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NAFTA Toward a Common Currency:
An Economic Feasibility Study

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NAFTA TOWARD A COMMON CURRENCY: AN ECONOMIC FEASIBILITY STUDY

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Abstract:

The recent emergence of the Euro, combined with the completion of a decade of North American Free Trade Agreement (NAFTA) has sparked interest in adopting a common currency for North America. This study examines the likelihood that Canada, Mexico, and the United States will adopt a common currency under fixed exchange rate regimes. The benefits and costs of a common currency are explored using the theory of optimum currency areas (OCA). Empirical research focuses on several variables including intra-regional and intra-industry trade, trade openness, gross domestic product, inflation rates, interest rates, economic growth rates, business cycle synchronization, factor mobility, fiscal policy and monetary policy coordination. The analysis also presents a comparative analysis of NAFTA with Economic and Monetary Union (EMU) nations on different economic criteria. Finally, correlation and regression analysis further explores the likelihood that members of NAFTA will economically integrate. Though this research concludes that it is economically feasible for NAFTA members to move towards a common currency, this venture depends on the political readiness of the nations.

1. Introduction

The recent emergence of the Euro, the common currency of several European countries, has sparked interest in monetary union amongst Canada, Mexico, and the United States. The Euro has given the United States an incentive towards a common currency as it has become a rival to the U.S. dollar's market leadership throughout the world as the leading international currency. Though the U.S. dollar, also known as the greenback, is "indisputably the market leader among world monies," [1] the Euro has become a recent threat to its power. The U.S. dollar accounts for nearly half the value in which the world's exports are invoiced while the Euro accounts for roughly 15 percent of the exports. [2]

Discussions of the movement towards a common currency have focused on fixed rather than flexible exchange rate regimes. The most common and most discussed regime is dollarization, which is the adoption of the U.S. dollar by Canada and Mexico. Some countries including El Salvador, Ecuador, and Panama have formally adopted the U.S. dollar as their legal tender, while other parts of the world informally use the dollar for international and inter-state transactions and recording purposes. A second approach in discussing a common currency has centered on the notion of a monetary union or currency unification. Rather than adopting the U.S. dollar, a monetary union requires an entirely new currency to be developed and managed collectively by the member countries.

With NAFTA's ongoing success in increasing exports, investment flows, and total trade, Canada and Mexico have shown an interest in further integration and cooperation and in advancing economic efficiencies through a common currency. The Bank of Canada governor

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[1] Benjamin Cohen, "North American Monetary Union: A United States Perspective," *Global and International Studies Program* (June 2004): 3.

[2] Benjamin J. Cohen, "America's Interest in Dollarization," in *Monetary Unions and Hard Pegs*, ed. Volbert Alexander, Jacques Mélitz, and George M. Von Furstenberg, 290 (New York: Oxford University Press, 2004).

David Dodge advocated for an update of the original NAFTA agreement since its implementation in 1993." Support from Mexico has been fueled by the Mexican crisis in 1995, and in August 2000 Mexican President-elect Vicente Fox spoke to leaders of the United States and Canada proposing several ideas to further integrate the economies of NAFTA members, including a recommendation for a single currency.[3] On October 23, 2002, Dodge recommended that there "ought to be a free flow of labor and capital, as well as goods and services, across the Canada-U.S. border."[4] More recently, in March 2005, a meeting between President Bush, President Fox, and Prime Minister Martin was held in Texas about plans to create a "super-NAFTA" which proposed a new currency deemed the "Amero."[5]

This article examines the likelihood that Canada, the United States and Mexico will adopt a common currency under fixed exchange rate regimes based on economic benefits and costs. Unlike the majority of past research on North American common currency, which focuses primarily on the U.S. and Canada, this research will include Mexico as well. Based on OCA theory this study will consider the notion of adopting a common currency to upgrade or further intensify the original North America Free Trade Agreement. The paper is organized as follows.

Section 2 focuses on the economic conditions and criteria based on optimum currency area theory. It also provides a review of the existing literature discussing the benefits and costs of a common currency for the members of NAFTA. Both dollarization and a monetary union are discussed. Section 3 empirically examines both inter-regional and intra-industry trade patterns and trends within NAFTA. Section 4 extends the empirical analysis from section 3 by examining

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[3] Michael Chriszt, "Perspectives on a Potential North American Monetary Union," *Federal Reserve Bank of Atlanta Economic Review* (Fourth Quarter 2000): 29.

[4] Peter C. Newman, "Beware of Freer Trade," *Maclean's* 115 no. 48 (December 2002): 46.

[5] Jerome R. Corsi, "The Plan to Replace the Dollar With the 'Amero," *Human Events* (May 2006), http://www.humanevents.com/article.php?print=yes&id=15017.

several other OCA criteria. Gross domestic product, trade openness, inflation rates, interest rates, economic growth rates, business cycle synchronization, fiscal and monetary policy coordination, and factor mobility amongst the three member nations are analyzed using correlations. A comparative analysis of NAFTA nations with EMU is also provided. Section 5 conducts some regressions to identify further the benefits of common currency. The final section summarizes the significance of the analysis and provides some policy comments.

2. Theory of Optimum Currency Areas

The decision for geographic regions to economically integrate and adopt a single currency is based on the Theory of Optimum Currency Areas (OCA), pioneered primarily in seminal works by economist Robert Mundell (1961), Ron McKinnon (1963), and Peter Kenen (1969). OCA theory describes a set of conditions that would ideally maximize economic efficiency through the adoption of a common currency. Mundell defined an optimum currency area as "an economic unit composed of regions affected symmetrically by disturbances and between which labour and other factors of production flow freely."[6] Mundell (1961) focuses on factor mobility and symmetry of shocks, McKinnon (1963) on trade openness, and Kennan (1969) on product diversification. Ideally, all countries considering a common currency should consider meeting the criteria for an optimum currency area.

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[6] Barry Eichengreen, *European Monetary Unification: Theory, Practice, and Analysis* (Cambridge: The MIT Press, 1997), 51-72.

Traditional OCA theory is defined by these specific characteristics: international factor mobility, degree of openness of the economy, product diversification, financial integration, and similarity of inflation rates.[7] These are addressed next.

Literature on international factor mobility stresses several aspects of factor mobility that significantly contribute to a successful monetary union. Factor mobility is the degree to which factors of production (capital and labor) move freely between countries. A high degree of factor mobility means that labor and capital are easily and efficiently moved across borders. Mundell argues that "factor mobility is the key criterion in the choice [for] or against currency union."[8] Sahin (2006) points out that for countries between which factor mobility is high, the degree of the adjustment in exchange rate risks, such as asymmetric instabilities and price rigidities, is lessened. With a high degree of factor mobility, if a country is subject to a shock, like a recession, then labor can move from one country to another. This helps to alleviate high rates of unemployment in the recession hit nation and allows the country to recover from the shock.

 In addition, even when countries do not have similar structures, high factor mobility may make the movement towards a common currency more appealing.[9] (Demopoulos and Yannacopoulos, 2001). When researching factor mobility, many economists begin by looking specifically at labor. Most economists agree that a high degree of factor mobility, especially labor mobility, are preconditions for an optimum currency area.

In addition to a high degree of factor mobility, OCA theory suggests that economies looking to integrate should also have a high degree of trade openness. DeGrauwe (2007) explains

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[7] Hasan Sahin, "MENA Countries as Optimal Currency Areas: Reality or Dream," *Journal of Policy Modeling* 28 no. 5 (July 2006): 513-14.

[8] Ibid.

[9] George Demopoulos and Nicholas Yannacopoulos, "On the Optimality of a Currency Area of a Given Size," *Journal of Policy Modeling* 23 no. 2 (January 2001): 17.

that a highly open economy reduces the probability of asymmetric shocks occurring.[10] If a country's currency depreciates, the aggregate demand for its exports increases and its aggregate demand of imports decreases, which means the country can charge higher prices for their exports and pay higher wages to the workers. An economy with a high degree of trade openness also increases welfare gains associated with the elimination of high transaction costs and decision errors from conducting business with foreign currencies. A highly open economy can use exchange rate policy like depreciation to overcome an adverse shock, such as a recession (Figure 1). The depreciation will raise exports and hence income for the country (from Y_0 to Y_1), but at the same time, it will bring inflation. The more open the economy, the higher the price rise. This is costly to the country. But, when a country adopts a common currency, it relinquishes the exchange rate policy. There are greater benefits of adopting a common currency for a more open economy, as the cost of giving up exchange rate policy is low.

Figure 1 Depreciation Overcomes Shocks in Open Economy
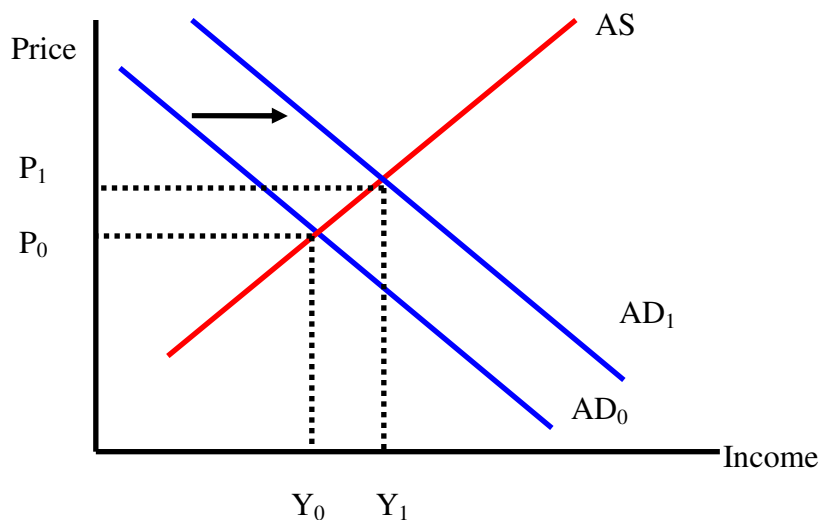
McKinnon (1963) similarly suggests the criterion for the degree of openness of the economy. If a country has a high degree of openness, meaning that the ratio of traded goods over

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[10] Paul DeGrauwe, *Economics of Monetary Union* (Oxford University Press, Oxford 2007), 58-60.

total domestic goods is large, a fixed exchange rate, as opposed to a flexible exchange rate, is beneficial.[11]

Arndt (2003) argues that trade encourages similarity among industrial structures and thus reduces the problems associated with asymmetric shocks.[12]Intra-product specialization reduces asymmetric shocks as it increases business synchronization. Krugman (1993) on the other hand, believes that specialization causes asymmetric shocks among nations because it emphasizes the differences between the nations.[13]

In addition to product specialization and diversification, OCA theory also stresses the importance of a high degree of financial integration between countries. Although a high degree of financial integration overlaps with the international factor (capital) mobility conditions, a high degree of financial integration incorporates similarities in interest rates. Sahin (2006) argues that, "slight changes in interest rate will give rise to sufficient equilibrating capital flows." The author opines that it acts as an "equilibrating element of payment imbalances." According to Tavlas (1997) financial integration helps to absorb the shocks in the adjustment process in the short run, and eases the overall integration for the long run.[14] A higher degree of financial integration allows for the possibility of maintaining fixed exchange rates. High fiscal integration enables

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[11] McKinnon states, "Those countries which are major trading partners should maintain a single fixed exchange rate system because continuous exchange rate adjustments are costly and inefficient between economies which are integrated with each other.

[12] In the end, the outcome is likely to depend on the relative importance of inter- and intra- industry trade in the integrated area. Where inter-industry trade dominates, as it would in currency unions between industrialized and industrializing countries, greater specialization and hence heightened asymmetry would be the likely result. Where intra-industry trade is dominant, as in the EU, greater specialization is compatible with rising correlation among business cycles, especially if specialization along product-variety lines is prevalent. Specialization in terms of intra-industry product variety ensures that industry-specific shocks affect everybody.

[13] P. Krugman, "Lessons of Massachusetts for EMU," in *Adjustment and Growth in the European Monetary Union,* ed. Francisco Torres and Fransesco Giavazzi, 241-60 (Cambridge: Cambridge University Press, 1993).

[14] G.Tavlas, "The International Use of the U.S. Dollar: An Optimum Currency Area Perspective," *The World Economy* 20 no. 6 (September 1997):715.

areas to "smooth diverse shocks through endogenous fiscal transfers from a low unemployment region to a high unemployment region."

In addition to financial integration, countries looking towards a common currency must have similar inflation rates. Literature on the subject identifies the similarity of inflation rates as a desirable outcome because there will be no effect on terms of trade[15]. Other economic conditions include high levels of intra-regional trade among the countries and intra-regional trade relative to a nation's GDP.

2.1 North American Monetary Union (NAMU)

When a group of countries shares a common new currency, it is known as a monetary union. For Canada, Mexico, and the U.S. a monetary union differs from dollarization in that the countries would develop a new currency and manage it collectively. A North American Monetary Union (NAMU) would unite member countries in ways similar to those of the Euro. They would also have one North American Central Bank.

Thus, Courchene and Harris (2000) explain that an "overarching central bank with a board of directors selected from the still-existing national banks" would be responsible for policy making for all three countries.[16] Several economists and politicians have discussed the emergence of the amero, which would be Canada and the U.S. version of the Euro, in which monetary sovereignty would be jointly shared, and both the U.S. dollar and the Canadian loonie would be replaced. There is an abundance of literature on the U.S. and Canadian monetary

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[15] Sahin (2006) notes that exceptionally different inflation rates influence the terms of trade between countries as the flow of goods is disrupted, the disequilibrium in the current account grows larger. While Tavlas (1997), if a country pegs its exchange rate to the currency of a country with a low inflation rate, the monetary policy unification becomes more credible.

[16] Courchene, Thomas J. and Richard G. Harris. "North American Monetary Union: Analytical Principles and Operational Guidelines." *North American Journal of Economics and Finance* 11 (March 2000): 3-18.

union, however, there is far less written about the inclusion of Mexico in the union. Throughout the literature both the potential benefits and costs for Canada and the U.S. are identified, and to a far less extent, the potential advantages and disadvantages to Mexico are included.

Economists are unclear as to the U.S.'s interest in NAMU, however, there is some speculation. Cohen (2004) states that U.S. gains associated with reduced transaction costs that "would be fully duplicated by the dollarization alternative."

With the theoretical threat of the Euro to the dollar's role as the international reserve currency, a monetary union would allow the United States to compete on a more level playing field with the Euro. According to Chriszt (2000), a monetary union would make it easier for the United States to finance its balance-of-payments deficit more easily. Courchene and Harris (2000) agree that "the U.S. would presumably be in favor of a larger formal U.S. dollar area given its proclivity to run current account deficits." However, the authors also argue that the U.S. would opt for dollarization as opposed to a monetary union as it would allow the country to gain wealth from seigniorage. Grubel (1999) argues in that a monetary union would lead to greater investment and trade opportunities for the U.S. as the NAMU could expand to include other countries including possibly the Central American and Caribbean nations. These countries would benefit from greater stability, which in turn would also allow the United States some relief in "bailouts of countries experiencing severe economic crises by promoting economic growth."[17] Though the benefits to the U.S. seem small, the possibility for NAMU is still significant to some economists.

Based on the literature, if Canada and Mexico agree to form a monetary union each country would reap greater benefits than they would as a result of adopting the U.S. dollar. If

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[17] Herbert Grubel, "The Case for the Amero: The Economics and Politics of a North American Monetary Union," *The Simon Fraser Institute Critical Issues Bulletin* (September 1999): 35.

both Canada and Mexico had a choice between a "well-functioning lender-of-last-resort with clear guidelines on how funds will be dispersed to financial institutions facing liquidity problems"[18] and dollarization, both countries would choose the former. Courchene and Harris (2000) agree in that "although dollarization has substantial initial appeal to many countries in the Americas, over the longer term these countries will surely prefer some version of NAMU than dollarization."[19] The authors agree that Canada's financial institutions and structures would be preserved with NAMU.

Grubel (2000) points out that a monetary union for Canada would bring about "static gains" associated with reduced costs of foreign exchanges as well as decreased interest rates and exchange rate risks.[20] The author also notes that there are "dynamic gains" in terms of increased labor market discipline, expansion of trade, and better structured adjustments in Canada. Chriszt (2000) mentions that a great advantage to Canada is that it would not forgo its seigniorage revenue, as it would with dollarization.[21]

Seigniorage revenues come as more of a cost than a benefit for the U.S. if it is involved in a monetary union. Though seigniorage revenues would be returned to member nations equally, the U.S. would suffer losses associated with the widespread success of the U.S. dollar as an international currency. The gains from the speculated international use of the amero would be shared with Canada, instead of going directly to the U.S.

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[18] Michael Chriszt, "Perspectives on a Potential North American Monetary Union," *Federal Reserve Bank of Atlanta Economic Review* (Fourth Quarter 2000): 35.

[19] According to De Grauwe (2007), "The costs of a monetary union derive from the fact that when a country relinquishes its national currency, it also relinquishes an instrument of economic policy, i.e. it loses the ability to conduct a national monetary policy

[20] Grubel, "The Merit of a Canada-U.S. Monetary Union," *North American Journal of Economics and Finance* 11 no.1 (August 2000): 19-40. 22-23.

[21] Seignorage is defined by Aurebach and Flores-Quiroga (2003) as "the excess of the nominal value of a currency over its cost of production."

In addition, the U.S. would suffer from "a loss in flexibility of macroeconomic policy in Washington."[22] As the American and Canadian economies unite monetary policy would be constrained because the countries are asymmetric. With asymmetric economies, the business cycles would continue to be unsynchronized, causing instability in both countries. Not only would monetary policy be limited, but fiscal policy would be restricted as both economies tighten policy to less budget deficits.

Economists disagree as to whether or not Canada's economy would face the same problem with the constraint of both monetary and fiscal policies. Gilbert (2007) explains that opponents of NAMU are concerned in that such a union "would disadvantage Canada because of the asymmetry of the Canada-U.S. relationship."[23] Grubel (2000) also addresses the losses in monetary policy, interest and exchange rate polices associated with a monetary union, as he believes they are rooted in a loss in national sovereignty for Canada. Alternatively, Grubel (2000), and Courchene and Harris (2000) see that asymmetric shocks would not be costly to either the U.S. or Canada. Courchene and Harris (2000) explain that adjustments to shocks and exchange rates would be addressed in other ways, "via changes in prices and wages, and internal migration, among other avenues." Although many of the economists referred to above identify some of the potential costs of a common currency, the works by Chriszt (2000), Courchene and Harris (2000), Grubel (2000), and Arndt (2003) argue favorably for common currency in the future.

There are economists, however, that argue against a monetary union. For example, Buiter (1999) argues that there are economic advantages to a monetary union but the overall "lack of

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[22] Benjamin J. Cohen, "North American Monetary Union: A United States Perspective," *Global and International Studies Program* (June 2004): 5.

[23] Emily Gilbert, "Money, Citizenship, Territoriality and the Proposals for North American Monetary Union," *Political Geography* 26 (February 2007): 147.

institutions for ensuring political accountability of a North American Central Bank means that NAMU is unlikely to happen and that, if it were to happen, it is unlikely to survive."[24] Carr and Floyd (2002), identify that sources of exchange rate volatility are real shocks and not monetary, and both the U.S. and Canada are subject to asymmetric shocks. Thus the adoption of a common currency would be highly unfavorable to Canada.[25]

For Mexico, issues of loss in fiscal and monetary policy are certainly a possibility, though the literature has failed to discuss specific costs to the country. Chriszt (2000) argues that costs rise with regards to the interest premium, defined as the "amount of interest a country must pay above U.S. rates on the international market for issuing debt." The interest premium may be a significant cost to Mexican borrowers and a large obstacle in Mexico's long-term economic goals as the country is still developing.[26]

Though there are apparent benefits and costs to each country involved in NAMU, economists have disagreed over many of the effects. Many economists agree that the United States is better off without a monetary union, though dollarization seems to hold more advantages than a monetary union. For Canada, economists recognize that the benefits far outweigh the costs, but there is still some uncertainty. The advantages and disadvantages for Mexico are ambiguous as much of the literature fails to include Mexico for a North American Monetary Union. Auerbach and Flores-Quiroga (2003) briefly acknowledge those who would benefit and suffer from a common currency in Mexico. The beneficiaries include export oriented industries, traders and grass root borrowers. For export-oriented industrialists, the transaction

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[24] William H. Buiter, "The EMU and the NAMU: What is the Case for North American Monetary Union?" *Canadian Public Policy* 25 no. 3 (June 1999): 285-305.

[25] Jack L. Carr and John E. Floyd, "Real and Monetary Shocks to the Canadian Dollar: Do Canada and the United States Form an Optimal Currency Area?" *North American Journal of Economics and Finance* 13 (May 2002): 21-39.

[26] To Mexican borrowers the interest premium is costly. For long-term planning and investment for the Mexican economy, the interest premium is a major obstacle as the Mexican government is working towards reducing the level and instability of the interest rate premium.

costs savings from a common currency are largely significant, while for domestically oriented firms may bear macroeconomic adjustment costs. As a result of lower transaction costs, Mexican banks may also benefit.[27] Those who would be adversely affected due to increased foreign competition are domestically oriented firms, service industries and some Mexican bankers and financial executives.

Section 3 next analyzes intra-NAFTA trade patterns over the last quarter century.

3. NAFTA Intra-Regional Trade Analysis

3.1 Intra-NAFTA Trade

High levels of intra-regional trade will reap the benefits of a currency union as exchange rate uncertainties and risks are eliminated and countries save on transaction costs. High levels intra-regional trade between members of NAFTA also suggests that business cycles will be synchronized and that the countries are likely to be subject to symmetric shocks.

Figure 2 shows each NAFTA member's share of trade with other members of NAFTA relative to the world. Data used in this section is sourced from the United States Commodity Trade Statistics database.

Canada's share of intra-regional trade in 1994 was 70 percent and in 2000 it decreased to 68 percent. Since the implementation of NAFTA in 1994 the percentage of total imports of Canada from NAFTA partners relative to the world has decreased by roughly 10 percent and stood at 59 percent in 2006. Overall, Canada's share of trade (exports plus imports) with NAFTA members relative to other countries has fluctuated slightly since NAFTA's implementation. However, the total share of trade has hovered around 76 percent. This relatively high percentage

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[27] Benefits to Mexican bankers may be attributed to intensified direct competition with foreign banks for providing low-cost loans for capital, and increased encounters with nonperforming loans in a downturn.

indicates that most of Canada's trade is with the United States and Mexico and only about 24 percent of the trade occurs with other countries outside of NAFTA. Canada's relatively high percentage of trade with the members of NAFTA compared to the world is consistent with one of the criteria for the theory of optimum currency areas discussed in the previous chapter.

Turning to Mexico, trade with NAFTA partners relative to world became relatively more stable since the inception of NAFTA. Though Mexico's trade with NAFTA nations has declined by approximately eight percent since 1994, Mexico's overall trade with NAFTA nations remains above 70 percent, which means that about 30 percent of all Mexico's trade occurs with countries other than the U.S. and Canada. This decline since 1999 may reflect the U.S. recession and its corresponding impact on intra-NAFTA trade.

Similar to Canada, Mexico's relatively high percentage of trade with NAFTA members relative to other countries is also consistent with one criterion for the optimum currency area theory. Mexico's overall trade with NAFTA members is also relatively high indicating that Mexico has a higher degree of intra-regional trade orientation with NAFTA members.

Finally, the United States' total share of trade with NAFTA members is significantly lower than both Canada and Mexico. Whereas Canada's and Mexico's total share of trade with members of NAFTA compared to the world is between 70 and 80 percent, the United States' total share of trade with NAFTA nations is roughly 30 percent. This means that more than half of the United States' trade occurs with countries other than Canada and Mexico. Since 2001 the total share of trade with NAFTA has declined. Unlike Canada and Mexico, the United States overall trades less with members of NAFTA relative to the world. This is reflective of the fact that the U.S. trade structure is much more geographically diversified, with a large percent of trade presently occurring with countries in Asia, including China.

Figure 2: NAFTA Intra-Regional Trade
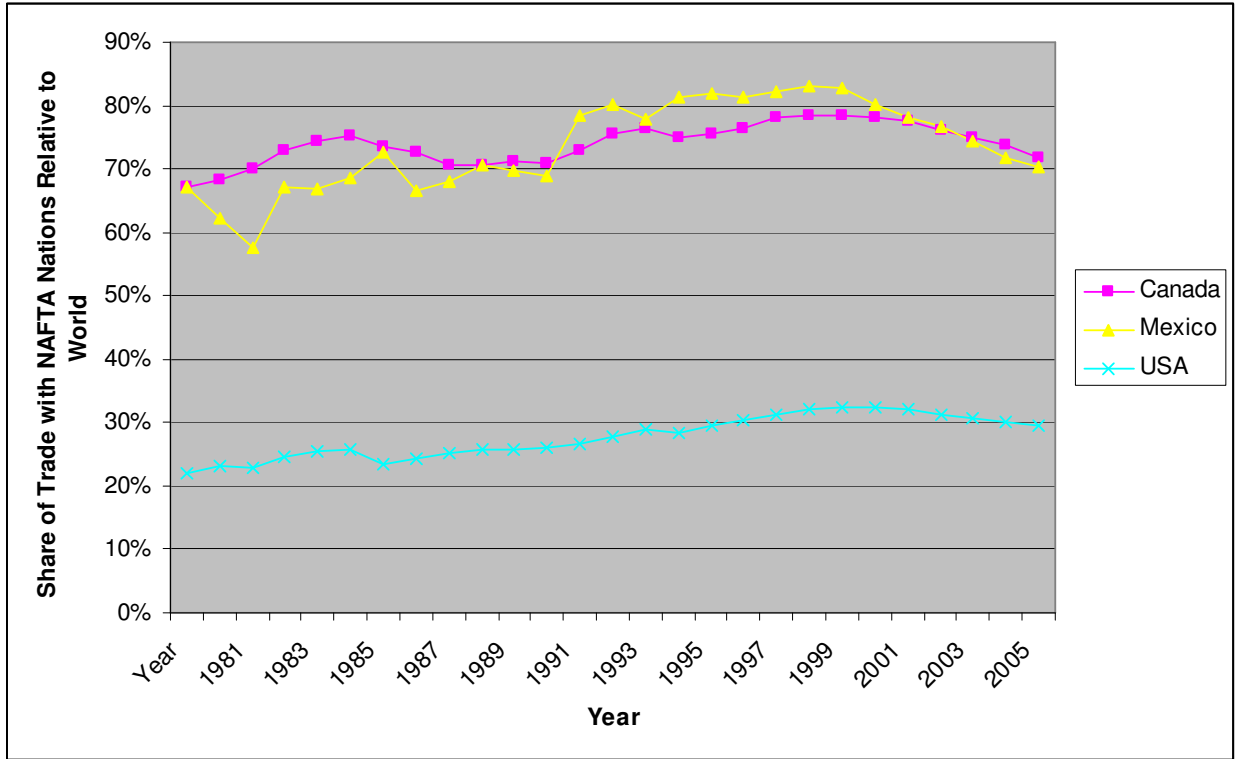
3.2 NAFTA Intra-industry trade

Intra-industry trade makes countries subject to symmetric shocks and also promotes business cycle synchronization among nations.

One way to measure intra-industry trade between countries is the Grubel-Lloyd index. This index ranges between 0 and 1. If Country A has no imports from and no exports to Country B, Country A is assigned an index measure of 0. If Country A and Country B have exactly balanced trade for a specific product, both countries are assigned a Grubel-Lloyd index measure of 1. The Grubel-Lloyd (1975) intra-industry trade (IIT) index is quantified by:

$$I_i = 1 - \frac{\left| X_i / X - M_i / M \right|}{\left| X_i / X + M_i / M \right|} \tag{1}$$

where X_i is the exports of product i by Country A to Country B, M_i is the imports of good i from Country B to Country A, X is the total exports of all goods to Country B, and M is the total imports of all goods from Country B. [28]

The Grubel-Lloyd indices for some industries—motor vehicles, motor vehicles parts and accessories, computer equipment, computer equipment parts and accessories, and aircraft for Canada and the United States are shown in Table 1.[29] The IIT index for aircraft in 2006 was 0.95, which means that the U.S. and Canada's intra-industry trade for aircrafts was nearly balanced and of a high degree. Aircraft intra-industry trade has remained relatively balanced since 1986. Motor vehicle trade, with an IIT of 0.77 in 2006, is also relatively high between Canada and the United States. Computer equipment remains in the IIT index below all other products since 1986, suggesting less trade integration in this industry.

Table 1: Grubel-Lloyd Index Measure of Intra-Industry Trade, Canada-U.S.

	1986	1991	1996	2001	2006
Motor Vehicles	0.78	0.73	0.67	0.68	0.77
Parts and Accessories for Motor Vehicles	0.71	0.68	0.55	0.56	0.61
Computer Equipment	0.66	0.49	0.46	0.36	0.44
Parts and Accessories for Computer Equipment	0	0.96	0.85	0.93	0.84
Aircraft	0.86	0.93	0.98	0.76	0.95

Source: United Nations Commodity Trade Statistics Database, http://comtrade.un.org/; author's calculations.

As aircraft and motor vehicle industries have high degrees of trade integration between Canada and the U.S., the high IIT indices may indicate that business cycles are fairly

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[28] H.G. Grubel and P.J. Lloyd, *Intra-Industry Trade: The Theory and Measurement of International Trade in Differentiated Products,* (London: Macmillan 1975).

[29] For recent work on intra-industry trade among similar selected industries in North America see Ronald W. Jones, Henryk Kierzkowski and Gregory Leonard, "Fragmentation and Intra-Industry Trade," in *Frontiers of Research in Intra-Industry Trade*, P.J. Lloyd and Hyun-Hoon Lee (Palgrave MacMillan: New York, 2002): 67-84.

synchronized. A low IIT for computer equipment indicates that business cycles are not likely to be linked or are not as similar as those for motor vehicles and aircraft.

Table 2 displays the Grubel-Lloyd indices for intra-industry trade between Mexico and the United States. In 1986, motor vehicle parts and accessories had the highest IIT index between Mexico and the United States. However, the 2006 measure shows a decline in the value of the index.[30] Since 1991, computer equipment parts and accessories have the highest IIT index with an index approaching 0.9. Televisions have the lowest index value with an IIT measure of 0.11 in 2006.

Table 2: Grubel-Lloyd Index Measure of Intra-Industry Trade, Mexico-U.S.

	1986	**1991**	**1996**	**2001**	**2006**
Motor Vehicles	0.17	0.09	0.22	0.44	0.63
Parts and Accessories for Motor Vehicles	0.69	0.28	0.59	0.49	0.23
Computer Equipment	0.54	0.67	0.64	0.49	0.47
Parts and Accessories for Computer Equipment	0.59	0.87	0.83	0.89	0.84
Televisions	0.32	0.02	0.09	0.19	0.11

Source: United Nations Commodity Trade Statistics Database, http://comtrade.un.org/; author's calculations.

The business cycles for computer equipment parts and accessories for Mexico and the U.S. may be somewhat synchronized as the indices are nearly 1. Television business cycles are the least synchronized, or maybe not synchronized at all, as the indices are closer to 0.

4. Empirical Examination of OCA Criteria

Section 4 examines the degree of factor mobility within NAFTA. Then it uses correlation analysis to study business cycle synchronization in NAFTA. Finally, it also takes a comparative perspective and evaluates members of NAFTA and members of EMU for the extent of similarity

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[30] Motor vehicle parts are imported by Canada from the U.S. are used in making a motor vehicle which is then exported back to the U.S.

in the economic development, economic growth, trade openness, and interest rate and tax revenue.

4.1 Labor and Capital Mobility

High degrees of factor mobility, specifically capital and labor mobility, are conducive to countries forming a currency union. High degrees of factor mobility allow countries to adjust to shocks by moving factors, instead of depending on exchange rate changes or exchange rate policy.

Capital mobility within NAFTA is measured by the extent to which foreign direct investment (FDI) flows from the U.S. into Canada and Mexico. Figure 3 displays the degrees of capital mobility for Canada and Mexico in the United States. Both countries have highly variable degrees of mobility. Capital mobility for Canada is higher than that of Mexico, as Canada has received more FDI from the U.S.

Figure 3: Capital Mobility
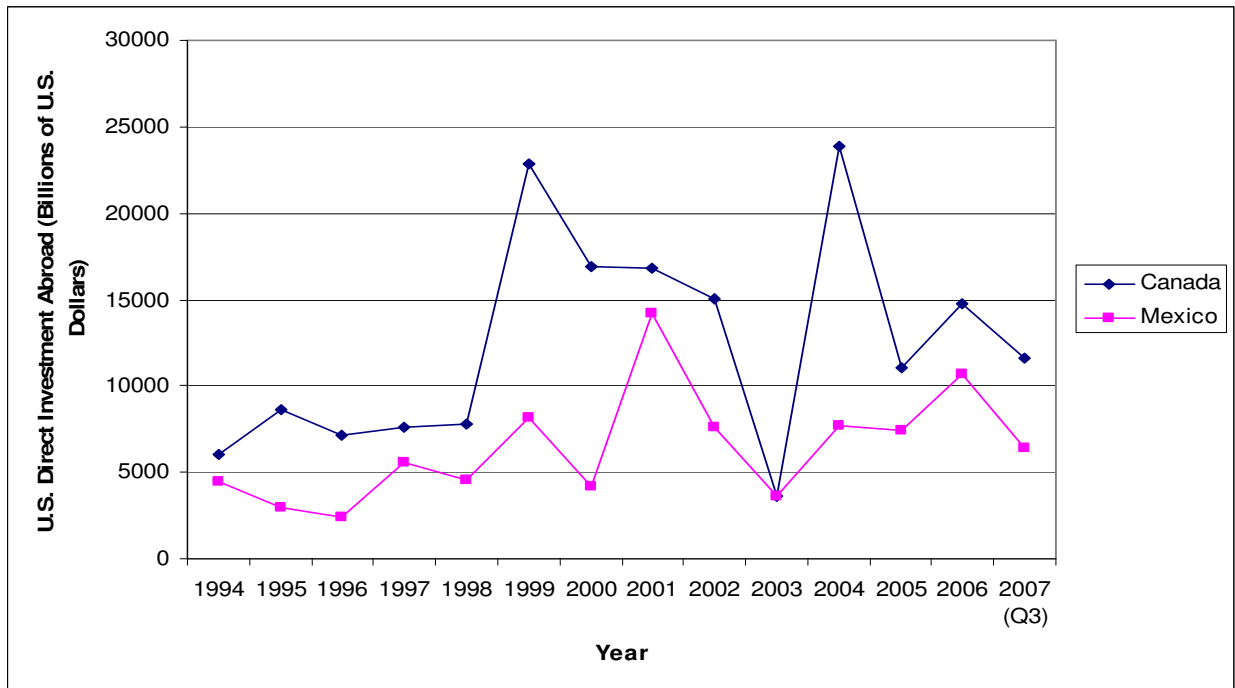
Source: U.S. Department of Commerce: Bureau of Economic Analysis, "U.S. Direct Investment Abroad: Balance of Payments and Direct Investment Position Data," http://www.bea.gov/international/di1usdbal.htm.

Following Goto and Hamada (1994), the share of labor inflow of foreign workers in the total U.S. labor force is used to measure labor mobility.[31] The inflow of Canadians and Mexicans into the U.S. labor force is shown in Table 3.[32] The total number of Canadians in the U.S. labor force has fluctuated since 1980. It decreased by about 79 percent between 1980 and 1990, then increased by 142 percent between 1990 and 2000, and finally increased again by 236 percent in 2000.

Unlike Canada's contribution to the labor force which has fluctuated since 1980, Mexico's contribution has continued to increase. Between 1980 and 1990 the number of Mexicans in the U.S. workforce increased by 20 percent. Again, the population increased by about 72 percent between 1990 and 2000 and then the number of Mexicans increased by 106 percent. Of the total population in the respective countries in the U.S., 425,310 (55.6%) Canadians are in the labor force while 4,900,795 (60.1%) Mexicans are in the labor force.

Table 3: Labor Mobility

	Canada		
	Non-U.S. Citizen	U.S. Citizen	Total
Population entering before 1980	151,520	324,625	476,145
Population entering between 1980 to 1990	68,585	32,095	100,680
Population entering between 1990 to 2000	222,610	21,340	243,950
Total as of 2000	442,715	378,060	**820,775**
	Mexico		
	Non-U.S. Citizen	U.S. Citizen	Total
Population entering before 1980	1,027,170	1,117,830	2,145,000
Population entering between 1980 to 1990	1,954,105	634,780	2,588,885
Population entering between 1990 to 2000	4,134,425	309,175	4,443,600
Total as of 2000	7,115,700	2,061,785	**9,177,485**

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[31] Junichi Goto and Koichi Hamada, "Economic Preconditions for Asian Regional Integration," in *Macroeconomic Linkages—Savings, Exchange Rates and Capital Flows,* ed. Takatoshi Ito and Anne Kruger, 359-385 (Chicago: University of Chicago Press, 1994).

[32] Source: United States Census Bureau, "Census 2000 Special Tabulations," http://www.census.gov/. Labor mobility table is similar to Table 14.14 by Junichi Goto and Koichi Hamada (1994).

4.2 GDP, IPI, and Interest Rate Correlations

Similarities in GDP and industrial production indices are suitable measures for business cycle synchronization as both are measurements of the member nations having similar trends in economic booms and recessions. Data used in section 4.2 is taken from IMF's IFS database.

Table 4 shows GDP correlations for Canada and the U.S., the U.S. and Mexico, and Canada and Mexico. The statistical significance of the coefficient is measured by the t-statistic, which is shown in parentheses below the coefficient. The U.S.'s GDP is positively correlated to Canada's as the correlations coefficient is both positive and close to 1. With an R^2 value of 0.997 the U.S.'s and Canada's GDPs are strongly related. The U.S. and Mexico also have positively related GDPs as the R^2 value of 0.969 indicates. Canada and Mexico have the least related GDPs of the country pairs, albeit at a high level, with a correlation coefficient of 0.966. This R^2 value also indicates that Mexico and Canada have positively related GDPs. Each country pair's coefficients indicate that the GDP for each country is similar to that of the other countries. Also for each country pair the correlations are statistically significant.

Table 4: GDP Correlations

	GDP_{CAN}	GDP_{US}	GDP_{MEX}
GDP_{CAN}	1	0.997***	0.966***
		(115.274)	(9.941)
GDP_{US}	0.997***	1	0.969***
	(115.274)		(10.928)
GDP_{MEX}	0.966***	0.969***	1
	(9.941)	(10.928)	

***Indicates figures are statistically significant at one percent using t-stat.

The Industrial Production Index (IPI) measures the level of physical output for a country. High levels of correlation also reflect more business cycle synchronization. The IPI correlations for each country pair is shown in Table 5. Similar to GDP, each country pair has highly and

positively correlated IPIs. The U.S. and Canada have the most related IPIs with an R^2 value of 0.984. Mexico and the U.S. have the second most correlated IPIs with a correlation coefficient of 0.971. Canada and Mexico have the least related IPIs with a coefficient of 0.935. The R^2 values for each country pair are relatively close to +1, thus indicating that each NAFTA country has similar industrial production output to that of its partners. Again the correlations are statistically significant.

Table 5: Industrial Production Index Correlations

	IPI_{CAN}	IPI_{US}	IPI_{MEX}
IPI_{CAN}	1	0.984***	0.935***
		(5.078)	(21.410)
IPI_{US}	0.984***	1	0.971***
	(21.410)		(11.699)
IPI_{MEX}	0.935***	0.971***	1
	(5.078)	(11.699)	

***Indicates figures are statistically significant at one percent using t-stat.

Monetary policy coordination as measured by interest rate correlations between each country pair are shown in Table 6. Using this measure, the United States and Canada have the most similar interest rates and hence most synchronized monetary policy, of the country pairs with an R^2 value of 0.862, which is statistically significant. Interest rates are somewhat strongly correlated. The U.S. and Mexico have the least correlated interest rates of the country pairs with a correlation coefficient of 0.702, which is statistically insignificant. Canada and Mexico have a correlation coefficient of 0.730, indicating a positive correlation. However, it is insignificant.

Table 6: Interest Rate Correlations

	Interest rate$_{CAN}$	Interest rate$_{US}$	Interest rate$_{MEX}$
Interest rate$_{CAN}$	1	0.862**	0.731
		(2.252)	(1.019)
Interest rate$_{US}$	0.862**	1	0.702
	(2.252)		(0.892)
Interest rate$_{MEX}$	0.731	0.702	1
	(1.019)	(0.892)	

**Indicates figures are statistically significant at five percent using t-stat.

4.3 NAFTA vs. EMU

Countries with similar levels of economic development and growth and trade openness find it easier to form a currency union. Countries with similar interest rates imply they are following relatively similar monetary policies. This helps in pursuing currency and monetary integration. Tax to GDP ratios are appropriate indicators for tax structures. Countries with similar tax structures find it easier to form a monetary union because they will also have similar rates of inflation. Finally, similarity of government debt/GDP ratios implies similarity in fiscal policy among nations. This section compares GDP per capita, GDP growth, inflation rates, trade openness, interest rates, tax/GDP ratios, and government debt/GDP ratios for members of EMU and NAFTA for 2001.

To better understand the likelihood that NAFTA will form a monetary union it is necessary to compare the above economic indicators discussed earlier for NAFTA against those for EMU. The standard deviations of these variables are useful in comparing similarity in these economic parameters between members of EMU and NAFTA. Table 7 displays these indicators for 2001. Data used here is from World Development Indicators. The year 2001 is appropriate because it was the year just before the Euro was adopted.

Table 7: EMU vs. NAFTA OCA Criteria

	GDP Per Capita (constant U.S. $)	GDP Per Capita Growth (annual %)	Inflation Rate (annual %)	Trade as % GDP	Interest Rate (annual %)	Tax/GDP Ratio (%)	Government Debt/GDP Ratio (%)
Austria	24,301	0	3	93	NA	21	18
Belgium	22,783	1	2	166	4.163	27	22
Finland	23,478	1	3	71	NA	23	21
France	22,851	1	2	55	4.258	23	23
Germany	23,366	1	2	68	3.659	11	19
Greece	10,998	5	3	57	4.083	24	17
Ireland	26,409	5	5	184	NA	24	15
Italy	19,604	2	3	53	4.052	23	19
Luxembourg	47,281	2	3	276	NA	26	16
Netherlands	24,431	1	4	129	NA	23	23
Portugal	11,165	1	4	68	NA	21	20
Slovenia	9,952	3	8	115	10.875	21	20
Spain	14,765	2	4	60	3.197	16	17
Standard Deviation	**9,640.21**	**1.55**	**1.61**	**66.70**	**2.66**	**4.21**	**2.59**
United States	34,484	0	3	24	3.452	13	15
Canada	23,392	1	3	57	3.768	12*	12
Mexico	5,864	-1	6	82	11.305	15	19
Standard Deviation	**14,430.11**	**1.00**	**1.73**	**29.09**	**4.45**	**1.53**	**3.51**

*Data for tax/GDP ratio for Mexico is for year 2000 as data was unavailable for year 2001.

The standard deviation for NAFTA's GDP per capita is more than that of EMU. With a standard deviation of $14,430.11 for NAFTA compared to EMU's standard deviation of $9,640.21, GDP per capita varies more between members of NAFTA than it does with members of EMU. The high deviation measure for NAFTA is attributable to the U.S.'s high GDP per capita at $34,484 and Mexico's GDP per capita at $5,864.

GDP per capita growth standard deviation measures are relatively close with EMU at 1.55 percent and NAFTA at 1.00 percent. Members of NAFTA are more similar than members of EMU in terms of economic growth because the standard deviation is lower.

Inflation rates are relatively similar for both sets of countries. NAFTA has a higher standard deviation at 1.73 percent than EMU at 1.61 percent. Although Mexico does not have the highest rate of inflation of all the countries (Slovenia has an inflation rate of 8 percent), the country's rate is relatively high at six percent. In fact, the inflation rate for NAFTA would be lower than that of EMU if Mexico's inflation rate was ignored.

EMU has a considerably higher standard deviation in terms of trade openness than NAFTA. Of the EMU countries, Luxembourg has the highest degree of trade openness at 276 percent, while Italy has the lowest at 53 percent. With a standard deviation of 29.09 percent for NAFTA compared to 66.70 percent for EMU, NAFTA members are more conducive to forming a monetary union with the lower standard deviation.

NAFTA's standard deviation for interest rates is higher than that for EMU. However, these results may be skewed due to the unavailability of data for many members of EMU including Austria, Finland, Ireland, Luxembourg, Netherlands, and Portugal. The EMU's standard deviation at 2.66 percent compared to the NAFTA's 4.45 percent means that NAFTA members may not be as similar when it comes to monetary policies for each country.

However, NAFTA has a lower standard deviation of tax to GDP ratios at 1.53 percent compared to the EMU at 4.21 percent. As tax to GDP ratios are good indicators of inflation rates, countries with similar tax to GDP ratios find it easier to maintain similar inflation rates. The low standard deviation for NAFTA may mean that inflation rates are similar between the U.S., Canada, and Mexico and may make it easier to form a monetary union.

Government debt to GDP ratios are useful in determining similarities in fiscal policies between countries. NAFTA has a higher standard deviation of 3.51 percent than EMU at 2.59 percent.

NAFTA has lower standard deviations than EMU for the following variables: GDP per capita growth, trade openness, and tax to GDP ratios. This means that members of NAFTA are more similar than members of EMU in these areas for year 2001.

5. Econometric Analysis within NAFTA

Section 5 uses regression analysis to determine the relationships between intra-regional trade, GDP, FDI, and exchange rates amongst the NAFTA nations. The first part describes the sources of data and explains the construction of the different variables such as gross domestic product, industrial production indices, exchange rates, and money supply (M2) growth rates. The second part identifies the regression equations and hypothesizes the expected signs of the coefficients. The results of the regressions are discussed in the final part.

5.1 Data and Variable Construction

Three sets of regressions capture the relationships between different variables for the three NAFTA nations. The first set of regressions examines the different transmission and linkages between the U.S.-Canada and U.S.-Mexico that may affect macroeconomic instability

in Mexico or Canada. The GDP volatility of a country measures the macroeconomic instability or disturbances in the real (goods) sector, similar to von Furstenberg (2006).[33] The second set of regressions analyzes the impact of exchange rate fluctuations and U.S. GDP growth on FDI flows from the U.S. to both Mexico and Canada, respectively. The third set of regressions explains bilateral trade flows between both the U.S.-Mexico and the U.S.-Canada by each nation's GDP and exchange rate fluctuations.

The data used to run the regressions in this chapter include GDP, IPI, GDP volume, money supply growth, and exchange rate. Data is extracted from the International Monetary Fund's International Financial Statistics (IMF, IFS) website. The data is quarterly and extends from the first quarter of 1980 to the third quarter of 2007.

A moving average, standard deviation of the GDP, IPI and exchange rates are used to capture the volatility of each series. The following equation measures the standard deviation, similar to McKenzie (1998), where m is the number of quarters:[34]

$$V = \left[(1/m)\sum_{i=1}^{m}(\log E_t - \log E_{t-1})^2 \right]^{1/2} \qquad (2)$$

The data is modified to construct the variables used in the regression. First, to determine the volatility of the exchange rate, the GDP and IPI for each country, quarterly data is converted to logs. Next, the difference between the logs is squared and summed by the quarter. Finally, the summed logs are divided by two and square rooted. Volatility is measured by standard deviation. Exchange rate volatility is also a measure of exchange rate uncertainty and exchange rate risk.

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[33] George M. von Furstenberg, "Mexico versus Canada: Stability Benefits from Making Common Currency with USD?" *North American Journal of Economics and Finance* 17 (March 2006): 65-78.

[34] McKenzie, M. "The Impact of Exchange Rate Volatility on International Trade Flows," *Journal of Economic Surveys* 13 (February 1998): 71-106.

Money supply growth is measured by taking M2 data for each country and determining the percent change from one quarter to another.

The U.S. Bureau of Economic Analysis (USBEA) provided FDI data for the second set of regressions while trade data for the U.S. with both Mexico and Canada is sourced from the United States International Trade Commission (USITC). FDI data extends from the first quarter of 1994 to the third quarter of 2007. Imports and exports data comes from USITC for 1989Q1 to 2007Q3.

Raw quarterly FDI data from USBEA is converted into logs before it is used to run the regressions. Exchange rate volatility is measured as described above, and GDP growth is measured by calculating the percent change from one quarter to the next.

Imports and exports between the U.S.-Canada and the U.S.-Mexico is summed to get a figure for total trade. Trade data available in value is divided by the U.S. Consumer Price Index (CPI) to get trade data in terms of volume, not dollars. The series is then converted into logs.

A two-stage dummy variable is used in the GDP and IPI regression set as well as in the trade regressions. The purpose of the dummy variable is to capture the effect of free trade agreements in North America. The dummy variable assigns the number 0 to those data from 1980 to 1988 (before any free trade agreement was formed), value of 1 to the data from 1989Q1 to 1993Q4 (when the US and Canada formed the Canada-U.S. Free Trade Agreement [CUSTA]), and 2 to data post 1994Q1 after Mexico joined the free trade agreement that is now NAFTA.

5.2 Macroeconomic Instability and Exchange Rate Volatility

The first set of regression equations that measure GDP and IPI volatility of both Mexico and Canada with the U.S. are as follows:

Volatility of country i's GDP = $a_0 + a_1$ (volatility of currency of country i with respect to U.S. dollar) + a_2 (volatility of U.S. GDP) + a_3 (country i's money supply growth) + a_4(FTA dummy)

(4)

where i = Canada or Mexico

Volatility of country i's IP = $b_0 + b_1$ (volatility of currency of country i with respect to U.S. dollar) + b_2 (volatility of U.S. IP) + b_3 (country i's money supply growth) + b_4(FTA dummy)

(5)

where i = Canada or Mexico

GDP and IPI volatility are measures of the macroeconomic instability of a country. A positive coefficient for the volatility of U.S. GDP or IPI variable (a_2 or b_2) implies that fluctuations in the level of economic activity in the U.S. are positively transmitted to fluctuations in GDP (or IPI) in Canada or Mexico. A positive coefficient for the volatility of the exchange rate with respect to the U.S. dollar (a_1 or b_1) variable means that fluctuations in Canada's or Mexico's foreign exchange market leads to macroeconomic instability in the country. As such, adopting a fixed exchange rate (like dollarization or a monetary union) would remove or reduce such impacts of fluctuations that cause macroeconomic instability. Macroeconomic instability may also be caused by the lack of sound monetary policy on the part of that nation's central bank. Money supply growth for either Canada or Mexico is used as the control variable for monetary policy. A positive coefficient indicates that money supply growth leads to fluctuations in GDP or IPI. Results presented are based on four-period volatility. Those using two-period volatility remained unchanged.

Table 8: Canada's and Mexico's GDP and IP Volatility

	CAN GDP	CAN IP	MEX GDP	MEX IP
C	-0.005	**0.015***	**0.082***	0.000
	(-1.475)	(2.278)	(4.380)	(-0.095)
CAD-USD volatility	**0.106***	0.058		
	(1.853)	(0.852)		
Peso-USD volatility			**0.204***	**0.043***
			(2.073)	(1.760)
GDP$_{US}$ volatility	**1.018***		**2.852***	
	(8.029)		(2.485)	
IP$_{US}$ volatility		**0.638***		**0.537***
		(2.176)		(1.784)
CAN M2 growth rate	**0.106***	-0.036		
	(1.891)	(-0.379)		
MEX M2 growth rate			0.038	**0.054***
			(0.345)	(3.653)
FTA DUM	0.000	**-0.006***	**-0.038***	0.003
	(0.407)	(-2.866)	(-4.028)	(1.485)
R^2	0.625	0.271	0.755	0.395
F-Stat	**41.740***	**21.408***	**62.486***	**13.223***
N	105	105	86	86

*** indicates significance at 0.01, ** indicates significance at 0.05, and * indicates significance at 0.10. Results are based on heteroskedasticity adjusted standard errors.

The first regression equation for Canada's GDP volatility has three significant variables. The exchange rate and U.S. GDP volatility and Canada's M2 growth rate are significant at ten, one, and ten percent, respectively. The positive coefficient 0.106 for the Canadian dollar to U.S. dollar (CAD-USD) exchange rate suggest that gyrations in Canada's foreign exchange market lead to macroeconomic instability in Canada in terms of its GDP. U.S. GDP volatility is also significant at one percent. As the coefficient 1.018 indicates, fluctuations in U.S. GDP affect Canada's macroeconomic instability. Fluctuations in Canada's money supply growth are also significant, at ten percent. The positive coefficient 0.106 indicates that changes in money supply

growth positively affect macroeconomic instability. The dummy variable for the equation is insignificant.

In the second regression equation, which measures Canada's IP volatility, free trade agreements, and the constant are significant at one percent and U.S. IPI volatility at five percent. U.S. IPI volatility at 0.638 positively affects Canada's IPI volatility, while the free trade agreement variable at -0.006 negatively affects the volatility, by only a small amount.

For Mexico's GDP volatility regression equation, the values for exchange rate (0.204) and U.S. GDP volatility (2.852) are significant at five percent. The large, positive coefficient for U.S. GDP volatility indicates that Mexico's GDP volatility is positively affected by changes in U.S. GDP. Similarly, peso-USD volatility positively affects Mexico's macroeconomic instability. The negative and significant coefficient for the free trade agreement dummy variable suggests that Mexico's involvement in free trade negatively affects fluctuations in GDP. Thus Mexico's joining NAFTA leads to more macroeconomic stability.

Mexico's IPI volatility is affected by U.S. IPI volatility (0.537) which is significant at ten percent. Positive fluctuations in Mexico's IPI is also attributable to peso-U.S. dollar volatility, which has a coefficient value of 0.043 at ten percent significance. Money supply growth, with a coefficient of 0.003 is significant at one percent, indicating that changes in M2 growth positively affect Mexico's IPI volatility.

These results show that the magnitude of exchange rate volatility affects Mexico's macro-economy to a greater extent than Canada's. [35]

5.2 Exchange rate volatility and intra-NAFTA trade flows.

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[35] Von Furstenberg (2006), using a foreign exchange regime dummy variable, finds that exchange rate volatility positively and significantly affects Mexico's GDP volatility, while Canada's GDP volatility is insignificantly affected by CAD-USD volatility over the period 1950-2003.

The following trade regression are used in measuring the extent to which GDP and exchange rate volatility affect trade between the U.S. and Canada, and the U.S. and Mexico:

$\log$(U.S. trade with country i) = c_0 + c_1 (volatility of country i's currency with U.S. dollar) + c_2 $\log$(real U.S. GDP) + c_3 $\log$(real GDP_i) + c_4(FTA dummy)   (5)
          where i = Canada or Mexico

A negative coefficient for the volatility of the exchange rate implies that gyrations in the foreign exchange market discourages trade flows between the U.S. with either Canada or Mexico. If the coefficient for either U.S. GDP or Canada (or Mexico) GDP is positive, then a rise in GDP promotes trade between the countries.

Table 9: Impact of Exchange rates on Canada and Mexico's Trade Flows with the U.S

	CAN Reg 1	CAN Reg 2	MEX Reg 1	MEX Reg 2
C	**13.566***	**14.502***	**7.657***	**10.101***
	(42.657)	(34.205)	(13.704)	(13.089)
CAD-USD volatility	**-1.119***	**-1.196****		
	(-1.851)	(-2.346)		
Peso-USD volatility			**0.342***	**-0.372****
			(1.973)	(-2.231)
GDP_{US}	**2.380***	**1.786***	**2.404***	**1.113****
	(8.753)	(4.859)	(7.803)	(2.223)
GDP_{CAN}	**-0.837***	**-0.486***		
	(-3.564)	(-1.716)		
GDP_{MEX}			0.278	**0.920***
			(0.793)	(2.784)
FTA DUM		**0.088***		**0.301***
		(3.160)		(3.906)
R^2	0.940	0.948	0.955	0.979
F-Stat	**362.532***	**312.211***	**490.474***	**788.245***
N	74	74	74	74

*** indicates significance at 0.01, ** indicates significance at 0.05, and * indicates significance at 0.10. Results are based on heteroskedasticity adjusted standard errors.

As shown by the results of the first regression equation, Canada's trade flows are significantly affected by exchange rate volatility, U.S. GDP, and Canada's real GDP. The negative value of -1.119 (significant at ten percent) for exchange rate volatility indicates that fluctuations in the exchange rate market between Canada and the U.S. are unfavorable to trade

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flows. Trade flows are also affected unfavorably by Canada's real GDP, as the negative value of -.0837 (significant at one percent) suggests.[36] The coefficient for U.S. GDP of 2.380 is significant at one percent, and since this value is positive, trade flows increase as U.S. GDP increases. The R^2 value of 0.940 suggests that Canada's trade flows are explained by exchange rate, U.S. GDP, and Canadian GDP 94 percent of the time.

The second regression equation, which includes the dummy variable, again indicates that exchange rate volatility, with a value of -1.196 at five percent significance, has a negative affect on trade flows. Canada's negative GDP at -0.486 and ten percent significance suggests that trade flows are negatively affected by this variable as well. On the other hand, U.S. GDP positively affects trade flows as the positive value of 1.786 indicates. Canada's involvement in free trade (0.088) also promotes bilateral trade flows. Based on the R^2 value of 0.948, exchange rate, GDP, involvement in free trade agreements, and U.S. GDP help to explain Canada's trade flows 94.8 percent of the time.

Mexico's trade flows are positively affected by U.S. GDP (2.404 at one percent significance) and exchange rate volatility (0.342 at ten percent significance). The R^2 value of 0.955 indicates that 95.5 percent of the time, Mexico's trade flows are explained by these variables.

The second regression equation for Mexico's trade flows includes the free trade agreement dummy variable. With a value of 0.301 at one percent significance, Mexico's involvement in free trade positively affects the country's bilateral trade flows. Both Mexico's GDP (0.920) and the U.S.'s GDP (1.113) also positively influence trade patterns. However, when the FTA dummy variable is included, exchange rate volatility negatively impacts trade as

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[36] The negative coefficient for Canada's GDP volume may be due to the high degree of GDP synchronization with that of the U.S.

the peso-USD variable value of -0.372. Exchange rate volatility, Mexico's and U.S.'s GDP and

Mexico's involvement in free trade agreements explain 97.0 percent of Mexico's trade flows.

This last regression for Mexico suggests that exchange rate fluctuations are inimical to trade with

the U.S. given Mexico has already joined NAFTA. As such, from a policy perspective, such

fluctuations can be reduced by moving towards a common currency.

5.3 Foreign Direct Investment

Foreign direct investment regression are run with and without the dummy variable using

the following equation:

$\log$(U.S. trade with i) = d_0 + d_1 (volatility of i's currency to U.S. dollar) + d_2 $\log$(real U.S. GDP)
+ d_3 $\log$(real GDP_i)   (6)
         where i= Canada or Mexico

Foreign direct investment promotes economic growth in the recipient country and

deepens financial linkages between the two nations. A positive coefficient for the volatility of the

exchange rate variable (d_1) means that FDI from the U.S. to Canada or the U.S. to Mexico

positively affects FDI flows, while a negative coefficient implies it adversely affects FDI flows.

As such, this regression captures the impact of exchange rate fluctuations on FDI flows. In the

same way, changes in U.S. GDP growth can cause changes in FDI as well. A positive coefficient

implies that higher growth in the U.S. GDP promotes more FDI flows into both Mexico and

Canada. A positive coefficient for the dummy variable implies the formation of a free trade

agreement positively contributes to FDI flows from the U.S. to either Canada or Mexico.

Canada's and Mexico's foreign direct investment flows are shown in Table 10. Mexico's FDI

inflows from the U.S. are negatively and significantly affected by exchange rate volatility as the

value of -5.339 indicates. CAD-USD volatility is insignificant in affecting Canada's FDI inflows from the U.S.

Table 10: Effect of exchange rates on Canada's and Mexico's FDI flows from the U.S.

	CAN	MEX
C	**7.777*****	**8.114*****
	(19.171)	(17.043)
CAD-USD volatility	8.371	
	(0.989)	
Peso-USD volatility		**-5.339*****
		(-4.060)
GDP_{US} growth	-0.016	-0.512
	(-0.076)	(-1.633)
R^2	0.018	0.169
F-Stat	0.423	**4.976****
N	49	52

*** indicates significance at 0.01, ****** indicates significance at 0.05, and ***** indicates significance at 0.10. Results are based on heteroskedasticity adjusted standard errors.

6. Conclusion

The present study examines the economic feasibility of NAFTA nations adopting a common currency. Certain results warrant summarizing.

Firstly, both Canada and Mexico have high levels of intra-regional trade and trade openness. This is consistent with the OCA criteria as highly open economies reduce the probability of asymmetric shocks and reduce the costs of adopting a common currency. The United States, on the other hand, does not fulfill these OCA criteria because the country has low levels of intra-regional trade with NAFTA members as well as low trade openness.

Secondly, intra-industry trade indices demonstrate that U.S.-Canada business cycles are synchronized for aircraft and motor vehicles while U.S.-Mexico business cycles are somewhat synchronized for computer equipment parts and accessories.

Thirdly, interest rate correlations used to capture monetary policy coordination imply that U.S.-Canada monetary policies are similar, while Mexico's financial markets are not as mature and efficient.

Fourthly, factor mobility data indicates that Canada and Mexico have different degrees of labor mobility, as Canada's contribution to the U.S. labor force continues to fluctuate while Mexico's contribution continues to increase. Canada and Mexico also have different degrees of capital mobility. Canada has a higher degree of capital mobility than Mexico. Mexico's mobility also fluctuates more drastically.

Fifthly, compared to EMU members, NAFTA nations are more similar for GDP per capita growth, trade openness, and tax to GDP ratios (and inflation rates, and in turn, supply shocks) than members of EMU. NAFTA members are not as similar to each other as EMU members in terms of GDP per capita (economic growth similarity), interest rates (capturing monetary policy similarity), and government debt to GDP ratios (measuring fiscal policy similarity).

Sixthly, the econometric results show that bilateral exchange rate volatility leads to macroeconomic instability in both Mexico and Canada. From a policy perspective one way of bringing macroeconomic stability is by reducing exchange rate fluctuations through a common currency. For both Canada and Mexico, bilateral trade flows with the U.S. are negatively affected by exchange rate volatility. Mexico's FDI flows are also adversely affected by peso-USD volatility.

For NAFTA, a common currency is eventually feasible given all its benefits; however, the member nations must also investigate certain political aspects of adopting a common currency.

The most discussed political issue in regard to adopting a common currency is the country's compromised monetary sovereignty. Cohen (2003) argues that

> Direct political benefits are derived from a strictly national currency: first, a potential political symbol to promote a sense of national identity; second, a potentially powerful source of revenue to underwrite public expenditures; and third, a practical means to insulate the nation from foreign influence or constraint.[37]

Countries looking to form a currency union must first consider the benefits of a national currency and the costs associated with giving up national identity. Labor mobility between the U.S.-Mexico is an area of concern both economically and politically.

The EMU was politically integrated before the launch of the Euro in 1999. In 1989, EC members outlined a three-stage plan toward the development of Economic and Monetary Union (EMU). The first step was to enhance policy collaboration, and in July 1990 the Committee of Central Bank Governors prepared annual reports for the European Parliament, the Council of Ministers, and the European Council. Multi-annual convergence programs were submitted by each member state and reviewed by the Council of Ministers.

The next step toward EMU began in January 1994 when the European Monetary Institute (EMI) was established to serve as an introduction to the single currency, the integrated monetary policy, and the European Central Bank (ECB). Lastly, the European Council met in December 1995 to determine that the single currency would be called the Euro and would be introduced on January 1, 1999. Since its implementation, the Euro has become a threat to the U.S. dollar in terms of international use and purchasing power (Cohen, 2004).

Although NAFTA does not lag far behind EMU in adopting a common currency, under purely economic conditions, NAFTA does lack the political willingness and integration that

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[37] Benjamin J. Cohen, "Monetary Union," in *The Dollarization Debate* ed. Dominick Salvatore, James W. Dean, and Thomas D. Willett, 225 (Oxford: Oxford University Press, 2003).

EMU possesses. The build up towards a common currency for NAFTA has not yet been politically initiated. Both economic and political harmony must be achieved amongst Canada, Mexico, and the United States before the initial steps in moving towards a monetary union.

This in-depth economic analysis demonstrates that a common currency is certainly possible, given the benefits that are discussed in this study. It is economically feasible for NAFTA to move towards a common currency, but this venture depends on political readiness and solidarity among NAFTA nations.

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