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THE MONEY SUPPLY IN CURRENCY BOARDS

Currency Board Working Paper

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Global Health, and Study of Business Enterprise

The Money Supply in Currency Boards

By Nicholas Krus[1]

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About the series

The *Studies in Applied Economics* series is under the general direction of Prof. Steve H. Hanke, Co-Director of the Institute for Applied Economics, Global Health and Study of Business Enterprise (hanke@jhu.edu).

This working paper is one in a series on currency boards. The currency board working papers will fill gaps in the history, statistics, and scholarship of the subject. The authors are mainly students at The Johns Hopkins University in Baltimore. Some performed their work as research assistants at the Institute.

About the author

Nicholas Krus (nkrus1@jhu.edu) is a research associate at the Institute. He recently graduated Phi Beta Kappa from The Johns Hopkins University with a B.A. (Hons) in Economics and Mathematics. Mr. Krus was a recipient of the Bela Balassa Dean's Undergraduate Research Award for his work on currency boards and was both a BB&T and a Patel Scholar. This paper originally served as a senior thesis under the direction of Prof. Caroline Fohlin, Prof. Steve H. Hanke, and Dr. Kurt Schuler for partial fulfillment of the requirements of Honors in Economics.

Abstract

How does a currency board obtain monetary equilibrium? This paper provides an in-depth analysis of the money supply in currency boards in order to review their monetary stability. After many years of neglect by economists and policymakers, currency boards enjoyed a revival in the 1990s. Although no new currency boards have been established since 1997, economists continue to consider them from time to time as a possibility for monetary reform in some countries. This paper hypothesizes that there are certain circumstances under which a currency board maintains monetary equilibrium while an unorthodox currency board may not. By taking a balance sheet model approach, one can make more definitive conclusions about the workings and efficacy of various currency boards.

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Table of Contents

I. Introduction

Past research on currency boards has used either specific case studies or data from electronic databases to describe how a currency board's money supply should operate. Some of this research has shown that, theoretically, a currency board provides an automatic stabilization of the money supply. The theoretical framework developed by Chwee-huay Ow (1985) provided for the first time a comprehensive model of how a currency board's money supply operates. This paper expands on a model presented by Hanke, Jonung, and Schuler (1993), utilizing some of Ow's contributions, to show that deviations from orthodoxy can result in monetary disequilibrium, and gives some evidence that orthodox currency boards may maintain monetary equilibrium while unorthodox ones may not. This paper begins by reviewing the definition of currency boards and by presenting the current theory developed in the literature.

II. Currency Boards

A currency board is an institution that issues currency that is freely convertible, at a fixed rate, into an external reserve asset. A currency board must hold external reserves equal to 100 percent of the currency board's currency in circulation (Schuler 1992). From the standpoint of monetary theory, however, a currency board must hold 100 percent foreign reserve ratio at the margin – not necessarily 100 percent total reserves. This results from the fact that a currency board cannot independently influence the money supply and cannot engage in any type of discretionary monetary policy. This means that at the margin, a currency board must hold only foreign reserves and no domestic reserves. In practice, most currency boards have held 100 percent foreign reserves against all monetary liabilities in order to improve the commitment to full convertibility of the currency.

A currency board is an alternative to a central bank and usually has a monopoly on the issuance of currency. A country operating a currency board not only has a transparent, fixed exchange rate, but also is free from balance-of-payment problems and speculative attacks (Hanke 2002a). It is essentially the same as dollarization, with the exception of having a "middle agent" – the currency board – which gains seigniorage equivalent to the nominal interest rate earned, minus the operating costs of the currency board. In addition to having a constant fixed exchange rate, the currency board must have no restrictions on the convertibility into or out of the anchor currency. This results in a domestic currency whose quantity is determined solely by market forces (Walters and Hanke 1992).

An "orthodox currency board" has three fundamental characteristics: 100 percent foreign reserves at the margin, a constant fixed exchange rate, and complete convertibility. Other features, described later, make certain that a currency board does not engage in discretionary monetary policy, which would compromise the fixed exchange rate.

i. Features of a Currency Board

A currency board is a monetary authority that maintains a fixed exchange rate

with an anchor currency. Unlike a monetary authority utilizing a pegged exchange rate, a currency board does not engage in any type of discretionary monetary policy. Thus, changes in quantity of money in circulation, under a currency board, are strictly determined by changes in the demand for money. Market forces, therefore, determine the quantity of money in circulation. The currency board simply offers to supply, at a fixed exchange rate, any quantity of money that is demanded (Hanke 2002a). In order to maintain commitment to the fixed exchange rate and provide credibility to its link, the currency board must adhere to strict requirements. The table below from Hanke & Schuler (1994) provides a clear outline of how a currency board differs from a typical central bank.

A typical currency board versus a typical central bank	
Typical currency board	Typical central bank
Usually supplies notes and coins only	Supplies notes, coins, and deposits
Fixed exchange rate with reserve currency	Pegged or floating exchange rate
Foreign reserves of 100 percent	Variable foreign reserves
Full convertibility	Limited convertibility
Rule-bound monetary policy	Discretionary monetary policy
Not a lender of last resort	Lender of last resort
Does not regulate commercial banks	Often regulates commercial banks
Transparent	Opaque
Protected from political pressure	Politicized
High credibility	Low credibility
Earns seigniorage only from interest	Earns seigniorage from interest and inflation
Cannot create inflation	Can create inflation
Cannot finance spending by domestic government	Can finance spending by domestic government
Requires no "preconditions" for monetary reform	Requires "preconditions" for monetary reform
Rapid monetary reform	Slow monetary reform
Small staff	Large staff
Note: The characteristics listed are those of a typical actual currency board or central bank, especially one in a developing country, not those of a theoretically ideal or exceptionally good currency board or central bank. *Source: Hanke and Schuler (1994), p. 4*	

In relation to money supply, the currency board's most important characteristics listed above are its rule-bound monetary policy, its inability to finance spending for the domestic government, its status as a non-lender of last resort, its lack of regulation over the banking system, and its foreign reserves of 100 percent. These characteristics prevent

the currency board from creating inflation and ensure a credible link to the anchor currency.

As shown by Wolf et al. (2008), there are potential incentives for abandoning a fixed exchange rate. One such incentive is to devalue the currency in order to counteract negative productivity shocks. Other short-term incentives include higher seigniorage by investing in riskier domestic assets and the prospect of obtaining a lender of last resort in times of crisis. Consequently, skepticism regarding the credibility of the fixed exchange rate can result in speculative attacks on the currency in question. Only if the political and economic costs of abandoning the peg are greater than the benefits of maintaining the exchange rate will a currency board be credible in its commitment to the exchange rate. This commitment is obtainable by protecting the currency board from political pressure (since most political systems have higher benefits for short term growth relative to the long term), providing a transparent operational system, having no lender of last resort, and providing strict laws against the financing of the domestic government. It is also important to provide confidence in the currency by maintaining 100 percent foreign reserves for the currency in issue.

ii. Differences Between a Pegged Exchange Rate and a Fixed Exchange Rate

The fundamental difference between a pegged exchange rate and a fixed one resides in the incentives and consequences of deviating from the proposed exchange rate. A fixed-exchange-rate regime is characterized by a credible commitment to maintain the proposed exchange rate. And, the record supports this – countries with currency boards have held constant exchange rates throughout the existence of the currency board. A pegged-exchange-rate regime, on the other hand, is characterized by a lack of commitment to its exchange rate and typically some exchange-rate variability (Hanke 2008). This causes doubts about whether the central bank will actually defend the exchange rate by raising interest rates when required. Thus, a monetary authority that operates under a pegged exchange rate is closer to one that operates a floating exchange rate than to one with a fixed rate. This is due to the fact that a pegged-exchange-rate regime may engage in any type of monetary policy and revalue its currency accordingly.

This fundamental difference creates uncertainty about the durability of the exchange rate by creating expectations for the future exchange rate to potentially differ from the current one. This is very similar to a floating exchange rate with an inflation target, in which the country engages in any type of monetary policy and can change its target at its discretion. Unlike these regimes, a currency board cannot engage in any monetary policy and must maintain an exchange rate to be defined as such. Hence, there are only two monetary regimes that can be classified as having a fixed exchange rate: dollarization and currency boards (Hanke 2008). It must be noted that a currency board is defined by its commitment to the exchange rate and *not* by how long the exchange rate is upheld. Even if a currency board maintains a fixed exchange rate for a short period of time, it is still a currency board if it satisfies the specific criteria for being one. Likewise, if a pegged-exchange-rate regime maintains a constant exchange rate for a long period of time, it would not be classified as a currency board if it engaged in any type of

discretionary monetary policy. In other words, a currency board must have—but is not solely defined by—a constant exchange rate.

III. Money Supply

This section presents the current theory of money supply in regards to currency boards. By understanding the theory of money supply, one can ultimately begin to understand how the practices of an unorthodox currency board can lead to monetary disequilibrium. One crucial tenet of currency boards must be kept in mind throughout the rest of this paper:

An orthodox currency board has no discretionary monetary policy.

i. Basic IS/LM Interpretation

Under a fixed exchange rate, there are two ways in which governments can influence the IS/LM curves: fiscal and monetary policy. Fiscal policy will shift the IS curve followed by an automatic shift of the LM curve in the same direction. Due to the simplicity of the model, however, monetary policy will have no lasting effects on the money supply.

Expansionary fiscal policy will shift the IS curve to the right, which in turn places upward pressure on the exchange rate. Because the monetary authority is committed to exchange any amount of domestic currency for the anchor currency on demand, arbitrageurs quickly react to the rising exchange rate by exchanging the anchor currency for domestic currency, leading to an automatic monetary expansion (Mankiw 2006). This, in turn, shifts the LM curve to the right, resulting in a constant exchange rate and higher output.

Monetary policy, however, has no effect on the IS/LM curves. If the monetary authority decides to engage in expansionary monetary policy in order to stimulate the economy and increase the money supply, an increase in the LM curve is expected. Since the monetary authority is committed to exchanging domestic currency for the anchor currency at a fixed exchange rate, arbitrageurs quickly react to the falling exchange rate by exchanging the domestic currency for foreign currency. This shifts the LM curve back to its initial position with no net change in the money supply (Mankiw 2006). A currency board must abandon monetary policy in order to achieve greater stability in the exchange rate and, by extension, inflation.

It must be kept in mind that this model assumes no capital controls and that these results may only hold in the medium-to-long run. There may be a monetary disequilibrium caused by monetary or fiscal policy that is not immediately corrected by arbitragers in the short run. For this reason, this model is not chosen for the purpose of the paper. Instead, the balance sheet model presented below is utilized.

ii. The Balance Sheet Model

The most direct way of understanding the workings of a currency board is through the analysis of its balance sheets. In the 1980s, John Greenwood (1981 & 1983) developed a rudimentary model of the money supply through the use of balance sheets.

A take on this model is provided by Hanke and Schuler (1994), who make the following simplifying assumptions:

1. Commercial banks convert domestic currency for anchor currency at a fixed rate.
2. The currency board is the only domestic issuer of notes and coins.
3. Commercial banks' ratio of reserves to deposits is constant.
4. The public's ratio of domestic currency to commercial bank deposits is constant.
5. Income and the money supply move in the same direction.
6. There is no international branch banking between the currency board country and the reserve country.
7. Changes in the balance of payments occur only in the current account; the capital account does not change.
8. No binding minimum reserve ratios or other special bank regulations exist.
9. People do not hold reserve currency or use the reserve currency in domestic transactions.

By making these assumptions, the following model of a currency board was created (Hanke and Schuler 1994).

Figure 3.1. Balance sheets

Currency board

Assets	Liabilities
Foreign reserves	Notes in circulation Deposits of commercial banks (optional) Net worth

Commercial banks

Assets	Liabilities
Currency board notes (reserves) Loans to public	Deposits of public Net worth

Public

Assets	Liabilities
Currency board notes Bank deposits	Bank loans Net worth

Monetary base = notes in circulation in currency board's balance sheet
Money supply = currency board notes + bank deposits in public's balance sheet
Commercial banks' ratio of reserves to deposits = currency board notes ÷ deposits of public in commercial banks' balance sheet
Public's ratio of currency to deposits = currency board notes ÷ bank deposits in public's balance sheet
Source: Hanke and Schuler (1994), pp. 31-32

One can see the self-adjusting nature of the system by analyzing how disturbances created by changes in the current account initially create disequilibrium, but are automatically corrected and relevant markets clear. A list of stages depicting the transition from one equilibrium to the next demonstrates this self-correction. (Hanke and Schuler 1994).

Stage 1: Initial monetary equilibrium and relevant markets clear.
Stage 2: Demand for imports decrease or demand for exports increase.
Stage 3: Current-account surplus.
Stage 4: Commercial banks increase their reserves followed by an issuance of loans.
Stage 5: Interest rates decrease causing income to increase.
Stage 6: Demand for all goods increase causing an increase in the prices of domestic goods.
Stage 7: Demand for imports increase or demand for exports decrease.
Stage 8: Return to monetary equilibrium and relevant markets clear.

This model shows that in the in the case of a current account surplus, efforts by banks to retain their desired deposit-to-reserve ratio and efforts by the public to retain its desired ratio of currency to deposits will reduce the money supply and move the currency board system to a new equilibrium. It is arbitrage—not discretionary action—that holds the key to changes in the money supply.

This model, however easy to understand, does not include some important features of the money supply in currency boards first pioneered by Chwee-huay Ow (1985). Ow's model includes many advances in regards to currency boards; its two greatest contributions are its relaxation of the assumption that banks maintain fixed reserve ratios and the notion that non-bank public maintains fixed currency deposit ratios. The model presented in this paper relaxes some of these assumptions as well.

IV. The Model

The model presented in this section is an updated and more detailed version first presented by Hanke, Jonung, and Schuler (1993). This paper uses the balance sheet model in order to give a clear and detailed view of exactly how a variety of factors can influence the money supply. A thorough explanation of the balance sheet is first presented along with an objective function or goal. This framework is then used to make predictions about how the actors react to different scenarios. Some of these scenarios are then tested empirically when data permits.

Currency board

Assets	*Liabilities and Net Worth*
Foreign assets*	Currency***
--Gold and silver	Deposits***
--Foreign securities	Bonds**
--Foreign currency	Net worth
Domestic assets	
--Government bonds**	
--Bank deposits**	
--Securities of private sector**	

**-Foreign currency is a liquid asset that can be converted to the anchor currency on demand at par. -Gold, silver and foreign securities are both semi-liquid assets for the currency board that can be converted to the anchor currency on short demand.*

***Typically zero or near zero for an orthodox currency board, but unorthodox boards may have them in order to conduct central baking-style operations.*

****Part of the monetary base. Deposits mean demand deposits.*

Goal: Maintain 100 percent foreign reserves and full convertibility of the currency at the fixed exchange rate. The asset side of the balance sheet should only consist of foreign assets. The currency board tries to maximize profit subject to a low tolerance for risk. In this model, this means that there is a very small chance of falling below 100 percent backing of the currency. This acceptable amount of variance is denoted as "v". Therefore, it is assumed that the currency board holds investments that have a return similar to United States or United Kingdom treasuries and maximize the expected return of their portfolio for the given level of variance "v".

Balance Sheet Equation:

$$FA = GS + FS + FC = C + D + NW = FL + NW$$

- FA = foreign assets
- GS = gold and silver
- FS = foreign securities
- FC = foreign currency
- C = currency
- D = deposits
- NW = net worth
- FL = foreign liabilities

Objective Functions:

$$\text{Expected Return} = ER_{GS} * w_{GS} + ER_{FS} * w_{FS} + ER_{FC} * w_F$$

$$\text{Variance} = (w_{GS}{}^2)(o_{GS}{}^2) + (w_{FS}{}^2)(o_{FS}{}^2) + (w_{FC}{}^2)(o_{FC}{}^2) + 2(w_{GS})(w_{FS})(o_{GS})(o_{FS})(\text{Covariance}_{GS,FS}) + 2(w_{GS})(w_{FC})(o_{GS})(o_{FC})(\text{Covariance}_{GS,FC}) 2(w_{GS})(w_{FC}) + (o_{FS})(o_{Fc})(\text{Covariance}_{FS,FC})$$

- ER_x = expected return of a given asset
- w_x = weight of portfolio in a given asset
- o_x = variance of a given asset

Banks (financial sector other than currency board)

Assets	*Liabilities and Net Worth*
Reserves*	Own currency issued***
--Currency board currency in vault	Deposits
--Deposits at currency board	Bonds issued****
Government bonds	Taxes owed*****
Loans to public	Owed to other banks
Securities of public	Net worth
Due from other banks	
Foreign assets**	

Note: Initial capital is fixed while additional capital can be raised from issuance of securities.
**An advantage of very liquid assets like currency and deposits is that they provide liquidity for interbank lending. They also enable the banks to avoid paying high interest rates in case emergency funding is needed to prevent bankruptcy. Therefore, holding currency and deposits has a positive expected return that is derived from the chance of being used in interbank lending and from avoiding emergency lending and bankruptcy.*
***It is assumed that foreign assets would be held in order to diversify a portfolio and would not be used for any other purpose except for maximizing risk and return (they would have no incentive to sterilize the currency in any sense).*
****Rare: there have been some historical cases where banks issued currency alongside currency boards. Usually, banks were restricted to issuing only in the higher denominations.*
*****Bonds issued and currency issued could be seen as leverage for the portfolio.*
******Taxes owed are seen as an exogenous variable.*

Goal: First, a bank must be able to prevent runs. Therefore, since an orthodox currency board does not impose reserve requirements, the bank should operate as described by Selgin (1988) – the amount of bank clearings will be held in relation to the frequency and size of withdrawals or payments. One therefore can assume that banks maximize profits subject to risk/return calculations that recognize that a certain amount of reserves must be held for bank clearings.

Simplified Balance Sheet Equation[2]:

$$R + L = C + D + K$$

- R = reserves
- L = loans & securities
- C = currency in circulation
- D = deposits
- K = equity capital

Objective Functions[3]:

$$\text{Expected Return} = ((ER_L)(w_L) + (ER_R)(w_R))\ ((C+D+K)/K)$$

$$\text{Variance} = (w_L{}^2)(o_L{}^2) + (w_R{}^2)(o_R{}^2) + 2(w_L)(w_R)(o_L)(o_R)(\text{Covariance}_{L,R})$$

[2] This equation is used by White (1999).
[3] For the banking system as a whole, competition implies that profits tend to be driven toward zero.
Expected Profit = 0 = Expected Return – Normal Operating Costs – Expected Taxes

Government

Assets	*Liabilities and Net Worth*
Tax & Bond Revenue (in the form of currency) Domestic assets Foreign assets	Bonds issued Net worth

Goal: The government issues taxes if there is a reason for the government to invest or spend on behalf of the people. Therefore, the government collects an exogenous amount of taxes and uses them for public spending. A separate portion of taxes is then collected during booms and is cut during recessions in accordance with fiscal policy. Similarly, during recessions, bonds are issued and repaid during booms. If there is an accumulation of excess taxes due to a period of prolonged booms, assets are accumulated by the government. It should also be noted that since the currency board is unable to buy government securities, the government has less incentive to run a large fiscal deficit because the monetary authority will not be able to bail it out. This point is further analyzed is section VI.

Balance Sheet Equation:

$$TBR + DA + FA = GB + NW$$

- TBR = tax and bond Revenue
- DA = domestic assets
- FA = foreign assets
- GB = bonds issued
- NW = net worth

Objective Functions[4]:

$$\text{Expected Return} = (ER_{DA})(w_{DA}) + (ER_{FA})(w_{FA})$$

$$\text{Variance} = (w_{DA}^{\ 2})(o_{DA}^{\ 2}) + (w_{FA}^{\ 2})(o_{FA}^{\ 2}) + 2(w_{DA})(w_{FA})(o_{DA})(o_{FA})(\text{Covariance}_{DA,FA})$$

[4] This function is used when excess taxes have been accumulated during a prolonged boom.

Public (businesses and households)

Assets	*Liabilities and Net Worth*
Currency board currency	Bank loans*
Bank deposits	Bonds issued by firms**
Bank securities	Taxes owed***
Firms' securities held	Foreign liabilities
Government Bonds	Net worth****
Foreign assets	

**Bank loans are predominantly to households and bonds are issued only by businesses. By being able to issue bonds, businesses can borrow directly from foreigners. -Bank loans and securities issued by firms along with foreign liabilities are treated the same way that banks treat them in optimizing their portfolio.*
****Taxes are exogenous.*
*****Initial net worth is exogenous and is predetermined by factors outside of the model.*

Goal: To maximize expected utility. Individuals hold liquid assets and illiquid assets using the above below. Under this model, the rate of return on capital exceeds that of fiat money (due to a liquidity premium) and fiat money is exchanged more often than capital. Fiat money is therefore held in the short tem and capital in the long term.

Liquid assets are composed of currency, banks deposits, and liquid securities. The optimal portfolio is calculated using standard risk/return evaluation. Illiquid assets are composed of foreign assets and illiquid domestic securities. The optimal portfolio is determined the same way as the liquid portion. It should be noted that foreign assets are liquid for the currency board, but illiquid for the public due to factors of size and convenience. Since the currency board deals in larger trades that are common in international financial markets, the currency board is assumed to have lower costs associated with trading. For convenience reasons, the public uses domestic currency for domestic transactions, causing a higher liquidity premium for foreign assets.

Simplified Balance Sheet Equation[5]:

$$c_{1,\,t} + (v_t / v_{t+1})(c_{2,\,t+1}) + (1/X)(c_{3,\,t+2}) \geq y$$

- $c_{x,\,t}$ = consumption in the x period of life by an individual born in period *t*
- v_t = value of one unit of fiat money
- v_t / v_{t+1} = the real rate of return of fiat money
- $1/X$ = the rate of return of capital over two periods
- y = initial value of endowment
- t = current time period
- t+1 = second time period in which liquidity is needed for purchases
- t+2 = third time period in which illiquid assets can be liquidated

[5] Base on the lifetime budget constraint developed by Champ and Freemen (2001).

Foreigners (The Rest of the World)

Assets	*Liabilities and Net Worth*
Assets in Domestic Country --Currency board currency --Bank deposits --Bank Securities --Firm's Securities --Government Bonds Assets in Foreign Countries	Liabilities to Domestic Country Liabilities to Foreign Countries Net Worth

Foreigners act the same as the public, but they have a simplified balance sheet since this model only considers their interactions with the domestic country.

V. How to Maintain Monetary Equilibrium

Using the balance sheets constructed above, a variety of scenarios can be constructed to show how a currency board automatically adjusts to maintain monetary equilibrium.

i. The Balance of Payments

a. Change in the Demand for Imports

First, consider the case of an increase in the demand for imports. Initially, assume that the currency board monetary system is in equilibrium. Now, preferences of consumers change and domestic goods and services are in greater demand than are foreign goods and services. This causes a current account surplus, as the country now exports more goods and demands less foreign goods. In order for the foreigners to purchase the domestic goods, foreign anchor currency will be exchanged for domestic money through the currency board. However, in practice this exchange is typically conducted through banks, which act as middlemen, exchanging foreign assets for currency at the currency board and then giving the currency to customers in the form of cash withdrawals from deposits. This is seen on the balance sheet of the currency board as an increase in foreign assets by an arbitrary amount of X and an equal increase in liabilities by X in the form of domestic currency.

This currency is now given to the public (businesses) in exchange for domestic goods. All else equal, by following the lifetime budget constraint, the public will want to invest a portion of this money in illiquid assets (t+2), a portion in liquid assets (t+1), and a portion in current consumption (t). The portion for current consumption will be spent by the public and then partitioned by each transacting member of the public. We can also conclude that a portion will be put into foreign assets, but for reasons of simplicity, we can make the initial amount X equal to the increase in demand for domestic goods from foreigners, accounting for the resulting increase in demand for foreign goods from actors in the domestic economy. Therefore, we can conclude that on net, a portion will ultimately be put into illiquid assets and a portion into liquid assets.

The portion in liquid assets will be held as currency or bank deposits. This illiquid portion will be saved in a diversified portfolio of assets including bank securities. For simplicity, we also assume that individuals are taxed only when they sell assets and not when they obtain liabilities. The illiquid portion that is put into bank securities and the liquid assets that are placed into bank deposits will change the reserve ratio of the banks. Since the public now has more money invested in a bank on a per person basis, the average size of future withdrawals is expected to increase. Therefore, by the square-root law of precautionary reserve demand, the total reserves will not increase proportionately, since by of the law of large numbers, withdrawals become more concentrated at the center of the distribution, causing the variance to increase less than the increase in the scale of clearings (Seglin 1988). Therefore, we expect a slight decrease in the reserve ratio of banks as banks issue more loans and securities. It is important to note, however, that the decrease in the reserve ratios is directly proportional to the size of the bank. The smaller the percent increase in the deposits, the smaller the impact on the increase in reserve requirements. This occurs until both the public and banks achieve a desired liquidity of assets and a desired reserve ratio respectively; hence, monetary equilibrium is achieved.

Naturally, the effect of a decrease in the demand for imports would be symmetric to an increase in the demand for imports, reversing the direction of each effect. In net, the system automatically adjusts to restore equilibrium. It is the economy's preferences restore balance—the currency board only has to exchange currency on demand.

b. Inflow of Foreign Capital

An inflow of foreign capital will most likely result from an increased attractiveness of domestic investment. This makes the optimal portfolio more weighted in domestic assets. Therefore, foreigners would exchange the anchor currency for the domestic currency through the currency board by using the banks as middlemen, as previously described. The foreigners would then use this cash in order to invest in the domestic asset. This would occur until the number of investments declined, causing the attractiveness of investments to equal the world equilibrium. The exchanged currency would then be given to the public (businesses) in exchange for securities issued. Therefore, the economy would react the same way to an inflow and outflow of foreign capital as described for an increase and decrease in the demand for imports, respectively.

This predicts that the changes in money supply could result from changes in attractiveness of domestic investment and changes in the demand for imports. Hence, it can be seen that changes in the balance of payments directly affect the money supply.

ii. Other Reasons for Changes in the Money Supply

Although changes in the balance of payments may be the driving force for changes in the monetary base, there are a variety of other factors that can influence the money supply. Some of these other factors are briefly described below.

a. Consumers Increase Current Consumption

If individuals increase their current consumption, more currency would be demanded and fewer illiquid assets would be desired. Therefore, individuals would sell illiquid domestic assets and illiquid foreign assets. Illiquid domestic assets would be purchased by foreigners in exchange for foreign assets. Illiquid foreign assets would likewise be sold for more liquid foreign assets. Domestic individuals (or, more likely, banks acting as their intermediaries) would go to the currency board in order to convert the foreign currency to domestic currency. In either case, more domestic money is in circulation in the hands of the public. Assuming all else equal, the money supply would increase as it did as in previous scenarios.

Therefore, an increase in the consumer demand for currency (for current consumption) versus future consumption should increase the money supply. Likewise, it is clear that a decrease in consumer demand for currency versus future consumption will decrease the money supply.

b. Consumer Demand for Currency Relative to Deposits

One of the potential sources of disequilibrium in a currency board results from changes in the currency-deposit mixture of the public. Here, deposits mean bank deposits and bank securities. This mixture is not constant (Agger 1918) and must be addressed. Therefore, by applying Selgin's model (1988) for central banks and free banking to currency boards, one can obtain the following model:

$$M = S_P + N_P + D_P$$

- M = total checkable deposits plus currency held by the public
- S_P = specie held by the public; assumed = 0
- N_P = currency board notes held by the public
- D_P = deposits held by the public

$$r = (S_B + N_B) / (D_P) = \text{Commercial Bank Reserves / Commercial Bank Liabilities}$$

- r = reserve ratio
- S_B = specie held by commercial banks; assumed = 0
- N_B = currency board notes held by commercial banks

$$r = (B - N_P) / D_P$$

- B (high-powered money) = $N_B + N_P$

$\Rightarrow \quad D_p = N_B / r$

$\Rightarrow \quad M = N_p + (N_B / r)$

This implies that if consumers economy-wide decide to increase their holdings of currency relative to deposits (N_p goes up and D_p goes down), either r will have to increase or N_B will have to decrease, since M does not change (currency boards have no monetary discretion). If this change is unexpected, banks will run out of reserves, potentially resulting in the bank's insolvency. This may also occur due to an unexpected economy-wide change in total quantity of deposits. However, this only happens in the case that the

change was dramatic and unexpected enough to prevent the reserves of the banks from satisfying these changes. In this case, there is monetary disequilibrium in which banks are solvent, but they do not have any liquid assets to meet the demand of the public. This causes the bank to become insolvent, since it is required to sell illiquid assets at a lower cost. This could be potentially offset in the case of a lender of last resort, as described by Diamond and Dybvig (1983) or if the bank is able to sell securities to foreigners within the period of time needed to satisfy the demand of currency from withdrawals. In regards to a lender of last resort, there is an issue in whether the central bank can determine the solvency of the bank. Selgin (1988) analyzes this fact in great depth, and also shows that free banking may be superior in this regard.

To summarize Selgin's conclusions, free banking automatically accommodates changes in the public's currency to deposit ratio. Central banking will do so if the central bank is alert and aware of these changes, while a currency board can never automatically accommodate them. Thus, banks have to hold greater precautionary reserves or retain greater liquidity than required under free banking or central banking.

It is important to note that if the increase in the currency- to-deposit ratio of the public is not economy-wide, banks could borrow currency from other banks that did not experience the change. This lending could come from other domestic banks or from international banks. In this case, if the withdrawal of notes does not result from solvency issues, the bank could borrow from other banks until it was able to sell off illiquid assets to adjust to the change in its currency to deposit ratio.

c. Increase in Taxes

Assuming equilibrium, a raise in taxes will either increase government spending – now or in the future – or future taxes will be lower. For convenience's sake, we assume taxes are raised equally between investments, income and consumption. This would increase the attractiveness of illiquid assets only in the case that taxes are assumed to be lower in the future, since the illiquid assets can be sold in the future, where they are not taxed as heavily as they are now.

Therefore, if taxes were raised with the expectation of lower future taxes, we would expect a contraction in the money supply. If taxes were raised accompanied with an increase in government spending, we would expect little change in the money supply. However, this section makes many assumptions about the actions of the government, which is the reason for its brevity in the paper.

VI. Unorthodox Currency Board

i. Investing Domestically

If a monetary authority invests in domestic assets, it is not an orthodox currency board by definition. However, if the monetary authority does invest domestically, there are two separate cases that might arise. Either the risk is high enough to potentially compromise the 100 percent backing, or it is not. If it does not compromise the 100 percent backing, the currency board sells foreign assets and buys safe domestic assets.

Assuming perfect financial markets and no capital controls, this would be completely offset because there would be lower interest rates domestically and higher foreign interest rates, causing a capital outflow equivalent to the currency board's domestic investment. This is only true under the assumption of perfect arbitrage. However, if the currency board did compromise the 100 percent backing, individuals would start to invest in foreign assets because the risk would be higher for holding the board's currency due to the perceived lack of commitment to the exchange rate.

Therefore, if the monetary authority attempted to engage in expansionary monetary policy – in other words, if the monetary authority issues securities or invests domestically – there would be an equal decrease in the money supply caused by the monetary disequilibrium. However, this decrease might be higher than the change in domestic assets, due to the skepticism on maintaining the 100 percent backing.

All of this assumes perfect capital markets with arbitragers having perfect information. In reality, there are imperfections in the capital market that further causes disequilibrium in the event of sterilization. It should also be noted that sterilization commonly occurs in the form of the unorthodox currency board buying domestic government securities at large quantities. Normally, these bonds are not only risky assets, but the buying of a high quantity of these bonds by the central bank also artificially lowers the interest rate required to sell the bonds to the private market due to the increased demand. This removes any potential fiscal discipline effects that are gained through the use of currency board, only further exasperating the situation.

Also, sterilization accompanied with lack of transparency and or/ capital controls could lead to markets not adjusting to the sterilization accordingly. For example, if the monetary authority bought risky domestic assets without providing transparency of its operations, or had excessive capital controls on its currency, the market might not automatically adjust for these changes. This could cause a flight from the domestic currency due to the prolonged sterilization that was not adjusted for a sustained period of time. This can cause expectations of a devaluation, which, according to uncovered interest rate parity, will be seen as a sudden jump in interest rates if the peg is upheld.

ii. Fiscal Deficit Dilemma

If the monetary authority invests domestically, it also signals to the domestic government that it would be more likely to buy domestic bonds in the case of a possible default. If the monetary authority goes even further and buys domestic government securities, it gives further incentive for the government to accumulate an unsustainable amount of debt. Therefore, we can expect governments with currency boards to incur lower deficits and to avoid relatively high levels of debt, whereas countries with pegged exchange rates would be more likely to accumulate relatively high levels of debt (Hanke 2002a). This increases the likelihood of a currency crisis.

This problem of moral hazard can be seen through the public sector's intertemporal budget constraint constructed by Wolf et al. (2008):

$$(D_{t-1} + M_{t+1})/ P_t = \sum^{\infty}_{j=0} [(R_{t+j} - E_{t+j} + S_{t+j})/ (1+r)^j]$$

- D_{t-1} = the nominal stock of government debt
- M_{t-1} = the nominal stock of money outstanding at the beginning of period t
- P = the price level
- R = government revenue
- E = government expenditure
- $R_{t+j} - E_{t+j}$ = the government's primary surplus
- S = the currency board's seigniorage (in real terms)
- (1+r) = the economy's discount factor

If the government runs an unsustainable fiscal deficit, either the government will have to default, or the price level will have to rise. In the case of a fixed exchange rate, an increase in the price level is inconsistent with the fact that the exchange rate must be held constant. Therefore, the government will have to default on its debt. In the case of a pegged exchange rate or a floating exchange rate, the government expects that the central bank might buy some of the government debt, ultimately increasing the price level and the exchange rate. This creates a moral hazard problem in which the government has an extra incentive to run a fiscal deficit, knowing that some of the deficit can be inflated away. This has also been shown empirically to be true (Hanke 2002a), where countries with currency boards have had smaller fiscal deficits, as a percent of GDP (in addition to higher GDP growth rates and lower inflation rates) when compared to countries with central banks.

VII. Empirical Support

i. The Balance of Payments and the Monetary Base

The model predicts that changes in the current account are associated with changes in the monetary base. However, this is only one of many factors that may influence the monetary base and money supply. One of the foremost original criticisms of currency boards was the concern that these boards could be deflationary in a country with a negative current account. This stemmed from the idea that the money supply (and the monetary base) was rigidly linked to the current account. Schuler (1992) and Gosh, Gulde and Wolf (1998) all found this criticism to have little empirical support. It was seen that countries with currency boards had significantly lower, yet still positive inflation rates compared to those with central banks. Regardless, the question still exists: exactly how closely does the current account actually shadow changes in the monetary base? What is the net influence of the other factors, such as the capital account, on the monetary base? This analysis has been conducted for a small number of countries (Treadgold 2006, Gedeon 2009), but due to lack of data, many of the older currency boards have never been analyzed accordingly. By documenting the reserve money from the official monetary authorities' reports and collecting the current account and trade data from various statistical abstracts, this analysis is finally possible.

It should also be noted that not all countries studied below are orthodox currency boards. Countries such as Hong Kong, Bulgaria, and Argentina are not considered to be orthodox currency boards (Krus and Schuler 2012). The analysis of these countries serves to see if this relationship is more tightly linked when accounting for the monetary authorities' degree of orthodoxy.

In summary, this section analyzes the effects of the current account (CA) on changes in the monetary base (MB). By finding the average contribution of the CA to the MB along with the statistical significance of the contributions, one can definitively determine how closely linked this relationship is. The change is measured annually on a year-over-year basis for all countries with attainable data. The findings are provided below.

QUANTITATIVE RESULTS FOR OLS AND ROBUST MODEL

Country or Currency Board	OLS Beta	Robust Beta	95% Confidence Interval	
			Lower Bound	Upper Bound
Argentina	-.092	-.089	-.252	.067
Bosnia and Herzegovina	-.146	-.2	-.374	.082
Bulgaria	-.162	-.322	-.305	-.018
East African Currency Board	.023	.021	-.335	.382
Estonia	-.217	-.255	-.339	-.095
Hong Kong	.602	.098	-.023	1.227
Lithuania	-.132	-.25	-.223	-.04

Countries analyzed, types of interest rates, time periods studied and sources are provided in an appendix

From this data, it is evident that the current account has generally no statistical significance with changes in the monetary base. The original criticism predicted that a current account surplus or deficit should cause an equal change in the monetary base:

$$\Delta MB = CA$$

The criticism also predicted that surpluses or deficits in the current account are the only way that the monetary base can change. As seen from these results, not only does the current account not move in perfect unison with the monetary base, it also has 95 percent confidence intervals that are negative for Lithuania, Estonia and Bulgaria. As seen in the appendix, these results are even robust under a panel regression that contains negatives value but not a value of one in its 95 percent confidence interval. Therefore, as theory supports, other factors, such as inflows of foreign investment, have a significant effect on the monetary base as well. These results also support the fact that the net effect of other factors is much more influential than the current account for the countries analyzed.

ii. Pegged and Fixed Exchange-Rate Regimes and Currency Crisis

Would an unorthodox currency board be more prone to currency crisis? If we find the absolute value of the change in net domestic assets for a significant number of currency boards and pegged exchange rate systems, is there predictive power for currency crises?

As described in the previous section, it is predicted that if, under a pegged exchange rate, the monetary authority engages in sterilization and has capital controls, then there will be a higher probability of a currency crisis. Therefore, if the market has expectations that the future exchange rate might be different than the current exchange rate, by uncovered interest rate parity, the interest rate in the domestic country will have to be higher than in the country the currency is pegged to. Therefore, it is predicted that the less committed a country is to a peg, the stronger the capital controls, and the greater the sterilization by the monetary authority, the higher the probability of a currency crisis.

The degree to which a currency board invests domestically is difficult to measure across a variety of countries and years. Some common ways to measure sterilization is by assessing the change in net domestic assets over the change in net foreign assets (Hanke 2002b). Sometimes, this measure is also calculated as a percent change in net domestic assets over a percent change in net foreign assets. This creates issues when the change in domestic assets is large and the change in foreign assets is very small, resulting in a very large number. Therefore, this paper proposes two numbers that provide a better measure of sterilization. The first figure is domestic assets over the reserve money. This figure is considered since it is predicted that if a monetary authority holds domestic assets, it signals to the market that it is not orthodox and is more likely to engage in sterilization. The second figure considered is the change in domestic assets over the previous period's reserve money, as it describes the net change in domestic assets or the degree in which the monetary authority engaged in monetary policy through the use of its reserves. But, it is scaled by a relative metric: the previous year's reserve money. This allows the figure to be used across a multitude of countries without any bias for the size of the economy. Due to the correlations between these two variables, the second figure was selected for the final regression due to its more direct relationship with the proposed model.

Previous research on this topic has provided an array of results. Studies that look at the effect of capital controls on the probability of currency crisis have found little support for and against a relationship (Edison and Reinhart 2001, Edwards 1999 and Gregorio et al. 2000). There have also been studies that have analyzed both the effect of capital controls and exchange-rate regime types on the probability of currency crisis, finding a positive relationship (Glick and Hutchison 2010 & Esaka 2010). Thus, this paper attempts to provide additional empirical support by focusing on pegged-exchange-rate regimes and the degree of sterilization.

First, a definition of currency crisis must be established. Similar to the definition provided by Bubula and Otker-Robe (2003), this paper defines a currency crisis as a

period in which there is a change in interest rates greater than three standard deviations away from the average for that country. This is slightly different than the definition used by Bubula and Otker-Robe's definition, since they include both interest rate changes and exchange rate changes to define a currency crisis. These variations are then normalized to find the occurrence of a crisis. Since this study only analyzes fixed exchange rates that have at most very little change in exchange rate, the definition is modified to only include interest rate changes to avoid skewed sample points due to a very small change in exchange rates. Using this definition, we looked at interest rate data for all pegged-exchange-rate regimes from the time period of 1990 to 2007.

The Chin-Ito Index was then utilized to define when capital controls existed (2006 and updated). This measure is based on the International Monetary Fund's Annual Report on Exchange Rate Arrangements and Exchange Restrictions (AREAER). The index uses a classification based on four binary categories: restrictions on capital account transactions, restrictions on current account transactions, requirement to surrender export proceeds, and presence of multiple exchange rates. Each of the four categories is given a zero if restrictions were present and a one if no restrictions existed. Each country was then given a single value for each year based on these measures. This measure was used because of its extensive size of data points and because of its primary source (an IMF publication).

Past research has classified countries based on their *de-facto* classification. Some of the more prominent classifications are Reinhart and Rogoff's classification (2004) along with Bubula and Otker-Robe (2003) and Ghosh, Gulde, and Wolf (2002). However, as shown by Schuler (2006) these classifications do not accurately classify countries' exchange-rate regimes. Regardless, a proxy for a country's commitment to a peg is needed. Therefore, Reinhart and Rogoff's (2004 and updated) fine classification is used to determine the exchange-rate regimes of a country because of its extensive number of countries and years available.

This paper presents both a logit and probit regression. A country was given a binary variable of 0 or 1 for each year that a country had a currency crisis. This model was used since a country could potentially have a currency crisis one year, and then maintain the peg and not have a currency crisis the following year. This is due to the fact that currency crises are defined as attacks on interest rates. This model was also chosen since this paper attempts to see if currency crisis are more likely for a given behavior within a given year and not based upon previous year's behavior. This type of model is also used in most of the existing literature. The definitions of the coefficients used and the results of the year over year regressions are shown below:

KAOpen: *The Chin-Ito Index with mean equal to 3 in order to provide strictly positive numbers.*

De-Facto Pegged: *Dummy variable of 1 if the de facto classification based on Reinhart and Rogoff's classification was 4 (de-facto pegged), and 0 if the classification was 2 (currency board or peg).*

Abs NDA Chge/RM: *The absolute value of the change in net domestic assets divided by the absolute value of previous period's reserve money.*

QUANTITATIVE RESULTS FOR LOGIT AND PROBIT MODEL

Model	Parameter	Estimate	Std. Error	Z	Sig.	95% Confidence Interval	
						Lower B.	Upper B.
Probit	KAOpen	-.002	.057	-.031	.975	-.114	.110
	De-Facto Pegged	.408	.195	2.088	.037	.025	.791
	Abs NDA Chge/RM	.266	.101	2.643	.008	.069	.463
	Intercept	-1.600	.207	-7.720	.000	-1.807	-1.393
Logit	KAOpen	-.005	.116	-.046	.963	-.232	.221
	De-Facto Pegged	.800	.372	2.151	.031	.071	1.529
	Abs NDA Chge/RM	.482	.183	2.629	.009	.123	.841
	Intercept	-2.822	.420	-6.717	.000	-3.242	-2.402

PROBIT model: PROBIT(p) = Intercept + BX; LOGIT model: LOG(p/(1-p)) = Intercept + BX

Countries analyzed, types of interest rates, time periods studied and sources are provided in an appendix

Under each regression, both De-Facto Pegged and Absolute (Net Domestic Asset Change) / (Previous Year's Reserve Money) provided statistically significant results in line with predictions. KAOpen was not statistically significant to even very low significance bands. This supports the proposed model because it is predicted that a monetary authority that engages in sterilization (expressed by Abs NDA Chge/RM) and has a lack of commitment to the peg (expressed by De Facto Pegged), increases the probability of a currency crisis. Openness is expected to only have an impact if it is combined with the other factors. However, due to a lack of examples of currency crises under these regimes, the use of interaction terms made the results insignificant.

The Person Goodness-of-Fit Test that is provided in the appendix also provides a p value of slightly above .45 for both models. This shows that the models by themselves cannot accurately forecast currency crises. Regardless, these findings yield positive results on which future analyses should hopefully shed more light upon by using additional data and variables to improve the models' results.

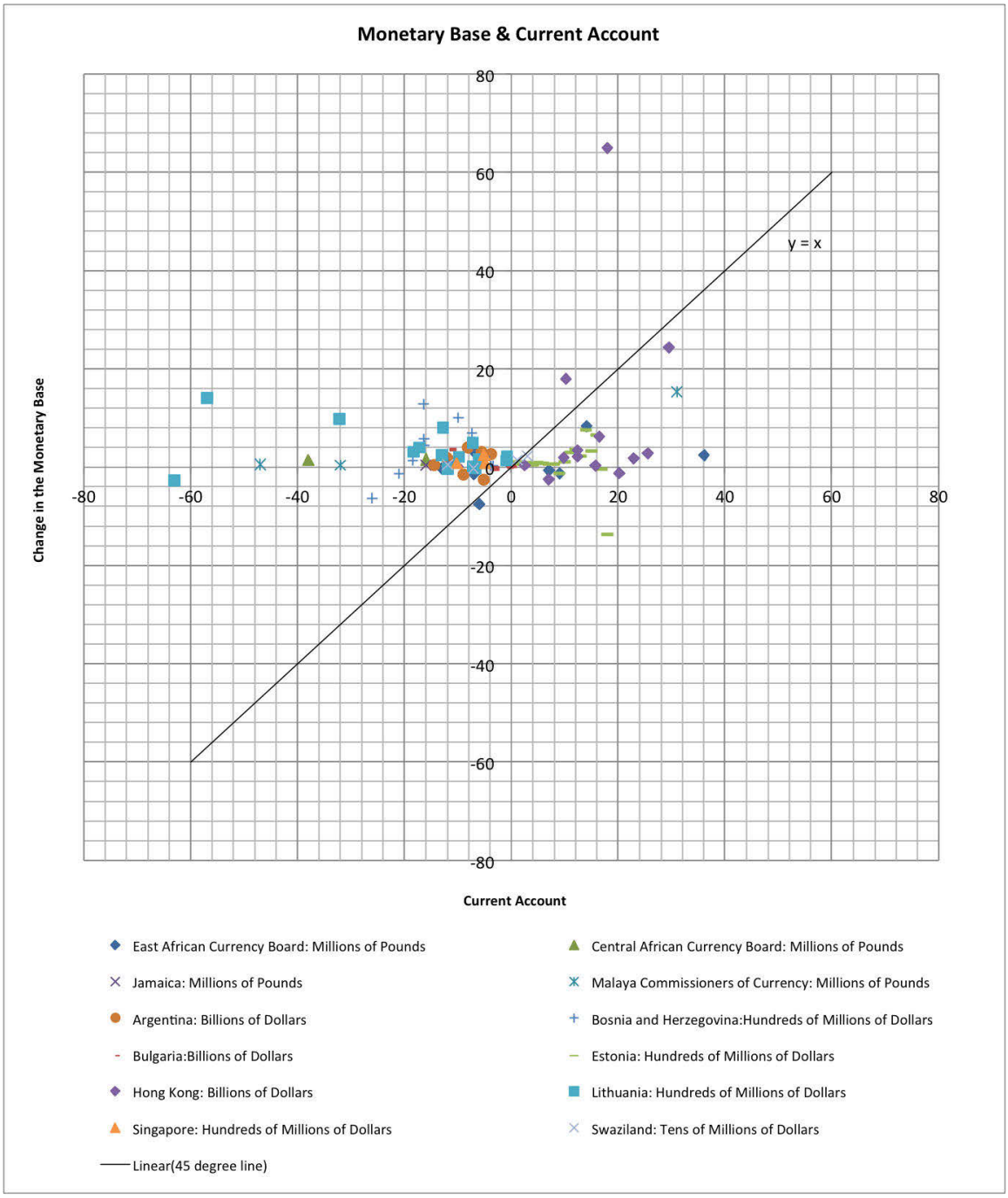
VIII. Conclusions

Currency boards have existed for over a century and a half, a period that has heard extensive arguments both for and against their establishment. However, there is a lack of

comprehensive empirical data on either side of this argument, with either side relying on theoretical framework and data with a relatively small sample size. On the topic of the money supply in particular, there is relatively little literature that goes into great depth in regards to a currency board. This paper provides an improved framework to provide a better understanding of the dynamics of a currency board and gives some evidence that orthodox currency boards may maintain monetary equilibrium while unorthodox ones may not.

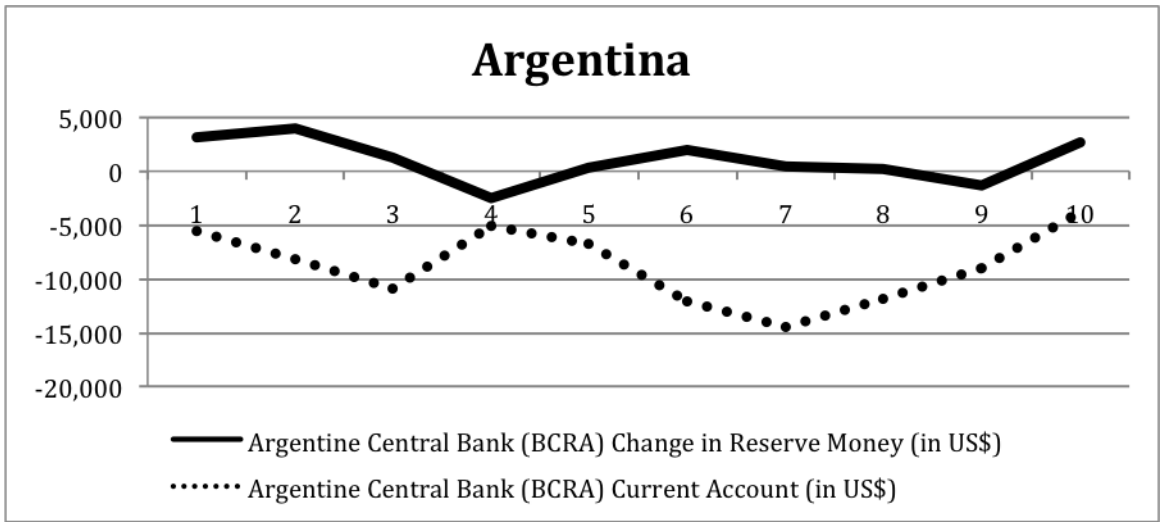
Appendix I: Graphs of Current Account and Changes in Monetary Base

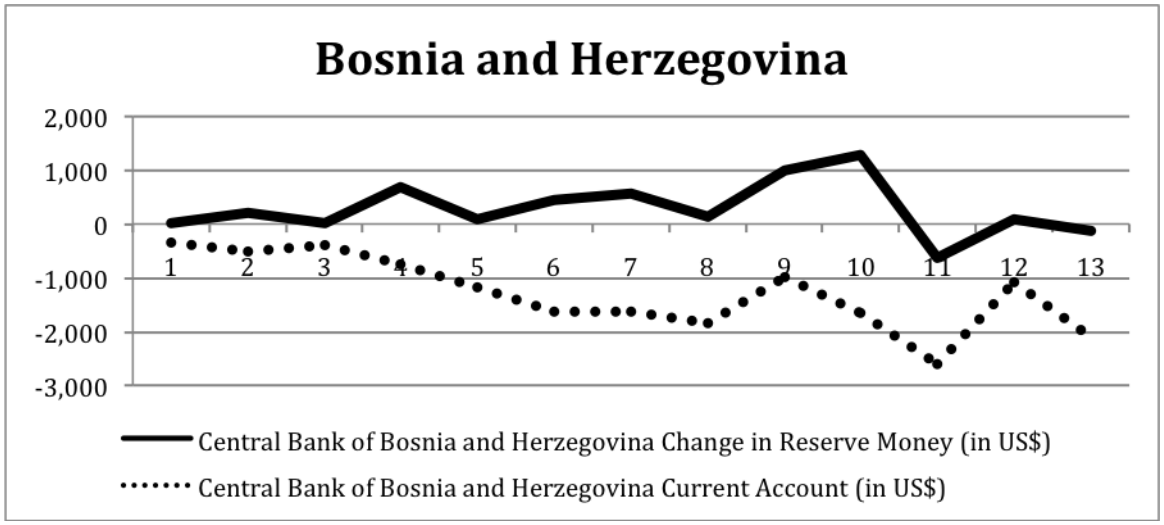
i. All Countries

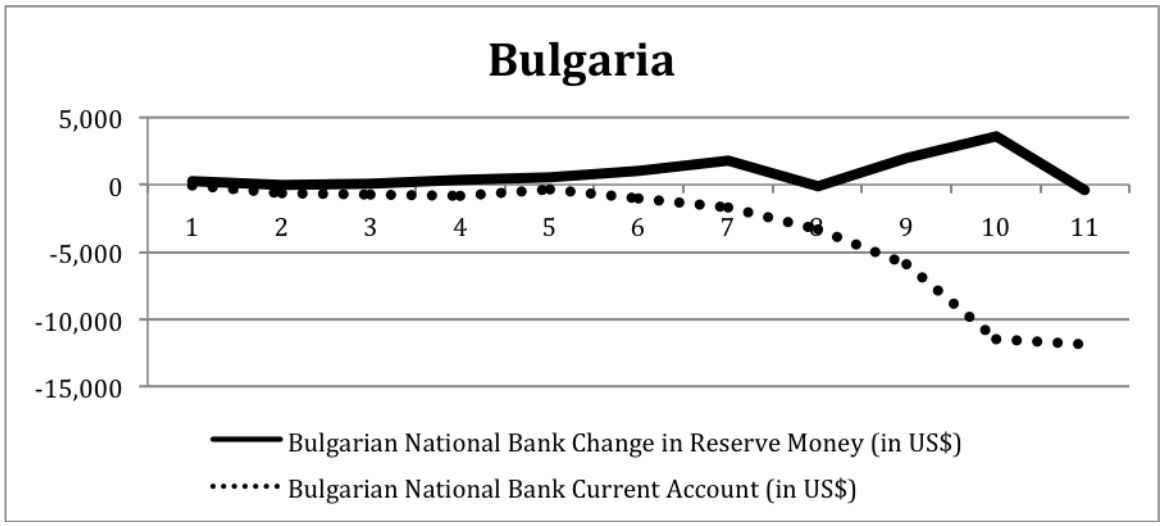


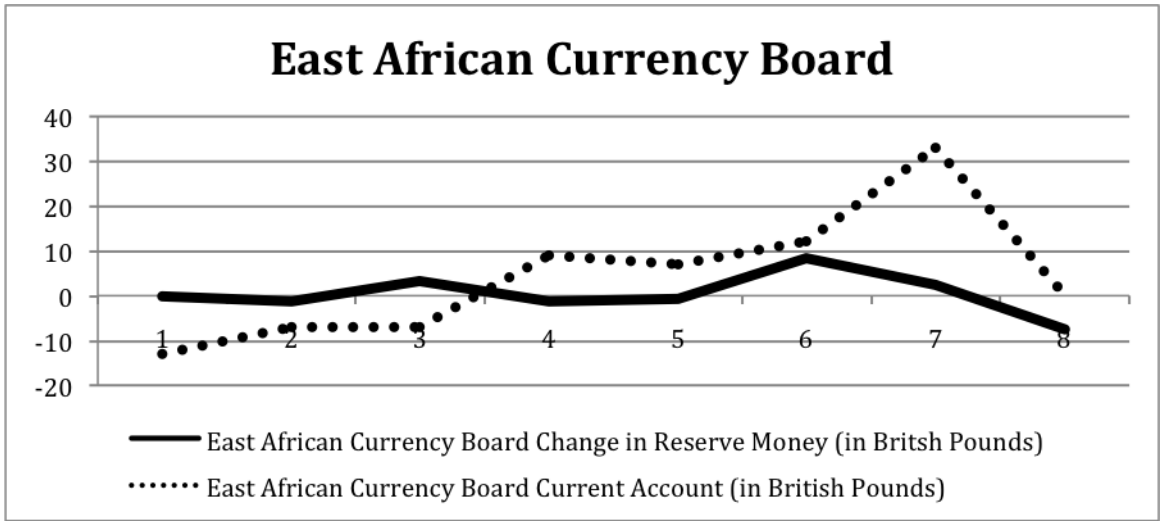
Notes: The points for Malaya Commissioners of Currency, Jamaica, Central African Currency Board, Singapore and Swaziland are included to give the reader additional information. However, these countries are not included in the main text due to their relatively small number of data points. Sources of all points are provided in a later appendix.

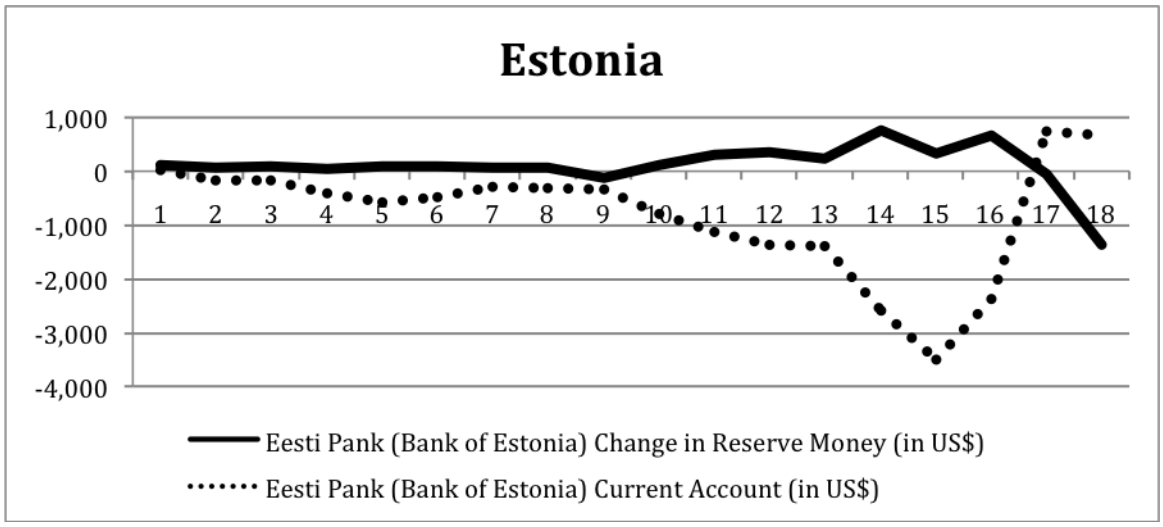
ii. Individual Countries

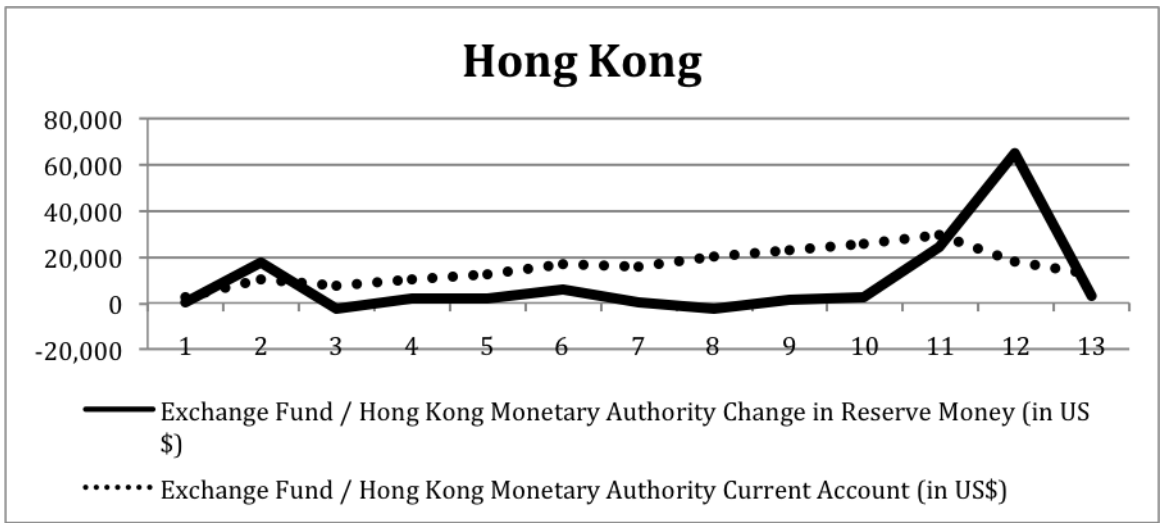


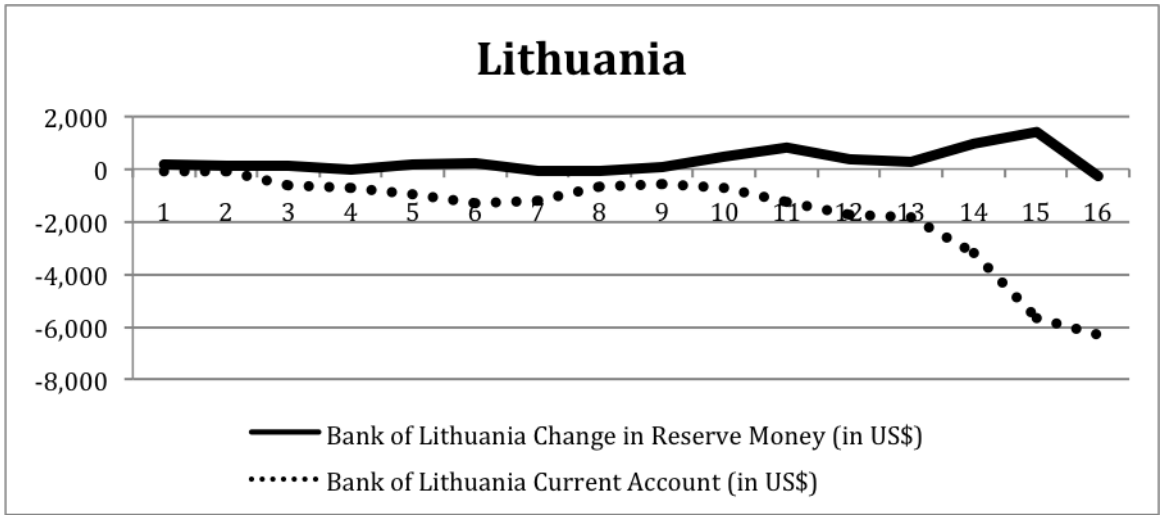





East African Currency Board
40
30
20
10
0
-10
-20
1
2
3
4
5
6
7
8
East African Currency Board Change in Reserve Money (in Britsh Pounds)
East African Currency Board Current Account (in British Pounds)


Estonia
1,000
0
-1,000
-2,000
-3,000
-4,000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Eesti Pank (Bank of Estonia) Change in Reserve Money (in US$)
Eesti Pank (Bank of Estonia) Current Account (in US$)


Hong Kong
80,000
60,000
40,000
20,000
0
-20,000
1
2
3
4
5
6
7
8
9
10
11
12
13
Exchange Fund / Hong Kong Monetary Authority Change in Reserve Money (in US $)
Exchange Fund / Hong Kong Monetary Authority Current Account (in US$)



Notes: All graphs are in scaled in millions. Sources of all graphs are provided in a later appendix. The x-axis of the graphs start with 1 signifying the first year of the given currency board or quasi-currency board.

Appendix II: Countries Analyzed for Empirical Studies and Additional Results

i. Currency Crisis Study

Format:

Country: Years Analyzed: Interest Rate Used: Currency Crisis Years

Argentina: 1990-2001: Money Market Rate: 1990

Bahamas: 1990-2007: Lending Rate: N/A

Barbados: 1990-2007: Lending Rate: N/A

Belize: 1990-2007: Lending Rate: N/A

Benin: 1990-2007: Money Market Rate: 1993

Bhutan: 1990-2007: Lending Rate: N/A

Bosnia and Herzegovina: 1999-2007: Lending Rate: 1999

Bulgaria: 1997-2007: Money Market Rate: 1997

Burkina Faso: 1990-2007: Money Market Rate: 1993

Cameroon: 1990-2007: Lending Rate: 1996, 2001

Central African Republic: 1990-2007: Lending Rate: 1990, 1996

Chad: 1990-2007: Lending Rate: 1990, 1996, 2001

Hong Kong: 1991-2007: Money Market Rate: 1998

China: Mainland: 1994-2007: Lending Rate: 1998

Dominica: 1990-2007: Money Market Rate: N/A

Egypt: 1992-2007: Lending Rate: N/A

El Salvador: 1990-2004: Money Market Rate: 1999, 2000

Equatorial Guinea: 1990-2007: Lending Rate: 1996, 2001

Estonia: 1996-2007: Money Market Rate: 1997, 1998, 1999

Gabon: 1990-2007: Lending Rate: 1990, 1996, 2001

Grenada: 1990-2007: Money Market Rate: N/A

Guinea-Bissau: 1990-2007: Money Market Rate: N/A

Lebanon: 1993-2007: Lending Rate: N/A

Lesotho: 1990-2007: Lending Rate: 1990, 1993, 1994, 1998

Lithuania: 1996-2002: Money Market Rate: N/A

Macedonia: 2001-2007: Discount Rate: N/A

Malawi: 1995-1997: Lending Rate: 1995, 1996

Maldives: 1990-2007: Money Market Rate: N/A

Mali: 1990-2007: Money Market Rate: 1993

Malta: 2001-2007: Lending Rate: N/A

Mexico: 1992-1993: Money Market Rate: N/A

Moldova: 1996-1997: Money Market Rate: 1996

Mozambique: 1995-2003: Money Market Rate: 1996, 1997, 1998, 2001

Namibia: 2002-2007: Money Market Rate: 2002

Nepal: 1993-1995: Discount Rate: N/A

Netherlands Antilles: 2002-2007: Lending Rate: 2004, 2005, 2006

Niger: 1990-2007: Money Market Rate: 1993

Philippines: 1996-1997: Money Market Rate: 1997

Qatar: 1990-2007: Deposit Rate: N/A

Senegal: 1990-2007: Money Market Rate: 1993

Sierra Leone: 2006-2007: Lending Rate: N/A

St. Kitts and Nevis: 1990-2007: Lending Rate: N/A

St. Lucia: 1990-2007: Money Market Rate: N/A

St. Vincent and the Grenadines: 1990-2007: Money Market Rate: N/A

Suriname: 2001-2007: Lending Rate: N/A

Swaziland: 1990-2007: Money Market Rate: 1993

Thailand: 1990-1997: Money Market Rate: 1995, 1997

Togo: 1990-2007: Money Market Rate: 1993

Ukraine: 2000-2007: Money Market Rate: N/A

United Kingdom: 1991-1992: Money Market Rate: N/A

Zimbabwe: 2000-2001: Money Market Rate: N/A

Source: IFS (International Financial Statistics)

ii. Current Account Study

QUANTITATIVE RESULTS FOR PANEL REGRESSION

Variables	B	Std. Error	Std. Beta	t	Sig.	95% Confidence Interval	
						Lower B.	Upper B.
(Constant)	3876.377	3269.296		1.186	.238	-2605.322	10358.075
Current	.352	.179	.360	1.966	.052	-.003	.707
Argentina	214.537	5072.114	.009	.042	.966	-9841.422	10270.497
Bosnia and	-3127.579	3862.594	-.149	-.810	.420	-10785.547	4530.389
Bulgaria	-1845.352	4232.886	-.082	-.436	.664	-10237.460	6546.757
Estonia	-3492.991	3687.016	-.191	-.947	.346	-10802.859	3816.877
Lithuania	-2964.291	3849.440	-.155	-.770	.443	-10596.181	4667.598
Singapore	-3652.410	3471.922	-.213	-1.052	.295	-10535.833	3231.013
Swaziland	-3853.265	4485.934	-.106	-.859	.392	-12747.065	5040.535
E.A.C.B	-3877.509	3922.138	-.149	-.989	.325	-11653.530	3898.512
M.C.C.	-3870.374	4818.778	-.093	-.803	.424	-13424.070	5683.323

R:.464; R Square:.215; Adjusted R Square: .141; Durbin-Watson:1.704
Countries analyzed, types of interest rates, time periods studied and sources are below

Format:

Country: Years Analyzed: Source: Monetary Base & Source: Capital Account

Argentina: 1992-2001: International Financial Statistics (IFS)

Bosnia and Herzegovina: 1998-2010: IFS

Bulgaria: 1998-2008: IFS

Estonia: 1993-2010: IFS

Hong Kong: 1998-2010: IFS

Lithuania: 1993-2008: IFS

Singapore: 1972-1992: IFS

Swaziland: 1976-1979: IFS

Central African Currency Board: 1955-1956: CACB. (1953/1954-1955/1956). *First [Second, Third] Report of the Central African Currency Board.* Salisbury, Southern Rhodesia: Government Printing and Stationery Office. & Great Britain. Board of Trade. *Statistical Abstract for the Commonwealth.* London: H.M.S.O.

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Jamaica: 1957-1959: Jamaica. Commissioners of Currency. (1956/1957-1959/1960). *Report of the Board of Commissioners of Currency for the Financial Year Ended 31st*

March, …. Kingston: Government Printer. & Great Britain. Board of Trade. *Statistical Abstract for the Commonwealth.* London: H.M.S.O.

Malaya: 1957-1959: Board of Commissioners of Currency, Malays and British Borneo. (1957-1959). *Report of the Commissioners of Currency, Malays and British Borneo.* Board of Commissioners of Currency, Malays and British Borneo: Singapore. & Great Britain. Board of Trade. *Statistical Abstract for the Commonwealth.* London: H.M.S.O.

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