REAL EXCHANGE RATES, FINANCIAL REPRESSION, AND REGIME TYPE - A POLITICAL ECONOMY ANALYSIS OF REAL EXCHANGE RATE UNDERSVALUATION

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ABSTRACT

For a number of reasons, including enhanced economic growth, greater competitiveness for the export sector, and increased capital formation, governments might wish to undervalue their country’s real exchange rate. However, pushing a key price of the global market like the real exchange rate out of equilibrium should, in theory, be unsustainable due to automatic adjustments in either the price level or the nominal exchange rate unless frictions are introduced into either of these two adjustment channels. I argue here that financial repression is a policy option that governments can pursue in order to introduce a substantial friction into the nominal exchange rate adjustment channel. Furthermore, I argue that due to the political costs associated with a sustained undervalued real exchange rate, such as repressed consumption and reduced purchasing power for the populace, autocracies are more likely to pursue these policies in order to achieve a sustained undervaluation. In order to test these hypothesized relationships, I use two random-effects logistic models to examine sustained periods of real exchange rate undervaluation lasting at least 3 and 4 years, respectively, and an ordinary least squares regression for a 5-year averaged dataset. I construct a main dataset consisting of 2591 country-year data points covering the time period of 1973-2005, and a 5-year averaged dataset consisting of 554 country-time-period data points covering 6 time periods. I draw on the work of Rodrik (2008) for my measure of real exchange rate undervaluation; Abiad, Detragiache, and Tressel...
(2010) and Ito and Chinn (2006) for my measures of financial repression; and Marshall and Jaggers (2002) for my measure of political system. Taken together, the results of these models provide support for the hypothesized relationship between autocracies and financial repression on the one hand, and a sustained undervaluation of the real exchange rate on the other hand.
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Introduction

In today’s depressed global economy, short of demand for goods and services, governments are desperate to find any source of advantage on the global market. Facing meager growth prospects at home, governments find boosting the export sector an attractive option. While competitiveness in the global marketplace is partially based on the productivity of a country’s work force, the real exchange rate also plays an essential role. The real exchange rate represents, at its core, the difference in price between an identical good or service in two countries once the nominal exchange rate, the value of the currency on the global market, has been taken into account. For this reason, a shift in the real exchange rate is likely to have a large impact on the total volume of a country’s exports because such a change will make the country’s goods and services either more or less expensive on the global market.

It follows from this analysis that governments may wish to distort their country’s real exchange rate away from its equilibrium value to a lower value in order to enhance the competitiveness of its exports sector (Rodrik, 2008), boost growth (Razin and Collins, 1997), and increase capital formation (Korinek and Serven, 2010). According to a balance of payments perspective, if the real exchange rate is pushed below its equilibrium level, the price level or nominal exchange rate will inevitably adjust to return it to equilibrium. This suggests that the monetary-based measures that are traditionally thought of as the instruments of exchange rate undervaluation\(^1\) will be insufficient to prevent this adjustment from occurring and returning the real exchange rate to its equilibrium level. From this perspective, financial repression in the form of credit controls, interest rate controls, and/or state ownership of the banking system will be necessary to sustain the undervaluation.

Since both financial repression and the undervalued exchange rate itself are associated with negative consequences, especially for workers and enterprises in the non-tradable sector of the economy, that are likely to be unpopular with voters in a democracy, autocracies will be more likely to implement and sustain these policies. Furthermore, little is known about the potential link between a country’s political system and the presence of a sustained exchange rate undervaluation. A policy of exchange rate undervaluation has a number of political implications, both positive and negative, and the question is whether democracies and autocracies are affected by these implications in the same way. As I will argue, the sum total of the effects of an undervalued exchange rate on the public is such that voters in democracies will prefer an appreciation, meaning autocracies will be more likely to execute such a policy.

This paper seeks to investigate whether the hypothesized relationship between financial repression and real exchange rate undervaluation is valid, and to examine whether such a relationship is influenced by a country’s political system. Rodrik (2008) and researchers from the IMF (2012) have found evidence linking credit controls to an undervalued real exchange rate, but no one has yet investigated the implications of the broader suite of financial repression tools, such as interest rate controls, which could play a role in preventing the adjustment of the domestic interest rate. It follows that because financial repression is an essential tool for sustaining an undervaluation, autocracies will be more likely to institute policies such as credit controls in pursuit of this goal.

In order to test these hypothesized relationships between financial repression/autocracy and a sustained undervalued exchange rate, I utilize a random-effects logistic regression model. This model is used to examine the relationship between a set of financial repression variables and a political system variable on the one hand, and two indicator variables coded to capture
periods of sustained undervaluation lasting a minimum of 3 and 4 years, respectively. In order to perform a robustness check of the results obtained from these two sets of models, I also utilize a standard ordinary least squares model on a dataset containing averages of all of the variables over 5-year windows, following Rodrik (2008).

This set of models produces results that are supportive of the notion that autocracies are more likely to sustain an undervaluation of the real exchange rate when compared to democracies. The results are also supportive of the notion that in order to achieve this policy goal, autocracies will implement the tools of financial repression that will prevent the real exchange rate from returning to its equilibrium level. These results have several policy implications. The first is that democracies are likely to be at a disadvantage in the global marketplace vis-à-vis autocracies due to the fact that autocracies can more freely pursue beggar-thy-neighbor, mercantilist policies through an undervalued real exchange rate that makes their goods and services relatively cheaper. As a result, democracies may want to press the World Trade Organization to include financial repression alongside tariffs as an anti-competitive practice. The second is that any government that desires to sustain an undervalued real exchange rate in order to boost growth and competitiveness can turn to the tools of financial repression to facilitate this goal.

**Literature Review**

By definition, an *undervalued* real exchange rate exists at a level below the equilibrium value that arises according to the long-run potential of the economy and international capital market equilibria. The transmission mechanism through which the real exchange rate returns to its equilibrium value is either the nominal exchange rate, which will appreciate as investors seek
to arbitrage the undervaluation and move money into the country to seek higher returns vis-à-vis the global economy, or the domestic price level, which will adjust upwards—in particular, wages—in order to bring the price of domestic tradable goods and services in line with international tradables per the “law of one price.” Such a correction will erase any discrepancy between the nominal exchange rate and the real exchange rate, thus eliminating any undervaluation. It is important to bear in mind, though, that the “law of one price,” while a neat theoretical concept, is empirically lacking (Isard, 1977). This is because almost all goods produced in different countries and sold on the global market are different from each other in meaningful ways. Discrepancies in transportation costs or tariffs and differing preferences of consumers across countries leads to the perfect arbitrage condition being violated, creating price discrepancies (Engel and Rogers, 1999). Nonetheless, significant price discrepancies that are based purely on exchange rate dynamics will result in a price level adjustment in a country with a misaligned exchange rate (Calvo, Reinhart, and Vegh, 1995).

Therefore, in order for an undervaluation to be sustained, there must exist some sort of friction(s) within the market that affect(s) the two key transmission mechanisms, discussed in the preceding paragraph, that prevent these adjustments (Adler and Tovar, 2011). The first place these frictions might be found is in the price level. As Klyuev (2003) points out, in the presence of flexible prices, the equilibrium real exchange rate will be reached over time as the prices adjust. It follows that inflexible prices could prevent this equilibrium from returning, and many prices, wages in particular, are indeed quite sticky. However, such frictions should give way over time to the elimination of any real exchange rate undervaluation. Rogoff (1996) and Chari, Kehoe, and McGrattan (2002) find that nominal stickiness of this sort cannot create large and persistent deviations from the real exchange rate equilibrium. Eventually, a price level increase
will result. For instance, Calvo, Reinhart, and Vegh (1995) find in their examination of three Latin American countries that undervaluation leads to inflation, exactly the outcome predicted by the classical model.

The second potential location for frictions that would prevent the return of the real exchange rate to its equilibrium level lies in financial markets. In addition to the price level, the nominal exchange rate is the other adjustment mechanism through which this process occurs. However, frictions associated with either the domestic interest rate or the capital account can block such an adjustment. An undervalued currency implies a rate of return that exceeds that of the world at large, i.e., the world interest rate, because nothing about the inherent productivity of the country’s economy has changed through the process of undervaluation, but the price of investing in the country from abroad has become cheaper. As a result, money should be drawn in from abroad to chase these higher returns (Frankel, 1979). This new demand for the country's currency should push the exchange rate upwards, naturally eliminating the undervaluation. Calvo, Leiderman and Reinhart (1993) find evidence of this appreciative impact on exchange rates caused by capital flows in the context of Latin America in the early 1990s. Thus, any undervaluation of the real exchange rate will be eliminated over a short time horizon due to capital movements associated with the disparity between the domestic interest rate and the world interest rate.

The adjustment of either or both the price level and the rate of return to capital in response to a disequilibrium between the real exchange rate and the nominal exchange rate suggests that in order for an undervaluation to be sustained, distortions must be present in the market. Thus, any government wishing to undervalue its real exchange rate for a sustained period of time would need to introduce frictions into either the price or interest rate adjustment process.
Since wages are one of the key components of the price level, any attempt to manipulate the price level would need to start there. Alternatively, a country might seek to create frictions in the financial market to prevent the easy adjustment of the domestic interest rate. Kern and Fahrholz (2010) argue that suppressed wages and financial repression are the essential components for countries that undervalue their currencies. Calvo, Reinhart, and Vegh (1995) find, empirically, in their examination of three Latin American countries that capital controls paired with an undervalued real exchange rate result in a higher domestic interest rate, exactly the result one would expect from stickiness in the financial markets. This also fits in broadly with the theoretical model developed by Jeanne (2012) that demonstrates how imperfect capital mobility is a major friction that theoretically should facilitate an undervalued exchange rate. In his work on the link between undervaluation and growth, Rodrik (2008) touches on this issue, finding evidence that credit controls and undervaluation are linked, presumably through the operative channel described here: by preventing capital inflows from appreciating the currency. Researchers from the IMF (2012) find similar evidence in their External Balance Assessment for the link between capital controls and a depreciated exchange rate.

Monetary intervention is another possible route through which frictions could theoretically be introduced into the exchange rate adjustment process. A central bank can seek to undervalue its country’s currency by either lowering the domestic interest rate and driving capital out of the country, or through a sterilized intervention that seeks to affect the nominal exchange rate independently of the domestic interest rate. However, a sterilized intervention that lowers the nominal exchange rate while leaving the domestic interest rate unchanged will create the arbitrage opportunity discussed above whereby foreign investors can gain returns higher than the world interest rate via the now-depreciated currency. Intriguingly, Adler and Tovar (2011)
find that sterilized interventions are much more effective in terms of fighting appreciation when paired with capital controls. The other method, non-sterilized interventions, is likely to be undone by a price level adjustment, depending on the relative magnitude of the exchange rate pass through channel relative to the interest rate channel of monetary intervention, i.e., the economic and financial openness of the economy (for an overview, see, BIS, 2008).

Nevertheless, an important take-away from this literature is that monetary policy is not sufficient to determine the price level and, thus, the real exchange rate in a country without supporting economic policy measures, e.g., financial repression.

It follows that governments can achieve the goal of a sustained undervaluation by either suppressing the price level through wage control (e.g., a managed labor market and/or surplus labor) or suppressing the adjustment of the nominal exchange rate through financial repression. However, theoretically speaking, even if the interest rate is manipulated, price adjustments on their own should be able to wipe out any misalignment of the real exchange rate, and thus wage suppression of some sort must be acting in concert with financial repression if an undervaluation is to be sustained over time. Due to the difficulties associated with measuring real wages, the literature has so far focused empirically almost entirely on the interest rate (and, thus, capital account) side of these frictions (e.g., Rogoff, 2008), and this paper will follow suit.

**Theoretical Considerations**

Fighting appreciation of the real exchange rate requires consumption to be suppressed (Jeanne, 2012), something that hurts consumers (and, thus, voters) on a day-to-day basis. Furthermore, by definition, an undervalued real exchange rate reduces the purchasing power of a country's residents below its equilibrium level, in effect making the citizens poorer relative to
where they would be absent the undervaluation. This forms an implicit tax on consumers that is
directly tied to the undervaluation. In aggregate, this tax takes the form of reduced purchasing
power and depressed consumption. Anything that makes the general populace poorer than it
would otherwise be is unlikely to be well received in a democracy.

In addition to the aforementioned negative effects, though, there are also clear benefits
that accrue to a country due to an undervalued real exchange rate. As research by Razin and
Collins (1997) and Rodrik (2008) show, an undervalued real exchange rate has a positive effect
on economic growth. Both autocracies and democracies should be inclined towards boosting
their country's growth because it benefits every interest group, as well as the leadership itself.
Growth means a larger pie for everyone in a society, as well as larger rents for the ruling class. It
is also a key provider of legitimacy for democratic and autocratic governments alike. This is the
so-called “performance legitimacy” that Huntington (1991) speaks of, by which governments
derive their authority from their ability to deliver positive economic performance. If a policy of
undervaluation simultaneously boosts growth and reduces the purchasing power of the public,
voters may judge the “performance legitimacy” of their government as lacking due to the decline
in their living standards (or, at least, the lower level of their living standards vis-à-vis where it
could be) and choose to vote it out of office. An autocracy is likely to have more flexibility in
managing this tradeoff (e.g., Drazen 2001).

In order to explain how an undervalued exchange rate leads to growth, two interrelated
channels associated with an undervalued real exchange rate have been proposed, both operating
through the tradable goods sector: a subsidy to correct for bad institutions and/or market failures
and "learning-by-investing" effects. Perhaps the most obvious of these channels is the support
the tradable sector receives from having the prices of its products lowered on the global market.
Rodrik (2008) theorizes that this price support functions as a subsidy that counterbalances the "tax" of bad institutions and/or market failures, which are borne disproportionately by the tradable sector (Rodrik, 2008). Thus, he suggests that an undervaluation might shift the price of tradables into line with their "true" price (the price minus the "tax"), resulting in an efficient outcome, though this is only likely to be the case for underdeveloped countries. The political effects of this channel are likely to be related to the size of the tradable sector in the economy (i.e., its potential lobbying power), rather than the political system per se, since the nullification of Rodrik’s “tax” is likely to affect voters working in the tradable and nontradable sectors in different ways. Broz, Frieden, and Weymouth (2008) find firm level evidence of the tradable sector’s preference for an undervalued exchange rate.

The second channel through which growth is boosted through an undervalued exchange rate relates to the accumulation of human and technological capital. This is the "learning-by-investing" effect that Korinek and Serven (2010) stress, whereby a country experiences positive externalities as a result of the investment taking place in the subsidized sector. These externalities take the form of technological spillover into non-exporting sectors and new skills for the country's workforce, both of which enhance the country's productive capacity. Benefits such as these accrue to society as a whole, though they may not be apparent outside of the industries that are directly affected. Either way, there is not an obvious transmission mechanism by which “learning-by-investing” effects would have different implications for the political calculations of those running a democracy versus an autocracy.

In addition to these growth benefits, an undervaluation also enhances capital formation in an economy. As long as wages remain suppressed, an undervaluation will stimulate investment and increase profitability for firms (Risager, 1988). Furthermore, if capital account restrictions
are found in conjunction with an undervalued real exchange rate, then the population is induced to increase its savings (Jeanne, 2012). An increase in savings, particularly in the context of a closed capital account, is anticipated to in turn boost domestic investment as well. Low-income countries, which benefit more from capital formation and “learning-by-investing,” and are also more likely to suffer from Rodrik’s “tax,” would seem to have the most to gain from these positive effects. The basic enhancement of the tradable sector through a price support would be the same for high-income countries, though the outcome is likely to be less than efficient. However, the diffuse nature of the manner in which the benefits associated with an undervalued real exchange rate accrue across the population, but the relatively particular nature of the costs (at least, in terms of the “consumer” or “wage earner” being affected), suggest the downsides are likely to be more important in terms of policy selected through the democratic process.

Beyond the effects of the undervaluation, there are a number of political consequences that are likely to be associated with financial repression itself. Voters are negatively affected by financial repression on a broad level because financial development has a negative effect on both poverty and inequality (Beck, Demirgue-Kunt, and Levine, 2007). One of the probable causes of this outcome is that a lack of financial access is a determinant of inequality (Claessens and Perotti, 2007). Voters are also affected by financial repression that takes the form of interest rate ceilings, which make loans artificially cheap and cause demand to exceed supply, leading to scarcity. When a government artificially lowers interest rates, income is transferred to privileged borrowers (Gonzalez-Vega, 1977). The subsidy is biggest for the largest borrowers, who are likely to be the most politically connected. This is because prices that are set below their equilibrium level by the government induce scarcity. These privileged borrowers can be thought of as rent-takers. Autocracies are more likely to suffer from rents in their economies (Mohtadi
and Roe, 2003), so rent-takers presumably wield more power under that system of government. The other outcome of scarcity is to significantly raise the cost of borrowing for those lacking these connections, who have to turn instead to the informal financial system. Those spurned can presumably express their unhappiness at the ballot box in a democracy. Interest rate ceilings also negatively affect savers, who are forced to take an artificially low rate of return on their bank deposits. Since nearly everyone in a country is a saver of some sort, the entire population, all of whom are potential voters, must bear this “tax.” Thus, autocracies will likely be able to tolerate the negative effects associated with both an undervaluation and the tools of financial repression that are needed to sustain it in a way a democracy cannot.

**Data Description & Variables**

In order to examine the hypothesized relationships between financial repression/autocracy and an undervalued exchange rate I utilize three key classes of variables. These attempt to measure a country’s a) degree of undervaluation in its real exchange rate, b) degree of financial repression, and c) system of governance. In order to examine the relationships between these three concepts, I use a basic model specification that takes on five related forms:

\[
UNDERVERALUATION_{it} = \beta_0 + \beta_1 Polity_{it} + \beta_2 REPRESS_{it} + CONTROLS + REGION_{it} + u_{it}
\]  

(1)

where

\[
UNDERVERALUATION = SusUnder3 | SusUnder4 | lnUnderval
\]

and

\[
REPRESS = FinRepress | CreditControls | StateOwnedBanks | IntRateControls | KA_Open
\]

and
\[ CONTROLS = \beta_3 NonTradables + \beta_4 DomCredit + \beta_5 CreditGrowth + \beta_6 Infl + \beta_7 CapFlows + \beta_8 TermsTrade + \beta_9 Trade \]

and

\[ REGION = \beta_{10} EastAsia + \beta_{11} EuropeCentAsia + \beta_{12} LACarib + \beta_{13} MidEast + \beta_{14} SoutAsia \]

\textit{UNDERVALUATION} represents three variables intended to capture a sustained undervaluation. \textit{lnUnderval} is a measure of the degree to which an exchange rate has deviated from its long-run expected value and is used in conjunction with averaged 5-year windows in the regression analysis. \textit{SusUnder3} and \textit{SusUnder4} are based on \textit{lnUnderval}, though from the full dataset instead of the 5-year averaged dataset. These two variables attempt to capture a sustained undervaluation of at least 3 and 4 years, respectively. For each variable, \( i \) represents an index of countries, and \( t \) represents an index of years.

Undervaluation is a tricky concept to operationalize. The notion of a real exchange rate is dependent upon differing price levels between countries and the nominal exchange rate as revealed in the foreign exchange market. These price levels are, in turn, notoriously difficult to measure. As a result, most researchers fall back on the Purchasing Power Parity (PPP) estimates present in the Penn World Tables, but there are important drawbacks to both PPP as a theoretical concept (Taylor and Taylor, 2004) and as a measurement (Deaton and Heston, 2009). PPP forms the basis of Rodrik's (2008) undervaluation index that I use as the \textit{lnUnderval} variable. This index is derived from a country's domestic price level, adjusted for the Balassa-Samuelson effect. One of the main strengths of this index is that it is comparable across both countries and time. Rodrik (2008) draws his data from the Penn World Tables, and I follow suit.

Rodrik's (2008) index is calculated as part of a three-step process. First, the real exchange rate is calculated by taking the natural log of the nominal exchange rate (\textit{XRAT}) over the
purchasing power parity conversion factors (PPP), where \( i \) is an index for countries and \( t \) is an index for year:

\[
\text{lnRER}_{it} = \ln \left( \frac{\text{XRAT}_{it}}{\text{PPP}_{it}} \right)
\]  

The value of \( \text{lnRER} \) indicates if the real exchange rate is under or overvalued; values greater than 1 signify an undervaluation and values less than 1 signify an overvaluation.

Next, Rodrik (2008) adjusts for the Balassa-Samuelson effect. This effect is related to the fact that non-traded goods, in addition to traded goods, are cheaper in lower-income countries. This means that the value of \( \text{lnRER} \) as originally calculated in step one is likely to be biased in the case of lower-income nations. In order to correct for this effect, Rodrik (2008) regresses \( RER \) on per-capita GDP (\( RGDPCH \)), where \( i_t \) is a time fixed effect and \( \varepsilon_{it} \) is the error term:

\[
\text{lnRER}_{it} = \beta_0 + \beta_1 \text{lnRGDPCH}_{it} + i_t + \varepsilon_{it}
\]  

My regression results for Equation 3 show a value of -0.24 for the coefficient on \( \text{lnRGDPCH} \), matching the results of both Rodrik (2008) and Berg and Miao (2010) for this step despite the differences in our datasets.

Finally, Rodrik (2008) takes the difference between the \( \text{lnRER} \) calculated in Equation 2 and the one adjusted for the Balassa-Samuelson effect calculated in Equation 3. This yields a final undervaluation measure that is comparable both over time and across countries, where \( \text{lnRER}_{it} \) is the predicted value of Equation 3:

\[
\text{lnUnderval}_{it} = \text{lnRER}_{it} - \text{lnRER}_{it}
\]  

Under Rodrik’s (2008) approach, a real exchange rate that is at its equilibrium level will have a value for \( \text{lnUnderval} \) of zero. A positive value indicates an undervaluation, and a negative value
indicates an overvaluation.²

Since this paper asserts that financial repression is necessary to sustain an undervaluation, as opposed to simply creating a short-run undervaluation, I develop two indicator variables, one for a 3-year sustained undervaluation and one for a 4-year sustained undervaluation. This adjustment also eliminates the noise associated with one-time undervaluations linked to a currency crisis.³ In order to capture most data points associated with a sustained undervaluation, I made these indicators both forward- and backward-looking. If InUnderval is greater than 0 (i.e., undervalued) in a given year, and that year is part of any 3-year (or 4-year) window of consecutive values of lnUnderval greater than 0, that year is assigned a 1 for the indicator variable. If it is not, it is assigned a 0.

REPRESS represents a series of financial repression indices and Polity represents an index of country’s level of democratization. These are used to examine the twin influences of political system and financial repression on whether a country’s RER is undervalued. Like undervaluation, both of these concepts are difficult to operationalize. Here, I use the Marshall and Jaggers (2002) Polity IV measure contained within the “Quality of Government Standard Dataset” developed by the The Quality of Government Institute at the University of Gothenburg to measure political system. The Polity IV is constructed by taking into account a spectrum of the factors that go into making a democracy, including institutions, rights, and constraints on executive power. It runs from a scale of -10 to 10, with 10 being the most democratic.

Because financial repression comes in so many flavors, governments sometimes try to

² Rodrik (2008) excludes several outliers from his database (Iraq, Laos, and the People’s Republic of Korea). These three countries are not included in my dataset, so there is no need to exclude them.
³ See Figure 2 in Appendix B, which shows the trend of InUnderval for South Korea over time. There is a sharp, temporary undervaluation associated with its currency crisis in 1999
conceal the extent of their repression, and there is so much potential for variation in the type of repression implemented, operationalizing this key variable presents its own unique difficulties. Happily for this paper, Abiad, Detragiache, and Tressel (2010) have already wrestled with many of the difficulties associated with measuring the extent of financial repression implemented by a government. Their work has yielded an extensive database, “A New Database of Financial Reforms,” that includes 91 countries and covers the period from 1973-2005.

Abiad, Detragiache, and Tressel’s (2010) construct indices for 7 broad classes of financial liberalization (which, by definition, is merely the inverse of financial repression): credit controls, interest rate controls, entry barriers, bank regulations, privatization, capital account, and securities market. Each of these indices is constructed by coding for various elements of each type of financial liberalization and then normalizing the results of this coding on a scale of 0 to 3, with 0 representing full repression and 3 representing full liberalization. They also construct a composite index based on these sub-indices in order to capture the degree of financial liberalization in a given country in a single number. This composite is coded on a scale of 0 to 21 and is merely the sum total of the 7 sub-indices, where 21 is maximum liberalization and 0 is maximum repression. It is represented by the notation \( \text{FinRepress} \) in the model. For both the composite index and the 7 sub-indices, I multiply all of the values by -1 in order to invert the scales. This eases the interpretation of the regression results because the variables are now measures of repression, instead of liberalization, since the highest value represents maximum repression and the lowest value represents maximum liberalization. This measure should shed light on the association, if any, between financial repression as a whole and undervaluation.

For the sub-indices, I select three of Abiad, Detragiache, and Tressel’s (2010) seven to investigate. The first of these sub-indices regards interest rate controls and is represented by
As discussed above, interest rate controls are potentially an important tool with which governments can reduce the negative consequences of the interest rate increase that is likely be associated with undervaluation, especially in the presence of credit controls (Calvo, Reinhart, and Vegh, 1995). Table 2 in the Data Description & Variables section below shows that there is a high correlation between the credit controls index and the interest rate controls index (0.61). Abiad, Detragiache, and Tressel (2010) construct their index of interest rate controls by considering both lending rates and deposit rates. Following the transformation of these indices from liberalization measures to repression measures, in my dataset a country that represses both is likely to score a 0 or a -1, whereas a country that represses neither will score a -3. Although the lending rate is likely to be the key one with regard to an undervaluation, I would expect countries that repress the lending rate to repress the deposit rate as well, in order to prevent the banking system from being squeezed.

The second sub-index I examine is for credit controls, which is represented by CreditControls in the model. Credit controls are likely to be an essential feature of any sustained undervaluation (Jeanne, 2012), and the evidence supports this (Rodrik, 2008) (IMF, 2012). This is because some friction, which prevents capital inflows from causing the currency to appreciate, needs to be introduced. In the absence of controls, investors from abroad would move their money into the country to chase the higher domestic interest rate caused by the undervaluation, which would eventually cause the real interest rate to fall back to its equilibrium level. However, capital account restrictions prevent this money from flowing into the country. Abiad, Detragiache, and Tressel (2010) create their index of financial account transactions by coding for capital inflow and capital outflow restrictions, as well as whether a country has a unified exchange rate system. The latter is included because countries often use multiple exchange rates
in order to selectively restrict what money can and cannot enter the country. Like the interest rate control index following my transformation, the financial account restrictions index is normalized to a 0 to -3 scale, with -3 representing full liberalization and 0 representing full repression.

The third sub-index I include is that for state ownership of the banking system, which is represented by $StateOwnedBanks$ in the model. Goodman and Pauly (1993) argue that an independent financial sector has an interest in an open capital account, and will push for this outcome. Thus, state-banking ownership and a restricted capital account are likely to go hand in hand. As can be seen in Table 2 in the Data Description & Variables section, the correlation between the state ownership of the banking system index and the credit controls index is moderately high (0.47). State ownership of the banking system is also likely to facilitate interest rate controls, since the state can directly prevent any cheating with regards to the interest rate controls by the banking system. The correlation between the state ownership of the banking system index and the interest rate controls index is also moderately high (0.43). State banks are also likely to be less inclined to try to defeat capital account restrictions, which in turn would undermine the undervaluation of the real exchange rate, by moving money out of the country.

This index is relatively straightforward, with each point on the 0 to -3 scale representing the degree of privatization found in a country (0 being full state ownership and -3 being full liberalization).

Finally, I also include a second measure of the degree of capital account openness of a country: $KA\_Open$. This represents the KAOPEN index developed by Ito and Chinn (2006) which is meant to capture the degree of capital account openness in a country on a continuous scale. Greater values indicate greater openness, so it is a measure of financial liberalization as opposed to financial repression. The scale is not anchored at 0 like the Abiad, Detragiache, and
Tressel (2010) indices, so I am unable to invert it to create a measure of capital account repression. As a result, the expected coefficient on this variable will be the opposite sign of the coefficient on the other credit controls measure, $CreditControls$. The $KA_{Open}$ variable is included in order to confirm the results obtained by Rodrik (2008) using this measure, and to compare with the results for the Abiad, Detragiache and Tressel (2010) measure of credit controls. Taken separately, these five financial repression indices each represent a unique model.

The same group of controls is used for both models, representing a number of the key drivers of under/overvaluation of the real exchange rate drawn from the literature. Before discussing the full set of controls, I would like to emphasize the importance of the first of my control variables, $NonTradables$, because it is potentially tied to two distinct, though related, phenomena that should have an impact on the level of the exchange rate. This variable represents the size of the nontradable sector within a country’s economy. Following Mendoza and Terrones (2008), it is calculated by subtracting the dollar value of the manufacturing sector from the industry sector contained within World Bank’s World Development Indicators (WDI), then adding the value of the agricultural sector to the difference, and then dividing this sum by the overall value of the country’s gross domestic product. The construction of this variable is such that “mining” is lumped in with the nontradable sector (the portions of the economy left out by this measure are manufacturing and services). Mendoza and Terrones (2008) do not seem to address this issue, but it has important implications for interpreting the variable.

There are two reasons it is important to control for this variable. The first is the presence of a potential Dutch Disease Effect, by which the export of large amounts of natural resources from a country causes the currency to artificially appreciate (and, in the disease part, strangles the manufacturing sector) (Corden, 1984). The impact of natural resource exports on the degree
of undervaluation should be captured by this variable due to the inclusion of mining. The second is related to the politics of a country. If the tradable sector is a major force in a country’s economy, then one would expect that it would have significant sway over decisions makers, whether in an autocracy or democracy. With this sway, it should be able to lobby for the undervalued exchange rate it desires. On the other hand, Bertola (1993) argues that owners of immobile capital, inherently part of the nontradable sector, will oppose growth and investment enhancing policies, such as an undervalued exchange rate.

As for the rest of the control variables, CreditGrowth represents the change in the amount of private credit present in a country in a given year compared to the previous year. This is calculated using the measure of the amount of domestic credit allocated to the private sector as a percentage of GDP contained in the WDI. Inflation represents annual growth rate of inflation based on the GDP implicit deflator, DomCredit represents domestic credit as a percentage of GDP, CapFlows represents the amount of net capital flows in a country in a given year, TermsTrade represents the terms of trade in a given country in a given year, and Trade represents the degree of trade openness in a country in a given year, calculated as the total value of exports plus the total value of imports over GDP. All are drawn from the WDI. The REGION variable represents a full set of dummies for the six regions contained in the region variable in the World Development Indicators. Sub-Saharan Africa is the omitted dummy variable. These are included to control for any regional effects due to an entire region being chronically undervalued.

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4 The OECD countries are not included in the World Bank’s regional groupings, so I assigned them manually to each region. The USA and Canada joined the Americas, Israel was added to the Middle East, the Western European nations were grouped with Europe, and Singapore, South Korea, Australia, New Zealand and Japan were placed in East Asia.
These controls are all drawn from the literature on over/undervalued exchange rates. Athukorala and Rajapatirana (2003), in their comparison of the Asian and Latin American experiences with exchange rates, focus on the role of net credit flows in determining the value of the real exchange rate. In their roundup of various other studies examining exchange rates they note that most of these studies control for credit flows, as well as trade openness and the terms of trade. MacDonald (1998), in his review of the fundamental determinants of the real exchange rate, also focuses on the terms of trade (among other things). Kern (2010) observes that appreciations happen more quickly in economies with lower levels of domestic credit, so a measure of the level of domestic credit is included in order to control for this effect. Klyuev (2003), for his part, believes credit expansion is a key driver of the value of the real exchange rate. This echoes the empirical results of Calvo, Leiderman, and Reinhart (1993), who find a strong link between capital inflows and real exchange rate appreciation, as well as the previous discussion of exchange rate adjustment transmission mechanisms. The final control is a measure associated with the other adjustment transmission mechanism: the price level. Calvo, Reinhart, and Vegh (1995) find inflation to be an essential determinant of the level of the real exchange rate.

**Descriptive Statistics**

My full dataset consists of 2605 country-year data points covering the time period of 1973 to 2005, though only 2591 of these are pertinent to my analysis as that is the number of country-year observations for the dependent variable (InUnderval). The number of countries contained in the dataset grows from 70 in the first year (1973) to 89 in the last year (2005). The country and time parameters are dictated almost entirely by the smallest of the datasets used
here: Abiad, Detragiache, and Tressel’s “A New Database of Financial Reforms.” When the dataset is recoded for 5-year windows in order to follow Rodrik’s (2008), there are 554 country-time-period data points covering six time periods.⁵

Table 1 gives a brief statistical overview of the key variables in the full panel dataset I use in my regression analysis. The country-time-periods covered in the dataset contain a good deal of variation across all of the listed measures. Approximately two-thirds of the country-time-period samples represent democracies.⁶ An examination of the real GDP per capita distribution across the dataset (not shown in the chart) reveals that a range of income levels are captured as well (minimum of $169.10; maximum of $48,701.21) though the distribution is skewed towards higher-income countries (median of $5,519.33; mean of $10,110.56). There is also decent variation across all of the control variables. As for the regions represented by the sample, the most country-year data points are from the Europe & Central Asia region and the least are from the South Asia region.

An undervaluation is slightly less likely than overvaluation in this sample (46% undervalued).⁷ At least one country’s currency appears to have been heavily overvalued at some point (minimum value of $lnUnderval being -3.16). A closer examination of which countries are extremely overvalued reveals that Zimbabwe is responsible for 30 of 38 instances of $lnUnderval

---

⁶ A dummy variable was created for the Polity variable in order to determine the percentage of democracy country-year observations (0.66), but it was not included in Table 2.
⁷ A dummy variable was created for the InUnderval variable in order to determine the percentage of country-year observations, where 1 was assigned to values of InUnderval > 0 and 0 was assigned to values < 0.
being less than -2.\(^8\) See Figure 1 in the Appendix B for a distribution of \(\text{lnUnderval}\) values for all countries over time. There are less examples of extreme undervaluation (10 data points where \(\text{lnUnderval}>1.2\)). All 10 of these data points are former Soviet Republics during the time period of 1991-1994 and the undervaluation is presumably associated with their independence.\(^9\) Financial reform and repression appear to be fairly balanced within the sample (means and medians are similar, and they are at about the midway point of the indices). Of the individual financial repression mechanisms, interest rate controls are the least popular, while state ownership of the banking system is the most popular. Capital controls are about as likely to be imposed as not.

\(^8\) The other countries are Ghana (1 instance), Mozambique (2 instances), Nicaragua (1 instance), and Uganda (2 instances). See Figure 3 in Appendix B for the distribution of values of \(\text{lnUnderval}\) for Zimbabwe over time.

\(^9\) The countries in question are Azerbaijan, Belarus, Estonia, Kazakhstan, Latvia, Lithuania, Russia Federation, Ukraine, and Uzbekistan; six out of the ten observations come from 1993.
<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Min.</th>
<th>Max.</th>
<th>Median</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2591</td>
<td>-3.16</td>
<td>1.69</td>
<td>-0.04</td>
<td>-0.06</td>
<td>0.50</td>
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<tr>
<td>Sustained Undervaluation (3 Years)</td>
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<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.44</td>
<td>0.50</td>
</tr>
<tr>
<td>Sustained Undervaluation (4 Years)</td>
<td>2591</td>
<td>0.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.42</td>
<td>0.49</td>
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<td>Financial Repression</td>
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<td>-10.50</td>
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<td>6.33</td>
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<tr>
<td>Interest Rate Controls</td>
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<td>0.00</td>
<td>-3.00</td>
<td>-1.79</td>
<td>1.32</td>
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<td>-1.58</td>
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<tr>
<td>Capital Account Restrictions 2 (KAOpen)</td>
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<td>1.53</td>
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<td>State-ownership of the Banking System</td>
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<td>-3.00</td>
<td>0.00</td>
<td>-1.00</td>
<td>-1.24</td>
<td>1.18</td>
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<td>Political System</td>
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<td>3.43</td>
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<td>NonTradables (% of GDP)</td>
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<td>0.05</td>
<td>0.74</td>
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<td>0.27</td>
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<td>Inflation</td>
<td>2557</td>
<td>-23.48</td>
<td>15442.30</td>
<td>8.52</td>
<td>65.24</td>
<td>562.39</td>
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<tr>
<td>Private Credit (% of GDP)</td>
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<td>231.08</td>
<td>30.50</td>
<td>45.30</td>
<td>38.52</td>
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<td>Private Credit Growth (% of GDP)</td>
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<td>-183.35</td>
<td>111.05</td>
<td>0.79</td>
<td>0.30</td>
<td>13.23</td>
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<td>Private Capital Flows (% of GDP)</td>
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<td>-26.58</td>
<td>34.13</td>
<td>0.88</td>
<td>1.36</td>
<td>3.61</td>
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<tr>
<td>Terms of Trade</td>
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<td>-1.13e+14</td>
<td>4.66e+13</td>
<td>-1.03e+08</td>
<td>-2.41e+11</td>
<td>6.94e+12</td>
</tr>
<tr>
<td>Trade Openness</td>
<td>2530</td>
<td>6.32</td>
<td>428.46</td>
<td>55.25</td>
<td>61.38</td>
<td>34.48</td>
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</tbody>
</table>

Underval, SusUnder3, SusUnder4: author's calculations, derived from Penn World Table
Controls: source, WDI
Financial Repression, Interest Rate Controls, Capital Controls
State-ownership of the Banking System: source, Abiad, et. al.
Polity: source, Quality of Government Standard Database
Table 7, in Appendix A, contains the descriptive statistics for the same variables as Table 1, but for the 5-year averaged dataset. In this dataset, the total number of country-time-period observations is identical to the number of useful country-time-period observations since there are 554 observations for lnUnderval. Of these, 249 (45%) represent an undervaluation, mirroring the full dataset. Overall the statistics change only marginally between the full dataset and the 5-year averaged dataset. The only exception is that the skew of IntRateControls decreases (the difference between the mean and the median in the full dataset is 1.21, but only 0.18 in the 5-year averaged dataset). The n associated with the 5-year averaged database is of some concern as its size limits the amount of variability that a regression can analyze and will likely result in larger standard errors vis-à-vis the full dataset.

Table 2 outlines the basic structure of the relationships between the variables in the form of correlations for the full dataset. In terms of the key relationships, democracy is not correlated with any of the undervaluation measures in a significant way, while the financial repression variables are. Although the correlations between the financial repression variables and the undervaluation variables are statistically significant, they are also small (the largest correlation coefficient for this series of relationships is 0.19 for StateOwnedBanks and SusUnder3). The relationship between democracy and the indices of financial repression is similarly ambiguous; most of the correlation coefficients are statistically significant, but the relationships are very small. These relationships hold for both the Ito and Chinn (2010) index and Abiad, Detragiache, and Tressel’s (2008) indices. In addition to the strong relationships between variables of a similar ilk (the financial repression variables with each other and the undervaluation variables with each other), there are a few other strong relationships. Inflation and financial repression

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10 A dummy variable for lnUnderval was also created for this dataset to obtain these figures.
appear to be linked, as posited earlier, and, unsurprisingly, financial repression is associated with a smaller domestic pool of credit. Finally, trade openness appears to be negatively associated with financial repression. See Table 8, found in Appendix A, for the correlations between the variables in the 5-year averaged dataset.
<table>
<thead>
<tr>
<th>Undervaluation Index</th>
<th>SusUnderval, 3 Yr</th>
<th>SusUnderval, 4 Yr</th>
<th>Financial Repression</th>
<th>Interest Rate Controls</th>
<th>Credit Controls</th>
<th>State Banking</th>
<th>C.C. 2 (KA Open)</th>
<th>Democracy</th>
<th>NonTradables</th>
<th>Inflation</th>
<th>Credit Growth</th>
<th>Domestic Credit</th>
<th>Capital Flows</th>
<th>Terms of Trade</th>
<th>Trade Openness</th>
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<td>Undervaluation Index</td>
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<td>SusUnderval, 3 Yr</td>
<td>0.700***</td>
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<tr>
<td>SusUnderval, 4 Yr</td>
<td>0.692***</td>
<td>0.972***</td>
<td>1</td>
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<tr>
<td>Financial Repression</td>
<td>0.0812**</td>
<td>0.171***</td>
<td>0.171***</td>
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<tr>
<td>Interest Rate Controls</td>
<td>-0.0239</td>
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<td>0.0555*</td>
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<tr>
<td>Credit Controls</td>
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<td>0.151***</td>
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<tr>
<td>State Banking</td>
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<td>0.183***</td>
<td>0.687***</td>
<td>0.425***</td>
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<tr>
<td>C.C. 2 (KA Open)</td>
<td>-0.0760**</td>
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<td>-0.528***</td>
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<tr>
<td>Democracy</td>
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<td>-0.0384</td>
<td>0.0743</td>
<td>-0.00642</td>
<td>0.0706**</td>
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<tr>
<td>NonTradables</td>
<td>-0.0451</td>
<td>-0.0698**</td>
<td>-0.0639**</td>
<td>-0.122***</td>
<td>-0.0981**</td>
<td>-0.110***</td>
<td>-0.0966**</td>
<td>0.125***</td>
<td>-0.0121</td>
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<td></td>
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<tr>
<td>Inflation</td>
<td>0.0877**</td>
<td>0.0144</td>
<td>0.0241</td>
<td>-0.502***</td>
<td>-0.494***</td>
<td>-0.332***</td>
<td>-0.304***</td>
<td>0.460***</td>
<td>-0.0268</td>
<td>0.0309</td>
<td>1</td>
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</tr>
<tr>
<td>Credit Growth</td>
<td>0.0596*</td>
<td>0.0814**</td>
<td>0.0835**</td>
<td>0.601***</td>
<td>0.469***</td>
<td>0.365***</td>
<td>0.447***</td>
<td>-0.509***</td>
<td>0.00725</td>
<td>-0.0793**</td>
<td>-0.602***</td>
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<tr>
<td>Domestic Credit</td>
<td>-0.194***</td>
<td>-0.273***</td>
<td>-0.267***</td>
<td>-0.454***</td>
<td>-0.277***</td>
<td>-0.306***</td>
<td>-0.372***</td>
<td>0.498***</td>
<td>-0.0416</td>
<td>0.195***</td>
<td>0.339***</td>
<td>-0.523***</td>
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<tr>
<td>Capital Flows</td>
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<td>0.207***</td>
<td>0.207***</td>
<td>-0.0297</td>
<td>-0.0984**</td>
<td>-0.0611*</td>
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<td>-0.0883**</td>
<td>0.000585</td>
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<td>-0.0483*</td>
<td>0.112***</td>
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<td>-0.102***</td>
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<td>-0.0390</td>
<td>-0.0341</td>
<td>-0.0879**</td>
<td>0.000007</td>
<td>0.00168</td>
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<td>-0.0675**</td>
<td>0.0337</td>
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<tr>
<td>Trade Openness</td>
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<td>0.120**</td>
<td>0.120***</td>
<td>-0.342***</td>
<td>-0.197***</td>
<td>-0.260***</td>
<td>-0.295***</td>
<td>0.206***</td>
<td>-0.0681*</td>
<td>0.0671**</td>
<td>0.0593*</td>
<td>-0.179***</td>
<td>0.136**</td>
<td>0.105***</td>
<td>0.0265</td>
</tr>
</tbody>
</table>

* p<0.05  ** p<0.01  *** p<0.001
Results

In order to test the hypothesized relationships between financial repression/autocracy and a sustained undervalued exchange rate, a random-effects logistic model of the 3-year sustained undervaluation/4-year sustained undervaluation indicator variables regressed on political system and each one of the series of 5 financial repression variables is used. Tables 3 and 4 contain these results. The model includes the full sets of control variables and regional dummy variables described earlier. A logistic model is used because the dependent variable is an indicator variable. Using an ordinary least squares (OLS) model with an indicator variable produces a model of probability, but one that is linear, allowing predicted probabilities of greater than 1 and less than 0 at the extremes. A logistic model is non-linear and forces the predicted probabilities to be between 0 and 1.

In a probabilistic regression model, the coefficients reflect the change in the predicted probability that the dependent variable will be equal to 1 given a one-unit change in the independent variable. Here, that means the predicted probability that a given year is part of a sustained undervaluation of at least 3 years for a given country. The downside of a logistic model is that the coefficients are tricky to interpret because the model is non-linear. All that can be said with certainty regarding the coefficients is whether the independent variables have a positive or negative relationship with the dependent variable.

This is not true of the coefficients associated with the model utilizing the 5-year averages dataset, though, because an OLS model is used. The coefficients yielded by this model can be interpreted as the change in the value of the undervaluation index associated with a one-unit change in the given independent variable, holding the other independent variables constant. This is possible because the 5-year averaged version of lnUnderval is a continuous variable, as
opposed to the $SusUnder3$ and $SusUnder4$ variables, which necessitated the logistic models. For this model, a set of time and fixed effects dummies are used in addition to the regional dummies and control variables. Table 5 contains these results.

In each of Tables 3-5, Column 1 shows the results for the Polity variable, the FinRepress variable, and the control/regional dummy variables on each of the three respective undervaluation measures. Columns 2-5 represent the results when the FinRepress variable is replaced with the IntRateControls, CreditControls, StateOwnedBanks and KAOpen variables, respectively.
As can be seen in Table 3, the relationship between political system and the probability of a given year representing part of an undervaluation of at least 3 years is both negative and statistically significant across all 5 columns. Polity is an ordinal variable that represents increasing democracy as it increases in value, so a negative value for its coefficient represents a positive relationship between autocracy and a sustained undervaluation over at least a 3-year period. In other words, the more autocratic a country is, as classified under the Quality of

<table>
<thead>
<tr>
<th>Variables</th>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polity</td>
<td>-0.113***</td>
<td>-0.137***</td>
<td>-0.127*</td>
<td>-0.141**</td>
<td>-0.121**</td>
</tr>
<tr>
<td>FinRepress</td>
<td>0.0792***</td>
<td>-0.0193</td>
<td>-0.0208</td>
<td>-0.0495</td>
<td>-0.0658</td>
</tr>
<tr>
<td>IntRateControls</td>
<td></td>
<td>0.0155</td>
<td></td>
<td>-0.248</td>
<td></td>
</tr>
<tr>
<td>CreditControls</td>
<td></td>
<td></td>
<td>0.445</td>
<td></td>
<td>0.445</td>
</tr>
<tr>
<td>StateOwnedBanks</td>
<td></td>
<td></td>
<td></td>
<td>1.068***</td>
<td></td>
</tr>
<tr>
<td>KAOOpen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.279</td>
</tr>
<tr>
<td>NonTradables</td>
<td>-1.088</td>
<td>4.484</td>
<td>-1.686</td>
<td>2.613</td>
<td>5.172</td>
</tr>
<tr>
<td>Infl</td>
<td>-1.48E-03</td>
<td>-2.44E-03</td>
<td>-0.00402**</td>
<td>-0.00486*</td>
<td>-3.95E-03</td>
</tr>
<tr>
<td>DomCredit</td>
<td>-0.0306***</td>
<td>-0.0394***</td>
<td>-0.0299***</td>
<td>-0.0377***</td>
<td>-0.0357***</td>
</tr>
<tr>
<td>CreditGrowth</td>
<td>-0.00409</td>
<td>-0.00863</td>
<td>-0.0153</td>
<td>-0.007</td>
<td>-0.00645</td>
</tr>
<tr>
<td>CapFlows</td>
<td>0.106***</td>
<td>0.027</td>
<td>0.0249</td>
<td>4.34E-02</td>
<td>0.0433</td>
</tr>
<tr>
<td>TermsTrade</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Trade</td>
<td>0.0323***</td>
<td>0.0727***</td>
<td>0.0285***</td>
<td>0.0904***</td>
<td>0.0707***</td>
</tr>
<tr>
<td>Regional Dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Random Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*p<0.05  **p<0.01  ***p<0.001
Governance polity measure, the higher the probability that in any given year it will be experiencing a sustained undervaluation of its real exchange rate of at least 3 years in duration. Likewise, the more democratic a country is, the lower the probability of a sustained undervaluation of this nature. These results support the hypothesized notion that autocracies are more likely to be able to overlook the various costs to the populace associated with an undervaluation and to sustain this undervaluation over an extended period of time.

The results for each of the *REPRESS* series of variables in relation to the *SusUnder3* variable in Table 3 are consistent in their direction, though not in their significance. These coefficients represent the relationship between the independent variables and probability of a given year representing part of an undervaluation of at least 3 years. Each column contains a different element of, or way of, measuring financial repression. Overall, though, the relationship between financial repression and a sustained undervaluation of at least 3 years is positive and, except for Columns 2 and 5, statistically significant. The relationship is most statistically significant for the *FinRepress* and *StateOwnedBanks* variables. The former provides support for the notion that financial repression, thought of in its broadest terms, is necessary to facilitate a sustained real exchange rate undervaluation. The latter supports the assertion that state ownership of the banking system is likely to facilitate the credit controls that can prevent capital inflows from appreciating the currency. The coefficients for the variables *IntRateControls* and the two credit control measures are not statistically significant. They are, however, of the predicted sign, with interest rate controls and credit controls both positively associated with a sustained undervaluation of at least 3-years, and credit openness (*KAOpen*) negatively associated with a sustained undervaluation of at least 3-years. This provides tentative support for the hypothesized relationships between interest rate/credit controls and sustained real exchange
undervaluation. The results utilizing the *SusUnder4* variable shown in Table 4 provide stronger support for these two relationships. Overall, these results provide mild support for the hypothesized relationship between financial repression and a sustained undervaluation and strong support for the hypothesized relationship between autocracy and a sustained undervaluation. These results are further corroborated by the results utilizing the *SusUnder4* variable.

Table 4 contains the results for the same set of random-effects logistic models as in Table 3, except here the dependent variable is an indicator for a period of sustained real exchange rate undervaluation of at least 4 years, as opposed to one lasting at least 3 years. According to the hypothesis laid out in this paper, it should become increasingly difficult over time to sustain an undervalued real exchange rate because the price level and/or the nominal exchange rate will adjust to bring the real exchange rate back to equilibrium. Thus, the introduction by governments of a friction into the nominal exchange rate adjustment mechanism through the tools of financial repression should be strongly associated with longer periods of sustained undervaluation. The results contained in Table 4 support this assertion.
In contrast to Table 3, all of the coefficients on the REPRESS variables in Table 4, with the exception of the KAOpen variable, are statistically significant. Like Table 3, all have the expected sign. Of particular interest is the fact that the coefficients for IntRateControls and CreditControls are statistically significant in relation to the probability that a given year is part of a sustained undervaluation lasting at least 4 years, as opposed to those lasting at least 3 years. This provides support for the hypothesized relationships between both credit controls and interest...
rate controls on the one hand, and the stickiness in the nominal exchange rate adjustment
mechanism necessary to sustain an undervaluation on the other. Oddly, neither the results in
Table 3 nor in Table 4 indicate a statistically significant relationship between the kaopen index
and undervaluation. This contrasts with the results of both Rodrik (2008), specifically, who also
uses the kaopen index, and the researchers from the IMF (2012), more generally, who use an
alternative index for credit controls. The results with regards to the Polity variable remain
unchanged from Table 3, except for Column 1, where the relationship ceases to be statistically
significant. Otherwise, these results confirm the results from Table 3 that autocracies are
associated with a higher probability of a given year being part of a 4-year period of sustained real
exchange rate undervaluation.

Also of interest in Tables 3 and 4 are the coefficients on the NonTradables and
DomCredit variables. Only in Columns 1 and 3 of Table 4 is the coefficient for NonTradables
statistically significant, but it has the expected negative sign as discussed in the variables section.

In order to perform a robustness check of the results obtained from the two sets of models
using the sustained undervaluation measures, I also replicate Rodrik’s (2008) approach to
examining undervaluation, whereby he creates a dataset which contained averages of all of his
variables over 5-year windows, as discussed earlier. Since the dependent variable in this case,
Underval, is a continuous variable, as opposed to the indicator variables that SusUnder3 and
SusUnder4 represent, I can utilize a standard OLS regression instead of a logistic model. Table 5
contains these results.
The results are decidedly mixed when compared to those in Tables 3 and 4. Interestingly, the coefficient for the *KAOpen* variable is statistically significant for this dataset in contrast to the results reported in Tables 3 and 4, just like in Rodrik (2008). The negative direction of the relationship, though, matches the other results. The *Polity* results remain negative, though they are not statistically significant and the relationship is generally very small. They suggest that a change from one extreme of the polity measure, full autocracy, to the other extreme, full
democracy, is only associated with a tiny change in degree of undervaluation in a currency over a 5-year window. The coefficients for the FinRepress, CreditControls and StateOwnedBanks variables remain positive, while the coefficient for IntRateControls becomes negative. All of these coefficients lack statistical significance. Except for IntRateControls, the size of the coefficients suggests a sizable relationship between the financial repression variables and the degree of undervaluation over a 5-year period, even if the relationship lacks statistical significance. The reason for the nearly complete lack of statistical significance for the coefficients of any of the key independent variables is likely due to the small sample size for the 5-year dataset, which is 350 for this set of models. Another weakness of this approach vis-à-vis the logistic models is that a 5-year average of the degree of real exchange rate undervaluation could mask lapses in sustained undervaluations that the SusUnder3 and SusUnder4 variable do not. Overall, though, they provide a degree of support for the hypothesized relationships, and, at a minimum, do not contradict the results found in Tables 3 and 4.

**Conclusion**

For a number of reasons, including enhanced economic growth, greater competitiveness for the export sector, and increased capital formation, governments might wish to undervalue their country’s real exchange rate. One potential approach would be to use monetary interventions to depreciate the real exchange rate. However, pushing a key price of the global market like the real exchange rate out of equilibrium should, in theory, be unsustainable due to automatic adjustments in either the price level or the nominal exchange rate unless frictions are introduced in either of these two adjustment channels. I argue that financial repression is a policy option that governments can pursue in order to introduce a substantial friction into the nominal
exchange rate adjustment channel. I also argue that due to the political costs associated with a sustained undervalued real exchange rate, such as repressed consumption and reduced purchasing power for the populace, autocracies are more likely to pursue these policies in order to achieve a sustained undervaluation. Taken together, the results of the regression analysis contained within this paper provide support for the hypothesized relationship between autocracies and financial repression on the one hand, and a sustained undervaluation of the real exchange rate on the other hand.

Although the regression results are supportive, there are a number of reasons to interpret the results with caution. The first concerns the measure of the dependent variable, undervaluation of the real exchange rate. I use a purchasing power parity-based measure, derived from the work of Rodrik (2008). However, there is a whole body of literature applying various approaches to the problem of measuring the real exchange rate, many of which are critical of purchasing power parity approaches (MacDonald, 2000). I do not test whether my results hold across some of these other measures, and the results may be dependent on the undervaluation measure used. Beyond the index of undervaluation itself, my operationalization of the concept of “sustained” undervaluation is another potential weakness. Due to the fact that my two sustained undervaluation measures are both forward and backward looking, they may capture an inverted relationship whereby financial repression in the future is associated with a sustained undervaluation in the past. Further research could introduce lags into my key variables to overcome this weakness. It is worth noting, though, that researchers from the IMF (2012) use a lagged measure of credit controls and also find a positive relationship with undervaluation. Finally, there is the problem of sample size. From a practical perspective, the small sample size for the 5-year averaged database undermines the statistical significance of those results. From a
more theoretical perspective, the small time-window covered by this analysis (1973-2005) might capture false relationships related to the end of communism and the dawn of globalization at the mid-way point of the dataset.

Overall, though, the results are supportive of the notion that autocracies are likely to be more capable of sustaining an undervaluation of the real exchange rate than democracies, and in order to achieve this policy goal, they will implement the tools of financial repression. There are several policy-related implications to this result. The first is that democracies will be vulnerable to beggar-thy-neighbor, mercantilist policies by autocracies that utilize financial repression to achieve an undervalued exchange rate. As a result, democracies may want to press the World Trade Organization to include financial repression alongside tariffs as an anti-competitive practice. The second policy implication applies to any government that would like to harness a sustained, undervalued real exchange rate to boost growth and competitiveness and can withstand any public backlash against the negative consequences of this policy. Such a government, likely an autocracy, can look to these results for inspiration on how to achieve this goal. Implementing financial repression will introduce frictions into the nominal exchange rate adjustment channel, allowing the desired real exchange rate undervaluation to be sustained.
Table 6: Summary of Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Short Form</th>
<th>Source</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undervaluation Index</td>
<td>lnUnderval</td>
<td>World Development Indicators; Penn World Table; Rodrik (2008)</td>
<td>An index of the divergence between the exchange rate and its long-run potential</td>
<td>lnUnderval is calculated using Rodrik’s (2008) technique</td>
</tr>
<tr>
<td>Sustained 3-Year Undervaluation</td>
<td>SusUnder3</td>
<td>Author’s calculation</td>
<td>A dummy variable indicating that a year is part of a series of at least 3 consecutive years of undervaluation</td>
<td>Coded as 1 if lnUnderval is greater than 0 (i.e., undervalued) in a given year, and that year is part of any 3-year window of consecutive values of lnUnderval greater than 0</td>
</tr>
<tr>
<td>Sustained 4-Year Undervaluation</td>
<td>SusUnder4</td>
<td>Author’s calculation</td>
<td>A dummy variable indicating that a year is part of a series of at least 4 consecutive years of undervaluation</td>
<td>Coded as 1 if lnUnderval is greater than 0 (i.e., undervalued) in a given year, and that year is part of any 4-year window of consecutive values of lnUnderval greater than 0</td>
</tr>
<tr>
<td>System of Government</td>
<td>Policy</td>
<td>Marshall and Jagers (2002); Quality of Government Standard Database</td>
<td>An index meant to capture the system of government in a country</td>
<td>The original scale runs from -10 to 10, with 10 being the most democratic, and -10 being the most autocratic</td>
</tr>
<tr>
<td>Financial Repression Index</td>
<td>FinRepress</td>
<td>Abiad, Detragiache, and Tressel (2010)</td>
<td>An index meant to capture the degree of financial repression present in a country</td>
<td>One of several indicators from “A New Database on Financial Reform”; originally on a scale of 0 to 21 in order to capture the degree of financial liberalization, I have inverted the scale so that -21 is the most financially liberalized, and 0 is the most financially repressed</td>
</tr>
<tr>
<td>Interest Rate Controls</td>
<td>IntRateControls</td>
<td>Abiad, Detragiache, and Tressel (2010)</td>
<td>One of several indicators from “A New Database on Financial Reform”; initially a measure of liberalization running from 0 to 3, I have inverted the scale so that -3 is the most financially liberalized, and 0 is the most financially repressed</td>
<td></td>
</tr>
<tr>
<td>Capital Account Controls</td>
<td>CreditControls</td>
<td>Abiad, Detragiache, and Tressel (2010)</td>
<td>One of several indicators from “A New Database on Financial Reform”; initially a measure of liberalization running from 0 to 3, I have inverted the scale so that -3 is the most financially liberalized, and 0 is the most financially repressed</td>
<td></td>
</tr>
<tr>
<td>Capital Account Controls 2</td>
<td>Ka_Open</td>
<td>Ito and Chinn (2006)</td>
<td>Another index meant to capture the degree of capital account controls in place in a country</td>
<td>This is used as a robustness check for the CreditControls variable and to confirm the results found in Rodrik (2008); unlike the other repression measures here, increasing values indicate greater liberalization</td>
</tr>
<tr>
<td>State-ownership of the Banking System</td>
<td>StateOwnedBanks</td>
<td>Abiad, Detragiache, and Tressel (2010)</td>
<td>One of several indicators from “A New Database on Financial Reform”; initially a measure of liberalization running from 0 to 3, I have inverted the scale so that -3 is the most financially liberalized, and 0 is the most financially repressed</td>
<td></td>
</tr>
<tr>
<td>Credit Growth</td>
<td>CreditGrowth</td>
<td>World Development Indicators</td>
<td>The change in the ratio of private credit-to-GDP present in a country in a given year compared to the previous year</td>
<td>Calculated using the measure of the amount of domestic credit allocated to the private sector as a percentage of GDP</td>
</tr>
<tr>
<td>Inflation</td>
<td>Inflation</td>
<td>World Development Indicators</td>
<td>The annual growth rate of inflation based on the GDP implicit deflator</td>
<td></td>
</tr>
<tr>
<td>Capital Flows</td>
<td>CapFlows</td>
<td>World Development Indicators</td>
<td>A country’s net financial flows in a given year</td>
<td></td>
</tr>
<tr>
<td>Terms of Trade</td>
<td>TermsTrade</td>
<td>World Development Indicators</td>
<td>A country’s terms of trade in a given year</td>
<td></td>
</tr>
<tr>
<td>Trade Openness</td>
<td>TradeOpen</td>
<td>World Development Indicators</td>
<td>Degree of trade openness in a country in a given year</td>
<td>Calculated as total imports plus total exports over GDP</td>
</tr>
<tr>
<td>Region Dummies</td>
<td>REGION</td>
<td>World Development Indicators</td>
<td>Set of dummy variables that correspond to each region contained in the WDI</td>
<td>The REGION variable is recoded from a strong variable containing region names into a set of dummy variables</td>
</tr>
<tr>
<td>East Asia &amp; Pacific</td>
<td>EastAsiaPac</td>
<td>World Development Indicators</td>
<td>Dummy for the East Asia &amp; Pacific region</td>
<td></td>
</tr>
<tr>
<td>Europe &amp; Central Asia</td>
<td>EuropeCentralAsia</td>
<td>World Development Indicators</td>
<td>Dummy for the Europe &amp; Central Asia region</td>
<td></td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>LatinAmericaCarib</td>
<td>World Development Indicators</td>
<td>Dummy for the Latin America &amp; Caribbean region</td>
<td></td>
</tr>
<tr>
<td>Middle East &amp; North Africa</td>
<td>MidEastNorthAfrica</td>
<td>World Development Indicators</td>
<td>Dummy for the Middle East &amp; North Africa region</td>
<td></td>
</tr>
<tr>
<td>South Asia</td>
<td>SouthAsia</td>
<td>World Development Indicators</td>
<td>Dummy for the South Asia region</td>
<td></td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>SubSubAfrica</td>
<td>World Development Indicators</td>
<td>Dummy for the Sub-Saharan Africa region</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- lnUnderval: Log of the Undervaluation Index.
- SusUnder3: Sustained 3-Year Undervaluation Indicator.
- SusUnder4: Sustained 4-Year Undervaluation Indicator.
- Policy: Quality of Government Index.
- FinRepress: Financial Repression Index.
- IntRateControls: Interest Rate Controls.
- CreditControls: Capital Account Controls.
- Ka_Open: Capital Account Controls 2.
- StateOwnedBanks: State-ownership of the Banking System.
- CreditGrowth: Credit Growth.
- Inflation: Inflation.
- TermsTrade: Terms of Trade.
- TradeOpen: Trade Openness.
- REGION: Region Dummies.
- EastAsiaPac: East Asia & Pacific.
- EuropeCentralAsia: Europe & Central Asia.
- LatinAmericaCarib: Latin America & Caribbean.
- MidEastNorthAfrica: Middle East & North Africa.
- SouthAsia: South Asia.
- SubSubAfrica: Sub-Saharan Africa.
Table 7: 5-Year Average Dataset, Key Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Min.</th>
<th>Max.</th>
<th>Median</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undervaluation</td>
<td>554</td>
<td>-2.86</td>
<td>1.42</td>
<td>-0.05</td>
<td>-0.05</td>
<td>0.49</td>
</tr>
<tr>
<td>Financial Repression</td>
<td>554</td>
<td>-21.00</td>
<td>0.00</td>
<td>-9.90</td>
<td>-9.90</td>
<td>6.27</td>
</tr>
<tr>
<td>Interest Rate Controls</td>
<td>554</td>
<td>-3.00</td>
<td>0.00</td>
<td>-2.00</td>
<td>-1.72</td>
<td>1.30</td>
</tr>
<tr>
<td>Capital Account Restrictions</td>
<td>554</td>
<td>-3.00</td>
<td>0.00</td>
<td>-1.50</td>
<td>-1.53</td>
<td>1.08</td>
</tr>
<tr>
<td>Capital Account Restrictions 2 (KAOpen)</td>
<td>526</td>
<td>-1.86</td>
<td>2.46</td>
<td>-0.34</td>
<td>0.02</td>
<td>1.48</td>
</tr>
<tr>
<td>State-ownership of the Banking System</td>
<td>554</td>
<td>-3.00</td>
<td>0.00</td>
<td>-1.00</td>
<td>-1.22</td>
<td>1.14</td>
</tr>
<tr>
<td>Political System</td>
<td>546</td>
<td>-10.00</td>
<td>10.00</td>
<td>6.30</td>
<td>3.29</td>
<td>6.87</td>
</tr>
<tr>
<td>NonTradables (% of GDP)</td>
<td>470</td>
<td>0.06</td>
<td>0.73</td>
<td>0.26</td>
<td>0.27</td>
<td>0.13</td>
</tr>
<tr>
<td>Inflation</td>
<td>542</td>
<td>-4.91</td>
<td>4828.71</td>
<td>9.78</td>
<td>63.98</td>
<td>348.26</td>
</tr>
<tr>
<td>Private Credit (% of GDP)</td>
<td>538</td>
<td>0.00</td>
<td>220.87</td>
<td>29.84</td>
<td>44.32</td>
<td>37.33</td>
</tr>
<tr>
<td>Private Credit Growth (% of GDP)</td>
<td>535</td>
<td>-58.45</td>
<td>36.27</td>
<td>0.69</td>
<td>-0.16</td>
<td>8.25</td>
</tr>
<tr>
<td>Private Capital Flows (% of GDP)</td>
<td>502</td>
<td>-16.47</td>
<td>16.90</td>
<td>0.98</td>
<td>1.34</td>
<td>2.82</td>
</tr>
<tr>
<td>Terms of Trade</td>
<td>499</td>
<td>-8.90e+13</td>
<td>3.73e+13</td>
<td>-1.60e+08</td>
<td>-2.88e+11</td>
<td>6.65e+12</td>
</tr>
<tr>
<td>Trade Openness</td>
<td>540</td>
<td>10.82</td>
<td>397.13</td>
<td>55.30</td>
<td>60.87</td>
<td>33.29</td>
</tr>
</tbody>
</table>

Underval: author's calculations, derived from Penn World Table

Controls: source, WDI

Financial Repression, Interest Rate Controls, Capital Controls

State-ownership of the Banking System: source, Abiad, et. al.

Polity: source, Quality of Government Standard Database

Table 8: 5-Year Average Dataset, Correlation Table for Key Variables

<table>
<thead>
<tr>
<th>Undervaluation Index</th>
<th>Financial Repression</th>
<th>Interest Rate Controls</th>
<th>Credit Controls</th>
<th>State Banking</th>
<th>C.C. 2 (KAOpen)</th>
<th>Democracy</th>
<th>NonTradables</th>
<th>Inflation</th>
<th>Credit Growth</th>
<th>Domestic Credit</th>
<th>Capital Flows</th>
<th>Terms of Trade</th>
<th>Trade Openness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undervaluation Index</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial Repression</td>
<td>0.0218</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest Rate Controls</td>
<td>-0.0862</td>
<td>0.829***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit Controls</td>
<td>-0.00104</td>
<td>0.804***</td>
<td>0.660***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Banking</td>
<td>0.134**</td>
<td>0.691***</td>
<td>0.438***</td>
<td>0.496***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.C. 2 (KAOpen)</td>
<td>-0.0313</td>
<td>-0.700***</td>
<td>-0.511***</td>
<td>-0.558***</td>
<td>-0.502***</td>
<td>1</td>
<td></td>
<td></td>
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<td>NonTradables</td>
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<td>-0.218***</td>
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<td>0.256***</td>
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<td>Inflation</td>
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<td>-0.516***</td>
<td>-0.371***</td>
<td>-0.325***</td>
<td>0.481***</td>
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<td>-0.295***</td>
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<td>-0.199***</td>
<td>0.145***</td>
<td>0.133**</td>
<td>0.0219</td>
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* p<0.05     ** p<0.01     *** p<0.001
Appendix B – Diagrams

Figure 1: Undervaluation Index Over Time, All Countries
Figure 2: Undervaluation Index Over Time, South Korea
Figure 3: Undervaluation Index Over Time, Zimbabwe
References


