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EXCHANGE RATE UNDERVALUATION, FINANCIAL DEVELOPMENT AND GROWTH

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Abstract

This paper examines the interaction between financial development and the impact of undervaluation on growth. No evidence is found of a positive effect of undervaluation on growth even with a well-developed financial sector. This conclusion survives different robustness tests such as alternative indicators of financial development, delay in the effect of undervaluation and alternative non-linear assumptions.

JEL Classification: F3, O2

Keywords: Equilibrium exchange rate, misalignment, undervaluation, growth, panel, co-integration

ملخص

تبحث هذه الورقة في التفاعل بين التنمية المالية وأثر ذلك فى خفض القيمة على النمو. لم يتم العثور على أي دليل على وجود تـأثير إيجابي من خفض القيمة على النمو حتى مع وجود قطاع مالي متطور. هذا الاستنتاج يبقى اختبارات متانة مختلفة مثل مؤشرات بديلة للتنمية المالية وتأخر وتأثير خفض قيمة الافتراضات البديلة وغير الخطية.

1. Introduction

Economic growth, a major component of development, is a key challenge to policy makers. Over the past decades, economic analysis, under the headline of the new growth theory and empiric, provides valuable new insights into the determinants of economic growth. Beside the uncontroversial and already emphasized role of factor accumulation and technical progress, it points to the importance of economies of scale, quality of governance, financial sector and integration to the world economy among others. This paper focuses on the financial sector and the integration to the world economy through exchange rate management.

The issue is of prime importance to Arab countries; many of them are facing a problem of economic diversification, which explains, at least in part, their limited growth performance (see Makdisi et al. 2006). The lack of diversification is not solely a problem in natural resources rich countries . It also characterizes many natural resources poor countries in the region. Even countries with “fair” shares of manufactured goods in total exports still have a diversification problem since many of them are highly specialized in few “traditional” manufacturing industries such as textiles, apparel and food (Sekkat 2008). Although the region has diversified its exports over the last decade, the diversification remains limited, and its exports tend to be produced at low levels of skill and sophistication, as Gourdon (2010) shows. Recent analyses of the issue (e.g. Nabli 2007 and World Bank report 2012) provide several policy recommendations to enable MRNA countries to tackle the problem of export diversification. In addition it is recommended that policymakers should avoid real exchange rate overvaluation through consistent fiscal policies, flexible exchange rates and adequate product and factor market regulations.

The economic approaches to exchange rate management have evolved markedly over the past decades. It was first seen as means to compensate producers for tariff removals or to maintain the balance of trade equilibrium (Krueger 1978 and Balassa 1982). Since the mid-1980s exchange rate management has been increasingly recognized as a crucial tool for supporting economic development. The focus was on real exchange rate (RER) misalignment; that is a country’s actual RER deviates from its equilibrium level. Very often, the misalignment took the form of domestic currency overvaluation. The empirical evidence (see, inter alia, Cottani et al. 1990 and Ghura and Grennes 1993) showed that currency overvaluation induces factor misallocations, low efficiency, higher inflation and lower GDP growth. Recently, new evidences (e.g. Hausmann et al. 2005; Freund and Pierola 2012 and Rodrik 2008) suggested that an active disequilibrium exchange rate strategy taking the form of a deliberate undervaluation of the national currency could boost growth. Such an idea led to a lively debate in both academic and policy circles.

Nouira and Sekkat (2012) argued that this claim is fragile at both the theoretical and the empirical level. They undertook a thorough investigation of the relationship between undervaluation and growth sought to address the empirical problems that cast doubt on the positive impact of undervaluation on growth. Overall, Nouira and Sekkat (2012) didn’t find any convincing support to the claim that an undervalued real exchange rate promotes economic growth. However, in light of the literature (e.g. Herrerias and Orts 2011 and Frenkel and Rapetti 2008) having provided many examples of individual countries where the adoption of undervaluation strategy aimed at fostering growth was successful, the authors concluded that undervaluation alone is not enough to boost growth but could do so if other companion policies are adopted. This is supported by the findings in Aghion et al. (2009) and El Badawi et al. (2012), which showed that the financial sector’s development limits the negative impact of exchange rate overvaluation on economic growth.

The relationship between the financial sector’s development and economic growth is not a new subject in the literature. Demirgüç-Kunt and Levine (2008) offered a comprehensive review of the issue and discussed the methodological shortcomings of this literature. The empirical evidence seems to produce a consensus about the positive impact of financial development on economic growth (see e.g. King and Levine 1993 and Levine and Zervos1998).

While the literature has supported the positive impact of financial sector development on growth on one hand and the negative impact of exchange rate misalignment on the other hand, little investigations have been conducted on the relationship between the impacts of the two. To our best knowledge, only two papers have investigated such a relationship: Aghion et al. (2009) and El Badawi et al. (2012). The present paper seeks to fill the gap in the literature regarding the link between two important determinants of growth (i.e. exchange rate misalignment and financial development).

The rest of the paper is organized as follows. The next section provides a brief review of the literature, which motivates the paper. Section three explains and discusses the methodology that will be used to compute REER, EREER and misalignment. Section four presents a descriptive analysis. Section five deals with the econometric analysis addressing the objective of the paper. Section six provides the conclusion.

2. Relation to the Literature

As mentioned in the previous section, the claim that an active disequilibrium exchange rate strategy taking the form of a deliberate undervaluation of the national currency could boost growth. Nouira and Sekkat (2012) refuted this claim, mainly on empirical grounds. [1] Three main problems were put forward. First, overvaluation episodes seem to dominate the samples. Hence, the results are better interpreted as the impact of a lower overvaluation on growth rather than the impact of undervaluation. Second, the definition of undervaluation (in general Purchasing Power Parity (PPP) corrected for the Balassa-Samuelson effect) is based on price comparisons and differs substantially from the alternative definition that emphasizes macroeconomic equilibrium (see, inter alia, Cottani et al. 1990; Ghura and Grennes 1993 and Razin and Collins 1997). The resulting undervaluation indicator mainly reflects the potential positive impact on exporters leaving aside the potential negative impact on the rest of the economy. Third, the measure of undervaluation might suffer from endogeneity. Generally, the authors admit that endogeneity is an issue and propose two ways of dealing with it. However, their solutions correct for a possible correlation between undervaluation and policy measures that falls in the error term in the non-expanded specification. Yet, this is hardly a proof that the remaining variation in the indicator of undervaluation is exogenous (Bhalla 2008).

Many of the existing studies that have explored the link between exchange rate misalignment and economic growth suffer from one or more of these criticisms. Regarding the misalignment indicator, most of the studies used measures of misalignment based on PPP, available from the World Bank (WB). Sometimes the PPP measure is corrected for the Balassa-Samuelson effect and/or combined with the Black Market Premium (BMP). Studies along this line include Dollar (1992), Easterly (1993, 2001, 2005), Acemoglu et al. (2002) and Polterovich and Popov (2003). A major weakness of the PPP measure of ERER to compute misalignment is the fact that changes in the sustainable ERER caused by changes in economic fundamentals such as terms of trade, capital inflows, technology and trade policies could be considered as misalignment (Ghura and Grennes 1993). Moreover, as stated by Easterly (2005), the BMP could also be a misleading measure of RER misalignment. An overvalued RER will not show up in the BMP on the foreign exchange in the absence of tight

[1] Note that some critics of the idea — the positive impact of undervaluation on growth— questioned the status of the RER as a policy instrument (see, Woodford 2008 and Henry 2008). This remains a strongly debated issue between economists (Bhalla 2008) but the present paper doesn't tackle this issue.

capital controls (e.g. the CFA zone). Moreover, the BMP on foreign exchange can display large swings in the short run which reflect more the asset market characteristics of the parallel market for foreign exchange than changes in economic fundamentals inducing real exchange misalignment (Sekkat and Varoudakis 2000).

To avoid such shortcomings, Cottani et al. (1990) and Ghura and Grennes (1993) used model-based measures of misalignment. The models imply that the evolution of the exchange rate depends on a set of "fundamentals" reflecting the requirements of internal and external equilibrium of the economy on the one hand, and on policy and non-policy exogenous shocks that drive the RER out from its equilibrium level on the other hand. The latter is associated with misalignment and considered as exogenous with respect to the fundamentals that determine the ERER. It is used, therefore, to examine the impact of misalignment on economic performance. However, these studies did not distinguish between the effects of under and over valuation. Since, overvaluation episodes dominate their samples; the results are better interpreted as the impact of a lower overvaluation on growth rather than the impact of undervaluation.

In contrast to the above studies, Razin and Collins (1997), Aguirre and Calderón (2005) and Nouira and Sekkat (2012) also used a model-based measure of misalignment but distinguished between the effects of under and over valuation on growth. Razin and Collins (1997) showed, using a fixed effects model, that overvaluation had an economically and statistically significant negative effect on economic growth while undervaluation did not have any significant effect on growth. The authors further divided the subsets of overvalued RERs and undervalued RERs into low, medium, high and very high. The results showed that very high overvaluation slowed growth, smaller overvaluation did not and high (but not very high) undervaluation promoted growth. However, this finding is not consistent across specifications. Aguirre and Calderón (2005) addressed a similar question using a different methodology (panel cointegration methods to compute misalignment and GMM-IV system for the growth equation). They found that RER misalignments hindered growth but that the effect was non-linear; growth declines were larger, the larger the size of the misalignments. Large undervaluation appeared to hurt growth but small to moderate undervaluation enhanced it. Nouira and Sekkat (2012) not only allowed for the possible asymmetry of the effects of undervaluation and overvaluation on growth but also used three different econometric methods (Panel-Cointegration, GMM and Fixed effects) and examined different scenarios (i.e. the effect of exchange rate undervaluation is delayed, this effect is dependent on the persistence and this effect depends on the level of undervaluation). Overall, their results didn't provide any convincing support to the claim that an undervalued real exchange rate promotes economic growth.

As stated in the previous section, the findings that cross-country analyses did not support the existence of a positive effect of undervaluation on growth coexist with various countries examples where the adoption of undervaluation strategy to foster growth was successful. This suggests that while undervaluation alone is not enough to boost growth, it could do so if other companion policies are adopted. In support of this, Aghion et al. (2009) and El Badawi et al. (2012) provide evidence that the financial sector's development limits the negative impact of exchange rate overvaluation on economic growth. Hence, one can expect that financial sector's development might affect the impact of undervaluation on economic growth.

Aghion et al. (2009) focused on exchange rate flexibility using three indicators: a classification of exchange regimes by degree of flexibility, exchange rate volatility and exchange rate overvaluation. The latter is the closest to our present exercise. It is constructed assuming Purchasing Power Parity adjusted for the Balassa-Samuelson effect. Specifically, the authors investigated whether the impact of exchange rate flexibility on economic growth depends critically on a country's level of financial development. Using a sample of 83 developed and developing countries over the period 1970-2000, they constructed a panel data set by transforming the time series into non -overlapping five-year averages and used as a dependent variable productivity growth (rather than total growth) and traditional growth control variables. The indicator of financial development is the ratio of domestic credit claims on private sector to GDP. The estimation method is the GMM dynamic panel data. Their results showed that real exchange rate flexibility can have a significant impact on productivity growth but such an impact depends on a country's level of financial development. The results resist various robustness checks (i.e. time window, measures of financial development and of exchange rate flexibility).

El Badawi et al. (2012) investigated necessary requirements to get the most growth from the aid given to SSA. Given SSA's disappointing growth record, the international development community started urging for a major scaling up of development aid. However, rapid aid surges could also pose serious macroeconomic stability problems among which a significant disequilibrium in the real exchange rate. The authors studied the nexus between growth, misalignment, aid, and financial development in SSA. They addressed three specific questions. One concerns the separate effects of aid, RER misalignment, and financial development on growth. The other relates to extent to which aid reduces or augments the impact of misalignment on growth. The last question is the closest to our present exercise i.e. is the growth loss from misalignment reduced by financial development?

The approach of El Badawi et al. to deriving misalignment is a model-based approach similar to ours. It consists in determining the equilibrium real exchange rate based on a single-equation, reduced-form model that accounts for both the current value of the fundamentals and anticipations regarding their future evolution. The real exchange equation is estimated as an error-correction model over a world panel of 83 countries for 1980–2004, including 36 SSA economies. They found that higher long-term aid contributes significantly to RER appreciation but short-term changes in aid do not have significant effects on the short-term behavior of the RER. The results remain robust to various robustness checks.

For growth analysis, the authors used a sample of 77 developed and developing countries over the period 1970-2004. They constructed a panel data set by transforming the time series into non-overlapping five-year averages and used as dependent variable per capita GDP growth and traditional growth control variables. The indicator of financial development is M3 over GDP. The estimation method is the system Generalized Method of Moments (S-GMM) dynamic panel estimation method.

The regression results indicated that aid, RER misalignment, and financial development have both direct and non-linear effects on growth. Aid is positively but non-monotonically associated with growth. Misalignment has a negative effect on growth. The interaction between misalignment and aid has a negative and significant effect on growth. Finally, the coefficient of the interaction between misalignment and financial development is significant and implies that financial development reduces the negative consequences of overvaluation. Again, the results survive robustness tests.

3. Exchange Misalignment

3.1 The economic model

One major issue with the construction of the Real Effective Exchange Rate (*REER*) is the choice of the appropriate price index. The most popular indexes are the unit labor cost (ULC), the Wholesale Price Index (WPI) and the Consumption Price Index (CPI). Each has merits and weaknesses as shown by Chinn (2006). The IMF regards the unit labor cost in manufacturing as a simple and useful index in this respect. However, if its evolution offers a reliable gauge of the profitability of traded goods, most developing countries lack the data to calculate it. The Wholesale Price Index is found to under estimate non-traded goods so that the condition price competitiveness for trade goods, especially for manufactured goods, is available for few countries with industrialized economies. The Consumption Price Index does not account adequately of the distinction between tradable and non-tradable goods and services. It is however generally the preferred one (Aghion et al. 2009 and Darvas 2012) because whatever the criticisms to the various indexes the constraint of data availability remain the most binding. This CPI is available over a long period for many developing and developed countries. We, therefore, compute the *REER* over the period 1980-2009 as:

$$Log(REER) = \sum_{j=1}^{j=10}\left[w_j * Log\left(e_j * \left({CPI}/{CPI_j}\right)\right)\right] \tag{1}$$

where *CPI* is the consumer price index of the country; CPI_j is the consumer price index of the country's partner *j*; e_j is the nominal bilateral exchange rate of the country with regards to partner *j*; w_j is the weight of the *j*-th partner in the bilateral trade of the country. We consider the 10 largest trade partners over the period 1999–2005 excluding oil-exporting countries. The *REER* is constructed such that an increase means appreciation.

The *REER* can be decomposed into two components: The Equilibrium Real Effective Exchange Rate (*EREER*) and misalignment. Edwards (1988) was the first to propose an approach that makes it possible to distinguish between the two sources of *REER* variations. The latter is regressed on external and domestic fundamentals, which are assumed to induce changes in the *EREER*. The resulting coefficients are used together with sustainable levels of the explanatory variables to compute a series of *EREER*. The difference between the *REER* and the *EREER* is associated with misalignment. To estimate the impact of the fundamentals, we use the following empirical model:

$$\text{Log}(REER) = \alpha_0 + \alpha_1 \text{Log}(Open) + \alpha_2 \text{Log}(Cap) + \alpha_3 \text{Log}(ToT) + \alpha_4 \text{Log}(rDebt) +$$

$$\alpha_5 \text{Log}(Gov) + \alpha_6 \text{Log}(BalSam) + \varepsilon \tag{2}$$

For clarity, we drop the year and country indices. The *REER* is defined in Equation (1). *ToT* is the terms of trade (the ratio of export to import prices). *Open* is the ratio of export plus imports (excluding oil) to GDP. *Cap* is the net capital inflow scaled by GDP. *Gov* is government consumption in percentage of the GDP. *rDebt* is the country debt services including interest payments and reimbursements as a share of GDP. *BalSam* is the ratio between the country's real per capita GDP and the geometric mean (weighted in a similar way as the *REER*) of the same variable in trading partners.

The literature expects, in general, the following signs of the coefficients. However, recent evidence by Ben Naceur et al. (2012) show that signs depends on other factors (e.g. the nature and use of the capital flows and whether government consumption is biased towards tradables or non-tradables). It is expected that a rise in the terms of trade to appreciate the equilibrium *REER* to the extent that it improves the trade balance because the income effect dominates the substitution effect; α_3 is expected to be positive. It is expected that restricted trade openness will exert downward pressure on the relative price of tradable to non-tradable goods, thereby leading to an appreciation in the equilibrium *REER*; α_1 is expected to be negative. Higher capital inflows involve stronger demand for both tradables and non-tradables and lead to a higher relative price of non-tradables and *REER* appreciation. This is needed for domestic resources to be diverted toward production in the non-tradable sector in order to meet increased demand; α_2 is expected to be positive. Government consumption has a similar effect. Stronger demand for non-tradables increases their relative prices leading to an appreciation in the equilibrium *REER*; α_5 is expected to be positive. The higher the country debt services the higher the demand for foreign currencies inducing depreciation of exchange rate; α_4 is expected to be negative. The variable BalSam reflects a productivity gap and aims at capturing the potential Balassa-Samuelson effect. Assuming that the prices for tradable sectors are homogeneous across countries and that their productivity is higher than in non-tradable sectors, the increase in wages in the tradable sectors due to higher productivity spills over into the wages in non-tradable sectors. The latter induces an increase in inflation and an appreciation of the *REER*; α_6 is expected to be positive.

3.2 The econometric analysis

Equation (2) will be used to estimate the *EREER* and potential misalignment considering a panel dataset of 52 developing countries from Africa, Asia and Latin America. The econometric methodology is the same as in Nouira and Sekkat (2012) but the estimation was re-conducted over a larger period (i.e. 1980–2009 instead of 1980-2005). The main source of data is the World Development Indicators of the World Bank**.**

Pooling the data potentially improves the robustness of estimations with misalignments being determined according to a normal behavior given by the average estimated coefficients over the sample. Moreover, panel data being vulnerable to countries heterogeneity, country-fixed effects can be introduced in the empirical model. However, as explained above, the *EREER* concerns the long-term relationship between the *REER* and the fundamentals. In order to determine such a relationship, one should use the cointegration methodology. The latter allows separating the long and short-term relationships between the *REER* and the fundamentals.

Cointegration analysis has for a long time been applied to "pure" time series (e.g. a given country over time), in this paper we take advantage of the time series and the cross-section dimensions of the sample to study the relationship in Equation (2) using recent developments of panel-data cointegration analysis which allows for more efficient estimation and testing, especially when the number of time periods is limited (e.g. Levin, Lin and Chu 2002; Im, Pesaran and Chin 2003; Moon and Perron 2004; Chang 2002; Pesaran 2007; Pedroni 2004 and Kao and Chiang 1998).

To present cointegration simply, consider two time series *x* and *y* that are integrated of order one [I (1)]. This means that their first differences (Δx and Δy) are stationary [I (0)]. If the regression of *x* on *y* (that are I (1)) gives a time series of residuals that is I (0), the two series are called cointegrated. This means that a long-term relationship between them exists. The latter is given by the regression coefficients of *x* on *y*. However, the OLS estimate of the coefficient is convergent but not efficient and other estimation techniques need to be used. Then, the cointegration approach involves three major steps. First, test whether the variables are I (1), second test whether the variables are cointegrated and third, estimate the long-term relationship.

First developed in a "pure" time series context, cointegration analysis has been subsequently extended to data combining both the time series and the cross-section (commonly referred to as panel data) dimensions. The three steps for the analysis are the same as above except that the nature of the data (i.e. time series and the cross-section) involves a preliminary check regarding whether individuals (e.g. countries) are interdependent or not. This is important for the choice of the test to be used in the cointegration analysis. In what follows, we apply the four steps to Equation (2)

3.2.1 Interdependence among countries

To examine whether individuals are interdependent, we use a test suggested by Pesaran (2004). The test is based on the average of the correlations between the residuals from a regression on each individual separately. Practically, consider the variable y_i pertaining to the individual *i*. The variable is regressed on its first lag and the residuals are collected to compute ρ_{ij} which is the correlation coefficient between the residuals from individual *i* and *j* regressions. The statistic

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \quad (3)$$

is shown to have an N (0, 1) distribution under the null hypothesis of independence, where *N* is the number of individuals and *T* is the number of years.

The results of the test applied to our sample are presented in Table 1. For all variables, the tests reject the null hypothesis of independence of individuals.

3.2.2 Stationarity tests

To examine stationarity, we should use a test that incorporates the interdependence of individuals. Among the existing tests, the one by Pesaran (2007) is the most adequate because it targets a situation where *N* (the number of individuals) is higher than *T* (the number of years). In addition, the test allows analyzing non-stationarity within a heterogeneous panel framework, i.e. a panel in which each country is allowed to evolve according to its own dynamics. The test builds on the well-known augmented Dickey-Fuller regressions. Practically, consider y_{it} pertaining to the individual *i* at time *t*. Run the regression:

$$\Delta y_{it} = \alpha_i + \rho_i y_{it-1} + \gamma_i \bar{y}_{t-1} + \delta_i \Delta \bar{y}_t + \vartheta_{it} \quad (4)$$

and take the calculated Student statistics of ρ_i ; t_i. Where $\Delta y_{it} = \alpha_i + \rho_i y_{it-1} + \gamma_i \bar{y}_{t-1} + \delta_i \Delta \bar{y}_t + \vartheta_{it}$ is the average of y_{it} over all individuals at time *t*. The statistic

$$CIPS\ (N,T) = \frac{1}{N} \sum_{i=1}^{N} t_i\ (N,T) \quad (5)$$

is used to test for stationarity but it does not have a standard distribution. We follow Pesaran (2007) and simulate the critical values using the Monte Carlo approach. If the computed statistic (*CIPS*) is above the critical value, one cannot reject the null hypothesis of stationarity.

Table 2 presents the results. The tests reveal that all variables are I (1). Hence, if we find a relationship among the variables, which gives stationary residuals, these variables will be considered as cointegrated.

3.2.3 Cointegration tests

The best-known tests are due to Pedroni (1995, 2004). They allow for taking account of heterogeneity among individuals. The author proposed seven versions of the cointegration test: four are suitable when studying the relationship of the variables within countries and three pertain to the relationship between variables of different countries. The former set of tests is the most suitable for our study. The procedure is the following. Consider a dependent variable y_{it} and set of explanatory variables x_{kit} observed for individual *i* at time *t*. To conduct the test, five steps are followed:

1. Estimate the following cointegration regression over the panel

$$y_{it} = \alpha_i + \delta_i t + \beta_{1t} x_{1it} + \beta_{2t} x_{2it} + \cdots + \beta_{kt} x_{Kit} + \varepsilon_{it}$$

2. Differentiate the original series for each member, and estimate the following regression over the panel

$$\Delta y_{it} = b_{li} \Delta x_{1it} + \cdots + b_{Ki} \Delta x_{Kit} + \eta_{it}$$

3. Calculate L^2_{11i} as the long-run variance of η_{it} using, for instance, the Newey and West (1987) estimator.

4. Apply DF and ADF regressions to the residuals ε_{it} and compute the long run (σ_i^2) and the simple variances (s_i^2) from of the residuals of the DF regression as well as the simple variances (s_i^{*2}) from of the residuals of the ADF regression.

5. Using the above parameters, the following four statistics can be computed to test for cointegration.

Panel *v*- statistic:

$$T^2 N^{3/2} Z_{vN,T} \cong T^2 N^{\frac{3}{2}} (\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{1li}^{-2} \hat{\varepsilon}_{i,t-1}^2)^{-1}$$

Panel ρ- statistic:

$$T\sqrt{N} Z_{\hat{\rho}N,T^{-1}} \cong T\sqrt{N} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{1li}^{-2} \hat{\varepsilon}_{i,t-1}^2 \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{1li}^{-2} \left(\hat{\varepsilon}_{i,t-1} \Delta \hat{\varepsilon}_{i,t} - \hat{\lambda}_i \right)$$

Panel t- statistic:

$$Z_{tN,T} \cong \left(\tilde{\sigma}_{N,T}^2 \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{1li}^{-2} \hat{\varepsilon}_{i,t-1}^2 \right)^{-\frac{1}{2}} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{1li}^{-2} \left(\hat{\varepsilon}_{i,t-1} \Delta \hat{\varepsilon}_{i,t} - \hat{\lambda}_i \right)$$

Panel ADF statistic:

$$Z^*{}_{tN,T} \cong \left(\tilde{s}_{N,T}^{*2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{1li}^{-2} \hat{\varepsilon}_{i,t-1}^{*2} \right)^{-\frac{1}{2}} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{1li}^{-2} \left(\hat{\varepsilon}^*{}_{i,t-1} \Delta \hat{\varepsilon}^*{}_{i,t} - \hat{\lambda}_i \right)$$

where $\lambda_i = 0.5\ (\sigma_i^2 - s_i^2)$

Pedroni (1995, 1997) showed that, with a slight correction, the statistics converge toward a normal distribution. Actually

$$\frac{x_{NT} - \mu\sqrt{N}}{\sqrt{\nu}} \sim N(0,1)$$

where x_{NT} is one of the four statistics and μ and v are tabulated by Pedroni (1999). The results of the cointegration tests applied to Equation (4) are presented in Table 3. Two tests suggest that the variables are cointegrated but two others suggest the reverse. We follow Pedroni (2004) who being faced with the same type of results concluded that the variables are cointegrated (See also Barisone et al. 2006).

3.2.4 Estimation of the coefficients

Although the variables are cointegrated, the OLS estimates of the parameter are convergent but not efficient (Kao, Chiang and Chen 1999). Two methods are available to obtain efficient estimates of the parameters. One, labeled dynamic OLS (DOLS), was developed by Kao and Chiang (1998) and consists of adding to the cointegration equation lags of the explanatory variables in order to clean the error term from any autocorrelation and heteroskedasticity. Pedroni (2000) proposed the second method, called Fully Modified OLS (FMOLS). It is a bit complicated to explain in a non-technical way. Roughly explained, it consists in running an OLS estimate of the cointegration equation and using the residuals to compute their variance-covariance matrix. This is then used to perform a sort of GLS on the cointegration equation. Both methods were applied to Equation 2 and the results are presented in Table 4. The overall quality of fit is good. Except for the variable *Cap*, the sign, level and significance of the coefficients are broadly similar. In the text, we will focus on the DOLS results.

Using the coefficients in Table 4, one can compute the extent of the *REER* misalignment. Recall, however, that misalignment refers to the difference between the *REER* and its equilibrium level, the *EREER*. The latter is given by the fitted values using together the estimates in Table 4 and the long-run values of the explanatory variables. To get such long-run values, some authors draws on theory (e.g. Cottani et al. 1990 and Ghura and Grennes 1993). We think, however, that such an approach might be influenced by the judgment of each individual author. Therefore, we prefer to stick to a purely econometric approach as adopted in this paper. We use the Hodrik-Precsott filter to separate the permanent and temporary components of each variable. We define misalignment as:

$$Mis = (REER / EREER - 1) * 100 \quad (6)$$

The positive values correspond to overvaluations.

4. Descriptive Analysis

Table 5 and Figures 1 describe the obtained misalignment series. On average, exchange rates have been overvalued by around 3 percent but with high variations across countries and time. The standard deviation was around 35 percent. Figure 1 shows that average (over all countries in the sample) misalignment decreased steadily until the mid-1990s, then it increased between 1995-2000. A similar increase and decrease is observed during the 2000s with 2005 as the break year. Finally, Table 1 shows that episodes of undervaluation represent a majority of observations between 1980-2009 but nonetheless those of overvaluation represent an important share (33%), which should allow us to examine the asymmetry in the impact of misalignment on growth.

Figure 2 compares the evolution of misalignment and growth over the period of observation. We stopped in 2007 to remove the effect of the crisis. Although the comparison is rough, some interesting features emerge. The most important is the opposite evolution of the two variables before 2000. Between 1986 and 1995, misalignment was decreasing while growth was increasing. The reverse holds for the period 1995-2000. From the beginning of the 2000s both variables were increasing which contradicts expectations.

Because of data availability, our sample includes only six Arab countries. Each of these countries have followed different exchange rate regime. Jordan (with respect to the US dollar), Morocco and Tunisia (with respect to a composite basket) adopted fixed peg arrangement. Pegged exchange rate within horizontal bands was followed by Syria (with respect to a composite basket) and managed floating by Algeria (with respect to a composite basket) and Egypt. Figure 3 presents the extent of misalignment in the six countries. Although with different scales a similar broad picture to Figure 1 merges. Misalignment decreased steadily until the mid-1990s, and then it increased between 1995-2000. A similar increase and decrease is observed during the 2000s with 2005 as the break year. There are, however, major differences between countries. In particular, the Syrian currency remains almost always overvalued. The undervaluation of the Algerian currency has been steadily increasing since the end of the 1900s. This might be a bit surprising since the 1995-2005 and 2005-2009 periods witnessed different oil prices behavior: one being a period of moderate oil prices and the last was an oil boom period. A possible interpretation is that undervaluation periods are the result of capital contractions. Finally, misalignment of the Egyptian currency is the most variable during the period.

Regarding the apparent linkages between growth and undervaluation, Figure 4 exhibits a contrasted picture across Arab countries. It is worth repeating that, we applied a scale transformation in order to ease the comparison. Hence, evolutions can be compared across countries but not the levels of the respective variables. A linkage between undervaluation and growth seems to exist (especially during the 2000s) in Algeria, Egypt and Morocco but not in the other countries. Of course these are only visual observations and don't imply any general rule regarding the relationship between undervaluation and growth. The latter should be examined more rigorously and for a larger sample of countries.

The third variable of interest in this paper is financial development. Different indicators are used to proxy financial development such as M2 or M3 over GDP (El Badawi et al. 2012) and the ratio of domestic credit claims on private sector to GDP (Aghion et al.2009). In the empirical analysis we use these two indicators as well as the ratio of domestic credit, provided by the banking sector, over GDP and the interest rate spread (lending rate minus deposit rate). Based on the results in the first the latter one gives the most consistent results. Hence, Figure 5 presents the level of financial development as measured by the interest rate spread in five different regions of the World. We consider that the higher the spread the less developed is the financial sector. It appears that the Arab world, with a similar performance to East Asia, scores among the best of the regions under consideration . However, the regional average hides important differences across Arab countries with Algeria, Egypt and Morocco as the best performers during the 2000s. This is interesting, although still informal observation, because these are the countries for which some linkages between undervaluation and growth seem to exist in Figure 4.

5. Empirical analysis: Undervaluation and Growth

5.1 The economic model

The developments in growth theory and the availability of rich datasets have fostered considerable empirical analysis. Most of the studies have been conducted in the framework of the single cross-country regression suggested by Barro (1991). Briefly summarized, the approach consists of estimating the following equation.

$$\ln(y_{i,t}) - \ln(y_{i,t-1}) = \beta_0 - \beta_1 \ln(y_{i,t-1}) + \beta_2 \ln(S_{Ki,t}) + \beta_3 \ln(S_{H_{i,t}}) - \beta_4 \ln(\delta + g^* + n_{i,t}) + \beta_5 \ln(X_{i,t}) + \varepsilon_{i,t} \quad (7)$$

where y is real income per capita, S_K is the rate of savings in physical capital, S_H the rate of savings in human capital, g^* is the rate of exogenous technical progress, n is the population growth rate, δ is the depreciation rate of physical capital and β_0, β_1, β_2, β_3, β_4 and β_5 are parameters. Indices i and t refer to country and time respectively.

The lagged per capita income $y_{i,t-1}$ captures the possible conditional convergence of income. This was suggested by the recent empirical growth literature under the assumption of diminishing marginal returns to capital: the lower the initial level of income the greater is the growth rate. The variable S_K is measured by the investment ratio, which is expected to have a positive impact on the growth rate. The proxy of S_H is the school enrollment ratio, which should have a positive impact on growth. Hence, β_1, β_2, β_3 and β_4 are expected to be positive.

The equation is generally augmented with additional variables (X_{it}) to control for other determinants of growth. The choice of such additional variables is very complicated however. Duarluf et al. (2005) showed that the number of regressors that can be potentially added to the regression approaches the number of countries available in the broadest samples. This plethora of potential regressors illustrates one of the fundamental problems with empirical growth research, namely, the absence of any consensus on which growth determinants should be included in a regression. A number of economists suggest that one focuses on a core set of explanatory variables that have been shown to be consistently associated with growth and evaluate the importance of the variable of interest (here misalignment and financial development) conditional on inclusion of the core set (Woo 2009). In what follows, we will therefore stick to the core variables presented in Equation (7). Misalignment is computed above and financial development is approached through 4 indicators: Domestic credit provided by banking sector (% of GDP), domestic credit to private sector (% of GDP), interest rate spread (lending rate minus deposit rate) and money and quasi money (M2) as % of GDP. The four variables are drawn from the WDI.

5.2 Estimation issues

Previous estimations of Equation (7) consisted in running a simple OLS on the time average of the variables for each country (i.e. cross-section data). However, this has the inconvenience of not using the information contained in the time dimension of the sample. Moreover, Islam (1995) argued that such approach rests on the assumption of identical aggregate production functions for all the countries. He advocates for, and implements, a panel data approach to deal with this issue. The panel data framework makes it possible to allow for differences in production functions across countries in the form of "country fixed effects." Many of the subsequent papers adopted the framework advocated by Islam (1995) and used either annual data or, more frequently, five-year averages together with country fixed affects.

However, in dealing with the impact of misalignment another econometric issue was raised, namely the potential endogeneity of misalignment. The literature adopts, in general, the GMM as the estimation method. The approach uses lagged values of regressors as instruments for right-hand-side variables and also introduces lagged endogenous (left-hand-side) variables as regressors. Although, our measure of misalignment is constructed in such a way that essentially reflects exogenous policy and non-policy shocks, the GMM is suitable for our analysis because of potential endogeneity of other variables.

5.3 The impact of misalignment on growth

As a preliminary step, we first estimate Equation 7 using our indicator of misalignment (i.e. without distinguishing under and overvaluations). Table 6 presents the results of the estimation using the three different methods discussed in Section 5.2 (OLS, Fixed effects and GMM). The period of observation is 1985-2009, all variables are 5 years averages and the measure of financial development is the opposite of the traditiona1 interest rate spread. Specifically, the explanatory variables are "-ln (interest rate spread)".

It should have a positive coefficient. The latter is the one giving the most consistent results among the four indicators we used. Estimation results with the other indicators are given in Appendix B.

The overall quality of the fit is fair to good depending on the estimation method. All the coefficients are significant with a sign in accordance with the findings of the literature with at least one method of estimation. The coefficients of the "core" variables (i.e. Initial GDP Per Capita, Investment/GDP, School Enrollment and Population) are in general significant with the expected sign. The coefficient of financial development is significant with the expected sign only when GMM is used. The coefficient of misalignment is significant with the expected sign when both fixed effects and GMM are used. However, the test of fixed effects recommends disregarding the OLS results and the over identifying restrictions test support the GMM's results. We will, therefore, disregard the OLS method in the rest of the analysis.

5.4 The impact of Undervaluation on growth

Table 7 presents the results of similar specifications as in Table 6. Now, however, the indicator of misalignment is split into two series: one includes observations of undervaluation only (the rest of observation is set to zero) while the other includes observations of overvaluation only (the rest of observation is set to zero). For clarity we recoded undervaluation figures to be positive. So, if undervaluation fosters growth, the coefficient should be positive. Columns 1 and 2 concern the resulting specification while columns 3 and 4 add interaction terms between undervaluation and financial development and between overvaluation and financial development.

Without the interaction terms, the overall quality of the fit is fair to good depending on the estimation method. The coefficients of the “core” variables are significant with the expected sign except the one of school enrollment when the fixed effects method is used. The coefficient of overvaluation is never significant while the one of undervaluation is significant and positive when the fixed effects method is used but not with the GMM. The potential positive impact of undervaluation on growth is not robust with estimation methods. The coefficient of financial development is significant with the expected sign only when GMM is used.

When the interaction terms are introduced (columns 3 and 4), the picture is similar to the previous specification (columns 1 and 2) except that the overall quality of the fit drops dramatically when GMM is used. Moreover the coefficients of the interaction terms are never significant and the financial development coefficient becomes insignificant with GMM. Given that the over identifying restrictions test support the GMM’s results, and that with the fixed effects we are uncertain that there is no endogeneity issue, we conclude that there is an absence of any consistent effect of undervaluation on growth in the absence of any relationship between such an effect and financial development.

5.5 Test for a possible delay in the impact of Undervaluation on growth

It might take time before undervaluation effects growth. For instance, Hausmann et al. (2005) examining growth episodes (i.e. growth acceleration by at least two percentage points lasting for at least eight years) found that real previous depreciation is among the factors significantly associated with these episodes. An increase of undervaluation by around 10%, which is sustained for five years, precedes growth episodes. Freund and Pierola (2012) found a surge in manufacturing exports following episodes of REER undervaluation. Since manufactured exports and economic growth are positively related (Sachs and Warner 1995), this supports the possibility of a positive relationship between undervaluation and subsequent growth. In order to allow for a time lag between undervaluation and subsequent growth, we re-estimate similar specifications as in Table 7 using the lagged values of undervaluation and overvaluation. The results are reported in Table 8.

Without the interaction terms, the results are similar to those in Table 7 except that the coefficient of the lagged overvaluation is significant and negative irrespective of the method of estimation. When the interaction terms are introduced the overall quality of the fit remains fair to good depending on the estimation method while it dropped in Table 6 with GMM. For the same reason as above, we will focus on the GMM results. All the coefficients of the “core” variables are significant with the expected sign. The coefficient of the lagged overvaluation is significant and negative. The one of undervaluation is not significant, the coefficients of the interaction terms are not significant and the one of financial development is significant and positive. Once again, we failed to find any robust impact of undervaluation on growth and on any relationship between such an effect and financial development.

5.6 Alternative nonlinear behavior of the impact of undervaluation on growth

The specification we used so far imposes that the impact of undervaluation on growth is a linear function of financial development. Clearly, this is not the only form of dependence that may exist. In this section we investigate another form of dependence. Since it is not possible to consider all potential forms, we adopt an approach to intervals of financial development. In practice, we consider the four quintiles of the values of financial development in the sample and create dummies that interact with the series of under and over valuation. This results in four variables Overvaluation and Undervaluation with i = 1,2,3,4. For instance, the variable Overvaluation takes the values of overvaluation corresponding to the i^{th} quintile of financial development. We re-estimate the same specification as before except that the interaction terms are replaced by the interaction variables. We expect that if financial development reduces the impact of, say, overvaluation on growth the estimated coefficients decrease with i. Since the estimation with lagged over and under valuation gave the most significant results, we focus on the corresponding specification.

The results are presented in Table 9 and are similar to those obtained before regarding the quality of the fit and the significance of the core variables. It one takes the GMM estimates as the most reliable (which confirmed by the Test of over identifying restrictions), he/she can reject that hypothesis that financial development reduces the impact of overvaluation on growth; when significant the estimated coefficients decrease with i. However, no evidence is found of a positive effect of undervaluation on growth and, hence, for any role of financial development.

6. Conclusion

This paper contributes to a current and intense debate among economists concerning the impact that real exchange rate (RER) undervaluation can have on economic growth. At the empirical level some authors showed that a depreciated RER promotes economic growth while others refuted it. One way to reconcile the two findings is to consider possible factors that might influence the relationship between undervaluation and growth among which the level of financial development is the focus of this paper. The literature has supported, for more than two decades, the positive impact of financial sector development on growth on one hand and the negative impact of exchange rate misalignment on the other hand. However, little investigation has been conducted on the relationship between the impacts of the two factors. The present paper sought to fill this gap.

The results confirmed the previous findings on the negative impact of overvaluation on growth, the positive impact of financial development on growth and the absence of any positive impacts of undervaluation on growth. To examine whether the latter is driven by the fact that the impact depends on the level of financial development, estimations allowed for the coefficient of undervaluation in the growth equation to depend on such a level of development. No evidence is found of a positive effect of undervaluation on growth and, hence, of any role of financial development. This conclusion survives different robustness tests such as alternative indicators of financial development, delay in the effect of undervaluation and alternative non-linear assumptions.

Going back to the Arab countries, which face limited growth performance, informal observations suggest that in some of them a positive linkage between undervaluation and growth seems to exist (especially during the 2000s). Moreover, these countries appear as the best performers in terms of financial development also during the 2000s. One could, therefore be tempted to recommend the undervaluation strategy especially for those countries with level of financial development. However, the rigorous econometric analysis conducted above shows that the positive relationship between undervaluation and growth is not a solid one even with a well-developed financial sector. Actually, the results suggest that the best strategy is more structural than opportunistic undervaluation: Arab countries should avoid exchange rate misalignment (being under or over valuation) and further develop their financial sector.

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Figure 1: Misalignment over Time: (Average over the whole Sample)

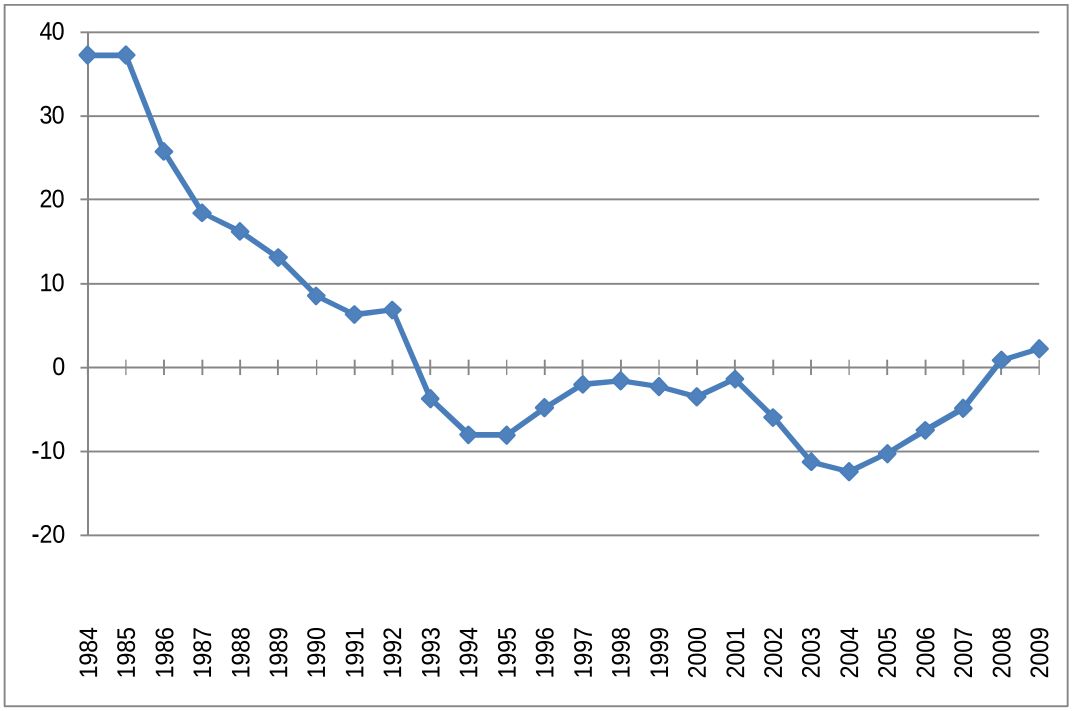
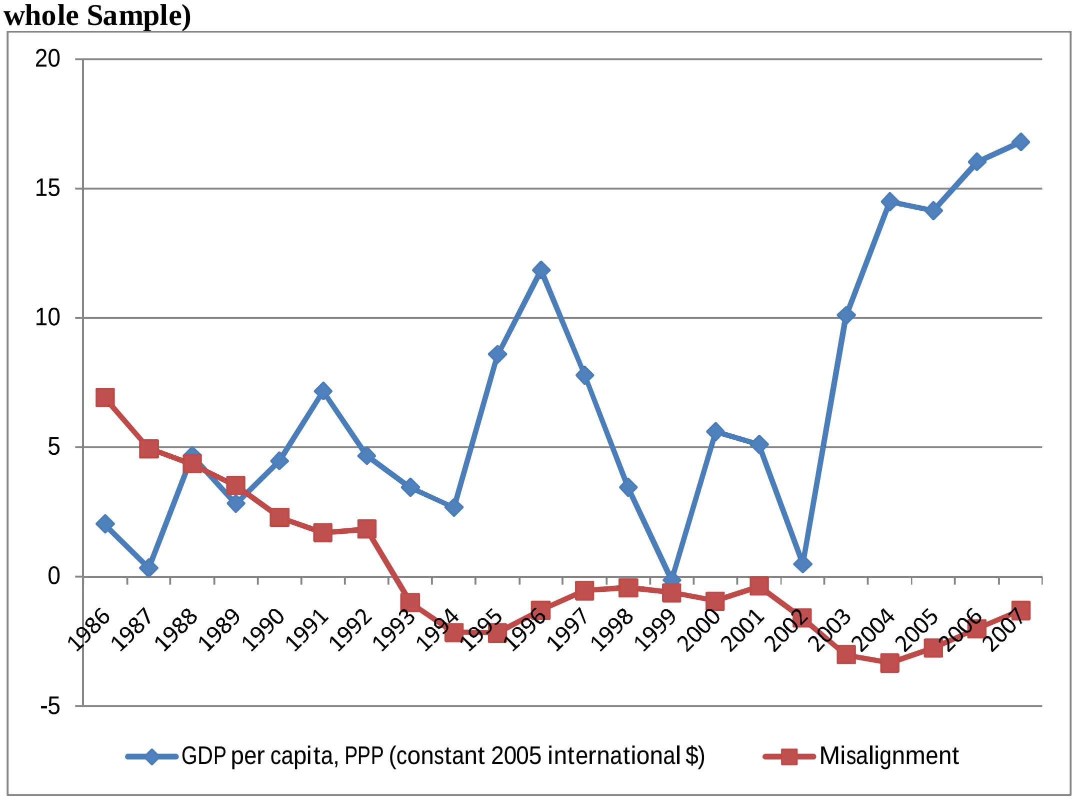


Figure 2: Exchange Rate Misalignments and Growth over Time (Average over the whole Sample)



Note: Since the focus is on the evolution of the two variables not their levels, we applied a scale transformation in order to ease the comparison.

Figure 3: Misalignment over Time (Arab countries)

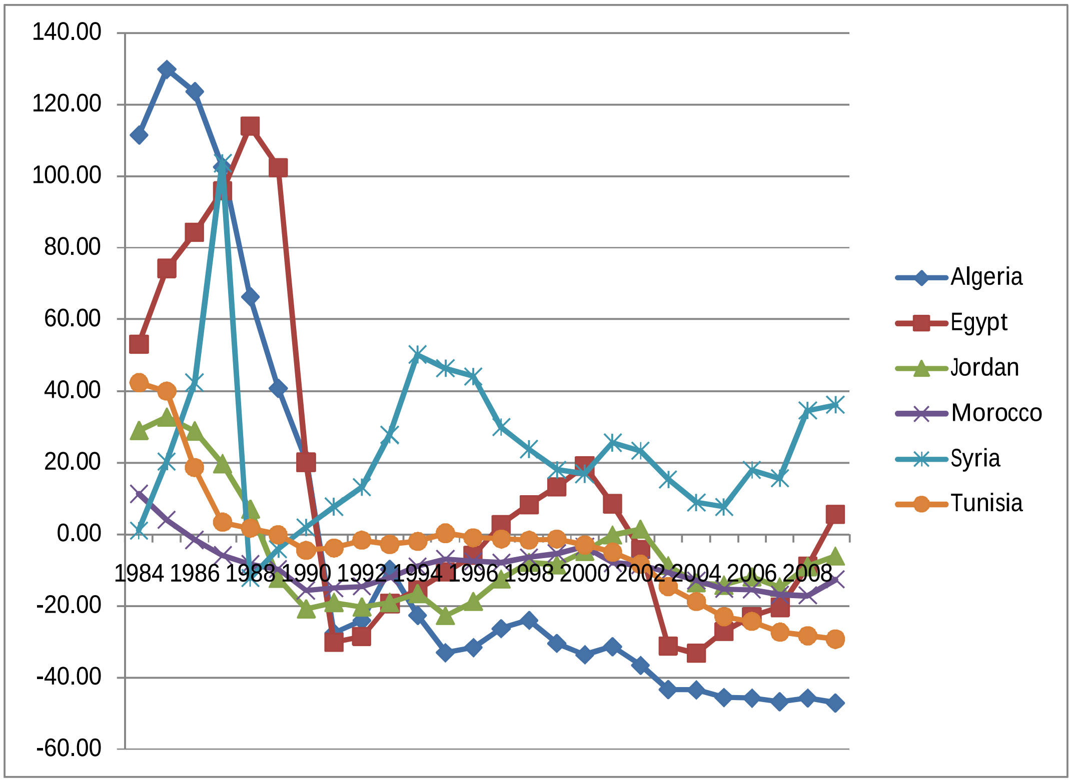
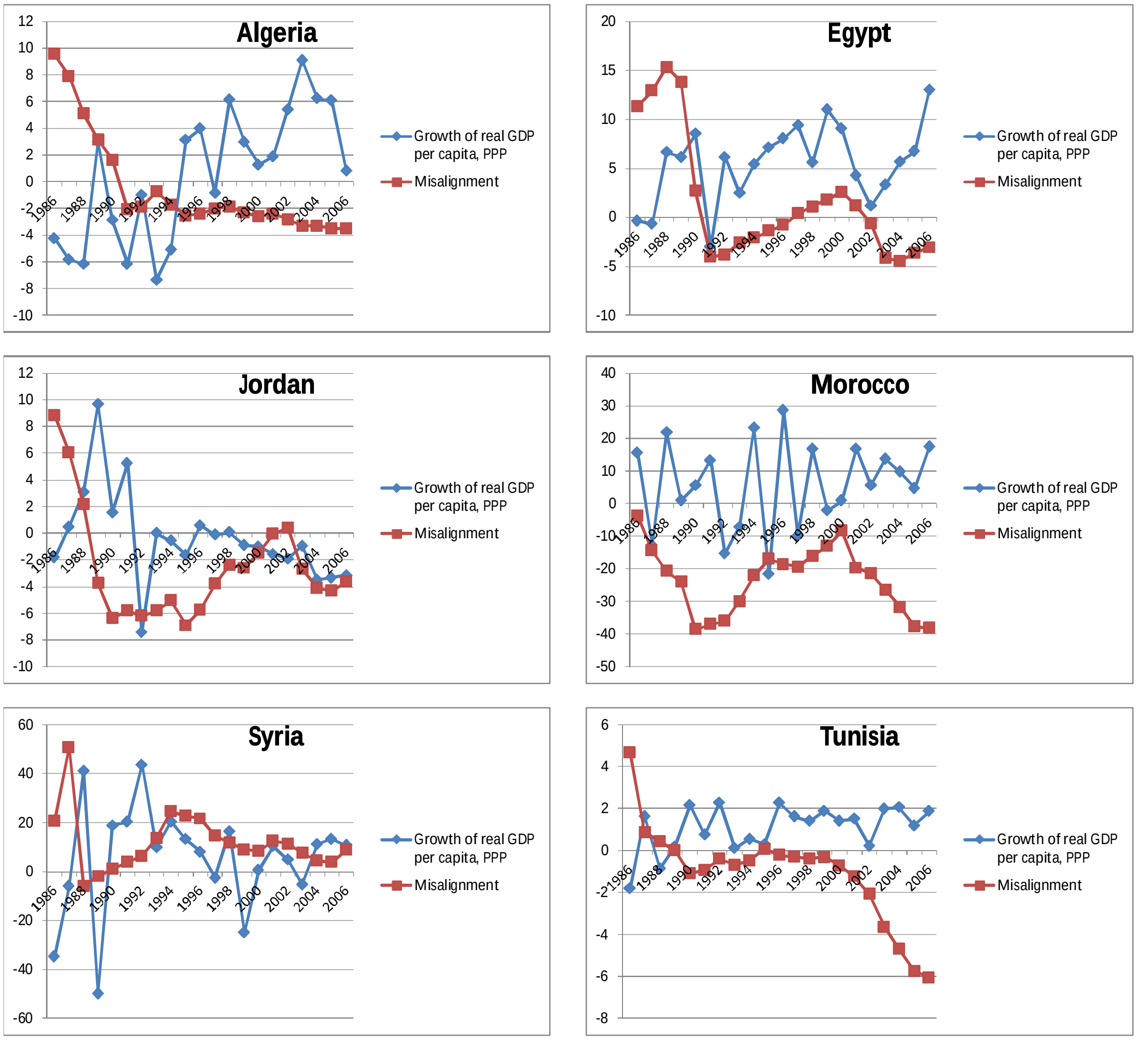


Figure 4: Growth over Time (Arab countries)



Note: Since the focus is on the evolution of the two variables not their levels, we applied a scale transformation in order to ease the comparison.

Figure 5: Financial Development: (Regions of the World)

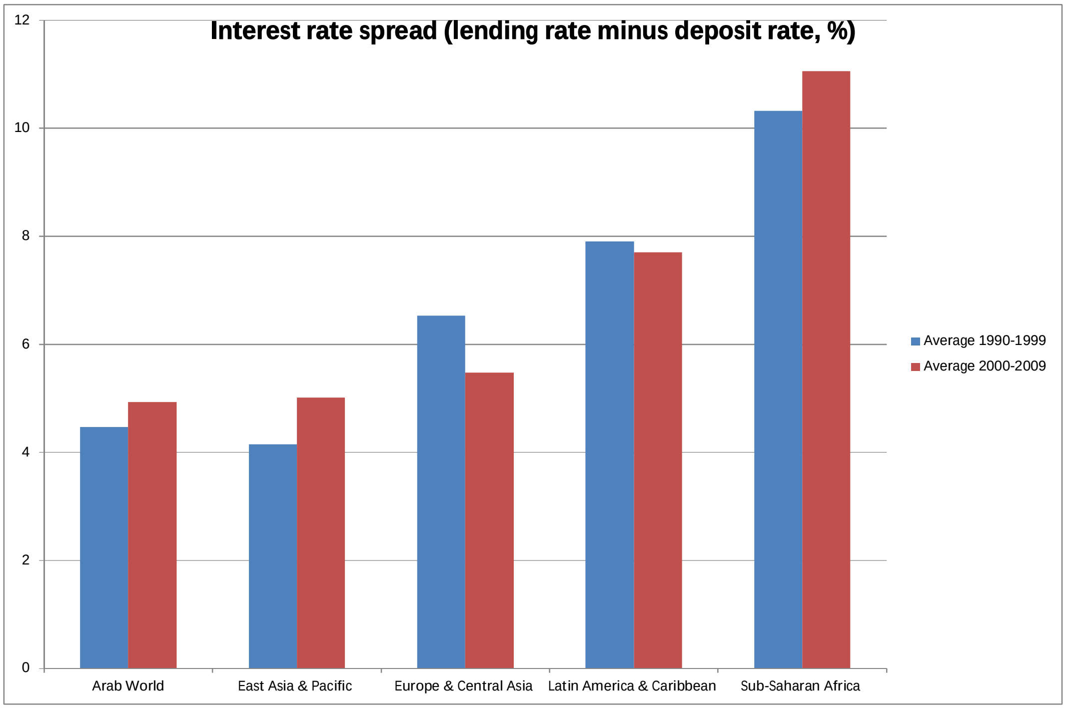


Figure 6: Financial Development: (Arab countries)

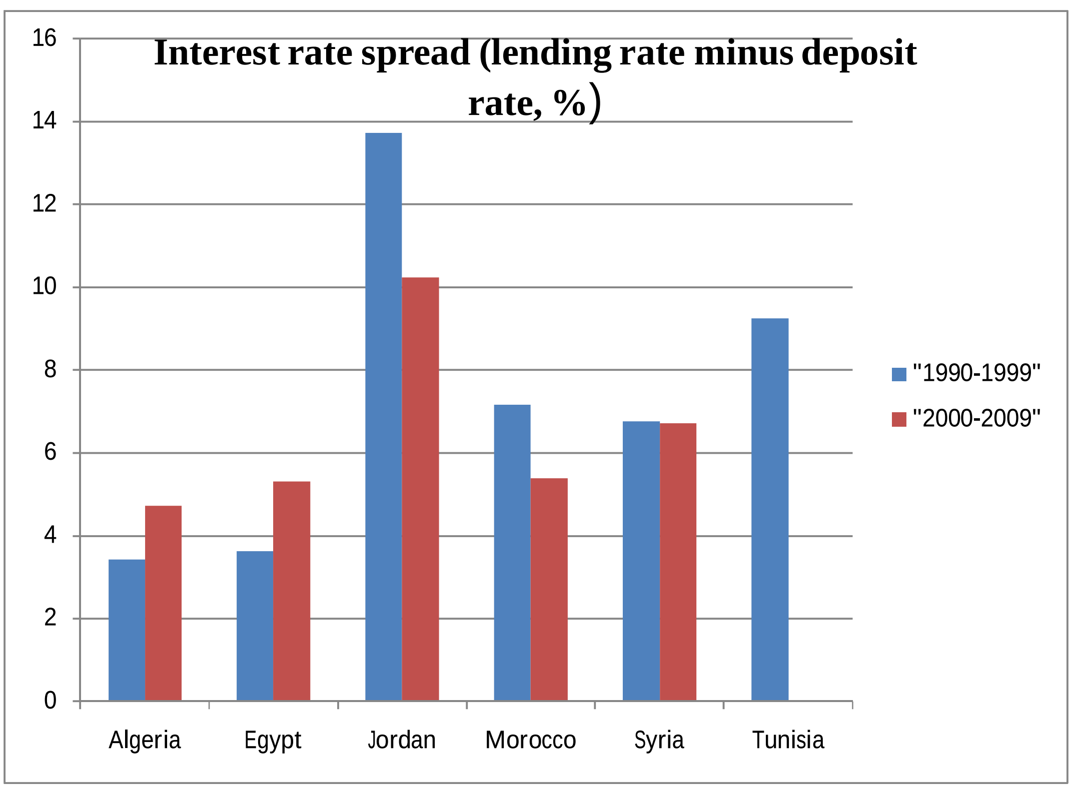


Table 1: Tests of the Independence of the Variables across Individuals

Variables	Calculated Statistics
Capital Inflow / GDP	6.11***
Openness	16.2***
Debt Services	8.36***
Government Consumption / GDP	5.42***
Terms of Trade	3.53**
REER	16.12***
Balassa Samuelson	12.42***
	Critical values: 1.96 (5%) 2.80 (1%)

Notes: ** = Significant at 5%, *** = Significant at 1%

Table 2: Test of the Stationarity of the Variables

Variable	Stationarity in	
	Level	First difference
Capital Inflow / GDP	-2.04	-3.26
Openness	-1.99	-2.63
Debt Services	-2.02	-3.07
Government Consumption / GDP	-1.69	-2.83
Terms of Trade	-1.87	-2.89
REER	-2.03	-2.87
Balassa Samuelson	-1.88	-2.86
	Critical values: -2.10 (5%) -2.20 (1%)	

Notes: ** = Significant at 5%, *** = Significant at 1%

Table 3: Test of Cointegration

Statistics	Calculated value
Panel *v*- statistic	-3.55***
Panel ρ- statistic	4.43***
Panel t- statistic	-0.73
Panel ADF statistic	-0.29
	Critical values: 1.65 (5%) 2.33 (1%)

Notes: ** = Significant at 5%, *** = Significant at 1%

Table 4: Estimation Results of Equation (2)

Variables	FMOLS
Capital Inflow / GDP	0.00 **0.25**
Openness	-0.36 **-8.69 *** **
Balassa Samuelson	0.33 **5.38 *** **
Debt Services	-0.07 **-8.6 *** **
Government Consumption / GDP	0.04 **5.01 *** **
Terms of Trade	0.11 **5.92 *** **
A-R^2	0.54

Notes: T-statistics are in bold, * = Significant at 10%, ** = Significant at 5%, *** = Significant at 1%

Table 5: Descriptive Statistics of Misalignment 1980-2009

Mean %	Standard Deviation	Minimum %	Maximum %	Negative Values	Positive Values
3.30	35.58	-64.20	484.69	794	532

Table 6: Misalignment, Financial Development and Growth

Variable	OLS	Fixed effects	GMM	OLS	Fixed effects	GMM
Initial GDP Per Capita	-0.007	-0.035	-0.011	-0.008	-0.034	-0.011
	-2.554	**-2.861**	**-3.589**	**-2.570**	**-2.915**	**-3.747**
Investment/GDP	0.006	0.032	0.006	0.006	0.034	0.006
	2.991	**3.493**	**2.619**	**3.058**	**3.656**	**2.832**
School Enrollment	0.012	0.014	0.025	0.011	0.007	0.024
	2.824	**1.914**	**5.036**	**2.561**	**0.846**	**4.989**
Population	-0.091	-0.081	-0.050	-0.091	-0.079	-0.056
	-3.438	**-2.792**	**-1.882**	**-3.427**	**-2.631**	**-2.057**
Financial development (Spread)	0.003	-0.002	0.009	0.003	-0.003	0.009
	1.432	**-1.139**	**3.838**	**1.381**	**-1.226**	**3.996**
Misalignment				-0.011	-0.020	-0.026
				-1.485	**-2.359**	**-2.707**
Number of observations	154	154	117	154	154	117
Number of Countries	40	40	40	40	40	40
Adjusted R-squared	0.28	0.50	0.32	0.29	0.52	0.35
Fixed effects test – P value		0.00			0.00	
Test of over identifying restrictions - P value			0.61			0.80

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Table 7: Undervaluation, Financial Development and Growth

Variable	Fixed effects	GMM	Fixed effects	GMM
Initial GDP Per Capita	-0.033	-0.010	-0.033	-0.011
	-2.847	**-3.058**	**-2.803**	**-1.913**
Investment/GDP	0.034	0.006	0.034	0.007
	3.733	**2.970**	**3.805**	**2.681**
School Enrollment	0.007	0.026	0.007	0.026
	0.833	**4.778**	**0.844**	**3.400**
Population	-0.077	-0.047	-0.079	-0.090
	-2.597	**-1.707**	**-2.606**	**-1.203**
Overvaluation	-0.002	-0.110	-0.015	0.367
	-0.237	**-1.631**	**-0.618**	**0.665**
Undervaluation	0.063	-0.057	0.116	-0.248
	2.797	**-0.989**	**2.001**	**-0.598**
Overvaluation* Financial development			-0.007	0.284
			-0.646	**0.838**
Undervaluation* Financial development			0.022	-0.082
			0.838	**-0.442**
Financial development (Spread)	-0.002	0.011	-0.001	0.009
	-1.133	**3.720**	**-0.227**	**0.868**
Number of observations	154	117	154	117
Number of Countries	40	40	40	40
Adjusted R-squared	0.53	0.26	0.53	0.08
Fixed effects test – P value	0.00		0.00	
Test of over identifying restrictions - P value		0.29		0.25

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Table 8: Lagged Undervaluation, Financial Development and Growth

Variable	Fixed effects	GMM	Fixed effects	GMM
Initial GDP Per Capita	-0.029	-0.011	-0.031	-0.010
	-1.869	**-3.483**	**-1.869**	**-3.298**
Investment/GDP	0.035	0.006	0.035	0.006
	2.598	**2.748**	**2.276**	**2.896**
School Enrollment	0.011	0.023	0.016	0.018
	0.981	**4.782**	**1.459**	**3.796**
Population	-0.062	-0.050	-0.068	-0.069
	-1.833	**-1.925**	**-1.549**	**-2.337**
Overvaluation (-1)	-0.038	-0.027	-0.037	-0.044
	-4.219	**-2.602**	**-1.404**	**-2.099**
Undervaluation (-1)	-0.020	-0.016	-0.096	-0.015
	-0.751	**-0.722**	**-1.491**	**-0.245**
Financial development (Spread)	0.007	0.010		
	2.124	**4.087**		
Overvaluation (-1)* Financial development (-1)			-0.002	-0.012
			-0.179	**-1.434**
Undervaluation (-1)* Financial development (-1)			-0.031	0.002
			-1.045	**0.100**
Financial development (Spread) (-1)			0.124	0.006
			0.254	**1.834**
Number of observations	126	117	121	117
Number of Countries	40	40	40	40
Adjusted R-squared	0.56	0.34	0.51	0.28
Fixed effects test – P value	0.00		0.00	
Test of over identifying restrictions - P value		0.71		0.10

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Table 9: Alternative Nonlinearity with Lagged Undervaluation

Variable	Fixed effects		GMM	
	Coefficient	T-statistic	Estimate	T-statistic
Initial GDP Per Capita	-0.028	**-2.052**	-0.004	**-1.243**
Investment/GDP	0.028	**3.144**	0.006	**3.236**
School Enrolment	0.022	**1.517**	0.014	**1.735**
Population	-0.004	**-0.094**	-0.085	**-2.839**
$Overvaluation_1$ (-1)	-0.012	**-0.357**	-0.069	**-2.329**
$Overvaluation_2$ (-1)	0.004	**0.128**	-0.042	**-1.277**
$Overvaluation_3$ (-1)	-0.032	**-1.852**	-0.012	**-0.811**
$Overvaluation_4$ (-1)	-0.028	**-1.928**	-0.030	**-1.975**
$Undervaluation_1$ (-1)	0.049	**1.003**	-0.031	**-1.108**
$Undervaluation_2$ (-1)	-0.018	**-0.444**	-0.066	**-1.583**
$Undervaluation_3$ (-1)	-0.007	**-0.161**	-0.009	**-0.229**
$Undervaluation_4$ (-1)	0.032	**0.727**	0.005	**0.146**
Number of observations	166		131	
Number of Countries	40		40	
Adjusted R-squared	0.45		0.20	
Fixed effects test – P value	0.00			
Test of over identifying restrictions - P value			0.14	

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Appendix A: Countries in the Sample

Africa	Latin America	Asia
Algeria	Argentina	China
Benin	Bolivia	Thailand
Burkina-Faso	Brazil	Pakistan
Cameroon	Columbia	India
Chad	Costa-Rica	Philippines
Comoros	Ecuador	Malaysia
Congo, Rep	Mexico	Jordan
Cote d'Ivoire	Paraguay	Syria
Egypt	Venezuela	
Gabon	Haiti	
Gambia	Honduras	
Ghana	Panama	
Guatemala	Uruguay	
Guinea-Bissau	Chile	
Kenya		
Lesotho		
Madagascar		
Malawi		
Mali		
Mauritania		
Mauritius		
Morocco		
Niger		
Panama		
Rwanda		
Senegal		
Sierra-Leone		
Sri Lanka		
Swaziland		

Appendix B: Results Using Alternative Measures of Financial Development

Table B.1: Misalignment, Financial Development and Growth

Variable	OLS	Fixed effects	GMM	OLS	Fixed effects	GMM
Initial GDP Per Capita	-0.010	-0.040	-0.012	-0.010	-0.039	-0.012
	-3.226	**-2.938**	**-3.666**	**-3.061**	**-2.954**	**-3.519**
Investment/GDP	0.003	0.042	0.004	0.003	0.041	0.005
	1.332	**4.255**	**2.062**	**1.451**	**4.145**	**2.237**
School Enrollment	0.015	0.027	0.022	0.013	0.022	0.021
	3.530	**3.340**	**4.154**	**3.069**	**2.488**	**3.968**
Population	-0.074	-0.030	-0.050	-0.073	-0.027	-0.056
	-2.901	**-0.997**	**-1.781**	**-2.863**	**-0.867**	**-1.940**
Financial development (Credit by bank)	0.002	-0.008	0.001	0.002	-0.006	0.001
	0.690	**-1.320**	**0.548**	**0.945**	**-1.076**	**0.589**
Misalignment				-0.016	-0.014	-0.022
				-2.355	**-1.759**	**-2.263**
Number of observations	177	177	139	177	177	139
Number of Countries	40	40	40	40	40	40
Adjusted R-squared	0.20	0.44	0.19	0.22	0.45	0.20
Fixed effects test – P value		0.00			0.00	
Test of over identifying restrictions - P value			0.80			0.53

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Table B.2: Undervaluation, Financial Development and Growth

Variable	Fixed effects	GMM	Fixed effects	GMM
Initial GDP Per Capita	-0.038	-0.011	-0.039	-0.011
	-2.855	**-2.768**	**-2.802**	**-1.991**
Investment/GDP	0.039	0.005	0.040	0.005
	3.943	**2.514**	**3.979**	**1.998**
School Enrollment	0.021	0.022	0.022	0.020
	2.411	**3.351**	**2.354**	**2.289**
Population	-0.023	-0.050	-0.023	-0.048
	-0.746	**-1.578**	**-0.731**	**-1.232**
Overvaluation	0.001	-0.199	0.037	0.646
	0.057	**-1.631**	**0.427**	**0.663**
Undervaluation	0.049	-0.099	0.127	0.444
	2.167	**-1.155**	**0.921**	**0.418**
Overvaluation* Financial development			-0.009	-0.231
			-0.443	**-0.772**
Undervaluation* Financial development			-0.022	-0.154
			-0.555	**-0.473**
Financial development (Credit by bank)	-0.007	0.001	-0.005	0.027
	-1.143	**0.209**	**-0.835**	**0.610**
Number of observations	177	139	177	139
Number of Countries	40	40	40	40
Adjusted R-squared	0.45	0.04	0.45	0.01
Fixed effects test – P value	0.00		0.00	
Test of over identifying restrictions - P value		0.89		0.57

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Table B.3: Misalignment, Financial Development and Growth

Variable	OLS	Fixed effects	GMM	OLS	Fixed effects	GMM
Initial GDP Per Capita	-0.010	-0.030	-0.012	-0.010	-0.030	-0.012
	-3.301	**-2.368**	**-3.768**	**-3.166**	**-2.371**	**-3.629**
Investment/GDP	0.003	0.038	0.004	0.003	0.038	0.004
	1.300	**3.916**	**2.043**	**1.396**	**3.952**	**2.192**
School Enrollment	0.015	0.026	0.021	0.014	0.022	0.020
	3.550	**3.292**	**4.055**	**3.127**	**2.439**	**3.893**
Population	-0.076	-0.024	-0.054	-0.075	-0.022	-0.059
	-2.997	**-0.835**	**-1.917**	**-2.967**	**-0.716**	**-2.038**
Financial development (Domestic credit)	0.001	-0.015	0.002	0.001	-0.014	0.003
	0.391	**-3.665**	**1.012**	**0.689**	**-3.165**	**1.209**
Misalignment				-0.015	-0.013	-0.021
				-2.226	**-1.678**	**-2.148**
Number of observations	180	180	142	180	180	142
Number of Countries	40	40	40	40	40	40
Adjusted R-squared	0.20	0.46	0.19	0.21	0.47	0.20
Fixed effects test – P value		0.00			0.00	
Test of over identifying restrictions - P value			0.22			0.40

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Table B.4: Undervaluation, Financial Development and Growth

Variable	Fixed effects	GMM	Fixed effects	GMM
Initial GDP Per Capita	-0.029	-0.011	-0.029	-0.017
	-2.298	**-2.949**	**-2.277**	**-1.616**
Investment/GDP	0.036	0.005	0.036	0.004
	3.940	**2.541**	**3.895**	**1.267**
School Enrollment	0.021	0.021	0.021	0.029
	2.439	**3.513**	**2.291**	**1.847**
Population	-0.017	-0.054	-0.018	-0.052
	-0.576	**-1.785**	**-0.593**	**-1.376**
Overvaluation	0.005	-0.160	0.002	0.339
	0.411	**-1.613**	**0.036**	**0.458**
Undervaluation	0.051	-0.067	-0.011	0.755
	2.434	**-1.153**	**-0.115**	**0.752**
Overvaluation* Financial development			0.001	-0.197
			0.075	**-0.711**
Undervaluation* Financial development			0.022	-0.323
			0.690	**-0.799**
Financial development (Domestic credit)	-0.014	0.002	-0.016	0.040
	-3.318	**0.928**	**-2.784**	**0.839**
Number of observations	180	142	180	142
Number of Countries	40	40	40	40
Adjusted R-squared	0.48	0.08	0.47	0.01
Fixed effects test – P value	0.00		0.00	
Test of over identifying restrictions - P value		0.26		0.58

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Table B.5: Misalignment, Financial Development and Growth

Variable	OLS	Fixed effects	GMM	OLS	Fixed effects	GMM
Initial GDP Per Capita	-0.010	-0.039	-0.012	-0.009	-0.037	-0.012
	-3.141	**-2.751**	**-3.774**	**-2.978**	**-2.718**	**-3.790**
Investment/GDP	0.003	0.038	0.004	0.003	0.037	0.004
	1.289	**3.890**	**2.060**	**1.386**	**3.872**	**2.139**
School Enrollment	0.014	0.028	0.021	0.013	0.022	0.021
	3.441	**3.309**	**4.230**	**2.969**	**2.363**	**4.127**
Population	-0.073	-0.034	-0.048	-0.072	-0.030	-0.053
	-2.936	**-1.088**	**-1.752**	**-2.912**	**-0.913**	**-1.870**
Financial development (M2/GDP)	0.004	-0.007	0.003	0.005	-0.006	0.003
	1.437	**-0.826**	**1.038**	**1.582**	**-0.710**	**1.123**
Misalignment				-0.015	-0.016	-0.020
				-2.228	**-2.185**	**-2.068**
Number of observations	180	180	142	180	180	142
Number of Countries	40	40	40	40	40	40
Adjusted R-squared	0.21	0.42	0.19	0.22	0.44	0.20
Fixed effects test – P value		0.00			0.00	
Test of over identifying restrictions - P value			0.63			0.38

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.

Table B.6: Undervaluation, Financial Development and Growth

Variable	Fixed effects	GMM	Fixed effects	GMM
Initial GDP Per Capita	-0.036	-0.011	-0.037	-0.015
	-2.594	**-2.983**	**-2.647**	**-1.695**
Investment/GDP	0.036	0.005	0.036	0.004
	3.862	**2.561**	**3.874**	**1.344**
School Enrollment	0.022	0.020	0.022	0.026
	2.447	**3.719**	**2.383**	**1.948**
Population	-0.026	-0.051	-0.027	-0.042
	-0.796	**-1.728**	**-0.815**	**-1.280**
Overvaluation	0.001	-0.136	0.019	0.908
	0.100	**-1.832**	**0.255**	**0.830**
Undervaluation	0.055	-0.057	0.015	1.112
	2.539	**-1.270**	**0.086**	**0.806**
Overvaluation* Financial development			-0.004	-0.309
			-0.230	**-0.921**
Undervaluation* Financial development			0.013	-0.348
			0.254	**-0.841**
Financial development (M2/GDP)	-0.008	0.003	-0.008	0.051
	-0.976	**0.770**	**-0.870**	**0.941**
Number of observations	180	142	180	142
Number of Countries	40	40	40	40
Adjusted R-squared	0.45	0.10	0.44	0.01
Fixed effects test – P value	0.00		0.00	
Test of over identifying restrictions - P value		0.40		0.91

Notes: All estimates are heteroskedastic-consistent. T-statistics are in bold.