universität wien

# MAGISTERARBEIT

Titel der Magisterarbeit

„Does the Exchange Rate Regime Matter for International Trade?"

Verfasserin

Ashley Curtin

angestrebter akademischer Grad

Magistra der Sozial- und Wirtschaftswissenschaften
(Mag.rer.soc.oec.)

Wien, 2012

| | |
|---|---|
| Studienkennzahl lt. Studienblatt: | A 066 913 |
| Studienrichtung lt. Studienblatt: | Magisterstudium Volkswirtschaftslehre |
| Betreuer | Univ.-Prof. Alejandro Cuñat, PhD |

# Table of Contents

## Section I: Introduction

*Does the exchange rate regime matter for international trade?*

This question was never asked in international economics before the collapse of the Bretton Woods System in 1973. Under that system currencies were pegged to the US dollar while the dollar was pegged to gold. Since the collapse, exchange rate regimes are a major issue for countries and they have had to make the decision on what kind of exchange rate regime they will implement.

Exchange rate regimes are important for countries because the exchange rate itself is important. It is the relative price of two monies in which each money has a couple of key roles. The first is that the money is a store of value. But the money also has to be able to be used for different market transactions like purchasing commodities, lending to a borrower and debt repayments to a creditor. In order to purchase goods from a foreign country, the domestic country must use the foreign currency to complete the transaction (Helpman, 1981).

Choosing an exchange rate regime is an important decision for every country and one that should be well thought out. Unlike before Bretton Woods where there was only one choice for a regime, countries now have a wide variety of regimes to choose from. Choices range from fixed regimes such as dollarization, monetary union, currency boards, hard pegs and crawling pegs to flexible regimes such as bands, managed floats and pure floats. Although it is difficult to know which exchange rate regime is appropriate for each country, and no one regime will work for every country at one time, it is necessary to understand how the various types of regimes affect industrial, emerging and developing economies.

Macroeconomic performance can also depend on the type of exchange rate regime that is being implemented. Two important macroeconomic targets that can be affected by the

exchange rate regime are inflation and growth. Fixed exchange rates have been associated with lower inflation and more monetary discipline from a central bank; however the relationship between fixed exchange rates and higher output growth is not as strong. It also has been argued that the collapse of the Bretton Woods System and adoption of flexible exchange rates has led to a decrease in international trade due to the higher volatility associated with them (Dellas, 1993).

So far, most research surrounding exchange rate regimes have been empirical studies about how inflation, growth and exchange rate volatility affect international trade. There have not been as many studies looking at how the regime itself can affect trading between two countries. The empirical studies most relevant to this research have been done by Rose (2000), who just measured the impact of currency unions on bilateral trade. Klein and Shambaugh (2005) also conducted research just on fixed exchange rates and trade. The emphasis of this research is concerns- how much do alternative exchange rate regimes matter for international trade? It will show that the exchange rate regime does matter for trade whether it is a fixed or flexible regime. Exchange rate volatility is also an important factor and will also be measured because the type of regime can affect volatility which as a result can have an effect on bilateral trade.

This study uses the gravity model to estimate and determine how much of a difference the type of regime makes regarding international trade. It begins with a baseline estimation excluding an exchange rate regime dummy variable as well as fixed effects estimation for the baseline. Following the baseline estimations, an estimation of the full gravity model including a dummy variable for the exchange rate regime is performed and also run fixed effects estimation on the full model. To account for any endogeneity, an instrumental variable estimation where exchange rate volatility is instrumented with inflation is used.

Section II includes a more in depth literature review, Section III will give a short history on exchange rate regimes during both the gold standard era and in the Bretton Woods System. Section IV explains the different types of regimes and a further breakdown of the benefits and drawbacks to each regime as well as classification approaches. Section V introduces the gravity model and how it works along with some of the inherent problems and how they should be addressed. Section VI is about the model used here and an explanation of the variables and a data summary, Section VII will discuss the results from each estimation as well as possible interpretations of the results, and finally the last Section VIII will give the concluding remarks.

## Section II: Literature Review

Many studies in the field of international economics involve exchange rate regimes and their impact on an economy. Most of these studies look at how macro performance is affected by the exchange rate regime. Alternative exchange rate regimes can have a significant impact on macro-economic indicators such as inflation, interest rates, exchange rate volatility and output growth as well as exchange rate regimes as shock absorbers.

Much of the work on exchange rate regimes and the macro-economic indicators listed above has been done by Ghosh, Gulde and Wolf (2002). Together they have done a number of empirical studies. In short, they found that under fixed exchange rate regimes, inflation as well as interest rates is often lower than under flexible regimes. The relationship between output growth and alternative exchange rate regimes is not as clear because the exchange rate does not have a direct effect. Output growth varies across regime types.

There have been many more empirical studies on exchange rate volatility under alternative exchange rate regimes and how international trade is affected by it. Flexible exchange rates are argued to have a higher volatility than a fixed regime. For example, Ghosh, Gulde and Wolf (2002) find that exchange rate volatility is higher under flexible regimes, but this is seen as "noise". Volatility can be lower for upper income countries using flexible regimes. For lower income countries, fixed regimes produce a reduced level of exchange rate volatility. Even though movements are much larger for low income countries, and since they offset inflation differentials, they reduce real exchange rate variability.

In theory, a higher volatility of the exchange rate should depress trade flow, but the empirical evidence has come up with mixed conclusions. Bacchetta and van Wincoop (2000) find that adopting a fixed exchange rate does not necessarily lead to more trade. In addition, Borda and Romalis (2003) find that the effects volatility has on trade are not as large as

previously thought. However, Arize, Osang and Slottje (2000) have found different results. They showed that for less developed countries, high exchange rate volatility has a significant negative effect on export demand in both the short and long run.

There have also been many empirical studies on the effectiveness of exchange rate regimes as shock absorbers. Conclusions from these studies are mostly in agreement that the main benefit from implementing a flexible exchange rate regime is the ability to absorb terms of trade shocks. Borda (2001) and Edwards and Yeyati (2004) were both able to find support for this theory.

One of the argued benefits of fixed exchange rate regimes is that there is more discipline and credibility. There is more discipline under a fixed regime because the central bank is committed to maintaining the parity. Because when a government decides to adopt a fixed regime, there is a level of commitment by their central bank that is required, giving the exchange rate credibility. However, discipline and credibility are not guaranteed under a fixed regime. Many authors, including Tornell (1999), Bordo (2003) and Barro and Gordon (1983) have been able to make several arguments as to why discipline and credibility are not necessarily greater under a fixed regime.

Fewer empirical studies have been done on how the exchange rate regime directly impacts trade flows. Rose (2000) made a study on how currency unions increased trade, especially when countries share the same currency. Klein and Shambaugh (2005) made a more general study on how fixed exchange rate regimes affect trade. They found that counties with a peg also trade more with all other countries, especially with the other countries they are pegged to.

## Section III: A Short History

Exchange rate regimes have changed a lot over the past 100 years. Before the Bretton Woods System, there was the Gold Standard, which lasted until 1914. Although there is no exact time when it started, but a global shift began in the late 1800's. The popularity of the gold standard was due to a few different aspects. Mainly, there was no other regime that was better than the gold standard during this time. The gold standard enjoyed a lot of credibility, mostly because there was no competing policy objective against the fixed rate.

Miners in 1896 made a huge discovery in the Klondike gold fields that amplified the world gold stocks, which consequently eased deflationary pressures that were caused by the demonetization of sliver. The costs of the deflationary pressures were able to be reduced because of the downward flexibility of prices and wages.

During this time period, the benefits of having global standards for measurements was becoming more apparent, so naturally having a gold standard soon followed. But there were standard rules that countries had to follow. Eventually volatility was increasing more and more, which affected terms of trade. By 1927, the gold standard was revised, but did that not last because monetary policy did not focus just on maintaining the fixed rate, but also had to achieve an "internal balance" (Ghosh, Gulde and Wolf, 2002).

By the 1940's, discussions headed by John Maynard Keynes and Harry Dexter about a post war international monetary system were an effort to finance reconstruction after the war, as well as promote free trade. Finally in 1944, the Bretton Woods Agreement was culminated. By this time, the importance of having a stable monetary system was well understood and for the first time, the "rules of the game" were created. These rules of the game were the first fully negotiated monetary order to establish and govern rules for commercial and financial relations.

A compromise had to be reached as there were disagreements on not whether to have a fixed or flexible exchange rate, but rather to what degree. The Americans were in favor of a hard peg because they would most likely be the major creditor and wanted the certainty of a fixed rate. While Europeans were hesitant to have a completely flexible exchange rate, they did not want to return to a hard peg like in the Gold Standard. Eventually a compromise was reached. The compromise was a system of adjustable pegs. This new system also led to the creation of the IMF and the International Bank of Reconstruction and Development, now known as the World Bank.

Problems with the Bretton Woods System started when the global gold coverage ratio began to decline and there was an unequal distribution of reserves. As a result, direct gold convertibility was no longer possible. So a new agreement had to be reached where currencies were pegged to the US dollar and the dollar was pegged to gold at $35 equal to 1 ounces (about 992 grams) of gold.

As successful as the Bretton Woods System was, there were two major flaws that led to the ultimate collapse. The first major flaw was that the growth of the reserves that was needed to finance world trade was dependent on the US balance of payment deficits. The problem with that was US policy was in no way tied to the world's monetary needs. Secondly, confidence in the system's reserve asset began to decline because the amount of dollars needed to cover global needs for reserves relative to the unchanged US gold reserves caused the decrease in the amount of gold coverage. There was little pressure for deficit countries to adjust their policies and no pressure at all for surplus countries, unless there was a crisis. Therefore, delayed and asymmetric adjustment returned (Ghosh, Gulde and Wolf, 2002).

As time went on, the US became more relaxed on polices. There were attempts to agree on how adjustments were to be carried out, but failed. The US dollar was becoming more overvalued and that needed to be resolved. A resolution was reached but did not last very long. On May 5, 1971, the Bundesbank had to stop purchasing dollars because within the first hour of trading, they received over $1 billion of inflows. Once the purchases of dollars were suspended, the Deutsche Mark was floating for the first time. Not long after, other major European currencies began to float. President Nixon closed the "gold window" on August 15, 1971 and ended the Bretton Woods System.

## Section IV: Explanation of Exchange Rate Regimes

Since the collapse of the Bretton Woods System, countries have a diverse choice of exchange rate regimes to choose from and it is a matter of the preferences of that country. Most industrial countries after the collapse decided to abandon the previous fixed exchange rate regimes in favor of a more flexible regime to allow their exchange rates to float freely. The whole international monetary landscape went through significant changes, but many developing countries still continued to keep fixed exchange rates (Edwards, 1991).

Choosing an appropriate regime is never easy for any country. The rational choice really depends on the goals of that country and what the central bank can manage. The two main types of regimes in the broadest sense are a fixed exchange rate and a flexible exchange rate. With a fixed exchange rate, the domestic country fixes its currency to an anchor currency. The purchasing power parity condition implies that the inflation rate should be equal to the foreign rate of inflation. It also requires a strong commitment from the central bank to uphold the parity. Flexible exchange rates are determined by the market and have little or no intervention by the central bank, which is allowed to pursue an activist monetary policy.

It basically comes down to a trade-off between reducing exchange rate volatility with a fixed regime or the central bank being able to have monetary policy with a flexible regime. Within this broad classification, there is a wide variety of exchange rate regimes, which are essentially a compromise the government tries to make for the impossible trinity in international economics; independent monetary policy, fixed exchange rates and complete capital mobility (Ghosh, Gulde and Wolf, 2002).

Within the broad categorization of fixed exchange rate regimes includes the finer classification of regimes in order of degree of fixity: dollarization, currency boards, monetary

unions, traditional pegs and crawling pegs. In the category of flexible exchange rate regimes are bands, target zones, managed float and pure float.

Crawling pegs, band and target zones can be considered an intermediate exchange regimes. The distinguishing characteristic between intermediate and fixed regimes is the commitment to a fixed rate. Within flexible regimes, the distinguishing characteristic between intermediate and completely flexible regimes is there is an explicit target zone that the central bank intervenes (Frankel, 2002).

Table 4.1 summarizes each type of fixed exchange rate regime and Table 4.2 summarizes the finer classification of flexible exchange rate regimes.

**Table 4.1: Summary of Fixed Exchange Rate Regimes**

| *Regime Type* | *Summary of the Regime* |
|---|---|
| Dollarization | A country uses a major foreign currency as a legal tender, although it is possible that domestic coins are used. As a result, monetary policy is conducted through the anchor country. With dollarization, any positive return on the coins goes to the country issuing the anchor currency. |
| Currency Boards | The exchange rate of a local currency is pegged to an anchor currency. The regime and the parity of the exchange rate are bound by law which requires central banks to keep a minimum amount of international reserves that will insure a predetermined percentage of the monetary aggregate. With currency boards, any positive return on bank notes stays in the country. |
| Monetary Union | A common central bank issues a single currency to several countries in the same region. Any type of exchange rate policy can be implemented by the central bank but individual countries in the union cannot change or adjust the exchange rate parity. Monetary policy is carried out at a regional level and any positive return on the currency is shared by the countries in the union. |

| | |
|---|---|
| Traditional Peg | There are two types of traditional pegs: a peg to a single currency and a peg to a basket of currencies.<br>*Peg to a single currency:* A fixed exchange rate to a single anchor currency is maintained by the central bank trading at the announced par-value. The rate is normally adjustable through re-evaluations in case there are disequilibria.<br>*Peg to a basket of currencies:* A currency is fixed to two or more anchor currencies in which the basket may be chosen because of criteria that is specific to a particular country or could also be a composite currency. |
| Crawling Peg | The exchange rate of a currency is adjusted by predetermined rates. The currency can be fixed to a single currency or a basket of currencies. This type of regime is the most flexible of fixed regimes. |

Each of these exchange rate regimes in the finer classification shares many of the same benefits and drawbacks. To begin with comparison, the first main drawback to dollarization and currency boards, is that they are not able to easily adjust to external shocks through exchange rate movements, which can impose costs when the business cycles are not in sync. Secondly, countries implementing these types of regimes do not have the ability to set monetary policy according to their own objectives. The main benefit these two regimes share is that they both can reduce the time inconsistency problem and real exchange rate volatility which is subject to the perceived possibility of a new domestic currency or abandonment of the regime (Ghosh, Gulde and Wolf, 2002).

When member countries operating under a monetary union experience asymmetric shocks, they lose the ability to stabilize, which can be very costly depending on the availability and effectiveness of adjustment tools. However, monetary unions also have the main benefit is that the time inconsistency problem is reduced and exchange rate volatility is also reduced because an agreement on policy from all member countries is required (Ghosh, Gulde and Wolf, 2002).

Both the single currency peg and the basket of currencies peg also provide the benefit on the reduction of the time inconsistency problem and exchange rate volatility through a commitment to an announced target. Traditional pegs do not create any hard constraints on both monetary and fiscal policy which helps reduce the time inconsistency problem. Any large shocks to the economy can be absorbed by the ability to re-evaluate the currency; however, this capability leaves countries implementing a traditional peg vulnerable to speculative attacks.

Of all of the exchange rate regimes classified under fixed, the crawling peg is the most flexible since it is a compromise of flexibility and stability. Crawling pegs are often popular among a number of countries that had a long trend of high inflation. The parity is decided day to day by taking the average rates determined by the market or adjusted according to the inflation rate differentials (Edwards, 1991). A divergence can occur between the actual rate and the parity within a band, and the parity would crawl in the same direction a flexible parity would crawl, although at a slower rate (Friedman, 1953). Because the exchange rate parity can be adjusted at a predetermined rate, the crawling peg is also vulnerable to speculative attacks (Ghosh, Gulde and Wolf, 2002).

One of the goals of hard pegs such as dollarization, currency boards and monetary unions is that a common currency is being established. The argument that the advantage of a single currency is that it encourages the integration of the local economy into a connected series of markets. These connected markets include the markets for goods and the factors of production. As a whole, fixed exchange rate regimes will help national economies integrate themselves into an international economy of connected markets (Friedman, 1953).

Two additional arguments have been made against modern fixed exchange rates. The first argues that there is no central control over the amount of international money and the international monetary conditions like there was with the gold standard. At least with the gold

standard, the quantity of international monetary control was automatically implemented by the available amount of gold and its rate of growth (Friedman, 1953).

The second argument against modern fixed exchange rates that there are a lot of barriers to trade including barriers to labor mobility (through immigration laws), capital movement barriers and tariffs to restrict the movement of goods. All of these barriers were created by some kind of government with their own protective objectives. But these types of barriers are not as harmful to an economy as the barriers to the mobility of goods and the factors of production. The fact that these harmful barriers even exists, suggests that governments operating under fixed exchange rate regimes may use the trade barrier variations to maintain the parity instead of adjustments to the purchasing power parity. When this is the case, then the argument that a fixed exchange rate regime promotes integration is contradicted (Friedman, 1953).

**Table 4.2: Summary of Flexible Exchange Rate Regimes**

| Regime Type | Summary of Regime |
|---|---|
| Cooperative Regimes | Central banks will cooperate with each other in order to the bilateral exchange rates of their currencies within a predetermined range. |
| Target Zones and Bands | The degree of flexibility is decided by the size of a band. Predetermined endpoints are set where the currency is allowed to fluctuate within the band. Intervention is also possible within the band to avoid pressure at the margins. |
| Managed Float | The exchange rate is allowed to move freely according to the supply and demand for the currency. Although the central bank is not bound to any rule or path, they can intervene when they feel it is necessary. |
| Pure Float | The exchange rate is allowed to move freely according to the supply and demand for the currency. There is very little or no intervention of the central bank as well as no restrictions for monetary policy. |

When there is not a suitable device to adjust imbalanced payments quickly enough without causing required countries to re-evaluate their currency or reducing the central bank's willingness to add credits to the international reserves, then the best device is more automatic flexibility of exchange rates (Friedman, 1953).

Like with fixed exchange rate regime types, flexible regimes share a couple of the same drawbacks. One of the main drawbacks with cooperative regimes, target bands and managed floats is that there are no hard constraints on monetary or fiscal policy, which will not provide a complete solution for the time inconsistency problem. These types of regimes are also at risk for speculative attacks, but it is hard for private speculators to speculate the exchange rate under a flexible regime because there are no easy marks to go by (Friedman, 1953).

The potential benefits for each type of flexible regime vary slightly. Since the introduction of flexible exchange rates, there has been a large demand for a regime that can achieve more automatic flexibility and keeping the advantages of the fixed exchange rate regimes. As a result, bands and target zones were devised (Friedman, 1953). Bands and target zones are the most restrictive regime out of the broad flexible classification. They allow for the exchange rate parity to be widened between one and five percent in both directions. Despite their mild restrictions, they still provide a limited role for exchange rate movements to absorb external shocks. Bands and target zones also encourage the development of a risk management system for exchange rates because there they only provide a partial expectations anchor; therefore there is still exchange rate uncertainty.

External shocks can be absorbed through exchange rate movements, since pure floats are completely determined by market forces. There are no restrictions from the exchange rate regime on monetary policy. The main drawback to a pure float regime is that unless there is another institutional measure, time inconsistencies can still be a problem. A managed float

provides a way for market determined rates to be combined with a non-rule based intervention system to stabilize the exchange rate. Normally, a nominal anchor such as inflation is used to accompany a managed float (Ghosh, Gulde and Wolf, 2002).

But what is really important to understand about each type of exchange rate regime is how they can affect macroeconomic performance. Inflation, output growth, interest rates and exchange rate volatility can be affected by the type of regime a country is using. As a result, trade flows are affected. An understanding for the interrelationship between international trade and the forward exchange market is necessary for answering the question of how do fixed and flexible exchange rate regimes affect trade because of their uncertainty (Etheir, 1973).

Most economic convention tells us that fixed exchange rates both promotes output growth and international trade because of the reduced uncertainty of the exchange rate. They are also thought to keep inflation low because of more monetary discipline. On the other hand fixed exchange rates have also been argued to decrease output growth and international trade because they hamper price adjustments. They also have been argued to increase inflations because of the ability to burden future governments with the costs of "cheating" (Ghosh, Gulde and Wolf, 1997). Fixed exchange rates are also argued to not work as effective shock absorbers.

In the next sections will discuss the theories on how the exchange rate regimes are argued to affect inflation and interest rates, exchange rate volatility, output growth, credibility and discipline and finally, shock absorbers. An understanding of these topics is important as they also have a direct effect on trade flows.

## Exchange Rate Regimes: Inflation and Interest Rates

There has always been a strong link between fixed exchange rate regimes and low inflation, possibly due to the discipline and confidence effect. The discipline effect works as an anti-inflation device for a couple of reasons.

First, a fixed exchange rate cannot be maintained under large fiscal imbalances that are financed by increasing the money supply. International reserves will decline and there will be high appreciation of the currency if the domestic inflationary pressures rise above the international rate of inflation (Edwards, 1991). Any type of anti-inflationary policies however, may not be used to stabilize domestic prices, but to conform to the global price trend, which may not be stable, but either inflationary or disinflationary (Friedman, 1953).

The second reason why the discipline effect works as an anti-inflation device is because the political costs of having ineffective monetary and fiscal policies can be too expensive. Inflation that is too high is often seen as undesirable for most countries. So there is an incentive for the central bank to keep inflation to a minimum. The confidence effect keeps inflation low because when the peg is credible, there is greater willingness to hold the domestic currency instead of spend it (Ghosh, Gulde and Wolf,1996).

Better inflation performance could be the result of slower money growth under the fixed exchange rate regime. As Ghosh, Gulde and Wolf (2002) showed that slower money growth is a cause, with scaled money growth being 3.5 percentage points lower per year than flexible regimes under de jure classification, which supports the hypothesis for the discipline effect. They also were able to show that inflation rates are generally lower under a fixed exchange rate regime given money growth.

Just because monetary discipline is better under fixed regimes, it does not always imply that fiscal discipline is as great. Countries can run up large debts without creating fears that the debts will be inflated away in the future.

Endogeneity of the regime choice may cause a simultaneity bias of the exchange rate regime coefficient because although it has been shown that countries using fixed exchange rate regimes experience lower inflation, the decision to adopt a fixed regime is dependent on other economic or political factors. Countries that tend to have low inflation are more likely to adopt a fixed exchange rate regime. On average, not only do countries with fixed exchange rate regimes have a lower inflation rate, but they also have lower inflation variability (Ghosh,Gulde and Wolf, 2002).

The confidence effect associated with fixed exchange rate regimes increases the demand for domestic currency, which will be reveal lower circulation velocity and lower domestic interest rates. This is because, if expected inflation is lower under fixed regimes, and if the real interest rates are at least not much greater than under flexible exchange rate regimes, then the nominal interest rate should also be lower under fixed regimes.

Changes in the nominal interest rates are a cause for concern because if they begin to decline, then that could mean a stronger demand for the domestic currency could follow. Real interests are often lower in a fixed exchange rate regime than in a flexible regime because the credibility granted by a fixed regime means a lower risk premium. This boost to a country's confidence level will increase the demand for the domestic currency, which will result in a lower velocity of circulation and a quick reduction in the domestic nominal interest rates. If perfect credibility exists, inflation will fall to the world level, even countries that have a record of high inflation.

As Ghosh, Gulde, Ostry and Wolf (1996) have shown, even though nominal interest rates have risen, the growth rate of the nominal interest rates for fixed regimes is 2 percent, while flexible regimes were at 6 percent. They also noted that for intermediate regimes, the growth rate of the nominal interest rate was the highest at 9 percent. Since the level of real interest rates can serve as a measure for confidence, they showed that the real interest rate for fixed regimes was 0.2 percent, while for flexible regimes was at 2.3 percent. Even though for nominal interest rates, the intermediate category was the highest, for the level of the real interest rate, it was lower than the flexible regime at 1.8 percent.

Although inflation is higher under a flexible exchange rate regime, the consequences of it, such as a devalued currency and an increase in prices, are more transparent to the public. When the goal of a central bank is to keep inflation low, then there is pressure to avoid a crisis and create a policy to solve the problem (Friedman, 1953).

### Exchange Rate Regimes: Exchange Rate Volatility

Since the collapse of Bretton Woods and the adoption of flexible exchange rate regimes in 1973, the relationship between the exchange rate uncertainty and international trade have been a popular research topic (Gagnon, 1993). It has been argued that flexible exchange rate regimes leads to lower trade because of the uncertainty associated with them. Most contracts for trade are not for an immediate delivery of goods, so there has to be a forward market. The high volatility of the exchange rate is costly for risk adverse traders and leads to less international trade (Arize, Osang and Slottje, 2000).

Usually trade between two countries is denominated in the currency of either the importer or exporter; therefore any unforeseen changes in the exchange rate can result in a loss of profits (Dellas, 1993). This is because the price of the traded goods and exchange rate is agreed upon on the day the contract was made but payment is not received until delivery is

made in the future (Arize, Osang and Slottje, 2000). But since exchange rates are predicted to move slow and steady under a flexible regime, traders should not be too negatively affected. Even with adverse traders to exchange rate uncertainties, they still have the possibility to hedge their transactions through the forward exchange market. Any speculation or arbitrage between the spot rate and the forward market rate would make sure that expectations of appreciation or depreciation was revealed in the spot or forward rate. This would ensure the cost of the forward cover is within a reasonable limit (Friedman, 1953).

It may seem trivial to say that the behavior of the nominal exchange rate is an important part of the exchange rate regime. However, it is not as clear to say under flexible regimes, the exchange rate volatility is higher than under a fixed regime. Many studies have been done in the past few decades and so far, the results are mixed and inconclusive. The relationship between exchange rate volatility is more of an empirical question than a theoretical question because theory alone cannot determine the relationship (Arize, Osang and Slottje, 2000).

Theory predicts that since under a flexible regime, exchange rates do not move unpredictably day to day. Instead, they will make small and slow movements in response to changes in the demand and supply of the currency, as well as any policy changes. More volatile movements in the exchange rate will be due to an unexpected change in circumstances. The same unexpected change that will cause a great amount of uncertainty in flexible regimes would also create uncertainty under a fixed regime that will cause policy changes in re-evaluation of the currency, inflation and possibly trade barriers (Friedman, 1953).

The relative volatility of the exchange rate may depend more with the length of time considered under the various types of regimes than the regime itself (Ghosh, Gulde and Wolf,

2002). The higher exchange rate volatility under flexible regimes in the short run may be due to short-term movements that are quickly reversed, which is referred to as "noise". The short-term movements will start to cancel out as the time horizon becomes longer and as a result, the exchange rate volatility becomes smaller over time.

The fixed regime behaves a little differently from the flexible regime under a longer time horizon. In the short run, currencies that are considered fixed may show no variability in the nominal exchange rate. But over time, there is a strong possibility that the parity has been re-evaluated at some point, which could mean there are large movements of the nominal exchange rate. Average volatility may be decreasing over time, however, because the movements of the nominal exchange rate are being spread out (Ghosh, Gulde and Wolf 2002).

One view point suggests that the reason why exchange rate movements are less volatile under flexible regimes than in fixed regimes is because they immediately adjust to inflation differentials. A second view point suggests that nominal exchange rates as well as real exchange rates are more volatile with sticky prices because it is argued that nominal exchange rates are a result of short-term and highly speculative capital flows (Ghosh, Gulde and Wolf 2002).

Opponents of the flexible exchange rate regime also argue that there is an incentive for "Destabilization Speculation". Any time speculators move the exchange rate away from the equilibrium instead of towards it, destabilization of the exchange rate occurs. There has not been any supporting evidence of this. In theory, speculators that try to destabilize the exchange rate will lose money because they will be buying high, selling low in contrast with the equilibrium value. The only way for this to be profitable for professional speculators is to

convince amateur speculators to destabilize the exchange rate, while the professionals would buy at the low and sell at the peak of the amateurs' losses (Friedman, 1953).

Destabilization speculation may also occur under the flexible exchange rate regime can also move the spot rate which can cause uncertainty among speculators. The level of perspective profits depends on the relation between the spot rate and the expected future exchange rate; neither will be fixed or independent from the level of transactions of the speculators (Friedman, 1953).

### Exchange Rate Regimes: Output Growth

In theory, nominal exchange rates are no known to be particularly important to economic growth, but there are two possibilities for the relationship between the exchange rate regime and economic growth: investment and trade openness (the ratio between imports plus exports and GDP), which is a result of faster productivity growth. Higher trade openness ratios can lead to more efficient resource allocation and allow a faster transfer of knowledge of technological advancements, therefore increasing growth. These two possibilities do differ across exchange rate regimes.

Productivity growth is the result of technological advancements and changes in economic efficiency. More productivity growth leads to more economic growth because of more use of capital and labor and the enduring productivity growth. To achieve both productivity and economic growth, investment and faster growth of productivity are necessary elements.

Fixed exchange rate regimes have higher investment possibilities because of more credibility of policies and lowered real interest rates, which can influence economic growth. However, fixed regimes do not have the same ability as flexible regimes to absorb shocks and as a result, put pressure on protection of the exchange rate and distort price signals. Faster

productivity growth that is often reflected in faster external trade is often associated with flexible exchange rate regimes, which can also influence economic growth. Trade growth is 3 percentage points higher under flexible regimes than in fixed regimes. Overall, per capita GDP growth is higher under a flexible regime (Ghosh, Gulde, Ostry and Wolf 1996).

According to Ghosh, Gulde, Ostry and Wolf (1996), investment rates are higher under fixed exchange rate regimes by as much as 2 percentage points of GDP and trade openness is about 20 percentage points higher. Investment may lead to more economic growth, it may not explain everything. Countries with intermediate regimes tend to have lower investment rates and trade openness ratios, but higher GDP growth rates than in fixed regimes. This difference can be seen for industrial and upper middle income countries and for developing countries, there is almost no difference. Although investment rates are higher, increases in productivity growth most likely are smaller under fixed regimes.

### Exchange Rate Regimes: Credibility and Discipline

When a country is trying to decide whether to use a fixed or flexible exchange rate regime, it might choose a regime that will provide more monetary and fiscal discipline and as a result, become more credible. Discipline can be anything from conservative spending to relaxed monetary policies. An exchange rate regime can be thought of as a way to allocate the burden of an inflation tax. Credibility exists when the central bank is able to maintain the exchange rate.

In theory, fixed exchange rate regimes are thought to provide more discipline and credibility, but this does not always need to be the case. Arguments have been made that discipline is greater under a fixed regime is a myth. Under the gold standard, it may have been the case since all countries were always committed to maintaining their parity.

However, countries operating under a modern fixed regime have developed the possibility to intervene and re-evaluate their currency (Friedman, 1953).

A relaxed monetary policy can cause the fixed exchange rate to come to an end because it can lead to exhaustion of the reserves (Tornell and Velasco 1999). The collapse of the fixed exchange rate could be very expensive politically, so policy makers are careful to maintain the fixed rate by trying to avoid pushing the inflation tax and unnecessary high costs to the future.

There are few main flaws with this argument, however. If bad policies under a fixed exchange rate result in bigger debts and the depletion of the reserves that cannot be sustained, then the costs will become more expensive. Under a flexible exchange rate, the consequences of bad policies can be evident through exchange rate movement and price levels, which can be immediately recognized and the cost of the consequences are paid up front and the burden of the inflation tax is spread out across time, therefore, forcing more discipline in the present.

When a government spends more than its revenue, the excess spending has to be covered through an inflation tax, borrowing or withdrawing from international reserves. Since higher inflation is not normally desired by central banks, there will be trade-offs between spending and inflation. If the central bank also discounts the future, the burden of the inflation tax will most likely be pushed to the future, whereas under a flexible regime the inflation tax spread across time. This would imply that under a flexible exchange rate regime, the marginal spending is higher (Tornell and Velasco 1999).

More fiscal discipline can also mean that there is a higher individual welfare because government spending has to be financed with inflation tax. As government spending increases, individual welfare decreases. When spending is higher under a fixed exchange rate

regime than under a flexible regime, then individual welfare suffers under a fixed regime (Tornell and Velasco 1999).

Fiscal discipline is not necessarily greater in either regime; that depends on many economic fundamentals. The point is that more discipline can present under flexible regimes, and the natural economic intuition that fixed regimes provides more discipline is not always the case as previously thought.

Fixed exchange rate regimes have also been argued to provide more credibility because of non-inflationary monetary policy, which is known to reduce the time inconsistency problem. Barro and Gordon (1983) use the case that a central bank will use discretionary monetary policy to create surprise inflation as a way to reduce the unemployment rate. A decrease in real wages, therefore increases employment and additionally output in. They argued the unemployment rate will not change because under rational expectations, the outcome will be a higher inflation rate. Since the workers are expecting higher inflation from the central bank, they will demand higher wages to compensate. In order to correct the time inconsistency problem, an effective, pre-commitment device or monetary rule is needed (Bordo, 2003). If there is no effective device or constraint in place, then the commitment of the central bank will not be credible, making it worthless (Edwards, 1991).

The choice of an exchange rate regime could also be based on the concept of a nominal anchor in order to achieve credibility. In countries with high inflation, fixing the currency to a country with low inflation is seen as a pre-commitment device to anchor inflation expectations to reduce the time inconsistency problem (Bordo, 2003). It works if the central bank can credibly commit to low inflation. Under rational expectations, workers would build their wage demands around the lower expected inflation rate, making a low

inflation equilibrium. Although welfare increases with lower inflation, there is still a trade-off between higher credibility and the lowered ability to absorb shocks.

Using an inflation anchor does not stop the central bank from creating surprise inflation however, but it does place a constraint on the ability of the central bank to create surprise inflation. Normally, the political costs to exit from a fixed regime are much higher than using surprise inflation, making it easier for the central bank to maintain its commitment to the fixed regime and earn more credibility.

Adopting a fixed exchange rate regime may not be worth the costs in order to gain more credibility, however. If a country already has a long record of stable monetary and fiscal policies, the marginal benefits for switching may not be worth the costs (Ghosh, Gulde and Wolf, 2002).

### Exchange Rate Regimes as Shock Absorbers

Of all the benefits and drawbacks to different exchange rate regimes, the most important benefit of a flexible regime is its ability to smooth adjustments to real shocks to the economy. This has been one of the least argued benefits in exchange rate regimes (Broda, 2001). If a country has a fixed nominal exchange rate, then adjusting the real exchange rate equilibrium to shocks has to happen through changes in domestic nominal prices and domestic wages. This can be very difficult when there is not much flexibility with prices or wages (Edwards and Yeyati, 2004).

One aspect that is argued in a classical debate however, is that the relative value of the exchange rate regimes depends on the type of shocks that affect an economy. One of the only times when a fixed regime may fair better than a flexible regime, is when the type of shock comes from the domestic money market. A fixed regime will automatically prevent the shocks from having an effect on the real economy. If there is a positive demand shock, the

central bank will buy foreign reserves in order to prevent an appreciation of the domestic currency, while the money supply increases and real output has not been changed. To reduce the money demand so that it is back to the same unchanged level of real money supply, under a flexible regime, income needs to fall (Borda, 2001).

A negative real shock such as the export demand should fall and domestic prices are sticky, then there will be depreciation of the nominal exchange rate. The depreciation of the exchange rate will then cause relative prices of tradable goods to decline while demand has fallen, moderately offsets the affects of the negative shock. In addition, the domestic price for exported goods increases due to the depreciation of the domestic currency while the foreign price has fallen; which also offsets the negative shocks (Borda, 2001).

Under a fixed regime, pegs have to deal with the negative real shocks because the adjustment period is much longer than under a flexible regime. Employment rates can also decline because the central bank has to avoid currency depreciation that would otherwise occur by using foreign currency to purchase domestic currency.

Flexible regimes can adjust to real negative shocks more smoothly because independent monetary policy can be practiced. Whenever the central bank feels a necessity to intervene for a crisis intervention, it can do so by using monetary expansion. Under a fixed regime, this is not possible because introducing money into circulation would cause an outflow of reserves and leave output unchanged (Borda, 2001).

As Edwards and Yeyati (2004), as well as Borda (2001) showed, flexible exchange rates do help absorb the effects of terms of trade shock for both industrial and emerging countries.

## Classification Approaches of Regimes

With any empirical study of exchange rate regimes, classification approaches are a major issue. There are two types of approaches- *de jure* and *de facto* classification. Each year the IMF publishes their *Annual Report on Exchange Arrangements and Restrictions* where each member country has declared what type of regime they intend to use. In theory, a fixed exchange rate means that the value of the currency does not vary much, if at all. However, in practice, what a central bank intends to do does not always happen. As a result, this is the reason why there are two classification approaches.

The de jure classification approach is the publically announced intentions of each member country. In an empirical study, using this approach shows the importance of signaling and expectations. But expectations about the regime are not always met. For example, a country announces that it will fix its currency at a certain rate, but has re-evaluated it a number of times throughout the year to accommodate independent monetary policy and the implemented polices are not in line with preserving the peg. As a result, the currency may not be considered a peg. Thus the reason there is a second approach- the de facto approach. It is the observed behavior of the regime. Naturally, this classification approach is backward looking.

Neither classification approach is ideal; both have their fair share of benefits and drawbacks. The main benefit of the de jure approach is that it does emphasize the importance of expectations in the market. Problems can arise when there are gaps between what the central bank has announced and what it actually does. With the de facto approach, there are also a few practical problems. Stability of the nominal exchange rate is the most important element for the de facto classification but being able to determine why the nominal exchange rate has remained stable is not always clear. A particular country is not vulnerable to the

same shocks as other countries, so trying to observe an exchange rate policy from exchange rate movements is difficult to gather. The stability of the nominal exchange rate may be due to an active policy to absorb external shocks, or it could just be that there were no shocks. Misclassification can easily occur with the de facto approach.

There have been many empirical studies on properly identifying de facto exchange rate regimes. One of the more famous studies by Reinhart and Rogoff (2002) developed a method to classify historical exchange rate regimes. Other authors such as Calvo and Reinhart (2000) and Levy-Yeyati-Sturznegger (2003) argue that the reason governments do not do what they intended to do is because of the "fear of floating" or not enough credibility. They tried to devise a method for de facto classification by using the observed behavior of the exchange and international reserves.

## Section V: The Gravity Model

The gravity model, inspired from a model in physics, is one of the most successful empirical frameworks in international economics (Klein and Shambaugh, 2005). In physics, the force of gravity between two objects is proportional to the product of the objects' masses divided by the square of the distance between them. If the value of bilateral trade between two countries replaces the force of gravity and replace the objects' masses with the GDP of each country, we have the gravity model for international economics:

$$X_{ij} = Y_i\, Y_j \left(\frac{T_{ij}}{P_i\, P_j}\right)^{(1-\sigma)} \qquad (1)$$

Where X*ij* is the value of bilateral trade between countries *i* and *j*, Y*i* Y*j* is the GDP of countries *i* and *j*, / P*i*P*j* is the overall price index for countries *i* and *j*, and T*ij* is the trading costs and is assumed to be T*ij*= T*ji* (Baldwin, 2006). The constant elasticity of substitution of all goods is σ, where 1>σ because there is a negative effect on trade from bilateral trade costs (Adam and Cobham, 2006). The formula is modeling the trade flows between two countries as being proportional to GDP and inversely proportional to the distance between them (Rose, 2000). The variable P*i*P*j* shows to what degree trade costs raises the price of goods for consumers compared to the price of goods in that and all other countries, which is known as "multilateral trade resistance". They also depend on trade cost determinants for each country's trade with itself and all the other countries. The gravity model now takes the form:

$$P_j = \left[\sum_i \left(\beta_i p_i {T_{ij}}^{1-\sigma}\right)\right]^{1/(1-\sigma)} \qquad (2)$$

Where p*i* is the price that exporters receive in country *i* and β*i* is the distribution parameter in the utility function. Theoretically, this model estimates the ratio of trade barriers for countries *i* and *j* between each other to the ratio of trade barriers for countries *i* and *j* to trade with other possible trading partners including domestic trading (Adam and Cobham 2006).

Of course bilateral trade cannot only depend on the exchange rate regime, which is why the gravity model works so well. The trade costs that could affect trade between two countries such as distance, colonial ties, language, trade agreements and exchange rate volatility, as well as any other measurable variables, are included in the model.

The gravity model has been quite popular in recent years for a number of reasons, being used in dozens or studies in international economics. Knowing what trade flows are is an important, because it is key factor in many economic relationships. Data needed to conduct studies has become easily available and the gravity model has been successful in a number of papers (Baldwin, 2006). The gravity model has been successful both theoretically and empirically.

Like any model in economics, there are a couple of major flaws with the gravity model that need to be addressed when using it in an empirical study. It is possible that in a data set, the nominal trade values are not properly deflated by the US aggregate price index. Because inflation rates are often global trends, this creates a small problem estimating with the gravity model. Including terms that have not been deflated can create a bias through spurious correlations. This bias can be easily corrected by including year dummies in the regression. As Baldwin and Taglioni show in their paper "Gravity for Dummies and Dummies for Gravity Equations" (2006), including time dummies in the regression will give the same estimation results as not having wrongly deflating the nominal trade values.

The second considerable problem that often occurs when estimating with the gravity model is that there is a "gravitational un-constant". In other words, the omitted variables in the regression could be correlated with the cost of trade variable. This correlation will cause a bias in the estimation of the trade costs and all of its determinants (Baldwin, 2006).

The gravitational un-constant can also be easily fixed by including time invariant nation dummies. According to Baldwin (2006), adding nation dummies eliminates most of the cross section bias in two steps. In the first step, the left hand variable is regressed on the time invariant nation dummies. In the second step, the residuals from the regression are then regressed on the right hand variables such as distance and the joint real GDP. In the first step, the gravitational un-constant will be completely removed, however, in the second step, some bias will still remain in the exchange rate regime dummy variable because of the omitted variables in bilateral trade.

Time invariant nation dummies may not be enough to eliminate the gravitational un-constant in the gravity model because in panel data, time series bias is not eliminated. Since panel data is used more frequently than cross section data, problems may still arise because the omitted variables have elements that may vary year to year. When this is not addressed and the gravitational un-constant is included, then only part of the bias will be eliminated. Since exchange rate regimes are not constant over time and are assumed to have an effect on bilateral trade, then the gravitational un-constant and the exchange rate regime dummy variable will be correlated.

A second approach to correct the gravitational un-constant problem is to include time invariant country pair dummies in the regression. But since the number of country pair dummies will equal the number of observations with cross section data, this method is not possible. With panel data, having country pair dummies is not necessary anyway, and the

method that will work is the classic fixed effects estimation. Most of the bias that stems from the correlation between the omitted and included variables will be eliminated.

Even though the gravity model is normally estimated where bilateral trade costs determinants often vary over time, using time variant nation and country pair dummies will not eliminate the bias. This is because those time varying determinants of bilateral trade are also not observable term (Baldwin, 2006).

Overall, the Gravity Model is an appropriate method to estimate how all of the trade determinants including the exchange rate regime affect trade flows between countries. In the following section, I will take about my model and the variables used.

## Section VI: Model

The OLS regression model used:

$$In(X_{ij}) = \beta_0 + \beta_1 In(Y_i Y_j)_t + \beta_2 In(Y_i Y_j / Pop_i Pop_j)_t + \beta_3 In(Dist_{ij}) + \beta_4(Comlang_{ij}) + \beta_5(Border_{ij}) + \beta_6(Regional_{ij})_t + \beta_7(Comcol_{ij}) + \beta_8(Colonial_{ij}) + \beta_9(SDD_{ij})_t + \beta_{10}(Fix\_float_{ij})_t + \beta_{11}(USA) + \beta_{12}(Japan) + \beta_{13}(75 - 90\ year\ dummies) + u_{ij}{}_t$$

Where:

With *i* and *j* denoting countries, *t* for time and:

- X*ij* is the value of bilateral trade
- Y*i*Y*j* is real GDP
- Y*i*Y*j*/Pop*i* Pop*j* is real GDP/capita
- Dist.*ij* is distance between countries
- Comlang*ij* is if there is a common language between countries
- Border*ij* if countries share a border
- Regional*ij* if countries share a trade agreement
- Comcol*ij* if countries share a common colony
- Colonial*ij* if country *i* colonized country *j* or vice versa
- sdd*ij* Exchange rate volatility
- Fix_float dummy for exchange rate regime
- USA and Japan are nation dummies
- Year dummies from 1975-1990

The data ranges from the years 1970-1990, which spans five different years (1970, 1975, 1980, 1985 and 1990) and includes 172 countries, territories and dependencies. Former communist countries were removed from the data set due to either a lack of data before 1990 or unreliable data. The variables for bilateral trade, real GDP, real GDP per capita, distance, common language, border, trade agreements, colonial ties and exchange rate volatility come

from Rose (2000). He collected the trade data from *World Trade Database*, *The Penn World Table* and data from the World Banks' *World Development Indicator* for real GDP per capita, and the remaining variables from the CIA World Fact Book. The trade agreements included in the *regional* dummy variable are EEC/EC; the Canada/US FTA; EFTA; the Australia/New Zealand closer economic relationship; the Israel/US FTA; ASEAN; CACM; PATCRA; CARICOM; SPARTECA; and Cartagena Agreement, which were all also obtained from the WTO.

The exchange rate volatility between countries *i* and *j* at time *t* was measured by estimating the standard deviation of the first difference of the monthly natural logarithm of the nominal bilateral exchange rate in the five years preceding time *t* (Rose, 2000).

Most information concerning the exchange rate regimes comes from the official de Jure classification that is published by the IMF in their *Annual Report on Exchange Rate Arrangements and Exchange Restrictions*. This study includes data on exchange rate regimes that was collected from Reinhart and Rogoff, (2002), because they also included a detailed history of the exchange rate regime from each country going back to 1970. I used a coarse classification system where either the country has a fixed or flexible regime even though there are some risks involved. Although there is a lot more diversity for exchange rate regimes in the real world, the reason for using such a coarse classification system is because using a too fine system is not practical for research. Many countries in the sample fall into the categories of a hard peg or float, whereas only a handful of countries would be considered an intermediate regime such as a crawling peg, target zone or a band.

De facto classification was used for the exchange rate regimes. Even though there are drawbacks, I decided to use this approach even though when countries trade with each other, they are doing so with the information that they immediately have. Using a de facto approach

emphasizes the actual behavior of each country and their commitment to the regime it has chosen.

Since de jure classification approach is the intentions of each country, one would expect that governments will do what they say they will do. Ghosh, Gulde and Wolf (2002) checked to see how much countries overlap with de jure and de facto classification. He found that the overlap between these two approaches is greatest with countries that used a fixed regime, but with flexible and intermediate regimes, the overlap is not as clear.

In this research I created an exchange rate regime dummy variable that I added to Rose's data set. When the country has a de facto fixed classification during a period, it received a 0 and a 1 when the country has a flexible classification. Then in Stata, I combined the two dummy variable to create the fix_float variable by giving a 0 when both countries in a country pair have fixed regimes and a 1 when a country in a country pair has a flexible regime or both countries have a flexible regime.

I also created two nation dummies in order to correct the gravitational un-constant, one for Japan and the USA. When one of the countries in a country pair are either Japan or the USA, they get 1 for the dummy variable, otherwise a 0 when neither country in a country pair contains either of these two countries. Japan and the USA were chosen as nation dummies because they are both large economies that do a great amount of trading with most of the world. Using a country with a smaller country would not have been as meaningful. In addition to the nation dummies, I added four time dummies (75, 80, 85 and 90) to correct the deflation mistake.

## Section VII: Empirical Results

To be able to determine the effect of the exchange rate regime on international trade, I start with a baseline model, which measure bilateral trade flows on the variables log of real GDP, log of real GDP per capita, common language, common colony, border, log of distance, regional trade agreement, exchange rate volatility, and if either country was colonized by the other, along with the time dummies. The first table presented is the results from this estimation without fixed effects.

**Table 7.1 Baseline Estimations without Fixed Effects**

| Variable | Coefficient (Standard errors) | t | P>\|t\| | | |
|---|---|---|---|---|---|
| Real GDP | 0.7961176 | 140.83 | 0.00 | Observations: 22,142 | $R^2$: 0.63 |
| | *-0.0056532* | | | | |
| Real GDP/Capita | 0.6620718 | 60.95 | 0.00 | | |
| | *0.0108624* | | | | |
| Common Language | 0.4215124 | 10.33 | 0.00 | | |
| | *0.0408139* | | | | |
| Common Colony | 0.6865874 | 13.22 | 0.00 | | |
| | *0.0519167* | | | | |
| Border | 0.4728639 | 5.00 | 0.00 | | |
| | *0.0945327* | | | | |
| Distance | -1.124007 | -57.58 | 0.00 | | |
| | *0.019521* | | | | |
| Regional | 1.110132 | 11.18 | 0.00 | | |
| | *0.0993288* | | | | |
| Exchange Rate Volatility | -0.0175529 | -7.68 | 0.00 | | |
| | *0.0022858* | | | | |
| Colonized | 2.264964 | 20.04 | 0.00 | | |
| | *0.1130405* | | | | |
| Year 75 | -0.1628176 | -3.62 | 0.00 | | |
| | *0.0450346* | | | | |
| Year 80 | -0.5421532 | -12.31 | 0.00 | | |
| | *0.0440343* | | | | |
| Year 85 | -1.279792 | -28.79 | 0.00 | | |
| | *0.0444541* | | | | |
| Year 90 | -1.441645 | -29.62 | 0.00 | | |
| | *0.0486716* | | | | |
| Constant | -18.85013 | -74.82 | 0.00 | | |
| | 0.2519257 | | | | |

The results from the first regression are not too surprising and are in line with traditional economic intuition. The variables that one would expect to increase trade such as sharing colonial ties, a common language, having a regional trade agreement and sharing a border all have significant positive coefficients. Higher GDP and higher GDP per capita also increase trade less than proportionately. Countries trade less when there is a greater distance between them as well as when there is more exchange rate volatility.

In the next estimation, I apply the country fixed effects using the same variables above and the results are presented in table 7.2.

**Table 7.2 Baseline Estimation with Fixed Effects**

| Variable | Coefficient (Standard errors) | t | P>\|t\| |
|---|---|---|---|
| Real GDP | 1.239457 | 13.61 | 0.00 |
| | *(0.0910799)* | | |
| Real GDP/Capita | -0.0580832 | -0.66 | 0.508 |
| | *(0.0877567)* | | |
| Regional Trade Agreement | 0.110164 | 0.89 | 0.375 |
| | *(0.124302)* | | |
| Exchange Rate Volatility | -0.0032668 | -1.74 | 0.082 |
| | *(0.0018771)* | | |
| Year 75 | -0.1769884 | -4.92 | 0.00 |
| | *(0.0360076)* | | |
| Year 80 | -0.5220563 | -9.82 | 0.00 |
| | *(0.0531878)* | | |
| Year 85 | -1.30965 | -19.42 | 0.00 |
| | *(0.0674294)* | | |
| Year 90 | -1.465122 | -17.07 | 0.00 |
| | *(0.0858252)* | | |
| Constant | -31.4281 | -16.26 | 0.00 |
| | *(1.932707)* | | |
| Observations: 22,142 | | | |

As with any fixed effects estimation, the time invariant variables are dropped out. Like in the previous estimation, real GDP has a positive coefficient and is highly significant, which still is a part of conventional wisdom that higher income countries trade more. Exchange rate volatility is still negative, but is highly insignificant.

One of the main differences between the estimation with and without fixed effects is that real GDP per capita variable has now a negative coefficient, although it is also highly insignificant. The variable for a regional trade agreement is still positive however it has become highly insignificant.

In the following estimations, I now add the dummy variable for the exchange rate regime to the model stated above, along with the two nation dummies to correct the gravitational un-constant. For each country pair, if at least one of the countries uses a fixed exchange rate, the dummy variable is assigned a 0. If at least one of the countries from the country pair uses a flexible exchange rate or both countries use a flexible exchange rate, then the dummy variable is assigned a 1. As for the nation dummies, if one of the countries in the country pair is either the USA or Japan, then that pair is assigned a 1, otherwise a 0. Table 7.3 displays the results for the full gravity model estimation and table 7.4 displays the same model, now with fixed effects.

**Table 7.3: Gravity Model Estimation**

| Variable | Coefficient (Standard errors) | t | P>\|t\| |
|---|---|---|---|
| Real GDP | 0.7743624 | 129.19 | 0.00 |
| | *(0.005994)* | | |
| Real GDP/Capita | 0.6455865 | 59.74 | 0.00 |
| | *(0.0108057)* | | |
| Common Language | 0.4122896 | 10.07 | 0.00 |
| | *(0.0409363)* | | |
| Common Colony | 0.6541829 | 12.71 | 0.00 |
| | *(0.0514891)* | | |
| Border | 0.4707122 | 5.02 | 0.00 |
| | *(0.0936756)* | | |
| Distance | -1.149175 | -58.97 | 0.00 |
| | *(0.0194867)* | | |
| Regional Trade Agreement | 1.090265 | 11.08 | 0.00 |
| | *(0.0984335)* | | |
| Exchange Rate Volatility | -0.0142429 | -6.18 | 0.00 |
| | *(0.0023032)* | | |
| Colonized | 2.372672 | 21.15 | 0.00 |
| | *(0.1121989)* | | |
| Fix_Float Dummy | -0.1147464 | -3.39 | 0.001 |
| | *(0.0338408)* | | |
| Japan Dummy | 1.587195 | 18.31 | 0.00 |
| | *(0.0866934)* | | |
| USA Dummy | 0.897812 | 10.21 | 0.00 |
| | *(0.087925)* | | |
| Year 75 | -0.118228 | -2.59 | 0.01 |
| | *(0.0455879)* | | |
| Year 80 | -0.4682952 | -10.17 | 0.00 |
| | *(0.0460526)* | | |
| Year 85 | -1.192292 | -25.06 | 0.00 |
| | *(0.0475798)* | | |
| Year 90 | -1.339678 | -25.58 | 0.00 |
| | *(0.0523626)* | | |
| Constant | -17.7201 | -66.43 | 0.00 |
| | *(0.2667606)* | | |
| Observations: 22,142 | $R^2$: 0.64 | | |

As with the baseline estimation without fixed effects, the full gravity model without fixed effects is also in line with conventional economic wisdom. All of the variables that one would expect to increase trade between two countries like a higher income and a higher income per capita, sharing colonial ties, sharing a regional trade agreement, sharing a common language and border all have positive, highly significant coefficients. The variables one would expect to decrease trade such as distance and exchange rate volatility both have negative and highly significant coefficients.

With this estimation, the variable of interest is the fix_float dummy, which is both negative and significant. This can be interpreted that countries with a floating exchange rate trade less with each other by 11 percent.

The following estimation is the full gravity model using fixed effects estimation. As I stated in Section V, the reason for using fixed effects is to eliminate the bias that stems from omitted variables that can affect bilateral trade. Those omitted variables may be represented in the error term could be unobserved political and/or institutional variables that are not accounted for in the gravity model, but are correlated with a country's decision to adopt a particular exchange rate regime (Qureshi and Tsangarides, 2010).

When variables that have an effect on a country's time invariant international trade resistance are omitted, it will lead to an inflation of the estimated effect of the reduction in trade due to national borders (Klein and Shambaugh, 2005). The best method to eliminate the bias, or the gravitational un-constant, is to use country fixed effects (CFE) in the gravity model estimation.

Theory predicts that with the CFE estimation, the border affects will be greatly reduced. However, the effects of an exchange rate regime will have an inflated estimate because the unobserved variables could be correlated with the error term of the gravity model and the probability that two countries have a fixed exchange rate.

For the purpose of estimating the effect that exchange rate regimes has on international trade, using country pair fixed effects (CPFE) will provide a better estimation even though it will automatically drop out any time invariant variables such as distance. This may be alarming since the gravity model measures the trade flows between two countries as being proportional to GDP and inversely proportional to the distance between them. However, the impact of the distance variable is still a part of the regression and is captured in the CPFE estimation (Klein and Shambaugh, 2005).

One cause for concern when estimating with the CPFE is that in a country pair both do not change their exchange rate regime for the entire sample period, then the estimations obtained will not provide very much information about the impact of the exchange rate on international trade. Most countries, however, have changed regime at some point in a long enough sample, so very few country pair observations are lost when estimating with CPFE (Klein and Shambaugh, 2005).

There could also be a simultaneity bias because a country's choice for an exchange rate regime may not be exogenous, but actually depend on the trade links between trading partners. When the exchange rate regime has large trade creating effects, this could be due to reverse causality. Most empirical studies from the past have ignored the possibility of reverse causality because of the difficulty in finding plausible instruments (Qureshi and Tsangarides, 2010). In table 7.4, the results for the CPFE estimation are presented.

**Table 7.4: Gravity Model Estimation with Fixed Effects**

| Variable | Coefficient (Standard errors) | t | P>\|t\| |
|---|---|---|---|
| Real GDP | 1.208964 | 13.23 | 0.00 |
| | *(0.0913608)* | | |
| Real GDP/Capita | -0.0239411 | -0.27 | 0.786 |
| | *(0.0881364)* | | |
| Regional Trade Agreement | 0.1123574 | 0.9 | 0.366 |
| | *(0.1242447)* | | |
| Exchange Rate Volatility | -0.0042602 | -2.25 | 0.024 |
| | *(0.0018929)* | | |
| Fix_Float Dummy | 0.1208567 | 3.97 | 0.00 |
| | *(0.0304557)* | | |
| Year 75 | -0.20984 | -5.68 | 0.00 |
| | *(0.0369305)* | | |
| Year 80 | -0.5735178 | -10.48 | 0.00 |
| | *(0.0547216)* | | |
| Year 85 | -1.367913 | -19.83 | 0.00 |
| | *(0.0689784)* | | |
| Year 90 | -1.52798 | -17.52 | 0.00 |
| | *(0.087235)* | | |
| Constant | -30.94381 | -15.99 | 0.00 |
| | *(1.935649)* | | |
| Observations: 22,142 | | | |

In comparison with the baseline fixed effects estimations of the gravity model, many of the results are not too surprising for the CPFE estimation. Real GDP is still positive and highly significant and the coefficient hardly changed, while real GDP per capita is still negative although the coefficient increased from -0.05 to -0.02, which is still insignificant. The variable for regional trade agreement did not change and is also still positive. Exchange rate volatility has actually decreased, from -0.003 to -0.004, although still insignificant in both fixed effects estimations.

The variable of interest in the gravity model is the fix_float dummy, which has changed the most dramatically between the estimation with the full gravity model and the

CPFE estimation. Without fixed effects estimation, the fix_float dummy has a negative coefficient, but with the CPFE estimation, it now has a positive coefficient and is highly significant.

Any endogeneity of the exchange rate regimes is normally addressed in the CPFE, which controls for the possibility that there are omitted variables that have an effect on the choice of exchange regimes as well as the amount of trade. When the exchange rate regime has large trade creating effects, this could be due to reverse causality. However, one could argue that bilateral trade may not respond to a change in the exchange rate regime, but instead the exchange rate regime responds to a predicted change in bilateral change (Klein and Shambaugh, 2005).

Countries with higher exchange rate volatility will trade less. But countries that trade extensively may have had an objective to lower the volatility in order to increase trade. A cause for a simultaneous bias may come from the fact that high exchange rate volatility should lower trade, but trading more should lower volatility (Rose, 2000).

In order to resolve the simultaneous bias is to use instrumental variables in the estimation. In the following two stage least squares regression, inflation is instrumented exchange rate volatility. According to Rose (2000), although inflation does not directly affect trade flow, it does have a direct effect on monetary relations. And since exchange rate regimes have an influence on inflation rate, which can impact international trade.

The inflation variable has been broken down to three parts: a) the product of two relevant inflation rates b) their sum and c) the absolute value of the difference between two inflation rates. Each part has been calculated over five year, proceeding the sample year (Rose, 2000). The results for the two stage least squares estimation is presented in tables 7.5 and 7.6.

**Table 7.5: Stage One Least Squares Estimation**

| Variable | Coefficient (Standard errors) | t | P>\|t\| | Variable | Coefficient (Standard errors) | t | P>\|t\| |
|---|---|---|---|---|---|---|---|
| Instrumental Variable | Inflation | | | Instrumental Variable | Inflation | | |
| Real GDP | 0.0124882 | 0.78 | 0.434 | USA Dummy | -1.246237 | -5.97 | 0.00 |
| | *(0.0159609)* | | | | *(0.2088202)* | | |
| Real GDP/Capita | -0.5272204 | 19.07 | 0.00 | Year 75 | -0.0306918 | -0.26 | 0.797 |
| | *(0.0276425)* | | | | *(0.1192514)* | | |
| Common Language | 0.3229208 | 3.23 | 0.001 | Year 80 | -0.2991824 | -2.46 | 0.014 |
| | *(0.1000614)* | | | | *(0.121471)* | | |
| Common Colony | -0.3269153 | -2.4 | 0.016 | Year 85 | 0.5023769 | 4.05 | 0.00 |
| | *(0.1360512)* | | | | *(0.1239383)* | | |
| Border | 0.0162008 | 0.07 | 0.947 | Year 90 | 1.795303 | 13.98 | 0.00 |
| | *(0.241486)* | | | | *(0.1284401)* | | |
| Distance | 0.3387657 | 7.05 | 0.00 | Inflation Difference | -0.0475543 | 20.03 | 0.00 |
| | *(0.0480728)* | | | | *(0.0023738)* | | |
| Regional | -0.4736259 | -2.01 | 0.044 | Inflation Product | -0.0000236 | 19.94 | 0.00 |
| | *(0.2354441)* | | | | *(1.18E-06)* | | |
| Colonized | -1.262613 | -4.54 | 0.00 | Inflation Sum | 0.066535 | 28.06 | 0.00 |
| | *(0.2779768)* | | | | *(0.0023713)* | | |
| Fix_Float Dummy | 1.753544 | 21.13 | 0.00 | Constant | 7.410821 | 10.48 | 0.00 |
| | *(0.0830045)* | | | | *(0.7069904)* | | |
| Japan Dummy | -0.5741414 | -2.81 | 0.005 | Observations: 16,470 | $R^2$=0.61 | | |
| | *(0.2046376)* | | | | | | |

**Table 7.6: Stage Two Least Squares Estimations**

| Variable | Coefficient (Standard errors) | t | P>\|t\| | Variable | Coefficient (Standard errors) | t | P>\|t\| |
|---|---|---|---|---|---|---|---|
| Instrumental Variable | Inflation | | | Instrumental Variable | Inflation | | |
| Exchange Rate Volatility | -0.0048258 | 1.52 | 0.13 | Fix_Float Dummy | -0.2386963 | -6.4 | 0.00 |
| | *(0.0031746)* | | | | *(0.0375317)* | | |
| Real GDP | 0.8379331 | 118 | 0.00 | Japan Dummy | 1.44271 | 15.9 | 0.00 |
| | *(0.0071064)* | | | | *(0.0910234)* | | |
| Real GDP/Capita | 0.722516 | 57.7 | 0.00 | USA Dummy | 0.7236004 | 7.78 | 0.00 |
| | *(0.0125287)* | | | | *(0.093062)* | | |
| Common Language | 0.3602978 | 8.08 | 0.00 | Year 75 | -0.0866859 | -1.7 | 0.1 |
| | *(0.0446103)* | | | | *(0.0525238)* | | |
| Common Colony | 0.6575998 | 10.8 | 0.00 | Year 80 | -0.4041378 | -7.6 | 0.00 |
| | *(0.060692)* | | | | *(0.0531531)* | | |
| Border | 0.2130911 | 1.99 | 0.05 | Year 85 | -1.101022 | -20 | 0.00 |
| | *(0.1073133)* | | | | *(0.0542556)* | | |
| Distance | -1.234731 | 57.5 | 0.00 | Year 90 | -1.288908 | -22 | 0.00 |
| | *(0.0214929)* | | | | *(0.0582799)* | | |
| Regional | 0.8235336 | 7.85 | 0.00 | Constant | -20.57441 | -65 | 0.00 |
| | *(0.1048902)* | | | | *(0.3164124)* | | |
| Colonized | 2.228974 | 18 | 0.00 | Observations: 16,470 | $R^2$=0.68 | | |
| | *(0.1240462)* | | | | | | |

We can see from the first stage of the estimation there is correlation between exchange rate volatility and inflation since the $R^2$ is 0.61. So it makes sense to use inflation as an instrumental variable for exchange rate volatility. After the second stage of the estimation is carried out, we can see that allowing for endogeneity of the exchange rate volatility does not change the results much from the full gravity model estimations. All of the variables that one would expect to increase international trade have positive coefficients and are highly significant like in the previous estimations. As usual, variables for distance and exchange rate volatility are still both negative and decrease trade.

The main variable of interest, the fix_float dummy however, has a highly significant negative coefficient and has gone from -0.11 in the full gravity model estimation to -0.24 with the instrumental variable estimation.

## Interpretations of the Results

In all of the estimations without fixed effects, the variables for colonial ties, common language, border and regional trade agreement has positive, highly significant coefficients, which can be interpreted that countries that share these characteristics, trade more with each other. Since the data set includes the post Bretton Woods Era from 1970-1990, many of the developing countries, such as those in the Caribbean and in Africa were still strongly connected to their colonizers. These colonizers still had the power to impose fixed exchange rate regimes and trade agreements on their colonies. Due to the "imperial preference", it is no surprise that low trade tariffs were associated with hard pegs and currency unions between countries with a colonial relationship (Adam and Cobham, 2006).

This could explain the difference in the results of the estimations for the fix_float dummy between the full gravity model and the fixed effects estimation. Countries trade less with each other when at least one of the countries in the pair has a floating exchange rate in the estimation without fixed effects. But since factors such as colonial ties are time invariant, they are automatically dropped from the fixed effects estimation. As a result, countries with floating exchange rates actually trade more.

The coefficient for distance has remained negative and highly significant in all of the estimations of gravity model. Of course it makes sense that the further away countries in a pair are from each other, they trade less due to transportation costs. One issue that may present a problem for analysis is that in Rose's (2000) data set, the distance variable is measured by the distance between the geographic centers between countries in the pair. A better measurement could be the distance between each country's biggest cities because it could be considered the center for economic gravity. This alternative measurement would make the most difference for countries whose biggest cities are not in the middle of the country, but rather near the shores, where goods can be easily delivered.

It is also worth mentioning that what is more important to bilateral trade is the distance between two countries relative to all other possible trading partners. As Adam and Cobham (2006) point out, there is a great distance between New Zealand and Australia, but there is an even greater distance between them and other industrialized countries.

Real GDP has also remained positive and highly significant throughout each of the estimations. Comparing the coefficients from the baseline model without fixed effects and the full gravity model without fixed effects, the coefficient for real GDP has decreased from 0.79 in the baseline model to 0.77 in the full gravity model. Even in the baseline fixed effects estimation and the full gravity model fixed effects estimation, the coefficient has decreased from 1.24 to 1.21. Although this makes sense since one would expect a higher income would increase trade less than proportionately.

As with real GDP, one would expect that a higher GDP per capita would increase trade less than proportionately as well. In both the baseline and full gravity estimations, the coefficients for real GDP per capita were positive and highly significant. However, in both fixed effects estimations, this coefficient was small but negative. When the fix_float dummy was introduced in the full gravity fixed effects estimation, the coefficient increased from -0.05 to -0.02. Although these results go against economic convention, the coefficients for both fixed effects estimations are very insignificant.

The impact of exchange rate volatility on international trade has been a controversial issue with mixed results. In the baseline estimation, the coefficient for exchange rate volatility is small at -0.02, while in the fixed effects estimation it has been reduced to -0.003 but is very insignificant. Exchange rate volatility in the full gravity estimation has a coefficient of -0.001, while -0.004 and also very insignificant in the fixed effects estimation, so it does not change much when the fix_float dummy is added to the equation. With the

instrumental variables estimation in the second stage, the coefficient for exchange rate volatility is -0.005 and still significant.

Flexible exchange rate regimes have been argued to increase volatility because rate can move abruptly, which as a result can lower trade flows. But the results I have obtained from my estimations shows that the impact of exchange rate volatility on trade flows, although negative and significant, is very small. In the fixed effect estimations, it is still negative and small, but also very insignificant.

Perhaps these results are because many of the countries in the sample used a fixed exchange rate regime and only a handful of industrial nations were using a flexible exchange rate regime. Therefore, fixed exchange rates may have an effect on something other than lowering volatility. As discussed in Section IV, fixed exchange rates can gain credibility by being able to maintain the parity. The certainty that is provided by a fixed exchange rate may help form trading relationships since fluctuations of volatility are not known by nations ahead of time. Even if countries have been able to maintain low exchange rate volatility over time, it may not help much to increase trade (Klein and Shambaugh, 2005).

The last, and most important variable to discuss in this paper, is the interpretation of the fix_float dummy variable. Flexible exchange rates seem to decrease trade in the full gravity model estimations, but increase trade in the fixed effects estimation. This could be because of "imperial preference" as mentioned before. Since in this data set, many of the developing countries were still connected to their colonizer, therefore trade more with each other than other countries. When those time invariant factors were dropped, flexible exchange rates seem to increase trade.

Perhaps some of the arguments against flexible regimes do not hold. For example, although fixed regimes are thought to have more fiscal discipline and therefore, more

credibility, it is not impossible it that flexible regimes can achieve them as well. As discussed in Section IV, discipline and credibility can be maintained in either regime.

Exchange rate volatility is often disputed whether it hampers international trade, when in most cases, firms are not so extremely risk adverse. In fact, they can use the ex ante exchange rate uncertainty to their advantage. Then there would be a lack of volatility from overall higher exports (Rose, 2000).

## Section VIII: Conclusion

An Exchange rate regime is an essential decision every country has to make and their decisions are based off of a variety of different economic and political reasons. Different exchange rate regimes can have different macroeconomic performance outcomes. Both regimes have been argued to increase bilateral trade for various reasons. Fixed exchange rate regimes are thought to lower volatility and inflation and provide a country with more discipline and credibility. In contrast, flexible regimes are argued to increase GDP growth more than fixed regimes and are able to provide a country with better shock absorption.

In this paper, I used the gravity model to estimate the impact of alternative exchange rate regimes on trade. A number of variables were used that could influence trade since a regime alone does not determine the amount of trade. Even after controlling for the possibility of there being unobserved omitted variables that could be correlated with the error term by using country pair fixed effects and controlling for endogeneity by using an instrumental variables estimation, I was able to show that many of the variables used in the gravity model that are thought to increase trade do so and that the exchange rate regimes has a significant impact on bilateral trade.

Fixed exchange rates seem to promote trade between countries more than flexible regimes. This could be due to the time of the sample. After the collapse of Bretton Woods, there was a lot of volatility due to the changing role of developing countries and having the currency pegged to a stronger anchor currency that can provide stability. Strong colonial ties could also result in an association between the hard pegged exchange rates and increased trade because of preferences in the sample as well. When all other variables are held constant, flexible exchange rates are shown to increase trade in my study. Some possible explanations could be that countries in the sample with a flexible exchange rate have been able to practice both monetary and fiscal discipline, therefore have gained credibility. Exchange rate

volatility may not be causing any substantial decreases in trade as argued in previous literature as it is possible for firms to gain from exchange rate uncertainty.

No one type of regime can work for all countries at all times and there are trade-offs between alternative exchange rate regimes. But one thing is certain, nations should carefully plan out their objectives and choose their exchange rate regime wisely. Their choice of regime will for sure have significant impacts on not only their own economy, but the world economy.

## Reference List


Adam, C. and Cobham, D., (2007), "Exchange Rate Regimes and Trade", Manchester School 75 (s1), 44-63.

Arize, A.C., Osang, T., Slottje, D.J., (2000), "Exchange-Rate Volatility and Foreign Trade: Evidence from Thirteen LDCs", Journal of Business & Economic Statistics 18, 10–17.

Bacchetta, Philippe, and Eric van Wincoop, (2000), "Does Exchange Rate Stability Increase Trade and Welfare?", American Economic Review, 90:5, 1093-1109

Baldwin, R. and Taglioni, D. (2006), "Gravity for Dummies and Dummies for Gravity Equations", NBER Working Paper 12516

Barro, Robert J. and David B. Gordon, (1983a", "A Positive Theory of Monetary Policy in a Natural Rate Model". Journal of Political Economy 91, August, 589-610.

Bordo, Michael D., (2003), "Exchange Rate Regime Choice in Historical Perspective," NBER Working Paper 9654 (Cambridge, Massachusetts: National Bureau of Economic Research).

Broda, C., (2000), "Terms of Trade and Exchange Rate Regimes in Developing Countries", Mimeo., MIT, Cambridge, MA Stanford: Hoover Institution Press.

Broda, C., (2000), "Coping with Terms of Trade Shocks: Pegs vs. Floats", American Economic Review 91 (2), 376–380.

Broda, Christian and John Romalis (2003), "Identifying the Relationship between Trade and Exchange Rate Volatility," mimeo, Federal Reserve Bank of New York and University of Chicago.

Calvo, Guillermo A. (1999b), "Fixed versus Flexible Exchange Rates: Preliminaries to a Turn-of-Millennium Rematch," www.bsos.umd.edu/econ/ciecalvo.htm/ .

Calvo, Guillermo, and Carmen Reinhart (2000), "Fear of Floating," NBER Working Paper No. 7993, (Cambridge, Massachusetts).

Dellas, Harris and Ben-Zion Zilberfarb,. (1993), "Real Exchange Rate Volatility and International Trade: A Reexamination of the Theory." Southern Economic Journal 59 (April): 641-7.

Edwards, S., (1993), "Exchange Rates as Nominal Anchors", Review of World Economics 129(l), l-32.

Edwards, Sebastian., (1996), "The Determinants of the Choice Between Fixed and Flexible Exchange-Rate Regimes". NBER Working Paper 5756. Cambridge, Mass.: NBER.

Edwards, Sebastian, and Eduardo Levy Yeyati., (2005), "Flexible Exchange Rates as Shock Absorbers". European Economic Review 49 (8): 2079–2105.

Ethier, W. (1973), "International Trade and the Forward Exchange Market", American Economic Review 63.

Fischer, S., (2001), "Exchange rate regimes: Is the Bipolar View Correct? "Distinguished Lecture on Economics in Government. Journal of Economic Perspectives 15 (2), 3–24.

Flood, Robert and Andrew Rose (1999), "Understanding Exchange Rate Volatility without the Contrivance of Macroeconomics", Economic Journal, 109 (November): F660-72.

Friedman, M., (1953), "The Case for Flexible Exchange Rates". In: Essays in Positive Economics. University of Chicago Press, Chicago.

Gagnon, Joseph E., (1993), "Exchange Rate Variability and the Level of International Trade."Journal of International Economics 34: 269-87.

Ghosh, Atish R., Anne-Marie Gulde, Jonathan D. Ostry, and Holger C. Wolf (1996), "Does the Exchange Rate Regime Matter for Inflation and Growth?" Washington, D.C.: International Monetary Fund.

Ghosh, Atish R., Anne-Marie Gulde, Jonathan D. Ostry, and Holger C. Wolf (1997). "Does the Nominal Exchange Rate Regime Matter?", NBER Working Paper 5874 (January).

Ghosh, Atish, Anne-Marie Gulde, and Holger C. Wolf, (2002), "Exchange Rate Regimes: Choices and Consequences" (Cambridge, Massachusetts: MIT Press).

Helpman, Elhanan., (1981). "An Exploration in the Theory of Exchange-Rate Regimes". Journal of Political Economy 89(5): 865-890.

Klein, M., and Shambaugh, J., (2004), "Fixed Exchange Rates and Trade", NBER working paper no. 10696.

Levy Yeyati, E., Sturzenegger, F., (2003), "To Float or to Fix: Evidence on the Impact of Exchange Rate Regimes on Growth". American Economic Review 93 (4), 1173–1193.

Levy-Yeyati, Eduardo and Federico Sturzenegger, (2005), "Deeds vs. Words: Classifying Exchange Rate Regimes." European Economic Review Volume 49, Issue 6, August, pp. 1603-1635.

Obstfeld, Maurice and Kenneth Rogoff, (1995), "The Mirage of Fixed Exchange Rates", *Journal of Economic Perspectives*, 9, 4 (Fall), 73-96.

Reinhart, Carmen M., and Kenneth S. Rogoff, (2004), "The Modern History of Exchange Rate Arrangements: A Reinterpretation". *Quarterly Journal of Economics* 119 (February): 1-48.

Rose, Andrew, "One Money, One Market: The Effect of Common Currencies on Trade," *Economic Policy: A European Forum*, April 2000, vol. 30, pp. 7-33.

Tornell,Aaron, and Andrés Velasco, (2000), “Fixed Versus Flexible Exchange Rates: Which Provides More Fiscal Discipline?” Journal of Monetary Economics, Vol. 45, (April), pp. 399–436.

## Appendix: List of Countries

| | | | |
|---|---|---|---|
| Antigua and Barbuda | Afghanistan | Anguilla | Algeria |
| American Samoa | Angola | Austria | Argentina |
| Aruba | Australia | Barbados | Bahamas |
| Belize | Bangladesh | Bermuda | Belgium/Luxembourg |
| Bolivia | Benin | Brit.Ind.Oc.Terr. | Bhutan |
| Brunei Darussalam | Brazil | Burkina Faso | Brit. Virgin Islands |
| C.A.R. | Cameroon | Canada | Burundi |
| Colombia | Chad | Chile | Cayman Islands |
| Costa Rica | Comoros | Congo | China |
| Denmark | Cuba | Cyprus | Cook Islands |
| Ecuador | Djibouti | Dominica | Dominican Republic |
| Ethiopia | Egypt | El Salvador | Finland |
| Fr. Guiana | Falkland Islands | Fiji | Gambia |
| Guam | Germany (West) | Ghana | Guadeloupe |
| Greece | France | Gabon | Gibraltar |
| Hungary | Greenland | Grenada | Guinea-Bissau |
| Iran | Guatemala | Guinea | Hong Kong |
| Italy | Haiti | Honduras | Indonesia |
| Jordon | Iceland | India | Israel |
| Kuwait | Iraq | Ireland | Japan |
| Libya | Ivory Coast | Jamaica | Korea Republic |
| Maldives | Kenya | Kiribati | Liberia |
| Mauritania | Laos | Lebanon | Malaysia |
| Montserrat | Madagascar | Malawi | Martinique |
| North Korea | Mali | Malta | Myanmar |
| Netherland Antilles | Mauritius | Mexico | Netherlands |
| Niger | Morocco | Nepal | Nicaragua |
| Oman | Nauru | New Zealand | Norway |
| Papua New Guinea | New Caledonia | Niue | Panama |
| Romania | Nigeria | Pakistan | Philippines |
| Senegal | Pacific Islands | Peru | Reunion |
| Solomon Islands | Paraguay | Qatar | Saudi Arabia |
| Spain | Portugal | Sierra Leone | Singapore |
| Sweden | Seychelles | St. Helena | St. Kitts & Nevis |
| St.Lucia | Rwanda | South Africa | St. Pierre & Miquelon |
| Tanzania | Somalia | Sudan | Suriname |
| Trinidad and Tobago | Sri Lanka | Syria | Taiwan |
| Tuvalu | St. Vinc. & Grenadines | Togo | Tonga |
| Uganda | Switzerland | Turkey | Turks & Caicos Islands |
| Venezuela | Thailand | USA | US Virgin Islands |
| Zambia | Tunisia | Uruguay | Western Sahara |
| | United Kingdom | | Zaire |

## Abstract

Exchange rate regimes have been an important topic since the collapse of the Bretton Woods System in the 1970's. Since then, there is a wide variety of possible regimes from fixed to a flexible regime, all with their own benefits and drawbacks. Flexible exchange rate regimes have been argued to decrease bilateral trade because of the associated volatility. This paper discusses each of the exchange rate regimes, and the arguments for and against them.

Following the discussion of the regimes, this paper introduces the Gravity Model, which is used to estimate how much of an influence the exchange rate regime has on bilateral trade. Problems that arise with the Gravity Model such as the incorrect time deflation and the gravitational un-constant are discussed and how they are addressed in the paper.

A baseline regression is run without the exchange rate regime dummy variable so that the results can be compared to the main regression that includes the exchange rate regime dummy variable. In order to account for the gravitational un-constant, fixed effects estimations is applied to the model.

Exchange rate volatility is thought to lower bilateral trade. However, countries that trade extensively may have had an objective to lower the volatility in order to increase trade. A cause for a simultaneous bias may come from the fact that high exchange rate volatility should lower trade, but trading more should lower volatility. Instrumental variables estimation is used to solve the simultaneous bias problem.

Exchange rate regimes are found to have a large influence on bilateral trade. Countries with fixed regimes seem to trade more than countries with flexible regimes.

**Zusammenfassung**

Das Wechselkursregime waren ein wichtiges Thema seit dem Zusammenbruch des Bretton-Woods-System in den 1970er Jahren. Seitdem gibt es zahlreiche möglichen Regimes von festen zu einem flexiblen Regime, alle mit ihren eigenen Vor-und Nachteile. Flexible Wechselkursregime sind argumentiert, dass sie den bilateralen Handel verringern wegen der damit verbundenen Volatilität. Diese Forschungsarbeit diskutiert jeden der Wechselkursregime, und die Argumente für und gegen sie. Nach der Diskussion der Regime, diese Forschungsarbeit führt die Gravity-Modell ein. Dieses Modell schätze ab, wie viel Einfluss das Wechselkursregime auf den bilateralen Handel hat. Probleme, die mit dem Gravity-Modell wie die falsche Jährliche Deflation und der Gravitational Un-constant entstehen, werden besprochen und wie sie in der Forschungsarbeit gerichtet. Eine Grundlinie Regression wird gemacht, ohne das Wechselkursregime Dummy-Variable, damit die Ergebnisse der Haupt-Regression mit dem Wechselkurssystem Dummy-Variable verglichen werden kann. wegen der Gravitational Un-constant, fixe Effekte wurden auf das Modell angewendet.

Die Volatilität der Wechselkurse wird gedacht, dass sie den bilateralen Handel verringert. Länder, die viel untereinander handeln, wollen die Volatilität zu senken, um den Handel zu erhöhen. Simultane Bias kann entstehen, weil eine hohe Volatilität des Wechselkurses Handel senken sollte, aber mehr Handel sollte die Volatilität zu senken. Instrumental Variable Schätzung wird benutzt, um die Simultane Bias Problem zu lösen.

Das Wechselkursregime hat einen großen Einfluss auf den bilateralen Handel. Länder mit festen Regimen handeln mehr als Länder mit flexiblen Regimen.

## Lebenslauf

Ashley Curtin attended George Mason University in Fairfax Virginia, USA from 2003 until 2008. After receiving a Bachelor of Arts in Economics, she moved to Vienna, Austria in 2008 to peruse a Master's Degree in Volkswirtschaftslehre (Economics). Her topics of interest are international economics and finance economics.

Ashley would like to thank her Supervisor Alejandro Cuñat and all her professors for guidance during her time spent at the University of Vienna.

She would also like to thank her Grandparents, Jack and Evelyn, her parents, Chris and Kim, and Olivia for all of their support over the years.