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Determining Yuan Valuation- An Extension of the IMF External Balance Assessment Approach

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Abstract

This paper applies the IMF EBA methodology to a China-specific time series analysis, using a 2SLS instrumented regression with Newey-West standard errors to determine the policy gap that results from PBOC intervention. We find the impact of reserve accumulation to be more significant in magnitude than indicated by the EBA, demonstrating a modest improvement in accuracy with the introduction of central bank liquidity swaps as a novel instrument. Evidence of a long term equilibrium relationship is also found between the real effective exchange rate and reserve accumulation, with the presence of medium level capital controls.

Cover Page Footnote

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Motivation

The past year's debate on the Trans-Pacific Partnership (TPP) and Trade Promotion Authority (TPA) has led to discussion on what is referred to as currency manipulation, the act of devaluing currency in order to increase exports and reduce imports.

Trade rules have obliged countries to refrain from such practices, but enforcement of such obligations depends on certification by the International Monetary Fund (IMF) "that a country's exchange rate policies were contravening IMF obligations as well as distorting trade flows" (Bergsten and Schott 2015).

The Hatch-Wyden amendment to TPP attempted to address the issue of currency manipulation through existing membership obligations in the IMF, with Senator Hatch (R-UT), chairman of the Senate Finance Committee, directly referencing the results of the External Balance Assessment (EBA) in May, 2015 speech on the senate floor. The amendment failed, but it highlights the significance policymakers attach to the conclusions of the IMF methodology.

Recent events have drawn attention to China in particular. The People's Republic has experienced $158.7 billion in capital outflows in December of 2015 alone, with the 2015 total outflows estimated to be at $1 trillion (*Bloomberg* 2016). In response, new capital controls were introduced in September of 2015. The People's Bank of China (PBOC) has had to intervene to support the Yuan. As a result, China's foreign exchange (FX) reserves hit a three year low in January of 2016 (Wei 2016), with December 2015 marking the largest single monthly drop ($107.9 billion) since 2003 (Yap 2016).

The purpose of this paper is to explore the impact of PBOC intervention on China's real effective exchange rate (REER). This paper builds upon the IMF's EBA methodology, with the goal of demonstrating value in country-specific analysis in contrast to the EBA cross-country panel approach.

Forex intervention is when a central bank enters the foreign exchange market to buy or sell currency, typically through FX reserves, to influence exchange rates.

As to the why, various motives are cited in literature. Mohanty and Berger of the Bank for International Settlements (BIS) survey 19 central banks to rank motives for intervention and find the primarily motivation for intervention is to curb excessive exchange rate speculation (Mohanty and Berger 2013, 58). Attempts to control inflation, discourage sudden capital inflows or outflows, ensure financial stability, and build or reduce FX reserves are all found to be motivators for intervention as reported by central banks.

The paper is divided into three sections. Beginning with a literature review that outlines the measures used to proxy for intervention, the recent history of the Yuan and China's exchange rate regime, as well as an explanation of the purpose

capital controls serve for sterilized intervention. This is followed by a data and methodology section, explaining the EBA and characteristics that make this paper distinct from the IMF approach. The final results section covers the instruments used in this study, the impact of intervention, consistency with the EBA results, as well as contributions to literature.

I. Literature Review

Measures of intervention & Lack of Transparency

Proxies are used to measure intervention because there is a lack of public intervention data, as only some central banks disclose such data, while others do not. This has acted as a major hindrance on the further study of intervention (Edison 1993).

The PBOC does not disclose intervention and currency composition of FX reserves. It is not uncommon for central banks to keep intervention confidential. One possible reason is Taylor's (1982a and 1982b) explanation, dating back to the fixed exchange rate Bretton-Woods era, where any reports of intervention could result in a panic and run on a currency. However, given the lack of transparency which has persisted since the end of Bretton-Woods, literature (Neely 2000, 21) argues central banks may wish to avoid accountability.

Neely also brings up the possibility of secret interventions, or attempts to conceal the size and/or volume of intervention, which can sometimes prove more effective in influencing exchange rates (Bhattacharya and Weller 1997).

Intervention Proxy

The metric used in this paper is changes in FX reserves from period-to-period, as used by the EBA. Multiple studies have used change in reserves as a proxy for intervention before (C. Neely 2000; Obstfeld 1983; Kearney and MacDonald 1986; Gartner 1987, 1991).

However, one concern over the use of changes in FX reserves as a proxy measure is such reserves can change for a variety of other reasons. This can be due to currency swap agreements, paying back foreign-denominated debt (Neely 2000), swap lines with private firms, and other factors outlined below.

Other measures can be found in the Treasury Department's semi-annual report to congress on exchange rates. The Treasury uses levels of FX reserves to observe reserve accumulation, which can indicate a devalued currency (Powell 2013, 2), as well as two undisclosed measures that, upon inquiry, remain confidential.

A third measure used in literature includes news reports, due a lack of transparent intervention data (Neely 2000; Peiers 1997; Goodhart and Hesse 1993).

Challenges to Change in Reserves Proxy

The value of FX reserves can change as a result of multiple reasons. The FX value of the currencies held in reserve can shift. One could potentially compensate for changes in valuation of a currency if one knows the composition of reserves. However, such composition is not disclosed by the PBOC. The other two reasons are interest income/coupon payments as well as changes in value of the underlying asset(s) (Neely 2000, 22) such as Treasuries. There are also other uses of reserves. For example, changes might encompass any government purchase from abroad or payment of debt denominated in a foreign currency (Neely 2000, 6).

Intervention can also be carried out without FX reserves, in order to show no changes in reserves on a central bank's balance sheets. Existing literature (Neely 2000, 22) discusses Taylor's (1982a and 1982b) findings regarding how France, Italy, Spain, and the UK utilized nationalized industries to conduct transactions in the 1970s to hide intervention. There is also evidence of Japan and France intervening using hidden reserves held at commercial banks (Neely 2000, 22). Neely also discusses how a central back can conduct intervention through forward markets, arguing a central bank can "offset with a spot transaction when the forward contract is executed."(Neely 2000, 22).

Neely further discusses how allocation of special drawing rights (SDRs) from the IMF may alter FX reserves, but this does not prove to be an issue in China's case as SDRs are kept as a separate line item on PBOC balance sheets.

The Yuan in review

This brief survey of the Yuan exchange rate begins in 2005, when China broke from the peg to the dollar in July, (Weisenthal 2015) and by Sept. the U.S. Treasury accused the IMF of being "asleep at the wheel" for allowing China to maintain an undervalued currency ("Remarks by Under Secretary… Adams" 2005).

By April 2012 the Yuan trading band went from 0.5 percent to 1 percent (Weisenthal 2015). The trading band is the rate at which the PBOC allows the Yuan to rise or fall from a daily midpoint rate set each day (Sweeney and Jianxin 2014). The larger this band is, the greater a role market forces can play in determining the exchange rate. The set midpoint rate can also be referred to as the central parity rate.

In March 2014 the PBOC widened the Yuan trading band from one to two percent(Sweeney and Jianxin 2014). By June China's FX reserves peaked at $3.9 trillion, as the PBOC began to sell dollars to support the Yuan (Weisenthal 2015).

The following April in 2015 Deputy Director of the IMF's Asia Pacific Department, Markus Rodlauer, said the Yuan was close to a point where it was "no longer being undervalued"(Weisenthal 2015). By Aug. the PBOC set the Yuan central parity down 1.9 percent, further closing the gap between central parity and the spot price. The move was welcomed by the IMF, as it allowed market forces to play a greater role in determining the exchange rate (Weisenthal 2015).

Later that month on Aug. 11 markets saw the single largest devaluation of the Yuan in 20 years, followed by a second devaluation the following day. However, the PBOC attempted to reassure markets it was not looking to embark on a steady depreciation (Inman and Ryan 2015). In November of 2015 the IMF approved the addition of the Yuan to its reserve currency (i.e. SDR) basket.

Finally, this February (2016) marked the lowest FX reserve levels since 2012, with half a trillion dollar decline in FX reserves in 2015, the first ever annual decline seen for China (*Bloomberg* 2016).

Use of Capital Controls

The use of effective capital controls allows policymakers to influence exchange rates through sterilized intervention (Engel 2011).

Given a basic scenario, let one say the PBOC sells dollar-denominated assets from its FX reserves. By increasing the supply of dollars in the dollar forex market, the PBOC can appreciate the Yuan against the dollar towards a target exchange rate. However, this sale of dollar-denominated FX decreases China's monetary base by definition. To counteract this effect, the PBOC sells bonds to sterilize the intervention, with capital controls necessarily to minimizing the impact on the monetary base effectively.

Sterilization by a central bank means "[reversing] the effects of the foreign exchange transaction on the monetary base,"(Neely 2000, 21). As opposed to unsterilized intervention, which is the equivalent of carrying out domestic monetary policy (Neely 2000, 21) through changing of the monetary base. Neely provides an example; "When a central bank buys (sells) foreign exchange, the monetary base increases (decreases) by the amount of the purchase (sale)."(Neely 2000, 1). To reverse (i.e. sterilize) the effect on the domestic monetary base, a central bank can buy (sell) domestic bonds (Neely 2000; Edison 1993).

However, sterilized intervention has no effect on exchange rates if domestic and foreign bonds are perfect substitutes (i.e. currency denomination of bond does not matter to investor). If investors are indifferent about holding a

domestic or foreign bond, then changes in the supply of bonds should not have an impact on the exchange rate (Dominguez 2008), and central banks attempts to issue bonds to sterilize intervention would be theoretically ineffective.

Capital controls provide for limited capital mobility, resulting in foreign and domestic currency denominated assets being imperfect substitutes. As a result, when a central bank issues bonds with capital controls in place, it can effectively lower the price of bonds domestically and absorb the extra liquidity to keep the monetary base unchanged.

Recent Events

The past decade has seen a gradual liberalization of capital controls in China. However, the capital flight in the third and fourth quarters of 2015 may change this, as China introduced new controls in September of 2015 (Wei and Trivedi). These controls are not perfect. December of 2015 alone saw $158.7 billion in capital outflows, while the year's outflow stands at $1 trillion (*Bloomberg* 2016).

Recent events from July 2015 onward are what led us to limit the paper's time horizon to 2015 quarter two, given the recent volatility in FX reserve changes, capital outflows, and the corresponding controls to prevent such outflows.

II. Data and Methodology

Real Broad Effective Exchange Rate (REER)

The REER index is an average of bilateral real exchange rates between a country (China) and its trading partners; weighted by respective trade shares of each partner. It constitutes the amount of foreign exchange needed to buy RMB. For example, if the REER rises for China the RMB appreciates, as you need more FX to buy RMB. REER indices are provided by the Bank for International Settlements.

Policy Variables

Foreign Exchange (FX) Intervention

Intervention is proxied for using quarterly changes in FX reserves as listed from the PBOC balance sheets. These changes are scaled to real GDP. Change in FX reserves is interacted with the Quinn capital controls index, where 0 represents no controls, while 1 represents full controls. These two variables are interacted because the use of effective capital controls allow policymakers to influence exchange rates through sterilized intervention (Engel 2011).

The issue of endogeneity arises with the use change in reserves interacted with capital controls. The presence of other control variables as well as instruments are used to correct for this.

M2 (scaled to GDP) is used to account for a crisis prevention motive, while U.S. short term interest rates are used to capture reserve accumulation motives (Phillips et al. 2013).

This paper also introduces a new instrument to control for endogeneity between reserve accumulation and the level of REER, liquidity swap agreements. This is proxied for through the volume of swaps as reported by the Russian Central Bank, as Russia and China have had liquidity swap agreements in place since Oct. 2014 (Ostroukh 2014). This instrument helps account for reserve changes uncorrelated with intervention and the REER.

Monetary Policy

This paper uses short-term real interest rate differentials to proxy for the impact of monetary policy on the REER. The interest rate differential is the difference between Chinese and U.S. short-term real rates. This is interacted with capital account openness, as the EBA suggests the magnitude to which monetary policy explains movements in the REER is influenced by the degree of openness to capital flows (Phillips et al. 2013, 26).

Public Health Expenditure; Lagged

Health expenditure is included to capture the impact on savings rates in a country. National savings rates can be influenced by rises and drops in public spending on health care. The variable is scaled to GDP. The data was obtained through the World Health Organization.

Non-Policy Variables

Demeaned Private Credit

Meant to serve as an indirect measure for financial excesses, the variable is also intended to capture the failure of policies meant to prevent such excesses. Such excesses can result in shocks to demand, and real appreciation (Phillips et al. 2013).The purpose of this variable is to indicate the impact financial policies have (Phillips et al. 2013) on the REER.

Financial Home Bias

This variable indicates domestic preference for domestic assets (Phillips et al. 2013). It is measured as the share of domestic debt owned by residents of that country. Data from the Bank of International Settlements.

Productivity Interacted with Capital Account Openness

Measure of output per employed person for China, constructed relative to the U.S. Constructed as an index, baselined at 2000 quarter one. In theory capital flows will move from low to high productivity countries (Gourinchas and Jeanne 2013), to the extent to which countries permit such capital inflows (Phillips et al. 2013); hence the interaction with capital account openness.

VIX/VXO Interacted with Capital Account Openness; Lagged

Demeaned VIX over VXO is used as an indicator of global risk aversion (Phillips et al. 2013). The negative coefficient is linked to the need to generate a current account surplus when global risk aversion increases and access to credit becomes more constrained (Phillips et al. 2013). The EBA finds the more open the capital account, the stronger the effect of risk aversion.

Commodity Terms of Trade

The ratio of real exports to imports prices of commodities. The commodity index is the ratio of a geometric weighted average price of main export categories to commodity import categories, relative to advanced economies manufactured goods prices (Phillips et al. 2013, 45). The weights are given by their share in the countries' exports to imports. The index is constructed from the prices of six commodity categories (food, fuels, agricultural raw materials, metals, gold, and beverages). These relative commodity prices of six categories are weighted by the time average of export and import shares of each commodity category in total trade (exports and imports of goods and services) (Phillips et al. 2013, 45). This data is obtained through the EBA dataset.

Trade Openness

The sum of exports and imports, scaled to GDP, as a proxy measure for trade liberalization.

IMF EBA Dataset and Gap Analysis

Data for log commodity terms of trade and financial home bias were obtained through the IMF EBA dataset. The data ends at 2010, with 2013 observations provided. For these two variables we use an autoregressive analysis to forecast the gaps until 2015. Residuals from the AR process are used as a regressor to provide for a more accurate forecasts, if the residuals are found to be statistically significant.

The EBA constitutes a cross-country panel regression involving 40 countries, with 769 observations from 1990 to 2010 at an annual frequency, while 2013 observations are used in gap analysis. The methodology utilizes a set of policy and non-policy variables outlined above, as well as additional non-policy variables (e.g. South African apartheid dummy variable, population growth, and GDP growth forecast, own currency's share in world reserves). These additional non-policy variables were not included in this paper due to data availability issues, or they were found to be negligible (i.e. apartheid dummy variable, currency share in world reserves).

The IMF EBA gap analysis can be broken down into the following steps.

1. $REER = \widehat{REER} + Regression\ Residual$

2. $\widehat{REER} = \alpha + X\beta + P\gamma$

3. $\widehat{REER} = \alpha + X\beta + P^{*}\gamma + (P - P^{*})\gamma$

Where X is a vector of non-policy variables and P is a vector comprising of policy variables. P* constitutes desirable policy variables, as determined by the IMF. Gamma represents the slope parameter for the policy variable of choice.

(P-P*)γ is considered the policy gap contribution to the deviation from the REER norm. This paper's focus is on the impact of intervention, and as a result focuses on the desirable value assigned to the intervention proxy measure (change in reserves/GDP * K Controls) for China. The desirable value for change in reserves in this case is zero. Gamma's value is the slope parameter for the intervention proxy.

The desirable value of zero is used for countries which are deemed by the IMF to have reserves in excess of what the IMF refers to as the "suggested adequacy range" ("2015 External Sector Report," n.d., 12), determined using a confidential metric for assessing reserve adequacy.

The ESR provides a composite metric. Countries with reserves in the range of 100-150 percent of this composite metric are considered to have adequate

reserves for precautionary purposes ("Assessing Reserve Adequacy - Further Considerations" 2013). In the IMF 2015 External Sector Report it is found that "China's reserves at end-2014 were 149 percent of the unadjusted metric and 238 percent of the metric adjusted for capital flow management measures. Under either metric, the staff assessment is that further accumulation is unnecessary from a reserves adequacy perspective."("2015 External Sector Report," n.d., 12).

This study carries out both a levels and log REER instrumented 2SLS regression with heteroskedastic and autocorrelation consistent (robust Newey-West) standard errors. The prior is used for gap analysis as discussed above, while the latter is used to predict a percent change in the REER, given a percent change in reserves. The 2SLS is carried out twice, using the same instruments as the IMF (i.e. M2/GDP and U.S. interest rates) as well as a new instrument (i.e. volume of Russian Central Bank FX swaps). The time horizon encompasses 2000 quarter one to 2015 quarter two.

III. Results

Instruments

The underidentification test rejects the null that the equation is underidentified at the 5% level. The underidentification test is an LM test of whether the equation is identified (i.e. excluded instruments are relevant and correlated with endogenous regressor). It is the test of the rank of a matrix, with the rejection of the null indicating the matrix is full column rank (i.e. model is identified).

In regards to testing for instruments, the first-stage F-test of the crisis prevention motive (m2/GDP) and Russian swaps is significant at the 1% level with an F-statistic of 27.27. The crisis prevention motive and U.S. short term rates results in an F-Statistic of 29.33, and is also significant at the 1% level. Both pairs of instruments exceed the F>10 threshold, rejecting the weak instruments null (Staiger et al. 1997; Stock and Yogo 2005).

Concerning instrument validity, the Hansen-J test indicates the instruments are valid at all levels for both instrument combinations.

Reserve Accumulation

We find an additional 1% increase in reserve accumulation relative to GDP (with medium level capital controls in place) is predicted to depreciate the REER by 14.9%, ceteris paribus. In contrast, EBA Results indicate a 0.75% depreciation of the REER for a 1% increase in reserves.

Using the EBA methodology's gap analysis, we find reserve accumulation results in a -3.1% contribution to the level of REER, in contrast to the -1.3% contribution the EBA finds ("2015 EBA: Individual Country Estimates" 2015, 26).

It is worth noting for the EBA the cross-sectional variation of reserve accumulation is twice the time variation within countries, which makes it difficult to determine the impact (Phillips et al.). In this paper's instance, there is no cross-country variation to be concerned with. What does make finding forex intervention's impact challenging in our paper is determining what observed value should be used for gap analysis. The paper uses the average level of intervention from the last two years as the observed intervention value. Single quarters are volatile, given the heavy intervention by the PBOC over the last year.

Consistency with EBA

This paper finds while the impact of each variable on the REER (the sign of each coefficient) is consistent with EBA findings, the magnitude of the reserve accumulation proxy measure is not.

Policy variables such as the real interest rate differential and lagged public health expenditure, along with non-policy measures such as productivity, are found to be statistically insignificant. This is unique to the case of China when contrast to EBA findings.

Concerning the accuracy of fitted values, the EBA root MSE is about 8%, in contrast to under 7% with our findings.

Mean Reversion

Both financial home bias and the real interest rate differential interacted with capital account openness are found to be I(0) (integrated to order 0) stationary, with the augmented Dicky-Fuller test at the 1 percent level, using several different lag lengths. Non-stationary variables' relevance is determined by cointegration testing through the Engle-Granger two-step method.

The non-stationary characteristics seen in some data may be due to a short time horizon or limited observations. In such cases the standard errors are not reliable, and statistical inferences are not valid as a result (Engle and Granger 1987)

We find ln REER and change in reserves interacted with capital controls are cointegrated at the 5% level until two or more lags, demonstrating the intervention proxy measure's significance as a non-stationary variable. This suggests a long-run equilibrium relationship between ln REER and reserve accumulation (Paul, n.d.). Cointegration also implies there exists an error correction data generating mechanism as well (Engle and Granger 1987). Our findings are consistent between both combinations of instruments used.

In regards to the use of lags, literature suggests with too few lags, remaining serial correlation in errors will bias the ADF test (E Zivot, n.d.). However, the power of the test suffers with too many lags (E Zivot, n.d.).

Implications for Literature

We find reserve accumulation in China's case has far more economically significant impact on the REER than in the cross-country panel EBA results. The novel use of Russian currency swaps proved to be a valid and strong instrument. Swaps have been used before to explain low correlation between reserves changes and intervention, particularly in the case of Germany (Neely 2000). The suggestion to use liquidity swaps to account for changes in reserves in regards to the intervention proxy came from Maurice Obstfeld.

However, the liquidity swaps for another central bank (i.e. Russia) that has a swap agreement with a country of interest's central bank (i.e. PBOC) was not found to be an instrument commonly used in existing literature to deal with the endogeneity issue presented by the of reserve accumulation measure.

There is existing literature on cointegration between nominal exchange rates and reserve accumulation (Adam Elhiraika and Léonce Ndikumana 2007). Specifically in China's case, evidence of cointegration has been found between the log difference in the level of forex reserves and log difference of the REER (Jin 2003). Our finding of cointegration between quarterly changes in FX reserves as a percentage of GDP and the ln REER for China is unique, and fits into current literature on the long-run relationship between reserve accumulation and the REER.

In regards to the EBA, this paper marks a move towards country-specific analysis. The reason this is of value is due to the fact that the EBA relies on statistical significance for the intervention proxy primarily from two countries in the sample. If China is removed from the EBA REER regression, intervention is no longer significant. If Malaysia is removed, intervention is significant only at the 10 percent level.

In terms of accuracy, our findings have a slightly lower root MSE than that of the EBA, indicating country-specific regressions may make a modest difference in accuracy.

Furthermore, the pooled regression used in the EBA is unbalanced, as there are different numbers of observations for different nations. For example, there are 21 observations for the US, but only 19 for India, 14 for Indonesia, and 12 for Pakistan. Country-specific analysis, as in this paper's case, need not be concerned over unbalanced panels potentially effecting results.

The EBA panel regression offers 21 observations at most for a nation, with the 2014 dataset only going as far as 2010. While it utilizes 2013

observations, it does not take into account 2011-2013 in the regression. In drawing conclusions for 2015 this paper utilizes a dataset that encompasses a time horizon up to the second quarter of 2015, utilizing observations from the time horizon it is drawing a conclusion on.

Limitations

One limitation to this paper is the short time horizon used, resulting in non-stationary variables that are not always cointegrated with ln REER (e.g. Demeaned private credit, log commodity terms of trade, demeaned VIX). The model's ability to explain about 75% of the variation seen in the observations does not hold as much weight when taking into consideration the small number of observations (i.e. 59) used.

There is also a higher likelihood of omitted variable bias in this work when contrast to cross-country panel data like that of the EBA. This is due to panel data's advantage in controlling for omitted variables.

Future Steps

There remain several steps to take to further this paper. A first-differences regression would aid in dealing with non-stationary data, and would go hand-in-hand with investigating for multicointegration in regards to I(2) systems.

We wish to test for nonlinear relationships as well. For example, some literature suggests a nonlinear approach to evaluate the relationship between the real interest rate differential and REER (Nakagawa 2002).

Next, country-specific analysis provides for looking at variables impacted by the level of capital controls in place. Little to moderate levels of capital controls has been found to influence financial home bias (Forslund, Lima, and Panizza 2011), so it would be appropriate to interact with CC as a future step.

Finally, we would like to find the impact of reserve accumulation by currency composition by Dollar reserves, Euro reserves, et cetera. This is currently impossible as the PBOC has not disclosed this publicly.

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Appendices

Exhibit 1

Ln(REER) Regression with M2/GDP and U.S. Interest Rates as Instruments

Variables	Coefficient
	P-Value
Delta Reserves/GDP * Capital Controls, Instrumented	-0.149157
	0.00
Real Interst Rate Differential * Capital Account Openness	0.0000369
	0.409
Demeaned Private Credit/GDP	0.7150828
	0.00
Financial Home Bias	0.6203986
	0.033
Log Commodity Terms of Trade	0.0085366
	0.344
Lagged Demeaned VIX * Capital Account Openness	-0.002095
	0.002
Constant	4.486607
	0.00

Centered $R^2 = 0.7447$
Lag is 3 quarters
Observations: 59

Exhibit 2

Fitted values Scattered Against Residuals with M2/GDP and U.S. Interest Rates

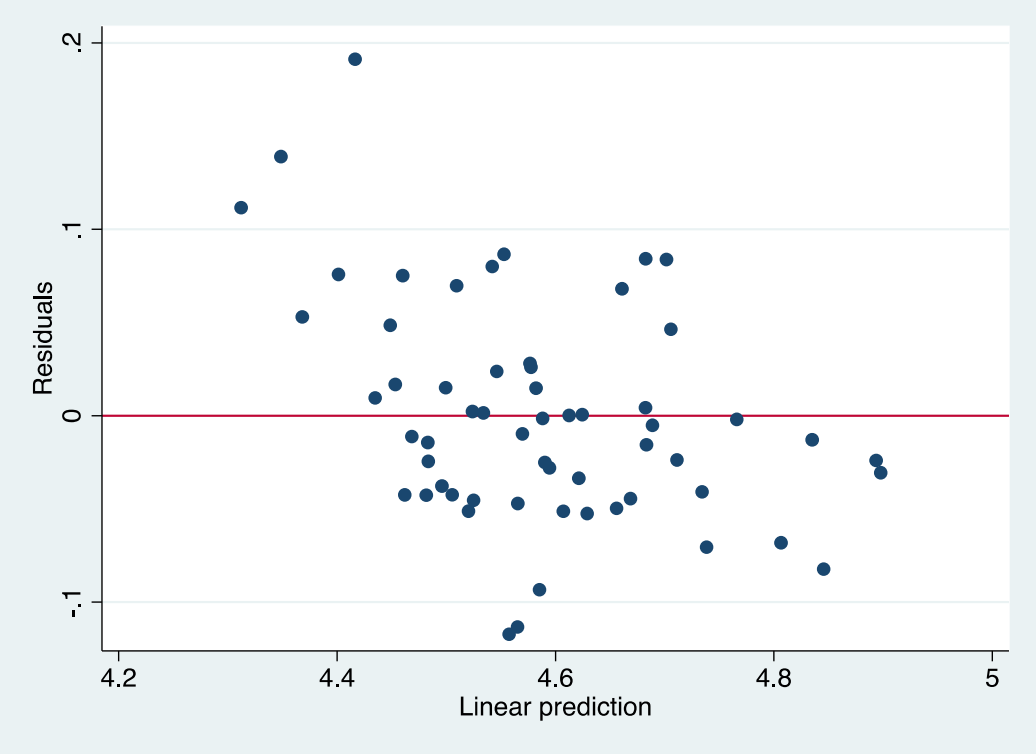

Exhibit 3

Fitted and Observed Values with M2/GDP and U.S. Interest Rates

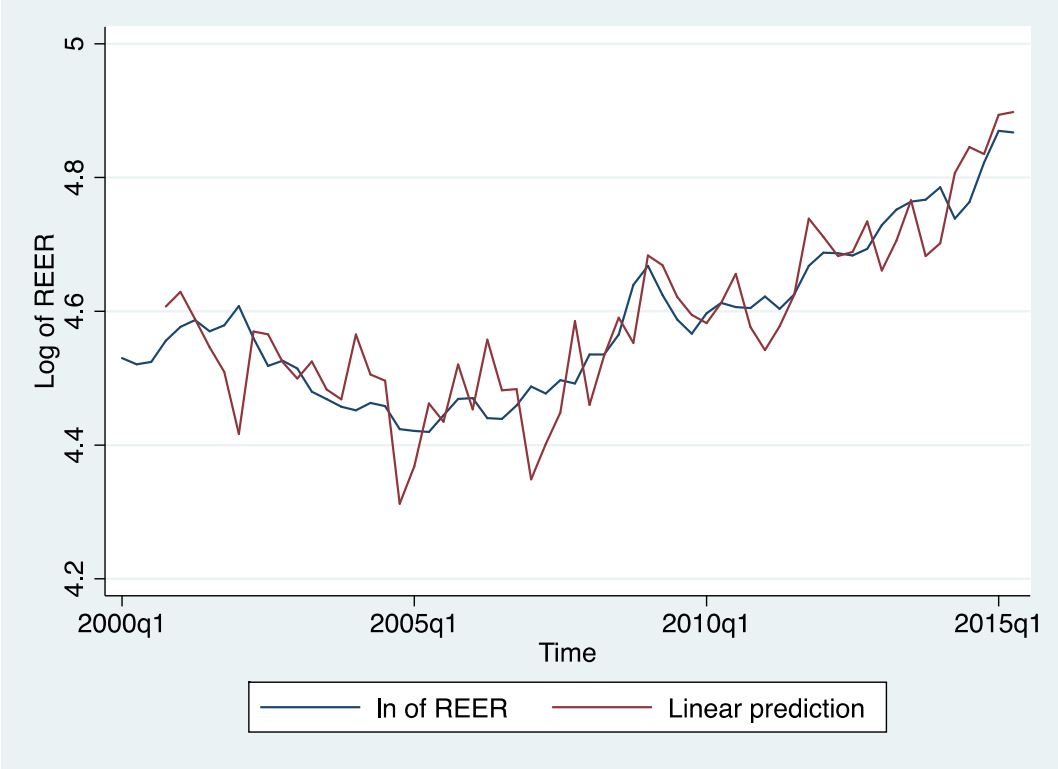

Exhibit 4

Ln(REER) Regression with M2/GDP and Russian Swaps as Instruments

Variables	Coefficient
	P-Value
Delta Reserves/GDP * Capital Controls, Instrumented	-0.145326
	0.00
Real Interst Rate Differential * Capital Account Openness	0.0000372
	0.397
Demeaned Private Credit/GDP	0.7254768
	0.00
Financial Home Bias	0.6266451
	0.024
Log Commodity Terms of Trade	0.009378
	0.271
Lagged Demeaned VIX * Capital Account Openness	-0.002103
	0.002
Constant	4.480621
	0.00

Centered $R^2 = 0.7557$
Lag is 3 quarters
Observations: 59

Exhibit 5

Fitted values Scattered Against Residuals with M2/GDP and Russian Swaps

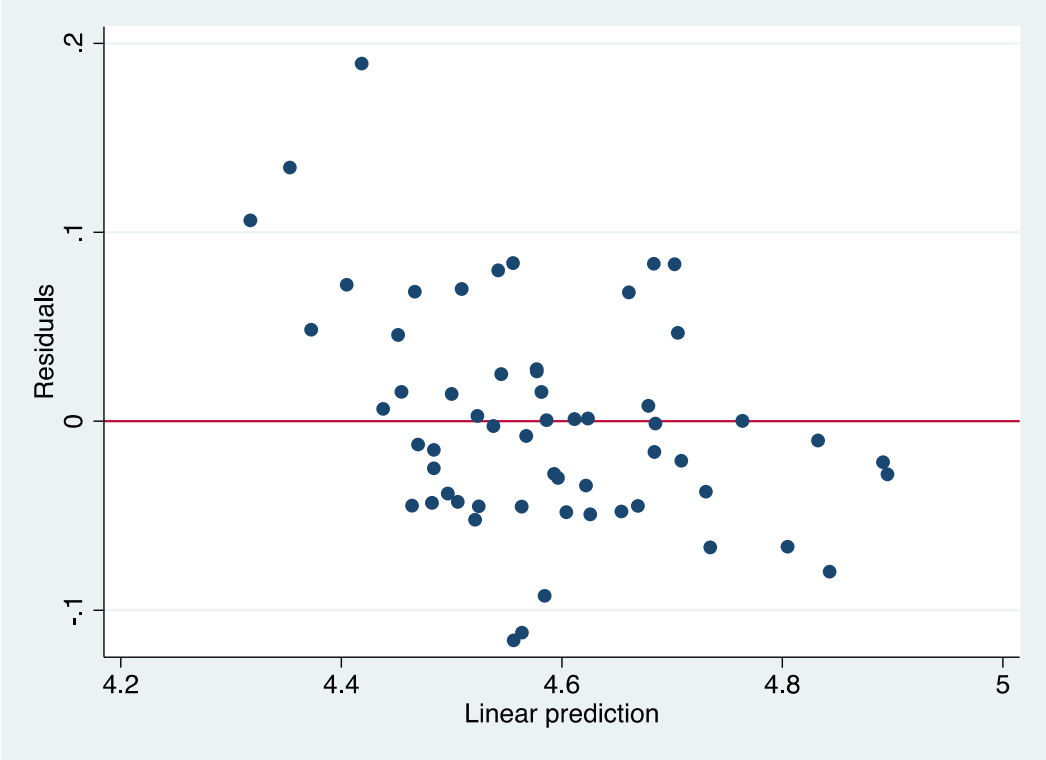

Exhibit 6

Fitted and Observed Values with M2/GDP and Russian Swaps

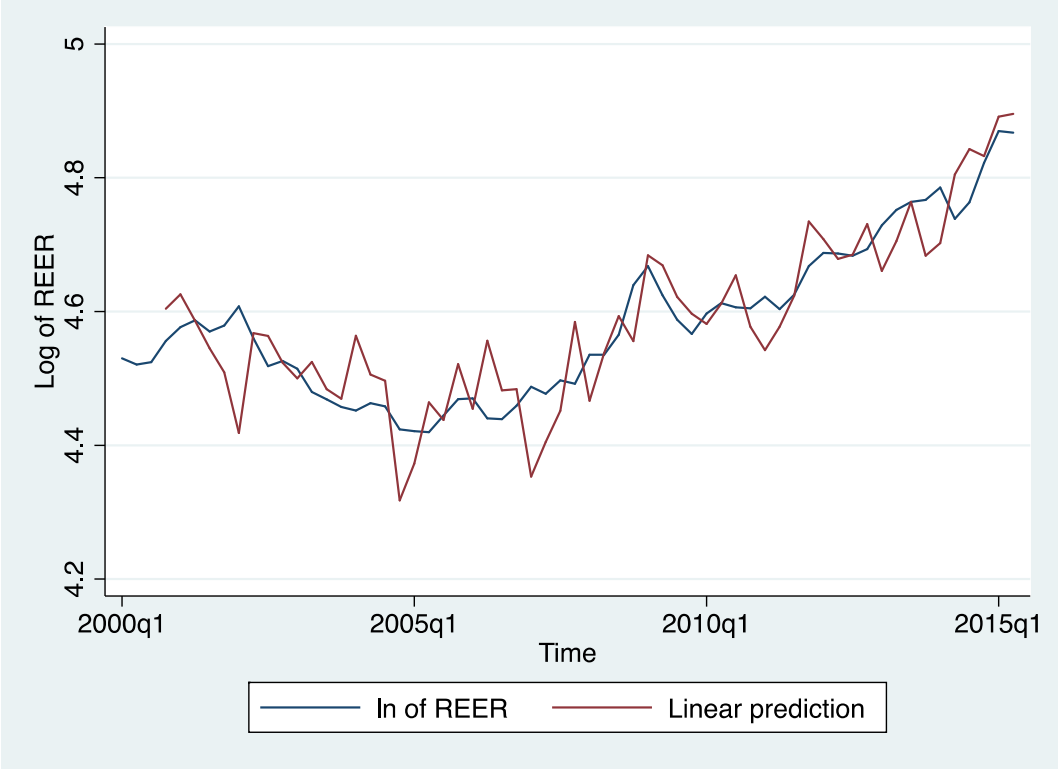

Exhibit 7

Log REER Actual and Fitted Values from EBA