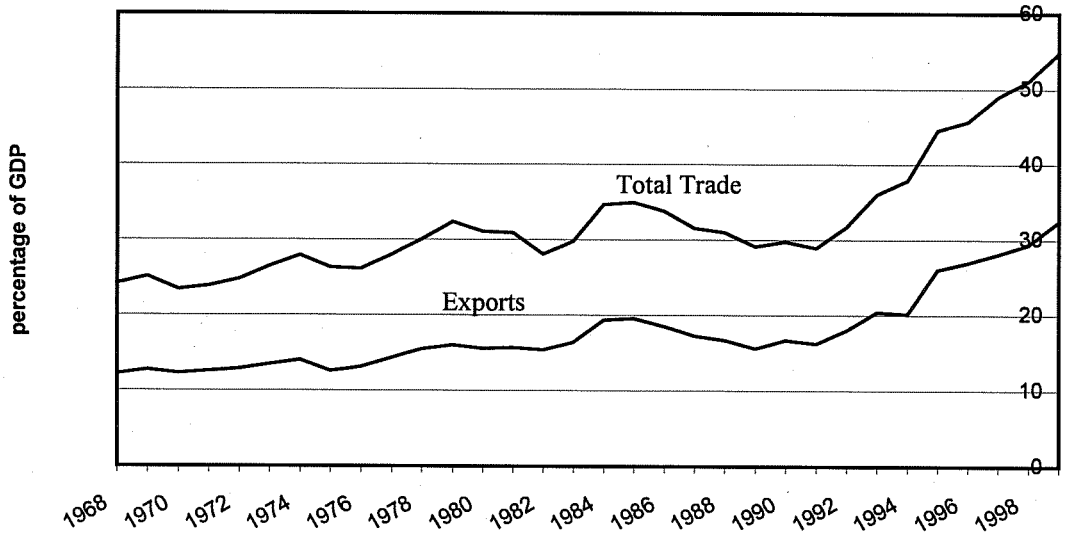
Measures of capital mobility include the existence or lack of capital controls, and capital flows. Neither Canada nor the U.S. has capital controls (IMF 1999, 175). An indication of the growth of capital flows is the cross-border transactions in bonds and equities for Canada, which increased from 3 percent of GDP in 1975 to 358 percent in 1997. International equity issues by Canadian firms increased by more than 2,000 percent (IMF 1998, 188).

The second measure of openness is the percentage that imports and exports contribute to GDP. Canada has a large propensity to import (imports from the U.S. were 22 percent of GDP in 1999 for example), and the greater the propensity to import, the greater the ability of exchange rate variability to induce inflation in the Canadian economy. Imports from the United States grew as a percentage of Canadian GDP from 12 percent in 1968 to 22 percent in 1999. Exports to the

[9] They cannot pursue an independent monetary policy without inducing capital flows.

U.S. grew during the same period from 12 percent to 32 percent. Total trade with the U.S. was almost equal to 55 percent of Canada's GDP in 1999 (see Figure 4).

Figure 4: Exports and Total Trade to the U.S. as a Percentage of GDP



In the U.S., exports and imports are not nearly as large a percentage of GDP as they are in Canada. In 1999, total U.S. trade with the world as a percentage of GDP was 19 percent, but 40 percent of that was trade with Canada.

McKinnon examines the implications of an economy's openness. In a simple model, he considers a country that has a very open economy. McKinnon makes the assumptions that the economy is small enough not to affect world prices (it is a price taker), and that the exchange rate is flexible. For this economy, a large portion of economic activity can be characterized as being of an international nature: consisting of the import and export of tradable goods. Remaining economic activity consists of domestically consumed non-tradable goods. He

considers the effect of currency depreciation on the economy. A depreciation of the country's currency towards that of its trading partner, results in an increase in the domestic price of imported and exported goods –inducing inflation. As a consequence of this domestic inflation, domestic exports become relatively more expensive on the international market: adversely affecting the country's current account. This causal link between exchange rate movements, internal price stability, and external balance strengthens, the greater the international component to the economy. Thus McKinnon concluded that as an economy moves across the spectrum of openness, flexible exchange rates become less effective for maintaining external balance and more damaging to internal price level stability (McKinnon 1963, 720).

The U.S. is not nearly as dependent on trade, in relative terms, as Canada is (giving it less of an incentive to adopt a single currency with Canada). The U.S. relies more on its domestic markets to drive growth than on its exports. Unlike Canada, which is highly susceptible to external shocks, the U.S. economy is more affected by internal shocks, making independent monetary policy more effective for economic adjustment. The sheer size of the U.S. economy allows it to carry out monetary policy independent of the monetary policy of its trading partners.[10]

With exports accounting for 40 percent of GDP, and the free movement of capital across its borders, Canada would be considered a small, open economy. As the trade data and financial flows data indicate, Canada is becoming even more open as the economy continues to further integrate with the U.S. economy. Based on their findings, Frankel and Rose (1998, 14) identify a trend of increased economic integration between Canada and the U.S. Thus we can conclude

[10] U.S. GDP of US$9248.5 billion is almost 14 times larger than Canadian GDP.

that for Canada, a highly open small economy, flexible exchange rates will not effectively maintain our external balance, and they will induce internal price instability.

Similarity of Shocks, Business Cycles and Economic Structure

Shocks

Mundell demonstrated the inefficiency of the exchange rate to bring about adjustment when the shock is industry- rather than country-specific. For example, separate currency areas may experience the same shock when the shock is industry specific. The likelihood that a shock affects both countries in a similar fashion increases the more their economies are similarly structured. The fact that approximately two thirds of manufacturing shocks occurring in Canada originate in the U.S. (Altonji 1991, 231) is an indication that Canada and the U.S. already experience similar shocks. A currency depreciation to stimulate economic activity on the part of one of the affected countries gives it a competitive advantage on the international market for its products. A logical response by the other affected country would be to match or exceed the initial depreciation; a response that renders the strategy of competitive depreciation futile. Competitive depreciation as a trade strategy is harmful for international relations and generally is not an option for trading partners whose trade is subject to rules based on international trade agreements.

Business Cycles

Business cycles, which can be thought of as broad demand shocks that affect the entire economy, are of particular concern for OCA theory. In a region that is being considered for a hard fix exchange rate arrangement, the degree of similarity across international borders can be used to

determine whether or not the currency area is optimal (Mundell 1961, 659). Thus, by comparing business cycles across all sectors between Canada and the U.S. economies, it can be concluded as to whether or not a flexible exchange rate would be an effective stabilizer.

Measures of cross-correlation[11] indicate the degree of similarity of growth cycles for similar industries on both sides of the Canada-U.S. border. Using GDP-by-industry data, economic activity for both Canada and the U.S. is classified into 30 industry groups according to the Standard Industrial Classification (SIC). The cross-correlation is then weighted for each industry category according to its respective percentage contribution to GDP, giving an index of economic similarity between Canada and the U.S.A. Summing up the weighted cross-correlations results in a measure of the cross-correlation for economic growth between Canada and the U.S. of 0.43 (1.0 would indicate perfect symmetry; see Table 2). Considering that 30 industry groups represent the entire economy, this shows a positive relationship for 43 percent of Canadian economic activity with that of the U.S. From Table 2, it is observed that cross-correlation is strongest in manufacturing, wholesale and retail trade, while it is considerably weak in resource-based industries. This would increase the susceptibility of the Canadian economy to crossborder shocks originating in these sectors — a fact born out empirically by Altonji's observations (Altonji 1991, 231).

Recent evidence suggests that increased trade with the U.S. will lead to an even greater symmetry of the business cycles. An interesting finding of a study using trade statistics for

[11] The formula used to measure growth is the following: growth =ln(Yr (t+1) / yr(t)) t= 1987-1997.

21 industrial countries, done by Frankel and Rose (1998, 1023), is that contrary to expectations that trade integration would increase the likelihood of asymmetric shocks, cross-correlations of business cycles increased as economic integration increased.

Given the similarity of business cycles that has been demonstrated, along with Frankel and Rose's findings that this is an increasing trend, we can conclude that flexible exchange rates are not an effective stabilizer for the Canadian economy, and that they will be even less effective as economic integration continues to mould Canada's economic development.

Table 2: Crosscorrelations of Growth Across Industries (1987-1997)

Industry	Weight of GDP	Crosscorrelation	Weighted Correlation
Agriculture Forestry and Fishing	0.0249	-0.0553	-0.0014
Mining	0.0166	-0.4777	-0.0079
Oil and Gas Extraction	0.0282	0.2865	0.0081
Construction	0.0535	0.4405	0.0236
Lumber	0.0120	0.8566	0.0103
Furniture and Fixtures	0.0037	0.5259	0.0019
Stone, Glass and Clay	0.0047	0.3667	0.0017
Primary Metal Products	0.0120	-0.1872	-0.0022
Fabricated Metal Products	0.0135	0.3743	0.0050
Machinery Industries	0.0100	0.6734	0.0067
Electric and Electronics Products	0.0129	0.4079	0.0053
Transportation Equipment	0.0326	0.5818	0.0190
Other Manufacturing	0.0056	0.5704	0.0032
Food and Kindred Products	0.0220	0.7736	0.0170
Tobacco	0.0020	0.7545	0.0015
Textiles and Apparel	0.0080	0.7623	0.0061
Paper and Allied Products	0.0137	0.4530	0.0062
Printing and Publishing	0.0116	0.6444	0.0075
Chemical Products	0.0153	0.1340	0.0021
Refined Petroleum Products	0.0013	0.3246	0.0004
Plastic Products	0.0080	0.4098	0.0033
Leather Products	0.0005	0.6353	0.0003
Transportation Industries	0.0455	0.4785	0.0218
Communications Industries	0.0299	-0.2925	-0.0087
Utilities	0.0342	0.0584	0.0020
Wholesale Trade	0.0566	0.7069	0.0400
Retail Trade	0.0548	0.8051	0.0442
Finance, Insurance and Real Estate	0.1628	0.0165	0.0027
Services	0.0601	0.4669	0.0281
Government	0.2433	0.7677	0.1868
Total			0.4344

Economic Structure

Another OCA measure for determining whether or not a hard fix exchange rate is optimal is the degree of similarity of economic structure. Similarity of economic structure would indicate that both the Canadian and U.S. economies would experience similar shocks. This would reduce the effectiveness of a flexible exchange rate as an economic stabilizer.

Again, using GDP-by-industry data, the percentage share of GDP for each of the 30 SIC industry groups for Canada and the U.S. is measured for cross-correlation using the following formula (i=industry; t= time period, 1987 - 1997):

$$r_{USiCANi} = \frac{COVUSiCANi(t)}{\sqrt{VARusi(t-1)}\sqrt{VARcani(t-1)}}$$

Table 3: Correlation of Economic Activity by Industry (1987-1997)

Industry	Correlation	Industry	Correlation
Agriculture Forestry and Fishing	0.3216	Textiles and Apparel	0.6720
Mining	0.8021	Paper and Allied Products	0.6422
Oil and Gas Extraction	0.1031	Printing and Publishing	0.7565
Construction	0.6180	Chemical Products	0.2614
Lumber	0.1375	Refined Petroleum Products	0.1901
Furniture and Fixtures	0.6577	Plastic Products	0.7354
Stone Glass and Clay	0.8136	Leather Products	0.7926
Primary Metal Products	0.7444	Transportation Industries	0.9385
Fabricated Metal Products	0.8412	Communications Industries	0.0422
Machinery Industries	-0.1617	Utilities	0.0195
Electric and Electronics Products	-0.1225	Wholesale Trade	0.2397
Transportation Equipment	-0.1846	Retail Trade	0.6379
Other Manufacturing	-0.6510	Finance Insurance and Real Estate	0.8919
Food and Kindred Products	0.7877	Services	0.7988
Tobacco	-0.5664	Government	0.9162

The cross-correlation for two thirds of the industries is positive and greater than 0.5.

The conclusion drawn from the analysis of economic structure is that the pattern of economic activity in both countries is strongly symmetrical, increasing the likelihood that both countries will experience shocks simultaneously. From this it can be concluded in the Canadian case that a flexible exchange rate would not be effective as an economic stabilizer.

Factor Mobility

The third requirement for an optimum currency area is factor mobility: unless the factors of production (capital and labour) are allowed to move freely between regions within a monetary union, economic adjustment will not occur (Masson and Taylor 1993, 7). In the United States, labour mobility is the primary way that adjustment occurs (Bayoumi and Prasad 1997, 54). In Canada also, despite the existence of barriers to provincial labour mobility, such as those faced by tradespeople, there is freedom to migrate between provinces. Large-scale labour migration from Ontario to Alberta during the early 1980s oil boom is an example of labour mobility that facilitates economic adjustment within Canada. Labour movements between Canada and the United States occur, but are limited in size and scope.

Since the 1960s, the emphasis of immigration legislation in the United States and Canada has shifted from occupational skills to family reunification, making it more difficult for labour migration to occur in both countries. There are two types of migration flows between Canada and the United States: permanent migration and temporary migration.

Permanent labour migration from Canada to the United States, which slowed markedly after the 1960s, allows immigrants to obtain a work permit known as a "green card." Judging by the small volume of annual permanent bilateral immigration between Canada and the United States, permanent immigration is too small to facilitate economic adjustment (see Table 4).

Table 4: Permanent Bilateral Immigration Flows

Canadian-born Immigrants to the United States, 1951–1996	
Years	**Average Annual Flow (000s)**
1951–1960	n.a.
1961–1970	41.3
1971–1980	17.0
1981–1990	15.7
1991–1996	16.2

Source: Globerman 2000, 16

U.S. Immigration to Canada, 1961–1994	
Years	**Average Annual Flow (000s)**
1951–1960	10.1
1961–1970	16.7
1971–1980	17.9
1981–1990	7.9
1991–1994	7.1

Source: Globerman 2000, 18

Temporary migration flows are facilitated by temporary work permits. These permits are intended for professionals, investors, businesspeople and intracompany transferees. Before the signing of the Canada-U.S. Free Trade Agreement, temporary Canadian workers, working in the U.S. were not permitted to be paid by U.S. firms; they had to be paid by the Canadian affiliate. For a Canadian to work temporarily in the U.S., it had to be shown that his or her activity was not taking employment away from U.S. citizens — a requirement that discouraged labour

migration. Following passage of the Free Trade Agreement, a reciprocal agreement was reached allowing professionals to work for an unlimited time under a temporary permit. This special permit, known as the TN, allows a Canadian or U.S. professional temporary worker to be paid directly by the company in the country in which he or she is temporarily working. Under the TN work permit in 1996, 26,987 U.S. professionals came into Canada and 9,055 Canadians went to the United States. The number of workers in both Canada and the United States working under the TN designation is increasing every year (Globerman, 19). However, TN permits are limited to a select group of workers having a professional designation.

Other temporary-type work permits are available for persons migrating temporarily as intrafirm transfers or businesspeople. As with permanent migration, the number of these movements is small. They would not be useful for economic adjustment in any event, because a shock is likely to affect a multinational firm's operations on both sides of the Canada-U.S. border. Any intrafirm transfers resulting from a shock would be limited to a few senior management personnel — the result of a firm closing up subsidiaries and consolidating operations.

The restrictions on the flow of labour between Canada and the U.S. prevent this OCA requirement from being satisfied.

Risk Sharing: The Role of Interregional Transfer Payments

To enable economic adjustment, in the absence of a flexible exchange rate, a currency union needs to have the means of allocating relief. Even if there were no legal restrictions on

crossborder labour flows, it is not reasonable to expect that labour migration would be sufficient as short-term labour migration is inefficient and costly; a period of short-term unemployment is not enough of a reason for an established household to migrate. Thus, there is the need for a system of interregional transfer payments. The question arises then, what institutional arrangement would allow for the disbursement of interregional assistance? It has been argued that a community-wide tax and transfer system is desirable and may be necessary for the survival of the European Monetary Union (Bayoumi and Masson 1995, 254). Contrary to this, it was found that when comparing the ability of European Union countries to stabilize national per capita income relative to the Union average, independent national fiscal policies were adequate (Bayoumi and Masson 1995, 255). This turns out to be the case for Canada and the U.S.

Canada and the U.S. already have systems in place to carry out stabilization and redistribution. Of each tax dollar in Canada, 39 percent goes to redistribution and 17 percent to stabilization. In the U.S. 22 percent of each tax dollar goes to redistribution, while 39 percent goes to stabilization (Bayoumi and Masson 1995, 225). There would be no need for a community-wide system of tax and transfer system under a hard fix arrangement, since there are already in place adequate systems for stabilization and redistribution.

Conclusion

The OCA criteria, measured for the Canadian economy, suggest that the utility to Canada of maintaining a flexible exchange rate is diminished for several reasons:

- the degree of openness of the Canadian economy reduces the effectiveness of the exchange rate as an economic stabilizer and contributes to misallocations of resources. Maintaining a flexible exchange rate in order to reap the benefits of an independent monetary policy is a false hope because a small, open country such as Canada cannot have a monetary policy that differs significantly from that of the United States without inducing capital flows.
- the Canadian and U.S. economies are highly symmetrical in terms of their business cycles, making currency depreciation as an adjustment mechanism inefficient, and a possible source of trade disputes.
- the actual structure of the Canadian and U.S. economies is symmetrical, which means that shocks will occur symmetrically, again rendering the exchange rate inefficient as a means of adjustment.

Thus, what were touted as drawbacks to adopting a hard fix exchange rate — loss of the exchange rate as an economic stabilizer, loss of monetary independence, loss of a national symbol, and loss of seigniorage — have been shown to be less costly then they appear at face value.

In regard to the labour mobility criterion, the failure to satisfy it does not negate the strength of our other findings, from which it can be concluded that a flexible exchange rate regime is not efficient as an economic stabilizer. Since the features of the Canadian economy satisfy the OCA criteria, the Canadian economy will gain more by adopting a hard fix, and being a part of a larger currency area, than it will lose.

The benefits of increased growth of trade and investment resulting from the adoption of a hard fix exchange rate are numerous. Eliminating exchange rate uncertainty, pricing misinformation and inefficient resource allocation far outweighs the diminished benefits of a flexible exchange rate and independent monetary policy for a small, open economy such as Canada's. A hard fix exchange rate can be expected to lead to efficiency gains and increased economic growth as a result of increasing the size of the currency area.

Appendix 1: Canadian Data

All the data is real GDP for the years 1987 – 1997. The Canadian data (Statistics Canada) is classified according to the 1980 Standard Industrial Classification (1980 SIC). The U.S. data (Bureau of Economic Analysis) is categorized using the 1987 SIC. The two classifications are different due to differences in the collection of data on both sides of the border. I was not able to harmonize them exactly, but they are very similar, and as a comparison of similarity, if they are in error, the error would be one of underestimating the degree of correlation between Canadian and U.S. industries. Thus, the argument for adopting a hard fix exchange rate would only be strengthened by a measurement error.

The Canadian-GDP-by-industry-at-factor-cost data, in theory, is the same as that for the United States — gross product originating by industry; however, in practice the U.S. data is calculated using gross domestic income, so this excludes the statistical discrepancy (indirect taxes) (Letourneau and Lajoie, 2000, Appendix A). The effect this would have on the correlation analysis would be minimal over all the industries considered since the statistical discrepancy is a very small percentage of GDP.

Bibliography

Altonji, Joseph, and John Ham. "Variation in Employment Growth in Canada. The Role of External, National, Regional, and Industrial Factors." *Journal of Labour Economics* 8 (1991) 198–235.

Bank for International Settlements, "Press Release: Central Bank Survey of Foreign Exchange and Derivatives Market Activity in April 1998, Preliminary Global Data," (1998) 1–10.

Bayoumi, Tamin, and Barry Eichengreen. "Exchange Rate Volatility and Intervention: Implications of the Theory of Optimum Currency Areas." *Journal of International Economics* 45 (1998) 191–209.

Bayoumi, Tamin, and Eswar Prasad. "Currency Unions, Economic Fluctuations, and Adjustment: Some New Empirical Evidence." *IMF Staff Papers* 44, 1 (March 1997): 36–57.

Bayoumi, Tamin, and Paul Masson. "Currency Unions: A Survey of the Issues," in *Policy Issues in the Operation of Currency Unions*. Bayoumi and Masson, eds. (Cambridge: Cambridge University Press, 1993) 3–51.

Bayoumi, Tamin, and Paul Masson. "Fiscal Flows in the United States and Canada: Lessons for Monetary Union in Europe." *European Economic Review* 39 (1995) 253–274.

Bodnar, Gordon, and William Gentry. "Exchange Rate Exposure and Industry Characteristics: Evidence from Canada, Japan, and the USA." *Journal of International Money and Finance*. 12, 1 (February 1993): 29–45.

Collignon, Stefan. "European Monetary Union, Convergence and Sustainability. A Fresh Look at Optimum Currency Area Theory." *Economia Internazionale* 52 (1) supplement (February 1999): 7–37.

Courchene, Thomas, and Richard Harris. "From Fixing to Monetary Union: Options for North American Currency Integration." *C.D. Howe Institute Commentary* 127 (1999) 1–28.

Dion, Richard, and Jocelyn Jacob, "Dynamic Effects of Exchange Rate Changes on Canada's Trade Balance, 1982-1987." Bank of Canada Working Paper 90-01 (1990) 1–26.

Dupuis, David, and David Tessier, "Une analyse empirique du lien entre la productivité et le taux de change réel Canada-E-U." Bank of Canada Working Paper 2000-22 (2000) 1-31.

Fortin, Pierre. "Should Canada Dump Its Floating Regime?" *World Economic Affairs* 3, 2 (Autumn 2000).

Frankel, Jeffrey, and Andrew Rose. "The Endogeneity of the Optimum Currency Area Criteria." *The Economic Journal* 108 (July 1998): 1009–1025.

Genberg, Hans. "Exchange Rate Management and Macroeconomic Policy: A National Perspective." *Scandanavian Journal of Economics* 91 (2) (1989) 439–469.

Globerman, Steven. *Trade Liberalization and the Migration of Skilled Workers. Perspectives on North American Free Trade. No. 3*. (Ottawa: Industry Canada, 2000).

Gros, Daniel. "A Reconsideration of the Optimum Currency Approach: The Role of External Shocks and Labour Mobility." *National Institute Economic Review* 158 (October 1996) 108–117.

Grubel, Herbert. "The Theory of Optimum Currency Areas," *Canadian Journal of Economics* 3 (1970) 318–324.

Caporale, Guglielmo, Maria, Pittis, Nikitas and Kyprianos Prodromidis. "Is Europe an Optimum Currency Area?" *Journal of Economic Integration* 14(2) (June 1999) 169–202.

Harris, Richard. *Trade Money and Wealth in the Canadian Economy*. Benefactors Lecture. C.D. Howe Institute, Toronto. 1993.

Harris, Richard. "The NAMU Debate." *Canadian Economic Policy* 25, 3 (1999) 320–323.

International Monetary Fund, *Exchange Arrangements and Exchange Restrictions*. Washington, 1999.

—— International Capital Markets: Development Prospects and Key Policy Issues. Washington, 1998.

—— Annual Report, Washington, 2000.

Kenen, Peter. "The Theory of Optimum Currency Areas: An Eclectic View" in Monetary Problems of the International Economy, Mundell R.A. and A.K. Swoboda, eds. (Chicago: University of Chicago Press, 1969) 41–60.

Kenen, Peter. "Preferences, Domains, and Sustainability." *American Economic Review* 87 (2) (May 1997) 211–213.

Letourneau, Reynald, and Martine Lajoie. *A Regional Perspective on the Canada-US Standard of Living: Comparison.* Occasional Paper No.22, (Ottawa: Industry Canada, 2000).

Mack, Connie. "Why the U.S. Should Encourage Dollarisation." *Central Banking* XI (01) (August 2000) 63–69.

Masson, Paul, and Mark Taylor. "Currency Unions: A Survey of the Issues," in Policy Issues in the Operation of Currency Unions, eds. Masson, Paul, and Mark Taylor. 1993 3–49.

McCallum, John. "National Borders Matter: Canada-US Regional Trade Patterns." *American Economic Review* 85 (3) (June 1995) 613–623.

McCallum, John "Seven Issues in the Choice of Exchange Rate Regime for Canada," *Current Analysis*, Royal Bank of Canada (February 1999) 1–10.

McKinnon, Ronald. "Optimum Currency Areas." *American Economic Review* 59 (1963) 492–500.

McKinnon, Ronald. "On the Periphery of the International Dollar Standard: Canada, Latin America, and East Asia." *North American Journal of Economics and Finance* 11 (November 2000) 105–121.

Mundell, Robert. "A Theory of Optimum Currency Areas." *American Economic Review* 51 (1961) 717–725.

Mundell, Robert. *International Economics* (New York: Macmillan, 1969).

Robson, William. "The Bank of Canada Must Use Its Independence — or Lose It." *The National Post* May 19, 2000: p. 19.

Rose, Andrew. "The Role of Exchange Rates in a Popular Model of International Trade: Does the Marshal-Lerner Condition Hold?" *Journal of International Economics* 30 (1991) 301–316.

Tavlas, George. "The 'New' Theory of Optimum Currency Areas." *World Economy* 16 (6) (1993) 663–685.

Thiessen, Gordon. "The Conduct of Monetary Policy When You Live Next Door to a Large Neighbour." *World Economic Affairs* 3,2 (Autumn 2000).

Visser, Hans. *A Guide to International Economics*. (Cambridge: Edward Elgar Publishers, 1995).

Willet, Thomas, and Edward Tower. "Currency Areas and Exchange Rate Flexibility," *Weltwirtschafliches Archive* 105 (1970) 48–65.