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Exchange-Rate Regime and Economic Growth: A Review of the Theoretical and Empirical Literature

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Abstract

The aim of this paper is to examine the theoretical and empirical arguments for the relationship between the exchange-rate regime and economic growth. As a nominal variable, the exchange rate (regime) might not affect the long-run economic growth. However, there is no unambiguous theoretical evidence what impacts the exchange-rate target exhibits on growth. The channel through which the regime might influence growth is trade, investment and productivity. Theoretical considerations relate the exchange-rate effect on growth to the level of uncertainty imposed by flexible option of the rate. However, while reduced policy uncertainty under a peg promotes an environment which is conductive to production factor growth, trade and hence to output, such targets do not provide an adjustment mechanism in times of shocks, thus stimulating protectionist behaviour, price distortion signals and therefore misallocation of resources in the economy. Consequently, the relationship remains blurred and requires in-depth empirical investigation.

The empirical research offers divergent result though. A big part of the studies focuses on the parameter of the exchange-rate dummy, but does not appropriately control for other country-characteristics nor apply appropriate growth framework. Also, the issue of endogeneity is not treated at all or inappropriate instruments are repeatedly used. Very few studies disgracedly pay small attention to the capital controls, an issue closely related to the exchange-rate regime and only one study puts the issue in the context of monetary regimes. Overall, the empirical evidence is condemned because of growth-framework, endogeneity, sample-selection bias and the so-called peso problem. An empirical investigation which will consider all those aspects might reveal clear and robust suggestion of the relationship between exchange-rate regime and growth.

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Introduction

The aim of this paper is to examine the theoretical and empirical arguments for the relationship between the exchange-rate regime and economic growth. The natural-rate hypothesis implies that the best that macroeconomic policy can hope to achieve is price stability in the medium-term. In terms of exchange-rate policy, the nominal exchange rate can not be used to keep unemployment rate away from its natural level on a sustained basis. Therefore, an attempt to over-stimulate the economy, by expansionary monetary policy or currency devaluation will result in higher rate of inflation, but no increase in real economic growth (Goldstein, 2002). Hence, as a nominal variable, the exchange rate (regime) might not affect the long-run economic growth. However, there is no unambiguous theoretical evidence what impacts the exchange-rate target exhibits on growth.

Many studies argue that the linkage between regime and growth exists, but the sign of the influence is blurred. The channel through which the regime might influence growth is trade, investment and productivity. Theoretical considerations relate the exchange-rate effect on growth to the level of uncertainty imposed by flexible option of the rate. However, while reduced policy uncertainty under a peg promotes an environment which is conductive to production factor growth, trade and hence to output, such targets do not provide an adjustment mechanism in times of shocks, thus stimulating protectionist behaviour, price distortion signals and therefore misallocation of resources in the economy. Consequently, the relationship remains blurred and requires in-depth empirical investigation.

The empirical research offers divergent result though. While one group of studies found that a pegged exchange rate stimulates growth, while a flexible one does not, another group concluded the opposite holds. Moreover, a third group of studies came up with no effect or inconclusive results. The latter could be due to a measurement error in the exchange-rate regimes' classifications, divergences in measuring exchange-rate uncertainty or sampling errors. A big part of the studies focuses on the parameter of the exchange-rate dummy, but does not appropriately control for other country-characteristics nor apply appropriate growth framework. Also, the issue of endogeneity is not treated at all or inappropriate instruments are repeatedly used. Very few studies disgracedly pay small attention to the capital controls, an issue closely related to the exchange-rate regime and only one study puts the issue in the context of monetary regimes. Overall, the empirical evidence is condemned because of growth-framework, endogeneity, sample-selection bias and the so-called peso problem. Further empirical investigation which will consider all those aspects might reveal clear and robust suggestion of the relationship between exchange-rate regime and growth.

The paper is organized as follows. The next section investigates the theoretical channels through which the exchange-rate regime might affect growth and particularly focuses on how it might affect production factors and hence growth. The next section summarizes all studies published on the relationship between exchange-rate regime and growth, focusing on their possible flaws. The last section concludes the paper.

Theoretical insights: Does exchange-rate targeting matter for growth?

Limited number of studies in the academic literature (Domac *et al*, 2004b; Levy-Yeyati and Sturzenegger, 2002; Bohm and Funke, 2001, Du and Zhu, 2001; Nilsson and Nilsson, 2000; Brada and Mendez, 1988) investigate the exchange-rate regime's effect on economic growth. However, unlike the linkage between exchange-rate regime and inflation (elaborated in Petreski, 2006), exploration of the relation between peg and growth has evoked

considerably less research, "probably due to the fact that nominal variables are typically considered to be unrelated to longer-term growth performance" (Levy-Yeyati and Sturzenegger, 2002, p.2). In that line, Goldstein (2002) argues that the natural-rate hypothesis implies that the best that macroeconomic policy can hope to achieve is price stability in the medium-term. In terms of exchange-rate policy, the nominal exchange rate can not be used to keep unemployment rate away from its natural level on a sustained basis. Therefore, an attempt to over-stimulate the economy, by expansionary monetary policy or currency devaluation will result in higher rate of inflation, but no increase in real economic growth (Barro and Gordon, 1983). Hence, as a nominal variable, the exchange rate (regime) might not affect the long-run economic growth. There is no unambiguous theoretical evidence what impacts the exchange-rate target exhibits on growth.

Economic theory does not noticeably articulate how the exchange-rate regime and particularly the exchange-rate peg affects growth. Instead, arguments typically focus on its impact on investment and international trade (primarily exports). However, Levy-Yeyati and Sturzenegger (2002) comprehensively treat how exchange-rate regime impinges on growth. They argue that the linkage between regime and economic growth exists, but the sign of the influence is blurred. Advocates of exchange-rate ageing (hereafter ERT) strategy usually highlight that by the reduced *policy uncertainty* and lowered interest-rates variability, this strategy promotes an environment which is conductive to growth. On the contrary, an exchange-rate target does not provide an adjustment mechanism in times of shocks, thus stimulating protectionist behaviour, distorted price signals and therefore misallocation of resources in the economy. In the same line, for instance, McKinnon and Schnabl (2003) argue that before the Asian crisis of 1997/98 the exchange-rate stability against the US dollar contributed to low inflation and the sound fiscal position. The resulting stable expectations then promoted investment and boosted long-term growth, which has become known as the East Asian miracle.

Ghosh *et al* (1997), Garofalo (2005) and Collins (1996) all deal with the relationship between the peg and growth. The first paper argues that a peg enhances investments, but a float produces faster productivity growth. Reverting to the production function and specifically to the Solow model of growth, output growth could be promoted if one of the *production factors (labour and capital) or the total factor productivity*, or all three, increase. Therefore, if there is considerable evidence that an exchange-rate target promotes investment, then the lower output under a peg has to be associated with slower productivity growth. Moreover, a part of the spurred productivity growth under more flexible option of the exchange rate is associated with faster growth of the international trade.

The ERT impact on productivity growth is especially emphasised in emerging markets, where credit markets appear to be thin. However, the ultimate effect of the peg channelled through productivity growth remains unclear. For instance, Aghion *et al* (2005) argue that increased exchange-rate volatility causes a higher share of the firms in the economy to experience credit constraints, given the under-developed financial (including credit) market. Their explanation follows this line of thought: suppose that producers can decide whether to invest in short-run capital or in a long-term productivity enhancing venture. Typically, the long-term productivity-enhancing investment creates a need for liquidity in order to face medium-term idiosyncratic liquidity shocks, the latter mainly stemming from the exchange-rate volatility. With perfect credit markets, the necessary liquidity is always supplied, but this is no longer the case when credit markets are imperfect. The liquidity shock is only financed when the firm has enough profits, because only profitable firms can borrow enough to cover their liquidity costs. A negative aggregate shock, by making all firms less profitable, makes it less likely that the liquidity needs of any of them will be met. As a result,

a fraction of the potentially productivity-enhancing long-term investments will go to waste, with obvious consequences for growth. A main implication is that firms in countries with better financial markets will deal better with exchange-rate volatility, and therefore will tend to go more for long-term investments, which in turn should generate higher aggregate growth, while uncertainty in developing markets will result in lower productivity growth.

Friedman (1953) explains that flexible rates act as absorbers of external shocks; in case of a stringent exchange-rate target, the adjustment is channelled through the change in the relative price level. But, in a world of Keynesian prices, the adjustment is slow, thus creating an excessive burden in the economy and ultimately harming growth. Furthermore, under perfect (or at least high) capital mobility, interest rates changes produce high costs for the economy, in attempts to defend a peg when the currency is under attack. Fisher (2001), in that regards, explains that in modern times, free capital across borders makes pegs unsustainable, leading to severe recessions in times of crisis.

Contrary to those views, Gylfason (2000) explains that the macro-stability imposed by pegging further promotes foreign trade, thus "stimulating economic efficiency and growth over the long haul and restraining inflation, which is also good for growth" (p.176). Fixing the exchange rate may enable faster output growth in the medium and long run by supporting greater openness to international trade. Also, the latter may spur growth by easing technology transfer, thus aiding the productivity growth, and which in turn is boosted by promoting greater openness (Moreno, 2001). De Grauwe and Schnabl (2004) argue that there will be higher output growth under a peg because of two factors: first, the eliminated exchange-rate risk which stimulates the international trade and the international division of labour; second, a credible fix promotes certainty, as argued earlier, thus lowering the country risk-premium embedded in the interest rate. Low interest rates in turn stimulate consumption, investment and growth. An analysis of how a peg affects investment is conducted later. Advocates of pegs blame floats for throwing bewilderment at the international market as to the exporters' competitiveness (Grubel, 2000), consequently promoting recourses' misallocation (Gylfason, 2000) and in that manner harming growth.

Bailliu *et al* (2003) argue that regime's influence on growth could be direct, through the regime's effect on ***shock adjustments***, or indirect, through ***investment, international trade and financial sector development.*** The first effect is channelled through regime's effect on growth by "dampening or amplifying the impact and adjustment to economic shocks" (p.385), thus allowing a flexible rate option to enable fast and easy accommodation and absorption of the economic shocks. Consequently, "when the adjustment to shocks is smoother, one would expect the growth to be higher, given that the economy is, on average, operating closer to capacity" (p.385). Whereas, the indirect implications, as explained by Bailliu *et al* (2003), arises from the relationship between the (un)certainty imposed by the exchange-rate regime and trade and investment. These aspects are analysed in details below.

Nilsson and Nilsson (2000) explore the impact of the exchange-rate regime on exports for developing countries. They argue that for developing countries, export-led growth is the ***spiritus movens*** for overall development, on one hand, while on the other, developing countries' exporters are severely affected by exchange-rate misalignments and volatility. That is to say, they are additionally harmed as to their market power and thus motivated to change export quality. Brada and Mendez (1988) further deepen this hypothesis. They argue that apologists of pegs assert that flexible rates depress the volume of international trade in two ways: either through the exchange-rate uncertainty for conducting foreign trade, or throughout erecting trade barriers as a reaction to the increased exchange-rate volatility. Likewise, Domac *et al* (2004b) point out that because of the uncertainty imposed, a floating

regime may hamper international trade. However, the same papers emphasize the efficiency of floats in correcting balance of payments disequilibria as their advantage, which in turn will enable internal stability to be achieved quicker.

The preceding notions are related to the exchange-rate risk which stems from allowing the rate to float. This risk is restrained with an exchange-rate target, completely with a currency board or irrevocable peg or considerably with an exchange-rate band or crawling peg/band. Then the relation between an exchange-rate target and trade could be straightforward: a stable macroeconomic environment promotes bilateral trade. However, Viaene and de Vries (1992) argue that such a straightforward assumption of a negative link between uncertainty and trade may not be appropriate, because agents might amplify their incentives to trade more under intensified exchange-rate fluctuations, depending on their risk aversion. Dellas and Zilberfarb (1995) found a significant positive link between exchange-rate variability and trade growth; however they acknowledged that (exporters') risk aversion matters. Namely, a low level of risk aversion could imply positive effect; nevertheless a developed forward market could be helpful and serve as shock absorbers by supplying a variety of hedging instruments. If exporters are provided with an efficient vehicle for hedging exchange-rate risk such as forward markets, increased exchange-rate volatility could ultimately have positive effects (Bailliu *et al*, 2003). However, such instruments are unavailable in developing markets.

As mentioned earlier, another important area of academic interest is how the exchange-rate regime affects investment in a country. That is, investment is another platform on which the overall economic growth is based. In that line of thinking, Bohm and Funke (2001) put forward the following question: "Should countries wishing to encourage investment increase the flexibility of their exchange rate, or adopt a fixed exchange-rate regime?" (p.2). In line with what has been said for the relationship between regime and exports, these authors suggest that the channel through which the exchange-rate regime influences investment is the level of uncertainty. That is, when the latter is reduced, investment is increased and therefore, new-jobs creation and output (Bohm and Funke, 2001).

The degree to which the concept of uncertainty imposed by the exchange-rate regime is essential, is the concern of the study of Dixit (1989), who states that instability leads to disinvestment or puts off already planned investment. In the same line of thinking, Krugman (1991; cited in Bohm and Funke, 2001) affirms the belief that exchange-rate volatility will "warm up" the reasons for taking on "a 'wait and see' attitude towards both investment and trading decisions" (p.3). In sum, the literature relates the exchange-rate regime to investment via the uncertainty imposed by the former. However, it offers negligible evidence of this relation which could be ascribed to the fact that the decision to invest internationally, or to engage in the international capital flows, is dependent not only on the exchange-rate system and the perception of uncertainty, but on other, probably more real factors as well (Crowley and Lee, 2003).

Concluding all aspects of the issue explored above, it could be inferred that directions in which the regime may impinge on productivity, investment, trade and thus, on the output growth are plentiful. Mainly, theoretical considerations relate the exchange-rate effect on growth to the level of uncertainty imposed by flexible option of the rate. However, while reduced policy uncertainty under ERT promotes an environment which is conductive to production factor growth, trade and hence to output, such targets do not provide an adjustment mechanism in times of shocks, thus stimulating protectionist behaviour, price distortion signals and therefore misallocation of resources in the economy. Consequently, the relationship remains blurred and requires more in-depth empirical investigation.

Evaluation of the empirical evidence of the growth effects of exchange-rate regime

Since economic theory does not reveal clear foundations for the relationship between the exchange-rate target and economic growth, the issue becomes empirical. However, the few published empirical studies have also indicated divergent results. These are summarized in table 1.1 at the end of this section and reviewed as the section proceeds. The methodological approach of the studies is the criterion through which these are examined in this section.

Two classic papers, Baxter and Stockman (1989) and Mundell (1995) compare growth between the two periods: the period of the fixed exchange rate system and the one under the generalized floating in the US and four other regions. The first study concluded that exchange-rate arrangements do have little effect on the key macroeconomic variables. The second found that the former period of fixed rates achieved better performance in all respects, including the real per capita growth. However, the simple comparison does not proceed with an econometric analysis which would discover significant causal relationships. Ghosh *et al* (1997) provides a descriptive analysis (means and standard deviation comparisons across regimes) of the growth performance under alternative regimes in 145 IMF-member countries for 30 years after 1960 and found a slightly higher GDP growth under a float (1.7% under floating compared to 1.4% under a peg). The study concludes that as investment rates contributed two percentage points of GDP, then the lower output growth under a peg must be a result of a slow productivity growth. Higher productivity growth under a float also supported the growth of external trade. However, the evidence is not overwhelming. Surprisingly, growth appeared to be the highest (2%) under an intermediate regime (soft pegs of managed float). Switching to a floating regime resulted to improved growth by 1 percentage points (p.p.) in three years. Moreno (2000; 2001) in his two studies, also using descriptive statistics, measured how the regime (actual behaviour) affected GDP growth and volatility on a sample of 98 developing countries and East-Asian countries, respectively, over the period 1974-1999. His work supports the view that real growth used to be higher under a peg by 1.1 p.p. and 3 p.p, respectively. The difference is robust to excluding the periods of currency crises preceded by a peg and excluding the top 1% high-inflation episodes. However, Moreno accounts for the so-called survivor bias (excludes sharp devaluation episodes which could be attributed to policies adopted while pegging) and finds that the growth difference between regimes significantly narrows. Both studies do not provide sufficient evidence that growth is a causal effect of the exchange-rate regime; in addition, as the growth of investment and output are opposite under certain regimes, the study prescribes the result on productivity, which is the residual. However, there are no any figures to confirm neither this nor an explanation of how the exchange-rate regime effect might be channelled to productivity.

In the article mentioned in the previous section, Levy-Yeyati and Sturzenegger (2002) examined the issue with a sample of 183 countries in the post-Breton-Woods era (1974-2000), using a pooled regression, estimated by OLS applied to annual data. They estimated the relationship presented in table 1.2 below. Initial per capita GDP refers to the GDP average in the years 1970-1973 and aims to identify conditional convergence. The population variable controls for the size of the economy, as the choice of exchange-rate regime is expected to be related to size. Specifically, the study tests the effect of hard pegs, explaining that conventional pegs (which might exhibit flexibility to limited extent) may fall short of credibility and thus making the strong commitment under hard pegs necessary. However, if the exchange-rate-regime change is understood as a policy change, then the relationship

might also be affected by other policy variables and this was not fully accounted for in their specification. Findings for developing countries are that a peg is likely to be associated with slower growth; however, the conclusion does not hold for industrial countries. Edwards and Levy-Yeyati (2003) and Husain *et al* (2004) use the same specification as in Levy-Yeyati and Sturzenegger (2002) to investigate the same issue. The first study investigated the period 1973-2000 over 183-country sample and using de-facto classification. It found that countries with fixed exchange-rate regimes have had a lower rate of per-capita growth ranging between 0.66 and 0.85 p.p. per year, than compared with a flexible regime. The second study investigated the period 1970-1999 over 158-country sample using de-jure exchange-rate regimes and found that neither pegs harm growth nor flexible rates support growth. Husain *et al*'s (2004) study is very weak on robustness checks.

Because of possible simultaneity between growth performance and the exchange-rate regime, Levy-Yeyati and Sturzenegger (2002) use a feasible generalized two-stage IV estimator which simultaneously allows correction for heteroskedasticity. Nevertheless, the study does not reveal which variables are used as instruments neither considers their validity. Yet, the authors point out that endogeneity, if found to exist, might be weaker for growth than for inflation (discussed in Petreski, 2006) in respect to exchange-rate regime, due to the general inconclusiveness of the channels through which exchange-rate regime might influence growth. The findings strengthen the negative causation originating from the peg to growth, i.e. the relationship is robust to estimation allowing for the endogeneity. The other two studies, although aware of the issue, do not allow for endogeneity in their empirical work.

The hypothesis that exchange-rate regime affects growth is investigated by Garofalo (2005) for the case of Italy over the period 1861-1998, with the same variables as in Levy-Yeyati and Sturzenegger (2002). The study used the OLS technique to estimate the specified regression and results indicate that Italy experienced the highest growth rates under some form of intermediate regime. To correct the potential endogeneity bias stemming from the direction of the link between growth and peg, Garofalo (2005) utilized two-stage instrumental-variable estimation with heteroskedasticity consistent standard errors and the estimation suggested that pegging slows growth rather than low growth suggests imposing a peg. However, the view that fixed rates foster slower growth has been supported by evidence from the countries of Latin America and Caribbean in the period 1987-1992 (Collins, 1996).

Dubas *et al* (2005) regress per capita growth on a set of growth control variables (listed in table 1.2) and a set of exchange-rate dummies for 180 countries in the period 1960-2002. The study utilizes random-effects panel regressions and finds that the highest growth rates are associated with de-facto fixers, who experience, on average, 1% faster growth than de-facto floaters. The conclusion is statistically significance for the non-industrial countries only. The same conclusion applies when the exchange-rate dummies are replaced with an indicator for the exchange-rate stability. However, the study does not report the coefficients on the control variables, which is important for considering if the growth model is suitable for such analysis; also, there are no robustness checks which might confirm the stability of the obtained coefficients, at least for the variables of interest. However, the study makes a pioneering approach to the issue if the distinction between de-jure and de-facto exchange-rate regime matters for growth. The evidence that such distinction matters for industrialized countries is scarce, but some important insights for non-industrial economies are found: countries that de-jure float, but de-facto peg are estimated to grow at 1.12% above countries that de-facto and de-jure float; countries that de-jure and de-facto peg are estimated to grow at 0.64% above countries that de-facto and de-jure float. In conclusion, countries displaying fear of floating (Calvo and Reinhart, 2002) experience significantly higher per-capita growth.

The study does not take into account the sample-selection problem by not reporting whether these results could be assigned to the exchange-rate regime itself or to some other factors. Namely, the sample might be biased towards countries that have experienced currency crises, which would have led to severe economic outcomes. The latter in turn, burrs the relationship regime – growth.

Huang and Malhorta (2004) examine the relationship between exchange-rate regime and growth by paying attention on two aspects: exchange-rate-regime classification and differentiation between developing and developed economies. They augment earlier approaches with the classification issue and achieve firm de-facto classification of exchange-rate regimes. In addition, the differentiation of the level of development should help in demystifying if financially underdeveloped economies need a credible anchor, whereas the latter does not matter for developed economies. The study uses 12 developing Asian countries and 18 advanced European economies over the period 1976-2001. No special cautions are considered when constructing the sample. It utilizes descriptive statistics and regression variables as presented in table 1.2. Findings suggest that the exchange-rate regime matters for developing economies: fixed and managed floating regimes outperform the others in terms of growth. However, for advanced economies, no significant regularity is discovered. Albeit the study makes considerable effort to highlight the importance of the proper classification of regimes and models advanced versus developing economies in separate regressions, still some criticism remains. The growth framework used is weak: the independent variables included do not coincide with the conventional persuasion of what basically determines growth. No diagnostics checking is offered and the R-squared is very low. Robustness checks are also weak.

The study of Bleaney and Francisco (2007) also pays attention to the regime classification. It utilizes de-facto classification carried out by previous studies, including 91 developing countries over the period 1984-2001. They regress the growth rate on its lagged value, exchange-rate dummies and time dummies and exclude high inflation-periods. Findings are that pegs are associated by significantly slower growth than soft pegs or floats. However, no theory-consistent growth framework is applied; there are many insignificant variables, suggesting that the specification might suffer from high level of colinearity; endogeneity is not considered; robustness checks are not offered. It could be argued, the study cannot see the forest from the trees: it pays to much attention on the classification schemes and too little to other important issues.

A different approach that opts to address the problems that undermine the robustness of the previous findings is carried out by Domac *et al* (2004b). At an outset, they accentuate that the effect of the regime on growth could not be independently revealed if macroeconomic fundamentals and institutional arrangements are not considered. Also, the study criticises previously mentioned studies for their failure to capture the change in regression parameters when the exchange-rate regime switches and hence to reflect the Lucas (1976) critique. In addition, as the sample selection problem is not addressed in these earlier studies (since the choice of the exchange-rate regime depends on macro-fundamentals and is not random), Domac *et al* (2004b) argue that the error term in a standard equation would be correlated with the regime choice and thus parameters would be biased. Addressing this issue, thus will address the endogeneity problem.

They trial several investigations of the link investigated in this section, but their findings are inconclusive. However, the technique applied deserves some attention since it is alone in the literature to address the outlined issues. Namely, the study analyses the

relationship between exchange-rate regime and growth with a *switching regression technique*, by a specifying separate regression for each regime:

$$Y_i = X_i B_1 + u_{1i} \quad \text{if} \quad n_i < Z_i g + a_1; \quad i = 1....I_1 \tag{1.1}$$

$$Y_i = X_i B_2 + u_{2i} \quad \text{if} \quad Z_i g + a_1 < n_i < Z_i g + a_2; \quad i = 1....I_2 \tag{1.2}$$

$$Y_i = X_i B_3 + u_{3i} \quad \text{if} \quad n_i > Z_i g + a_2; \quad i = 1....I_2 \tag{1.3}$$

Where u_{ij} is i.i.d. N~(0,σ_j); v_{ij} is i.i.d. N~(0,1); cov(u_{ij};n_j)=σ_{jv}; j=1,2,3; a_1, a_2, and g are parameters which are obtained by ordered probit approach. Equations (1.1)-(1.3) correspond to different regimes. The same set of independent variables is employed in each equation in order to test the equality of parameters across regimes.

The regime is determined by the realization of normally distributed random variable n_j which is not observable. However, the expected value of u_{ij}, given the value of n_j, could be derived with appropriate density and cumulative normal distribution functions. Given that, the ultimate equations are as follows:

$$Y_i = X_i B_1 - s_{1v} h_{1i} + e_{1i} \tag{1.4}$$

$$Y_i = X_i B_2 - s_{2v} h_{2i} + e_{2i} \tag{1.5}$$

$$Y_i = X_i B_3 - s_{3v} h_{3i} + e_{3i} \tag{1.6}$$

The X_i matrix includes: fiscal balance; the change in liberalization index; inflation and other initial factors (as specified in table 1.2). The most important test in this estimation is the one that tests the hypothesis of no different output outcomes and variances among different regimes (H_0: $B_1 = B_2 = B_3 = 0$; $s_{1v} = s_{2v} = s_{3v} = 0$) against the alternative hypotheses that all these differ from zero. Based on the empirical results, the study does end up with the inference that there is no particular exchange-rate regime being superior to another in terms of growth performance. However, the study suggests that there is an association between exchange-rate regime and growth but the strength of the coefficient is found to be different under different exchange-rate arrangements. Nonetheless, the low explanatory power of the regression does not offer firm conclusions about the link between exchange-rate regime and growth.

The technique pursued by Domac *et al* (2004b) is rare in the exchange-rate regime literature. However, in terms of robustness of results, it provides sufficient superiority over techniques which employ exchange-rate dummies in reduced-form equations. In particular, as the authors emphasize, these coefficient estimates for the exchange-rate dummy variable are intended to reveal the effect of the applied exchange-rate regime on growth. But, in times of regime switch, the coefficients associated with policy variables also change – an aspect referred to as the Lucas critique. In light of this, the approach of Domac *et al* (2004b) is superior over the other approaches as it models each regime in a separate regression allowing for time-variant estimates of the effect of the independent variables. While this technique directly addresses the sample selection problem (the biasness of the regime choice), by a modelling of the different regimes in separate equations, it also addresses the endogeneity issue by specifying constant covariance between the error term in the structural equation and the normally distributed random variable whose realization determines the exchange-rate regime. Nevertheless, some caution in interpreting the results are needed: the study uses de-jure classification, a short time period (less than 10 years for the majority of countries in the

1990s) and 22 transition countries. Hence, albeit the results might be applicable for transition economies, the exchange-rate-regime effect on growth in general remains ambiguous.

De Grauwe and Schnabl (2004) carried out a standard growth model investigation of 10 CEE countries for the period 1994-2002. To the standard set of variables explaining growth (table 1.2), they added a measure of exchange-rate stability, yielding the following regression equation:

$$w_{it} = g_i + n_{it}^{`} d_i + e_{it} \qquad (1.7)$$

Where w_{it} is a vector encompassing the annual real growth rates over the examined period. $n_{it}^{`}$ consists of investment-to-GDP ratio, export growth, fiscal balance-to-GDP, short-term capital inflows-to-GDP and the real growth of EU-15. Dummies for 1998 Russian crises and for inflation targeting are included as well. The endogeneity issue (but not the sample selection one) is removed by utilizing GMM technique. GMM uses a full set of valid lags of all endogenous and exogenous variables as instruments. The technique however is superior to Domac *et al*'s (2004b) as it may create more effective instruments. In this study, the real growth of EU and the dummy for the Russian crises are assumed to be exogenous, while all the others are endogenous. Additional variables (like openness, export concentration to EU and a measure for the volatility of the official reserves) could be used as instrumental variables. Without attempting an exhaustive explanation of results, this study suggests that the exchange-rate pegging promotes growth in the CEE countries, the results being more significant than studies that use all-country samples.

Considering the endogeneity problem when investigating the effect of the exchange-rate regime on growth, Eichengreen and Leblang (2003) investigated the issue on a sample of 21 countries over the period 1880-1997. They use instrumental variables and dynamic panel estimators which contain internal instruments to eliminate bias arising from possible endogeneity of the independent variables. The independent variables used are given in table 1.2; averages over 5-year period are used. The study advances the issue of the inclusion of the economy in the global capital markets, approximating it by a dummy variable for capital controls. However, the study is problematic in another way: it uses long period within which the international monetary environment has been subject to considerable change: the effect of the generalized pegging under Bretton Woods and that of pegging today on growth might be different (due to capital restrictions, say). Also, the sample could be biased towards countries that use a flexible or floating rate but are developed because of other reasons. The overall finding is that pegged economies perform worse than compared to flexible-rate ones by 5.2 to 8.6 p.p. per annum in terms of per capita growth. Nevertheless, these findings seem considerably high; in that line, the results are not robust.

Distinct from previous studies, Bailliu *et al*'s (2003) research turns the focus from the exchange-rate regime to another important aspect of the story, that is, the ***monetary-policy framework*** applied along with the exchange-rate regime. They accentuate their belief that the exchange-rate anchor is a monetary anchor simultaneously, thus providing firm grounds for appropriate assessment of the link regime-growth. On the other hand, intermediate and floating regimes might be associated with weak monetary regimes which will reflect upon the mentioned relationship. Explicitly, Bailliu *et al* (2003) assessed the impact of regime on growth on a panel data set of 60 countries over period 1973-1998 using the GMM technique in order to correct the endogeneity bias and the correlation between the unobserved country-specific effects and the explanatory variables. The variables included are those identified in the other studies. Bailliu *et al* (2003) found that if a regime is accompanied by a monetary policy anchor, it "exert[s] a positive influence on economic growth", regardless of its type

(Bailliu *et al*, 2003, p.398). On the contrary, when there is no monetary anchor, a regime other than peg destructs growth. Briefly, according to Bailliu *et al* (2003), it is the monetary anchor (like monetary aggregates or inflation itself), not the exchange-rate regime on its own, that affects macroeconomic performance under alternative exchange-rate regimes.

The study presents a growth framework consistent with both the neoclassical and endogenous-growth models: the growth being a function of state and control variables. The former accounts for initial conditions and belong to the neoclassical framework; the latter capture differences in steady-state levels across countries. In an endogenous-growth model, an economy is assumed to always be in its steady state, and therefore the explanatory variables capture differences in steady-state growth rates. "The specification can be used to explain either what determines differences in transitional growth rates across countries as they converge to their respective steady states (consistent with a neoclassical framework), or what determines differences in steady-state growth rates across countries (consistent with an endogenous-growth framework)" (p.385). In specific, the following model is specified:

$$GR_{it} = a_i + h_t + V_{it}b + X_{it}d + e_{it} \qquad (1.8)$$

Where GR_{it} is the real per capita growth rate over a five-year period; a_i captures country-specific effects; h_t is a time dummy; V_{it} captures initial real per-capita GDP; X_{it} captures five-year averages of the variables in table 1.2. The exchange-rate regime is averaged over the five-year period as well, grouped into pegged, intermediate and floating regime, but then augmented with the monetary regime: pegged; intermediate without anchor; intermediate with anchor; floating without anchor; floating with anchor. However, averaging the exchange-rate regime might hide valuable information about regime switches, hence blurring the ultimate objective and findings of the study.

All estimated coefficients are found to be statistically and economically significant. When the monetary anchor is not considered, the exchange-rate dummies are significant when the de-facto classification is used only: the growth is found to be positively affected by a peg then compared to intermediate or floating regimes (which affect growth adversely). When the monetary framework is considered, the estimations yield different results: intermediate regimes that do have firm monetary anchor do not exert negative influence on growth. In addition, the negative effect of the float on growth disappears. The study finds a positive influence of a well-defined monetary-policy framework on growth.

However, the study does not explain how the conflict between exchange-rate and monetary-policy anchor, when appears, is being resolved; the exchange-rate anchoring is a monetary-policy framework by itself and thus the study is unclear on these issues. Some of the implicit targeters (defined in this study as no-anchors) use several indicators for controlling inflation and thus might be more efficient in their endeavour. This aspect is not distinguished in the study. Although the study makes a pioneering inroad to account and distinguish between exchange-rate and monetary-policy regimes, it does not clearly classify the former and is weak on robustness checks.

The next table summarizes the studies above.

Table 1.2. Summary-table of the empirical research of the exchange-rate regime effect on growth

Study	Data and sample	ER classification	Model	Technique	Result (Peg and Growth)	Problems
Baxter and Stockman (1989)	1946-1984; 49 countries	Only sub-periods of general fixing and general floating considered	Descriptive analysis	Averages and standard deviations	NO EFFECT No systematic relationship between real aggregates and exchange rate system	Unconditional analysis
Mundell (1995)	1947-1993; US, Japan, Canada, EC, other Europe	Only sub-periods of general fixing and general floating considered	Descriptive analysis	Average growth rates between two sub-periods	POSITIVE Considerable higher growth under generalized pegging	Unconditional analysis
Ghosh *et al* (1997)	1960-1990; 145 countries	De-jure supplemented by categorizing non-floating regimes by the frequency of the parity changes	Descriptive analysis	Means and standard deviations comparison across ERRs	INCONCLUSIVE Slightly higher growth under a exchange-rate floating regime; Growth the highest under soft peg or managed float	Unconditional analysis; no evidence of whether ERR affects productivity; causal relationships and the effect on productivity only assumed
Moreno (2000 and 2001)	1974-1999; 98 developing countries East-Asia countries	De-facto classification	Descriptive analysis	Means and standard deviations comparison across ERRs	POSITIVE Higher growth under a peg by 1,1 p.p and 3 p.p respectively in both studies. The difference narrows when survivor bias considered	Unconditional analysis
Levy-Yeyati and Sturzenegger (2002)	1974-2000; 183 countries	De-facto	Pooled regression; Real growth = f (inv/GDP; ToT; GC; political instability; initial per capita GDP; population; openness; secondary enrolment; regional dummies and exchange-rate dummies)	OLS; 2SLS to correct for endogeneity	NEGATIVE NO RELATION Slower growth under a peg for	Is growth equation good? Other policy factors?

					developing countries; No association for developed countries	
Edwards and Levy-Yeyati (2003)	1974-2000; 183 countries	De-facto	Pooled regression; Real growth = f (inv/GDP; GC; political instability; initial per capita GDP; population; openness; secondary enrolment; regional dummies and exchange-rate dummies)	OLS	NEGATIVE Lower growth under fixed regime then compared to flexible	Same
Husain *et al* (2004)	1970-1999; 158 countries	De-jure	Pooled regression; Real growth = f(investment ratio; trade openness; terms of trade growth; average years of schooling; tax ratio; government balance; initial income/US income; population growth; population size; exchange rate dummies)	OLS	INCONCLUSIVE Pegs do not harm growth, but flexible rates do not deliver growth rates	Same; Weak robustness checks; Classification issues
Garofalo (2005)	1861-1998; Italy	De-facto	Simple regression; Real growth = f (inv/GDP; ToT; GC; political instability; initial per capita GDP; population; openness; secondary enrolment; regional dummies and exchange-rate dummies)	OLS; 2SLS to correct for endogeneity	INCONCLUSIVE Highest growth under soft peg or managed float	Same
Dubas *et al* (2005)	1960-2002; 180 countries	De-facto versus de-jure especially considered	Random-effects panel regression; Real per capita growth = f(initial year GDP; initial year population; population growth; investment to GDP; secondary education attainment; a political indicator of civil liberties; trade openness; terms of trade; dummies for transitional economies; regional dummies for Latin America and Africa; time-specific dummies; exchange-rate dummies)	Random-effects estimation	POSITIVE De-facto fixers, on average, have 1% higher growth than de-facto floaters; de-jure floaters - de-facto fixers grow at 1,12% above de-facto and de-jure floaters. Conclusions significant for non-industrialized economies only.	No robustness or diagnostics checking. Other variables not reported if in line with theory
Huang and Malhorta (2004)	1976-2001; 12 developing and 18 developed countries	De-facto	Panel regression; Per capita growth = f(Financial crisis; Openness; Government consumption; Initial GDP; Fertility rate; Secondary school enrolment ratio; exchange-rate dummies)	OLS	INCONCLUSIVE NO RELATION For developing economies, fixed and managed float outperform the others in terms of growth; for developed economies, no relationship	Weak growth-framework; no robustness checks

					revealed	
Bleaney and Francisco (2007)	1984-2001; 91 developing countries	De-facto	Growth = f(growth[-1]; exchange-rate dummies; time dummies)	OLS	NEGATIVE Growth is slower under more rigid exchange-rate regime	Weak specification; endogeneity not treated; no robustness checks
Domac *et al* (2004b)	10 years (1990s, different period for each country); 22 transition countries	De-jure	Growth = f (budget balance, lagged liberalization index, inflation, years under communism, share of industry, urbanization, share of CMEA trade)	Switching regression technique	INCONCLUSIVE There is an association ERR-growth, but the strength is different for different ERRs	Small period and small sample; does not account for de-facto exchange-rate behaviour.
De Grauwe and Schnabl (2004)	1994-2002; 10 CEE countries	De-facto	Real growth = f(inv/GDP, export, fiscal balance/GDP, short-term capital flows/GDP, real growth of EU-15, ER dummy)	GMM	POSITIVE ER peg does not reduce economic growth	Short time period and small sample
Eichengreen and Leblang (2003)	1880-1997; 21 countries	De-jure	Real per capita growth = f(Per capita income as a share of US income; primary and secondary enrolment rates; capital controls and exchange-rate dummy)	Dynamic panel and IV estimators	NEGATIVE More flexible exchange rates associated with faster growth	De-jure classification and sample selection; weak robustness
Bailliu *et al* (2003)	1973-1998; 60 countries	De-jure and de-facto, but the latter more important in terms of findings	Real per capita growth = f(initial growth; investment-to-GDP; secondary schooling; real government share of GDP; trade-to-GDP; M2-to-GDP; private sector credit-to-GDP; domestic credit-to-GDP; gross private capital flows-to-GDP; exchange-rate dummies)	GMM	POSITIVE ERR exercised by any monetary anchor positively affects growth; otherwise, ERR other then peg destructs growth	Weak on robustness check

Conclusion

The aim of this study was to articulate the arguments as to the relationship between the exchange-rate regime and growth present in the literature. At theoretical level, the directions in which the regime may impinge on productivity, investment, trade and thus, on the output growth are plentiful. Mainly, theoretical considerations relate the exchange-rate effect on growth to the level of uncertainty imposed by flexible option of the rate. However, while reduced policy uncertainty under ERT promotes an environment which is conductive to production factor growth, trade and hence to output, such targets do not provide an adjustment mechanism in times of shocks, thus stimulating protectionist behaviour, price distortion signals and therefore misallocation of resources in the economy. Consequently, the relationship remains blurred and requires more in-depth empirical investigation.

The review of the empirical studies, however, came to a conclusion neither. Whereas one group of studies found that a pegged exchange rate stimulates growth, while a flexible one does not, another group concluded the opposite holds. Moreover, a third group of studies came up with no effect or inconclusive results. The latter could be due to a measurement error in the exchange-rate regimes' classifications (Levy-Yeyati and Sturzenegger, 2002), divergences in measuring exchange-rate uncertainty (Du and Zhu, 2001) or sampling bias (Huang and Malhorta, 2004). A great part of the studies focuses on the parameter of the exchange-rate dummy, but do not appropriately control for other country characteristics nor apply appropriate growth framework (Bleaney and Francisco, 2007). Also, the issue of endogeneity is not treated at all or inappropriate instruments are repeatedly used (Huang and Malhorta, 2004; Bleaney and Francisco, 2007). Very few studies pay attention to the capital controls, an issue closely related to the exchange-rate regime and only one study puts the issue in the context of monetary regimes. Du and Zhu (2001) add that results from many empirical studies differ among counties when the same method of examination is applied and even for the same country at different points of time.

An overall critique of the literature examining the relationship between exchange-rate regime and growth is offered by Goldstein (2002), whose assertion from the beginning of this study might be helpful: as a nominal variable, the exchange rate (regime) does not affect the long-run economic growth. In addition, the empirical evidence is condemned because of growth-framework, endogeneity, sample-selection bias and the so-called peso problem (which arises if the sample period does not include instances of the kind of severe economic stress that can lead to foreign exchange system demise). Moreover, in the majority of studies, parameters in the regressions are time-invariant which might be problematic, because conditions on the world capital market changed, especially since the end of the Breton-Woods system.

Addressing all flaws identified in the empirical literature might be a good basis for unveiling the relationship between exchange-rate regime and growth at an empirical level. On the other hand, the inconclusiveness of the manner in which exchange-rate regime affects growth in the theory and practice, gave rise to the belief that exchange rate, similarly to inflation, could not affect the long-term growth performance of an economy, but rather its short-term departure from the long-run trend. The latter is a challenge for further investigation of the academic literature and for doing empirical work.

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