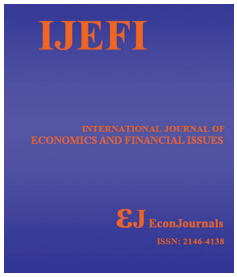

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The Effect of Zimbabwe's Multi-Currency Arrangement on Bilateral Trade: Myth Versus Reality

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ABSTRACT

To tame the hyperinflation experienced in the country, Zimbabwe adopted a relatively unique solution by implementing a multi-currency system in January 2009. Five foreign currencies were granted official status. However, this arrangement is viewed as a temporary measure to restore stability and there is no commitment by authorities to maintain it long-term. The present study uses a theoretically consistent gravity model that accounts for endogeneity, to estimate the effect of the multi-currency arrangement implemented in Zimbabwe on bilateral trade. The period covered by the study is from 2004 to 2012 using a total of 50 potential trading partners from Africa, Asia, Western Europe, Eastern Europe, North and South America. The results suggest that the multi-currency arrangement as adopted has depressed Zimbabwe's bilateral trade by nearly 15%.

Keywords: Multi-Currency Regime, Gravity Model, Trade, Zimbabwe
JEL Classifications: F14, F15, F33

1. INTRODUCTION

To tame the devastating hyperinflation, Zimbabwe introduced a multi-currency regime in January 2009. Unlike in traditional dollarization schemes where a dollarizing country adopts one hard currency, five currencies initially were legally allowed to circulate at the same time. The currencies adopted initially are the US dollar, Euro, UK Sterling pound, South African Rand and Botswana Pula. Further, there is no long-term commitment to this regime by authorities in Zimbabwe. The adoption of the multi-currency regime is viewed as a temporary measure to restore stability, and even the number of currencies included in the basket is mutable. In early 2014, this basket of currencies was expanded to include four new currencies, namely the Australian Dollar, Chinese Yuan, Indian Rupee, and Japanese Yen (Reserve Bank of Zimbabwe, 2014). It is expected that at some point the multi-currency arrangement will be abandoned. But there is as yet no official time line or indication what new monetary regime will replace it. The lack of an immediate plan to change has not eliminated market jitters though.[1]

Credibility will be a major concern in the choice of a monetary policy framework to replace the multi-currency regime given the culpability of the Reserve Bank of Zimbabwe (RBZ) in the recent hyperinflation. Kramarenko et al. (2010) review the pros and cons of alternative monetary regimes available to Zimbabwe to succeed the multi-currency system. They opine that some form of official dollarization rather than a rush to re-introduce the Zimbabwean dollar as sole currency would be preferable. The two leading options they propose are membership in the common monetary area (CMA)[2], and official dollarization with the US dollar as sole legal tender.

Since the introduction of the multi-currency regime in 2009, output and trade in Zimbabwe has slowly recovered. The present study takes advantage of this rare event experienced in Zimbabwe to provide evidence of the effect of a multi-currency regime on bilateral trade. To the best of our knowledge this is the first study to attempt to answer this question. A large literature has assessed the effect of currency union (dollarization) on bilateral trade. A smaller list of researchers (e.g. Klein and Shambaugh, 2006; Adam and Cobham, 2007) have investigated an expanded menu of exchange

1 After rumors started circulating, the governor of the Reserve Bank of Zimbabwe on 6th August 2013, issued a statement to reassure the market that there were no plans to re-introduce the Zimbabwe dollar in the immediate or near term (Gono, 2013).

2 CMA membership include South Africa, Lesotho, Namibia, and Swaziland.

rate regimes. This paper attempts to extend this strand of literature to the use of multiple currencies. We present a quick overview of the causes of the Zimbabwe hyperinflation before discussing the literature on exchange rate regimes and trade.

1.1. The Genesis of Hyperinflation and the Original Sin

Various forces have been blamed for fueling Zimbabwe's hyperinflation, ranging from socio economic factors and political instability to military adventurism. Critical also was the lack of independence of the RBZ. The start of the decline can be traced back to 1997. However, one of the basic ingredients was actually inherited at birth. When Zimbabwe attained political independence in 1980, she inherited a highly skewed land distribution. Some 4500 large scale commercial farms covering about 11 million hectares (ha) of the best arable land were owned largely by white farmers (AfDB/OECD, 2003). In contrast, about 1.2 million indigenous households (about 40-50% of the total population then) subsisted on 16.6 million ha of poorer quality, drought prone land.

In an effort to redress the problem, the government resettled over 3 million ha under the "first option to buy" conducted at market prices (Coomer and Gstraunthaler, 2011; IMF, 2001) during the first half of 1980's. This process however slowed down during the second half of the period. The 1992 land act provided for compulsory purchase of farms, as long as the property was derelict, located on underutilized land, owned by absentee landlord, or surrounded by communal areas, and the owner had multiple farms (IMF, 2001). The act required fair compensation and provided for right of appeal. However the new act did not add much traction to the pace of resettlement. But it paved the way for the government to ratchet up the process in subsequent years.

To deflect the growing despondency among war veterans the government in August 1997 awarded a new compensation and monthly pension to approximately 60,000 war veterans (Coomer and Gstraunthaler, 2011; Kairiza, 2009) the value of which amounted to about 3% of gross domestic product (GDP) at the time. The award, approximately USD 3000 immediate payment at the time and 125 USD monthly payment, served to increase the budget deficit as it was not properly budgeted for. And in November 1997 President Mugabe announced plans for the compulsory acquisition of white-owned farms. About 1,471 commercial farms were gazette for compulsory acquisition (Coomer and Gstraunthaler, 2011; Kairiza, 2009; IMF, 2001). Without a clear indication of how this was to be financed, the plan spooked investors and strained relations with the World Bank (WB) and International Monetary Fund (IMF). Informal land invasion and the launch of the fast-track development programme covering 5 million ha and 150,000 families in mid-2000 increased uncertainty and had a major impact on agricultural production.

Military adventurism also contributed to the fiscal burden. In September 1998 President Mugabe send troops to the Democratic Republic of Congo to support the beleaguered President Laurent Kabila. Kairiza (2009) estimates the cost to Zimbabwe could have been in the range of USD 1.3 billion per month in 1998. As Zimbabwe experienced these events that swelled the fiscal burden, a mismanaged land reform spawned uncertainty and shrunk production. With the donors limiting and withdrawing support, the RBZ found itself saddled with the task of supporting the fiscal operations.

The journey to hyperinflation and the eventual demise of the Zimbabwe dollar have been well chronicled in a number of studies (for example Hanke and Kwok, 2009; Hanke, 2012; Coomer and Gstraunthaler, 2011; Kairiza, 2009; Coltart, 2008; Noko, 2011; Ndlela, 2011). Crucially, the RBZ's lack of independence and its inability to contain the quasi-fiscal role thrust upon it hampered efforts to contain the hyperinflation. The result was the second highest inflation in history according to estimates by Hanke and Kwok (2009) who have attempted to construct a more complete record of Zimbabwe's inflation beyond July 2008 when the official inflation data ceased. Their computations suggest that the highest monthly inflation rates occurred in mid-November 2008 and reached month-over-month rate of 79.6 billion percent. Their estimated year-over-year rate is a staggering 89.7×10^{21} percent.

Faced with a hyperinflation of this magnitude, the market basically rejected the Zimbabwe dollar, and de facto dollarization ensued. Bowing to reality the RBZ, toward the end of September 2008, introduced what it called foreign exchange licensed warehouses and shops (FOLIWARS), initially intended for a trial period of 18 months to March 31st, 2010 (Gono, 2008). A number of retail and wholesale outlets were licensed as foreign currency denominated shops, to sell goods and services in foreign currency. Under this program, only the licensed outlets were legally authorized to charge in foreign currency. In addition there was a rather long list of basic commodities that were required to be payable in the local currency even in the FOLIWARS. Shops not licensed under FOLIWARS, along with critical service providers such as commuter transporters, were required to charge in local currency.

1.2. The Era of Multi-Currency Regime

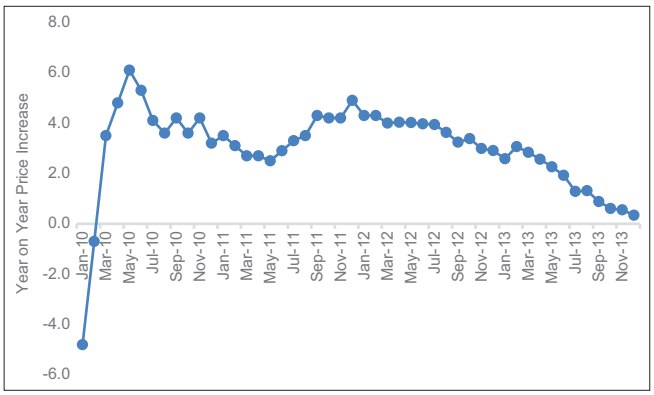
The Zimbabwe hyperinflation ended with the introduction of the multi-currency system. This also spelt the demise of the Zimbabwean dollar. The currency reforms contained in the monetary policy statement of January 2009 (Reserve Bank of Zimbabwe, 2009) allowed for the circulation of multiple currencies in the economy and sought to close the RBZ's quasi-fiscal operations.

As Zimbabwe struggles with restoration it is appropriate at this point to take stock of the impact this regime has had on the country's economy. By adopting a multi-currency regime the RZB effectively gave up its monetary policy as a policy tool to influence the economy. However an obvious benefit of the multi-currency regime is price stability. Since the introduction of the multiple currency regime, the rampant inflation has been tamed. Figure 1 shows inflation rate has declined to settle at around 3%. Economic growth has shown signs of picking up though the recovery is still fragile.

Figure 2 shows the trend of GDP from 1990 to 2012. The real GDP declined steadily from 8.79 billion US dollars in 1998 by

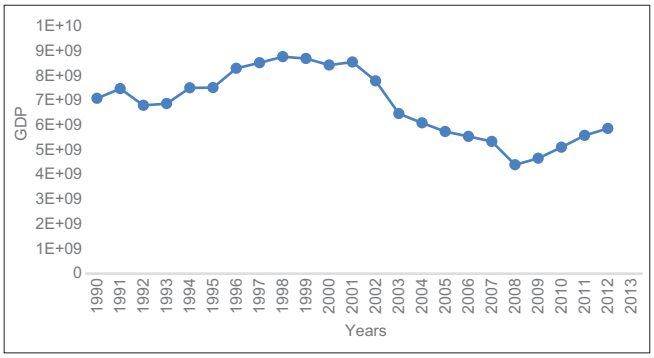
about 50% to a low of 4.41 billion US dollars in 2008. After 2008, it has risen by about 33% to 5.88 billion in 2012. In per capita terms the GDP declined 50% from 718.4 constant (2005) US dollars in 1998 to 344.7 US dollars in 2008. Since then it has recovered about 24% to 428.5 US dollars in 2012. The value of exports (Figure 3) shows a decline from 1996 and remains depressed through 2009. The worst export performance was recorded in the year 2001 coinciding with the escalation of land reforms under the fast-track development programme. Imports depict a similar trend. Both imports and exports show some recovery after 2009.

Figure 1: Zimbabwe's year on year inflation, 2010-2013



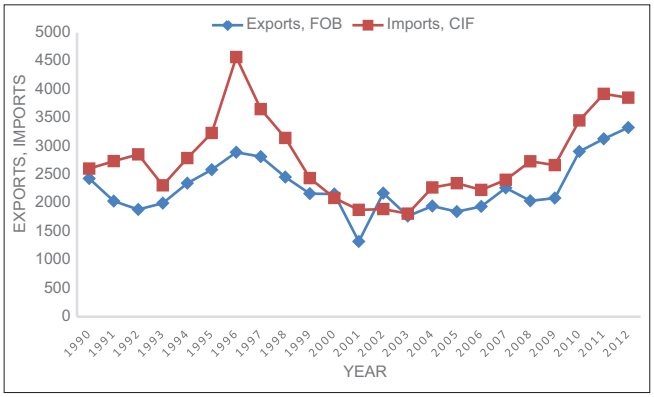
Source: Reserve Bank of Zimbabwe, http://www.rbz.co.zw

Figure 2: Gross domestic product constant (2005) US dollars, 1990-2012



Source: The World Development Indicators, April 2014

Figure 3: Export and import values (millions of 2005 US dollars), 1990-2012



Source: The International Monetary Fund CD, December 2013

2. EXCHANGE RATE REGIMES AND BILATERAL TRADE

There is a large literature attempting to estimate the effect of a common currency on trade. Rose's seminal work (Rose, 2000) as well as subsequent work with co-authors (such as Frankel and Rose, 2002; Glick and Rose, 2002; Rose and van Wincoop, 2001) use a gravity model to investigate the effect of currency union on bilateral trade. The large size of the impact they obtained (about 3 times in Rose, 2000) generated a wave of research, much of it attempting to "shrink" this effect in the vein of Nitsch (2002). Rose and Stanley (2005) perform a meta-analysis (of about 34 studies) of the currency union effect and suggest a range of 30-90% as the currency union effect. More recent studies shave this effect even more. The consensus now seems to be that currency union does have some positive impact on bilateral trade but way less than originally predicted by Rose (Baldwin, 2006). For example recent estimates put the effect of the Euro on bilateral trade in the single digits (Bun and Klaassen, 2007; de Nardis et al., 2008). Jagelka (2013) also estimates a Euro effect of about 9% on bilateral trade of the newest Eurozone members (Slovenia, Malta, Cyprus, and Slovakia) who joined between 2007 and 2009.

Some studies (e.g. Tsangarides et al., 2008; Qureshi and Tsangarides, 2011) have found that currency union effect of African currency unions is significantly positive and not much different from other estimates of the rest of the world. However, using a model of the welfare implications of forming a currency union, Masson (2008); Debrun et al. (2005) show that the effects from forming a currency union in Africa depends very much on the membership of that union. Asymmetries across countries would make even regional currencies undesirable for some countries. Buigut and Valev (2009) using a closely related model calibrated for the east African community shows support for these results.

These studies however have focused on the traditional monetary union such as Euro, or the adoption of one hard currency (such as the US dollar) by a country as legal tender in the simple form of dollarization. Some researchers however have tried to expand the menu of exchange rate regimes considered. For example Klein and Shambaugh (2006) extend the analysis to fixed exchange rates. They find a positive and significant effect of a fixed exchange rate regime on bilateral trade. Adam and Cobham (2007), using a theoretical gravity model suggested by Anderson and van Wincoop (2003; 2004), attempt to identify the effect on trade of a wide range of bilateral exchange rate regimes including currency union, pegging, managed floats and full floats. They find that some regimes other than currency union are also significantly pro-trade than flexible exchange rates. In summary, they find that there is a gradual positive effect on trade as uncertainty and transaction costs are reduced. Qureshi and Tsangarides (2011) suggests that both currency unions and direct pegs promote bilateral trade in Africa relative to more flexible exchange rates.

The present paper extends this strand of literature to multi-currency regimes as adopted in Zimbabwe. Several aspects of this regime differentiate it from what has generally been the focus of

existing literature, making this study a worthwhile pursuit. First, the adoption of several currencies at the same time is unique. Usually a dollarizing country would pick one currency to adopt. Zimbabwe adopted five currencies at once, and in 2014 has added another four. The benefits of sharing a single currency generally cited include reduction of transaction costs related to trade. It also helps enhance transparency, and provide a credible commitment to exchange rate stability. However in the case of a multiple currency regime, these benefits may not be forthcoming. The use of multiple currencies is likely to cause confusion and reduce clarity that is so essential in market transactions. For example a firm in Zimbabwe which decides to operate using "Euros" because its major market is in the "Eurozone" for example, would still have to interact with other firms/agents locally that may have opted to use the "Rand" or any of the other three currencies. Hence economic agents face added transaction costs internally. Technically, the Zimbabwe economy is subdivided into five, albeit unequal and overlapping common currency (dollarized) zones. Such sub-divisions and overlaps lead to transactional inconvenience and related transaction costs. Noko (2011), explaining the experience in Zimbabwe, states that Rand/US dollar exchange rates differ from city to city and even from shop to shop within a city. The increased dominance of the US dollar is then partly explained as a shift towards transactional convenience and the importance of the state in the economy which carry out budget estimates in dollars and pay most civil service wages in dollars (Kramarenko et al., 2010; Noko, 2011). Some estimates suggest that around 80% of the transactions take place in dollars (Kramarenko et al., 2010). The transactional inconvenience is a shortcoming of the use of multiple currencies. There is a second shortcoming related to how it was implemented in Zimbabwe. There is no long-term commitment to the multi-currency arrangement by the authorities in Zimbabwe. It is not clear how long it will last and there is currently no framework explicitly laying out a structure for the replacement of the regime. This certainly is a source of uncertainty for the market.

The interesting question posed in this study then is "would a temporary dollarization arrangement that uses multiple currencies have any effect on bilateral trade?" This question, to the best of my knowledge, has not been directly answered before, and forms the focus of the present study. The Zimbabwean experience provides a unique experiment that could shade some light on it.

The rest of the paper is organized as follows: Section 3 briefly reviews the gravity model, Section 4 and 5 describe the data and empirical model respectively. In Section 6 the results are discussed and concluding remarks provided in Section 7.

3. THE GRAVITY EQUATION

Basically, the gravity equation relates trade between two countries to GDP, distance, and other variables that influence trade. The effects of a monetary union/free trade agreement (FTA) is then measured by a currency union/FTA dummy. A traditional gravity model commonly estimated using cross section data takes the form:

$$\ln\left[X_{ij}\right] = \beta_0 +_1 \ln\left[d_{ij}\right] + \beta_2 \ln\left[Y_i\right] + \beta_3 \ln\left[Y_j\right] + \beta_4 CU_{ij} + \sum_{n=1}^{N} \alpha_n \ln Z_{ij}^n + \varepsilon_{ij} \quad (1)$$

Where $\ln X_{ij}$ are the natural logs of exports from country i to j, d_{ij} is the distance between countries i and j, Y_i and Y_j are the GDP of exporter and importer (source and destination) countries, (n = 1…N) a set of other observables which influence bilateral trade. CU is a binary variable taking the value of one if i and j share a currency and zero otherwise, while ε_{ij} is assumed to be a log-normally distributed error term.

Increasingly, however, studies have cautioned against the use of the traditional, atheoretical, gravity model as shown in Equation (1). These studies suggest that countries select endogenously into monetary unions or FTAs for a host of reasons that may include historical, cultural, and other unobservable reasons that are likely to be correlated to level of trade. Hence the estimation of the effects of currency union (or FTAs) on trade is plagued with endogeneity issues. Magee (2003) shows that higher bilateral trade flows increase the likelihood that countries will form FTAs. In their study of the economic determinants of FTAs, Baier and Bergstrand (2004) find strong evidence that countries that have FTAs tend to share economic characteristics that should enhance net economic welfare gains from an FTA. For example countries tend to have an FTA the larger and more similar their GDPs, the closer to each other, and the more remote the country pair is from the rest of the world. These variables also tend to explain a large amount of trade flows between countries.

The switch to multi-currency in Zimbabwe was not planned, but still the choice of the five currencies introduced in 2009 can be linked to trade. South Africa is Zimbabwe's leading trading partner, followed by the European Union. The US is a major source of imports. The acting Governor of the RBZ (Dr. Dhliwayo) cited increasing trade and investment with the respective countries as reason for the choice of the new currencies added to the basket of circulating currencies in 2014 (Reserve Bank of Zimbabwe, 2014).[3] Thus the endogeneity problem would still be a factor to consider.

First used by Tinbergen (1962), earlier applications of the gravity model where not grounded in a formal theoretical foundation. After the initial attempt by Anderson (1979), a number of studies have contributed to the development of the theoretical foundation of the empirical gravity equations. Some recent key works to contribute to the development of the theoretical foundation of the gravity equation include Feenstra (2002); Feenstra (2004); Anderson and van Wincoop (2003); Anderson and van Wincoop (2004). The theoretical gravity equation suggests the need to account for multilateral price variables – termed "multilateral resistance" in the literature.

Anderson and van Wincoop (2003) show that starting from identical homothetic preferences approximated by a constant elasticity of

3 The unplanned nature of the multi-currency regime introduced in Zimbabwe would however rule out any anticipation effects on trade.

substitution utility function, with all goods differentiated by place of origin, the gravity equation can be presented as:

$$X_{ij} = \left[\frac{Y_i Y_j}{Y_w}\right]\left[\frac{t_{ij}}{\Pi_i P_j}\right]^{1-\sigma} \quad (2)$$

$$\Pi_i = \left[\sum_j (t_{ij}/P_j)^{1-\sigma}\theta_j\right]^{1/(1-\sigma)} \quad (3)$$

$$P_j = \left[\sum_i (t_{ij}/\Pi_i)^{1-\sigma}\theta_i\right]^{1/(1-\sigma)} \quad (4)$$

Where, Y_w is the world GDP, t_{ij} the trade cost factor (bilateral trade barriers) between i and j. The σ is the elasticity of substitution between all goods, with $\left[\theta_i \equiv Y_i/Y_w\right]$ and $\left[\theta_j \equiv Y_j/Y_w\right]$ the income shares, while P_j is country$j$'s overall price index defined as in Equation (4). Anderson and van Wincoop then assume symmetric trade barriers ($t_{ij} = t_{ji}$) to show that a solution for Equations (3) and (4) is $\Pi_i = P_i$ with:

$$P_j^{1-\sigma} = \sum_i t_{ij}^{1-\sigma} P_i^{\sigma-1}\theta_i, \forall j \quad (5)$$

The gravity equation then becomes:

$$X_{ij} = \left[\frac{Y_i Y_j}{Y_w}\right]\left[\frac{t_{ij}}{P_i P_j}\right]^{1-\sigma} \quad (6)$$

Equation (6) suggests that the bilateral trade between countries depends on their GDPs and also on their implicit price indices. Anderson and van Wincoop call the price indices P_i "multilateral resistance" variables because they depend on all bilateral resistance (t_{ij}). They then model the unobservable trade cost factor t_{ij} as a log linear function of observables, bilateral distance (d_{ij}) and whether there is an international border (b_{ij}) between i and j as in Equation (7). Note however, that the list of observables used in the trade cost function is often extended in the literature to include directly measured trade costs, adjacency, preferential trade membership and common language among others.

$$t_{ij} = b_{ij} d_{ij}^{\rho} \quad (7)$$

Taking logs in Equation (2), and substituting Equation (7) for transport costs, Anderson and van Wincoop provide the theoretical gravity model:

$$\ln X_{ij} = k + \ln Y_i + \ln Y_j + (1-\sigma)\rho \ln d_{ij} + (1-\sigma)\ln b_{ij} - (1-\sigma)\ln P_i - (1-\sigma)\ln P_j \quad (8)$$

The main difference between the traditional gravity model in Equation (1) and the theoretical gravity equation shown in Equation (8) is the multilateral resistance terms. Since these terms are correlated with distance and border effects, they create an omitted variable bias if not accounted for.

The literature proposes three different approaches to estimating this theoretical gravity equation. Briefly, the first approach is to use multi-country price indices and apply ordinary least squares (OLS) (e.g. as in Baier and Bergstrand, 2001). The shortcoming of this approach is that published price indices may not accurately reflect the true border effects (Feenstra, 2002). The second approach is to use non-linear least squares as adopted in Anderson and van Wincoop (2003). Though it produces consistent estimates, this approach requires custom programing to perform the constrained minimization. A third technique is to replace the multilateral resistance indices with inward and outward region-specific (importer and exporter) dummies. Examples of studies that apply this approach are Hayakawa and Yamashita (2011); Feenstra (2002); Baier and Bergstrand (2007). Like the second approach the third approach also produces consistent estimates. For a more detailed discussion of these approaches see for example Anderson and van Wincoop (2004); Feenstra (2002); Hayakawa and Yamashita (2011). This paper follows the third approach and include country-and-time effects as in Baier and Bergstrand (2007).

Baldwin (2006); Baldwin and Taglioni (2007) identify three common errors they dub the gold, silver and bronze medal errors in the gravity equation estimation. The gold medal error is related to the endogeneity just discussed above. The silver medal error, they content, is the most common mistake researchers make. Gravity equation explains uni-directional bilateral trade. Most researchers estimate the gravity equation using the average of the two-way exports (average of Country A exports to Country B, and Country B exports to Country A) rather than uni-directional flows (e.g., exports of Country A to Country B). The mistake is in how the averaging is done. The correct way, they point out, is to take the average of the sum of logs of the two trade flows, not the log of the average. The bronze medal error is related to the deflation of the nominal trade data using US aggregate price index. This, they suggest causes bias since there are global trends in inflation rates.

This study estimates the bilateral trade effects of Zimbabwe's multicurrency regime using a theoretically founded panel gravity equation and attempts to account for the source of bias. Country-pair fixed effects (ij) are included to control for historical and time constant factors that affect the level of trade between partner countries. In addition, to account for time varying multilateral resistance, country-and-time (both source and destination) (it, jt) effects are included. Country-and-time fixed effects capture the changes in output, income per capita, population and other variables that are included in a gravity specification. Further, as Magee (2008) notes, fixed effects are more flexible as they also capture any aggregate shocks to the countries' trade flows in a given year. This eliminates the need to choose which variables to include as controls in the regression, and thus eliminates researchers prior believes as to which variables are important.

4. DATA SOURCES

Uni-direction trade data is obtained from the IMF's Direction of Trade Statistics (May, 2014) in nominal US dollars. The period considered is for the years 2004-2012 with a total of 50 potential trading partners. Thus only the first five currencies introduced 2009 are considered, not the second set of currencies introduced in 2014. The end period is dictated by the availability of data. The countries included cover Africa, Asia, Western Europe, Eastern Europe, North and South America and are listed in the Appendix.

As suggested by Baldwin and Taglioni (2007) uni-directional trade is used. However, averaged data is used for robustness checks. With 50 countries and 9 years there are 44,100 ($2 \times N \times N-1 \times T$) bilateral trade data points, since each trade flow is reported as import and export. Of these there were 183 and 27 zero and missing respectively. In line with a number of studies (e.g., Carrère, 2006; Magee, 2008) only non-zero values are included in the analysis. When the missing or zero import values are excluded we have 43,890 observations left in the analysis. Botswana, one of the countries whose currency was adopted is not included due to incomplete data. One half of the trade records is unavailable.[4] The key control variables included are the GDPs sourced from the WB's World Development Indicators (April, 2014). Other variables that may influence trade flows such as distance between trade partners, contiguity, similarity in languages, and colonial relations are sourced from the Institute of Research on International Economy (CEPII) data base.[5]

5. EMPIRICAL MODEL

Our primary interest is to identify the average effect on bilateral trade arising from the adoption of the of multi-currency regime in Zimbabwe. The theoretical gravity model discussed in Section 3 recommends the inclusion of multilateral resistance terms. In a panel format this suggests the following:

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln[gdp_{ijt}] + \beta_2 \left[\ln distcap_{ij}\right] + \beta_4 \left[contig_{ij}\right] + \beta_5 \left[comlang_{ij}\right] + \beta_6 [comcol_{ij}] + \beta_7 col45_{ij} + \beta_{mcu}\, mcu_{ijt} - \ln P_{it}^{1-\sigma} - \ln P_{jt}^{1-\sigma} + \varepsilon_{ijt} \quad (9)$$

Where ln is the natural logs. mcu_{ijt} is a dummy variable to capture the multi-currency system. A significant $\beta_{mcu}>0$ coefficient would imply that the use of multiple currencies has had positive effect on Zimbabwe's bilateral trade. Several other variables are included. The variables included (*contig*, *comlang*, *comcol*, *col45*, *distcap*, *gdp* and *mcu*) and their expected signs are described in Table 1.

4 Botswana's export/ import data, as reported by Botswana, is missing in the Direction of Trade Statistics (DOTS). It is only available as reported by trade partner countries as imports/exports respectively. Since our approach uses uni-directional trade data (not averaged data) as the dependent variable, we decided to exclude this country.

5 These are sourced from http://www.cepii.fr/anglaisgraph/bdd/distances.htm. (dist_cepii.xls file)

Including the country-pair fixed effects (*ij*), such that $\alpha_{ij} \neq \alpha_{ji}$, accounts for the impact of distance between countries, common language, adjacency, colonial status or other historical ties and other unobserved characteristics of the country pair that are constant over time. Therefore with these bilateral fixed effects included, the equation estimated is:

$$\ln X_{ijt} = \beta_0 + \alpha_{ij} + \beta_1 \ln gdp_{ijt} + \beta_{mcu} mcu_{ijt} + \varepsilon_{ijt} \quad (10)$$

Note that in a panel setting the multilateral resistance variables would be time-varying. Hence using only bilateral fixed effects, (*ij*) may result in omitted variable bias.

Including exporter-year and importer-year, that is country-and-time for both source and destination, effects (*it, jt*) will account for variations in GDPs, population, multilateral resistance terms and other unobserved time-specific shocks. The estimated equation will in effect be:

$$\ln X_{ijt} = \beta_0 + \alpha_{ij} + \alpha_{it} + \alpha_{jt} + \beta_{mcu} mcu_{ijt} + \varepsilon_{ijt} \quad (11)$$

A major advantage of (11) is that it controls for nearly every variable included in gravity equation and unobserved factors. It thus tempers the difficult choice about which of the many variables one needs to include in the model. The main disadvantage of (11) is that it is not possible to estimate the effect of any other factors that affect bilateral trade even if time varying.

6. RESULTS

To get an initial sense of the effect of the multi-currency arrangement, a traditional gravity equation (pooled OLS) is estimated. This is obtained from estimating Equation (9) excluding bilateral fixed effects, and ignoring the multilateral resistance terms. The results are shown in Table 2 as specification 1 (S1). The dependent variable is the natural log of uni-directional bilateral trade. The control variables included (*contig*, *comlang*, *comcol*, *col45*, *distcap*, and *gdp*) all are significant and carry the expected sign. Of special interest is the coefficient on multi-currency variable (β_{mcu}). This is negative (−0.29) and significant at 1% level, suggesting that the adoption of multicurrency regime has depressed bilateral trade by about 25% ($100*[e^{-0.29}-1] = 25.2\%$).

This basic estimate, however, ignores the endogeneity issue (baptized the "gold medal error" in Baldwin and Taglioni, 2007). Various specifications of the gravity model that attempt to account for this are estimated. The results are shown in Table 2, columns S2-S7. To control for historical and time constant factors that affect the level of trade between partner countries, country-pair fixed effects (*ij*) are used as indicated in Equation (10). These control for characteristics that are time constant. Hence in addition to the *mcu*, only the *gdp* is included as the other variables are constant over time. The results are shown in Table 2 (S4). The coefficient on *gdp* is the expected sign and significant. The coefficient on *mcu* (β_{mcu}) reduces somewhat to −0.23 (a 20.5% decrease in bilateral trade). It is still significant at 1%. To account for both time-constant and the time-varying multilateral resistance, both bilateral (*ij*)

Table 1: Definition of variable used in regressions

Variable	Description (expected sign)
Bilateral trade: (X_{ijt})	The dependent variable is nominal uni-directional bilateral data in US dollars. The natural log of bilateral trade is used
Contiguity: (*contig*)	A dummy variable equal one if the two countries (i and j) are contiguous, and zero otherwise (positive)
Common language- official: (*comlang*)	A dummy variable equal one if the two countries share a common official language, and zero otherwise (positive)
Common colonizer _after 45: (*comcol*)	A dummy variable equal one if the country pair were ever colonies and had a common colonizer after 1945, zero otherwise (positive)
Colonial relationship after 1945: (*col45*)	A dummy variable equal one if the two countries have had a colonial relationship after 1945, zero otherwise (positive)
Distance: (*distcap*)	Great circle distances calculated between capitals cities of country pair. The natural log of distance is used (negative)
Product of the GDPs: (*gdpijt*)	The product of the nominal GDPs in US dollars (GDP_{it}*GDP_{jt}) is used to represent the economic mass variable. The natural log of the product of the *gdps* of the country pair is used (positive)
Multi-currency variable: (*mcu*)	A dummy variable equal one if Zimbabwe is in a multi-currency arrangement with the trade partner since 2009, zero otherwise. To operationalize this, *mcu*=1 for countries whose currency Zimbabwe adopted in 2009. These are US, South Africa, UK, and Euro countries.[6] Also, *mcu*=1 for countries in a CB or conventional peg (P) arrangement with any of these four countries.[7] The countries identified and included in the currency share arrangement with Zimbabwe are shown in the Appendix. (positive)

GDP: Gross domestic product, CB: Currency board

Table 2: Gravity equation estimates using uni-directional trade data

Variables	Coefficient (*t*-value)						
Dependent variable: Uni-directional trade	**S1: OLS**	**S2: Year effects only (*t*)**	**S3: Country-year only (*it*)**	**S4: Country-pair only (*ij*)**	**S5: Country-pair, and year (*ij* and *t*)**	**S6: Country-pair and country-year (*ij* and *it*)**	**S7: Country pair, exporter-year and importer-year (*ij*, *it*, and *jt*)**
contig	0.56	0.54	0.47	-	-	-	-
	(12.63)***	(12.24)***	(11.39)***				
comlang	0.32	0.33	0.31	-	-	-	-
	(13.75)***	(14.41)***	(13.54)***				
comcol	1.49	1.54	1.31	-	-	-	-
	(40.51)***	(42.29)***	(36.57)***				
col45	0.74	0.72	0.88	-	-	-	-
	(11.47)***	(11.21)***	(14.28)***				
distcap	−0.91	−0.91	−1.00	-	-	-	-
	(−96.27)***	(−97.19)***	(−102.96)***				
gdp	1.06	1.08	1.06	0.60	0.75	0.68	-
	(338.35)***	(341.26)***	(266.86)***	(58.81)***	(29.63)***	(19.18)***	
mcu	−0.29	−0.037	0.07	−0.23	−0.15	−0.27	−0.16
	(−3.27)***	(−0.41)	(0.77)	(−3.05)***	(−1.96)**	(−3.20)***	(−1.67)*
Constant	−29.04	−29.57	−28.26	−10.78	−19.41	−15.16	20.88
	(−155.48)***	(−158.57)***	(−100.25)***	(−16.71)***	(−13.03)***	(−7.30)***	(0.00)
Adjusted R^2	0.76	0.77	0.80	0.90	0.91	0.90	0.90

*,**,***Significant at the 10%, 5% and 1% levels respectively. OLS: Ordinary least squares

and country-and-time (*it* and *jt*) (source and destination) fixed effects are included as in Equation (11). The result are provided in Table 2 as S7. The coefficient on *mcu* is −0.16, and significant at 10%, indicating a negative impact of about 14.8% on bilateral trade. Other specifications are provided in Table 2. But we note that all the specifications that include both (*ij*) and some form of time effects (S5-S7) show a negative value for the (β_{mcu}) ranging from 13.9% to 23.7%.

Table 3 provides some robustness checks. The *mcu* effect is re-estimated, alternately using uni-directional exports (imports) and averaged bilateral trade data as the dependent variable as is the practice in several studies. The first two columns uses uni-directional exports as the dependent variable, while the next two columns imports is the dependent variable. For brevity only specification results corresponding to S1 and S7 in Table 2 are provided. The results are similar to what was observed in Table 2. The *mcu* effect seen in S7 in Table 3 are −0.16 and −0.19 (14.8% and 17.3%). Note that the *mcu* effect in S7 in Table 2 was also about 14.8%. The last three columns of Table 3 shows estimates

6 As discussed in section 4, Botswana Pula could not be included for lack of data.

7 The de facto classification of exchange rate arrangements and monetary policy framework by the IMF (IMF 2012, 2013) is used.

Table 3: Estimates using bilateral exports, bilateral imports, and averaged data

Variables	Coefficient (*t*-value)						
Dependent variable: Trade	Bilateral export trade data		Bilateral import trade data		Averaged bilateral trade data		
	S1: OLS	S7: Country pair, exporter-year and importer-year (*ij*, *it* and *jt*)	S1: OLS	S7: Country pair, exporter-year and importer-year (*ij*, *it* and *jt*)	S1: OLS	S4: Country-pair only (*ij*)	S7: Country pair, exporter-year and importer-year (*ij*, *it*, and *jt*)
contig	0.61	-	0.51	-	0.56	-	-
	(10.00)***		(7.96)***		(10.77)***		
comlang	0.27	-	0.36	-	0.31	-	-
	(8.65)***		(10.77)***		(11.67)***		
comcol	1.51	-	1.46	-	1.47	-	-
	(30.15)***		(27.31)***		(34.41)***		
col45	0.72	-	0.77	-	0.74	-	-
	(8.07)***		(8.17)***		(9.87)***		
distcap	−0.86	-	−0.96	-	−0.92	-	-
	(−66.55)***		(−69.73)***		(−83.08)***		
gdp	1.05	-	1.07	-	1.06	0.61	-
	(244.12)***		(235.44)***		(287.96)***	(98.14)***	
mcu	−0.35	−0.16	−0.23	−0.19	−0.32	−0.23	−0.18
	(−2.86)***	(−1.90)*	(−1.80)*	(−2.48)**	(−3.03)***	(−5.13)***	(−3.25)***
Constant	−28.72	22.38	−29.35	18.91	−28.69	−11.03	16.19
	(−112.31)***	(27.75)***	(−108.07)***	(0.01)	(−131.53)***	(−28.35)***	(0.01)

*,**,***Significant at the 10%, 5% and 1% levels respectively. The last three columns uses the average of the natural log of two-way trade flows. OLS: Ordinary least squares

based on averaged bilateral trade data.[8] Note under S7, the *mcu* depresses bilateral trade by about 16.5%. Again this is similar to that previously obtained, confirming Jeffrey Frankel's comment in Baldwin (2006) - that it does not make much difference whether uni-directional or aggregated data is used.

Overall these results strongly suggest that the multi-currency regime has a small and negative impact on bilateral trade. What might explain the negative impact? The reason is likely attributable to the inherent confusion and inconvenience caused by the multiple currency system. Overall it does cause transactional inconvenience in the home country, rather than reduce it. Furthermore since there is no long-term commitment to the regime, firms are likely treating the stability created by the system as short-term and unwilling to commit long-term resources. These result though should be interpreted cautiously, given the very short time period since the adoption of this regime in Zimbabwe.

7. CONCLUSION

Rose's (2000) seminal work on currency union effect on bilateral trade has spawned a large literature in this area. A few studies expand the exchange rate regimes studied beyond currency unions to pegs and managed floats. The gravity model has become the preferred tool in these studies. The current study uses a theoretically consistent gravity model that accounts for endogeneity to estimate the effect of adoption of the multi-currency arrangement in Zimbabwe on bilateral trade. Overall the results suggest the multi-currency regime depresses bilateral trade by about 15%. This may be attributed to transactional inconvenience and uncertainty on its durability.

This suggests the authorities in Zimbabwe should consider an alternative to the multicurrency regime that they (authorities) can commit to long-term, and eliminate the transaction inconvenience. It also has to be an alternative the market would trust is capable of delivering stability. If as suggested in Tyavambiza and Nyangara (2015), in their study of the causal relationship between financial development and economic growth in Zimbabwe, that financial development and particularly the banking sector promotes economic growth, it stability of the sector takes on an even more significant role in the development of the economy. A re-introduction of the Zimbabwe dollar at this point is unlikely to secure that trust given the RBZ battered credibility and token independence. Analysis by Kramarenko et al. (2010) point to two leading options for Zimbabwe - join the CMA (Rand Zone), or dollarize with the US dollar as the sole currency. The first choice is likely a better option. South Africa is Zimbabwe's top trading partner. Both belong to the Southern African Development Community. Hence a link to the Rand would foster regional integration in the southern Africa. However, Zimbabwe ideally would have to exit the Common Market for Eastern and Southern Africa.[9] The second option – that of dollarizing with the USD as sole currency seems doubtful. It is worth noting again that the dominant currency in the current multi-currency regime (to about 80%) is the USD. Would a dollarization scheme that had only USD as sole currency perform better? The results obtained in this analysis casts some doubt on that.

8 This is computed by taking the average of the sum of the logs, consistent with suggested procedure in Baldwin and Taglioni (2007) to avoid what they term as the silver medal error.

9 Zimbabwe is a member of both SADC and COMESA. A number of studies (e.g. Buigut, 2006; UNECA, 2012) have pointed to the overlapping membership as a major stumbling block facing regional integration initiatives in the east and southern Africa region.

There are some limitations that need to be considered when interpreting the results obtained in this study. The time period and data available post adoption is short. But how long the multi-currency system in Zimbabwe will last remains an open question. Furthermore, since it is considered temporary, it is unlikely to provide the incentive and confidence markets need to commit resources to expanding bilateral trade flows. Another limitation of the study is that Botswana is excluded from this analysis due to incomplete trade data. However the use of the Pula is considered small. Kramarenko et al. (2010) note that currencies other than the US dollar and Rand have limited circulation. So the absence of Botswana should not bias the results much. Finally, it is worth noting that the multi-currency system has been expanded in January 2014 to include another four currencies. Our results do not hold out much promise in terms of how this will impact bilateral trade. But this is a study that needs to be revisited when more data becomes available.

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APPENDIX

List of countries included in the analysis

Country	Code	Country	Code	Country	Code
*$ - United States	111	*€ - Portugal	182	Singapore	576
*≤ - United Kingdom	112	*€ - Spain	184	Thailand	578
*€ - Austria	122	Turkey	186	Gabon	646
*€ - Belgium	124	Australia	193	Kenya	664
[P]€ - Denmark	128	New Zealand	196	Madagascar	674
*€ - France	132	*R - South Africa	199	Mauritius	684
*€ - Germany	134	Brazil	223	[A]Zimbabwe	698
*€ - Italy	136	[P]$ - Saudi Arabia	456	Tanzania	738
*€ - Netherlands	138	[P]$ - United Arab Emirates	466	Uganda	746
Norway	142	Egypt	469	Zambia	754
Sweden	144	[CB]$ - Hong Kong	532	[CB]€ - Bulgaria	918
Switzerland	146	India	534	Russia	922
Canada	156	Indonesia	536	China P.R.	924
Japan	158	Korea	542	Czech Republic	935
*€ - Finland	172	Malaysia	548	Hungary	944
*€ - Greece	174	Pakistan	564	Poland	964
*€ - Ireland	178	Philippines	566		

[A]Zimbabwe is the adopting country. *The currency directly allowed to circulate in Zimbabwe since 2009 in multi-currency arrangement, [CB]Country has adopted a currency board arrangement with the currency indicated, [P]Country has peg arrangement to the specified currency. We use *de facto* classification by the IMF in the Annual report on Exchange arrangements and exchange restrictions. IMF: International Monetary Fund