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# Exchange rate undervaluation and economic growth: Díaz Alejandro (1965) revisited☆

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ABSTRACT

To understand the growth effects of currency undervaluation we estimate its impact on the different components of GDP. We find that, for developing countries, undervaluation does not affect the tradable sector, but does lead to greater domestic savings and investment, as well as employment.



## 1. Introduction

The mercantilist view that exchange rate policy – more precisely, a temporarily undervalued currency – could be used to protect infant industries as a development strategy has a long tradition in economic theory and has recently enjoyed a minor revival, as a result of China's reluctance to float its exchange rate, a strategy presumed to be aimed at preserving the competitiveness of China's exports.[1] Depreciated real exchange rates have also been found to play an important role in growth accelerations (Hausmann et al., 2005; Rodrik, 2008); overvaluations have been made responsible for stagnation (Johnson et al., 2006), a "Dutch disease" effect of foreign aid (Rajan and Subramanian, 2011) and disappointing growth dividends of financial integration (see Prasad et al. (2006)). However, this neo-mercantilist premise that a depreciated exchange rate fosters growth has been saluted, at best, with skepticism either because economists tend to think that nominal exchange rates, as any other nominal variables, are immaterial to growth or, alternatively, because the real exchange rate is ultimately an endogenous variable beyond the control of the policy maker.[2]

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[1] See, e.g., Rodrik (2006) for a modern exposition of this view.

[2] Neo-mercantilism as a deliberate policy decision has also been under dispute. For example, Aizenman and Lee (2007) and Levy-Yeyati (2008) argue that the evidence on reserve accumulation favors prudential over mercantilist motives, although they acknowledge that this pattern has been reversing in more recent years where prudential motives appear to have been fulfilled or weakened (Aizenman and Lee, 2008).

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In this paper, as a natural first step to evaluate the mercantilist hypothesis we perform a simple exercise: based on a commonly used definition of undervaluation, we estimate the contribution of an undervalued currency to output growth and then to each of its individual components. More precisely, following Rodrik (2008), we first define undervaluation as the deviation from a standard real exchange rate income relationship based on the typical Balassa–Samuelson result that richer countries exhibit more appreciated real exchange rates.[3] Using this measure, together with initial per capita GDP and time and country fixed effects as controls, we run regressions of the growth rate and confirm that undervaluation is positively and contemporaneously associated with growth (replicating Rodrik's reported results). Finally, we run the same regressions for the components of GDP: consumption, savings, investment, exports and imports, to shed some light on the possible channels underlying the undervaluation-growth effect—and to test, in particular, the presence of the export growth-import substitution channel that is usually invoked by the mercantilist view.

Interestingly, while we fail to find a significant response to undervaluation in exports and imports, we do find positive effects on savings and investment, as well as on employment, in line with the findings in Levy-Yeyati and Sturzenegger (2007).[4] In the last section, we propose a possible explanation that is consistent with these facts: that depreciations that erode real labor income represent a transfer from low-income households to high-income households with a greater propensity to save, adding to the pool of domestic loanable funds – or, alternatively, from labor to financially constrained firms that benefit from a larger flow of internal funds – thereby enhancing the economy's investment capacity. This paper concludes with a discussion of this hypothesis in light of the seminal contribution of Diaz Alejandro (1965) – who highlighted the *contractionary* effects of the regressive transfer associated with exchange rate undervaluation – and the links with recent work by Aghion et al. (2005, 2009a,b) on savings and growth in the presence of financial constraints.

## 2. Economic implications

*Methodology*

Following Rodrik (2008), we compute an index of overvaluation in three steps. First, we use data on exchange rates (*XRAT*) and purchasing-power parity conversion factors (*PPP*) from Penn World Tables 6.3 (Aten et al., 2009) to calculate a "real" exchange rate (*RER*) defined as:

$$\ln RER_{it} = \ln\left(\frac{XRAT_{it}}{PPP_{it}}\right),$$

where $i$ is an index for countries and $t$ is an index for the time period. *XRAT* and *PPP* are expressed as national currency units per US dollar. When *RER* is greater than one it indicates that the value of the currency is lower (more depreciated) than predicted by purchasing-power parity. We then account for the Balassa–Samuelson effect (the well known fact that non-traded goods are cheaper in poorer countries) by regressing *RER* on per-capita GDP (*RGDPCH*).[5] More precisely, we run:

$$\ln RER_{it} = \alpha + \beta \frac{\ln RGDPCH_{it}}{\ln RGDPCH_{USt}} + f_t + u_{it}, \quad (1)$$

where $f_t$ is a fixed effect for time period and $u_{it}$ is the error term. This regression yields an estimated $\beta = -0.233$ (with a predictably high $t$-statistic of around 22).

Finally, we compute the index of undervaluation as the difference between the actual real exchange rate and the Balassa–Samuelson-adjusted rate:

$$\ln UNDERVAL_{it} = \ln RER_{it} - \ln \hat{RER}_{it},$$

where $\ln \hat{RER}_{it}$ is the predicted value from Eq. (1). Defined in this way, *UNDERVAL* is comparable across countries and over time. Whenever *UNDERVAL* exceeds unity, it indicates that the exchange rate is such that goods produced at home are cheap in dollar terms, the currency is undervalued. When *UNDERVAL* is below unity, the currency is overvalued.

After computing our undervaluation index, we are ready to run panel growth regressions (we run one-year to five-year average panels to make sure that the results do not depend on the time window being used), where we include a convergence term (initial income level, $RGDPCH_{it-1}$) and a set of country and time period dummies ($f_i$ and $f_t$) to capture other exogenous time-varying global factors, as well as country-specific characteristics:

$$GDPpc\ growth_{it} = \alpha + \beta \ln RGDPCH_{it-1} + \delta \ln UNDERVAL_{it} + f_i + f_t + u_{it}. \quad (2)$$

We use the same specification for the panel regressions of consumption, investment, savings, external variables and employment below.

Table 1 reports the results for the one-year and five-year panels for different country subsamples. The results, which are surprisingly stable across specifications, show a statistically significant link between an undervalued exchange rate and output growth. Given the definition of the variables, the figures indicate that a 10% undervaluation is associated with an increase in growth rates of between 0.1% and 0.2%.

Both in Levy-Yeyati and Sturzenegger (2007) and in Rodrik (2008) there is a discussion on whether this result may occur a result of reverse causality. For external shocks reverse causality does not invalidate our estimations. Typically, shocks that positively affect GDP tend to generate overvaluations rather than undervaluations.[6] But for countries with imperfect capital motility, internal shocks that reduce the interest rates could generate undervaluation together with increases in GDP.[7] In order to avoid this reverse causality problem we run the regression (shown for the one year window) using the lagged values of Rodrik's undervaluation measure:

$$GDPpc\ growth_{it} = \alpha + \beta \ln RGDPCH_{it-1} + \delta \ln UNDERVAL_{it-1} + f_i + f_t + u_{it}. \quad (3)$$

Table 2 shows the results of estimate Eq. (3), using the same samples of Table 1.

As can be seen, while the sign remains consistently positive, the estimates are more unstable (now the range for a 10% depreciation

[3] Alternative, Levy-Yeyati and Sturzenegger (2007) study the relationship between exchange rates and growth by looking directly at intervention measures aimed at depressing the real exchange rate, and find they generally lead to faster long-run output and productivity growth.

[4] While we are aware of the apparent simultaneity problems of a contemporaneous growth regression (which we address in detail in Levy-Yeyati and Sturzenegger (2007)), here we are more interested in the relative contributions of the net exports and domestic savings and investment, for which this exceedingly simple specification offers a more transparent picture.

[5] Although we depart slightly from Rodrik's specification by using per capita GDP relative to the US (rather than per capita GDP) as the exchange rate is measured relative to that country, we find that this does not alter the results in any visible way.

[6] For example, an exogenous increase in demand for the country's exports will tend to generate an increase in production together with appreciation pressures.

[7] For example, an exogenous increase in savings could reduce the interest rate, generating an increase in production together with real depreciation pressures. See Woodford (2009). We also thank an anonymous referee for making this point.

**Table 1**
Replicating Rodrik (2008).

| The basic growth specification | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Dependent variable: GDPpc growth | | | | | | | |
| | $T = 1$ | | | | $T = 5$ | | | |
| | All countries | Developed countries | Developing countries | Emerging countries | All countries | Developed countries | Developing countries | Emerging countries |
| lnrgdpch_lag | −0.017*** | −0.061*** | −0.015*** | −0.008* | −0.028*** | −0.051*** | −0.027*** | −0.020** |
| | (6.820) | (8.550) | (5.410) | (1.730) | (7.000) | (6.650) | (6.010) | (2.560) |
| lnunderval | 0.018*** | 0.012* | 0.020*** | 0.011* | 0.014*** | 0.017*** | 0.015*** | 0.019** |
| | (7.720) | (1.900) | (6.910) | (1.950) | (3.630) | (2.690) | (3.240) | (2.160) |
| Constant | 0.162*** | 0.661*** | 0.145*** | 0.080* | 0.259*** | 0.479*** | 0.229*** | 0.182*** |
| | (7.960) | (9.060) | (6.090) | (1.920) | (7.510) | (7.040) | (6.620) | (2.860) |
| Observations | 6432 | 1444 | 4988 | 1092 | 1116 | 246 | 870 | 193 |
| $R$-squared | 0.171 | 0.353 | 0.160 | 0.178 | 0.424 | 0.663 | 0.394 | 0.403 |

Robust $t$ statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

**Table 2**
The basic growth specification using lagged undervaluation.

| | Dependent variable: GDPpc growth | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $T = 1$ | | | | $T = 5$ | | | |
| | All countries | Developed countries | Developing countries | Emerging countries | All countries | Developed countries | Developing countries | Emerging countries |
| lnrgdpch_lag | −0.016*** | −0.060*** | −0.013*** | −0.011** | −0.028*** | −0.051*** | −0.027*** | −0.021*** |
| | (6.600) | (8.370) | (4.770) | (2.330) | (6.870) | (6.750) | (5.770) | (2.680) |
| lnunderval_lag | 0.011*** | 0.005 | 0.011*** | 0.017*** | 0.006* | 0.006 | 0.007 | 0.022*** |
| | (4.730) | (0.830) | (3.850) | (3.300) | (1.710) | (1.030) | (1.470) | (3.160) |
| Constant | 0.153*** | 0.644*** | 0.126*** | 0.113*** | 0.265*** | 0.483*** | 0.227*** | 0.186*** |
| | (7.710) | (8.790) | (5.380) | (2.660) | (7.370) | (7.160) | (6.390) | (3.060) |
| Observations | 6406 | 1442 | 4964 | 1089 | 1097 | 246 | 851 | 192 |
| $R$-squared | 0.171 | 0.344 | 0.160 | 0.190 | 0.437 | 0.655 | 0.407 | 0.416 |

Robust $t$ statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

widens from 0.05% to 0.22%) and in some cases less significant (e.g. developed countries). In what follows, however, we use this specification that better deals with potential endogeneity concerns. In particular, for emerging countries, the coefficient is strongly significant and stable in value across all five windows.

Our core results are reported in Tables 3–5, where we analyze the growth effect by looking at effects of undervaluation on GDP components in shares. We do this for our full sample, as well as for developing and emerging countries separately (we found no effects for developed economies). In these tables we replace our GDP growth variable in (3) above by the component share (expressed as a proportion of GDP). To exclude anomalous observations and outliers, we filter out observations outside a 4-standard deviation interval around the mean of all dependent variables and the log of undervaluation. The data source is the new and corrected version of the Penn World Tables (PWT 6.3).[8] The PWT 6.3 extend the years of sample until 2007 and includes a new GDP variable (RGDPL2) that allows to compute consistent component shares of GDP in real values. We use alternatively the component shares in current and constant terms as dependent variables, which is particularly important for Export and Imports to filter the valuation effect of devaluations on these components.[9] In Tables 3–5, the columns refer to the time window used for the estimation (one – to five-year non-overlapping panels).[10]

Finally, Table 6 shows the same specification for employment,[11] which is measured in two ways: the growth in total employment as well as the change in the participation rate.

The results suggest that undervaluation operates through an increase in savings and investment, as well as an increase in employment, but not through the external sector. Not surprisingly, these results largely reflect those for the emerging subsample.

## 3. Discussion: evidence in search of a theory?

Our results provide an interesting vantage point from which we can revisit the several hypotheses that have been suggested by the mercantilist view regarding the role of exchange rates as a development strategy. While our findings (as well as those previously reported in Levy-Yeyati and Sturzenegger (2007) support the claim that undervalued exchange rates foster growth, they cast doubts on the import-substitution-cum-export-boom mechanism often suggested as the natural channel. Instead, the exchange rate-growth link seems to be associated with an increase in aggregate savings and investment, and a decline in unemployment.

Of course, whether undervaluation itself is the source of growth, rather than other causes that are driving the undervaluation, remains at this stage an open question. The drivers of undervaluation

[8] Rodrik (2008) uses PWT6.2.

[9] Appendix is a complete list the variable definitions and sources.

[10] Alternative estimations using GMM with internal instruments provide similar results, though somewhat weaker statistically. Results are available upon request.

[11] Since PWT do not provide employment information we use data from World Development Indicators (The World Bank) to construct dependent variables of Table 6. See Appendix for more details.

**Table 3**
All countries, coefficient of undervaluation.

| | All countries: coefficient of lagged ln *UNDERVAL* | | | | |
|---|---|---|---|---|---|
| | $T = 1$ | $T = 2$ | $T = 3$ | $T = 4$ | $T = 5$ |
| GDPpc growth | 0.011*** | 0.010*** | 0.007** | 0.007** | 0.006* |
| | (4.730) | (3.800) | (2.180) | (2.160) | (1.710) |
| Curr. consumption/curr. GDP | −0.028*** | −0.026*** | −0.029*** | −0.025*** | −0.036*** |
| | (8.670) | (5.930) | (5.430) | (3.810) | (4.990) |
| Curr. invest/curr. GDP | 0.041*** | 0.044*** | 0.048*** | 0.044*** | 0.051*** |
| | (14.420) | (11.340) | (9.710) | (7.760) | (7.780) |
| Curr. exports/curr. GDP | 0.042*** | 0.038*** | 0.034*** | 0.031*** | 0.030*** |
| | (9.980) | (6.330) | (4.730) | (3.470) | (2.980) |
| Curr. imports/curr. GDP | 0.055*** | 0.056*** | 0.053*** | 0.050*** | 0.045*** |
| | (12.680) | (9.340) | (7.230) | (5.470) | (4.470) |
| Curr. saving/curr. GDP | 0.028*** | 0.026*** | 0.029*** | 0.025*** | 0.036*** |
| | (8.670) | (5.930) | (5.430) | (3.810) | (4.990) |
| Const. consumption/const. GDP | −0.015*** | −0.016*** | −0.013** | −0.014* | −0.017* |
| | (4.160) | (3.420) | (2.170) | (1.930) | (1.950) |
| Const. invest/const. GDP | 0.005* | 0.009** | 0.011** | 0.011* | 0.014* |
| | (1.820) | (2.290) | (2.310) | (1.790) | (1.920) |
| Const. exports/const. GDP | −0.028*** | −0.028*** | −0.032*** | −0.022** | −0.021** |
| | (5.840) | (4.130) | (4.120) | (2.310) | (1.990) |
| Const. imports/const. GDP | −0.038*** | −0.035*** | −0.034*** | −0.026** | −0.025** |
| | (7.260) | (4.870) | (3.850) | (2.380) | (2.060) |
| Const. saving/const. GDP | 0.015*** | 0.016*** | 0.013** | 0.014* | 0.017* |
| | (4.160) | (3.420) | (2.170) | (1.930) | (1.950) |

Robust $t$ statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

**Table 4**
Developing countries, coefficient of undervaluation.

| | Developing countries: coefficient of lagged ln *UNDERVAL* | | | | |
|---|---|---|---|---|---|
| | $T = 1$ | $T = 2$ | $T = 3$ | $T = 4$ | $T = 5$ |
| GDPpc growth | 0.011*** | 0.009*** | 0.006 | 0.006 | 0.007 |
| | (3.850) | (2.980) | (1.610) | (1.550) | (1.470) |
| Curr. consumption/curr. GDP | −0.011*** | −0.009 | −0.014** | −0.008 | −0.022** |
| | (2.740) | (1.640) | (2.090) | (1.000) | (2.410) |
| Curr. invest/curr. GDP | 0.022*** | 0.028*** | 0.033*** | 0.028*** | 0.038*** |
| | (6.560) | (5.900) | (5.540) | (4.220) | (4.710) |
| Curr. exports/curr. GDP | 0.055*** | 0.050*** | 0.046*** | 0.039*** | 0.040*** |
| | (10.790) | (7.040) | (5.380) | (3.840) | (3.230) |
| Curr. imports/curr. GDP | 0.067*** | 0.069*** | 0.065*** | 0.059*** | 0.057*** |
| | (12.130) | (9.200) | (7.180) | (5.370) | (4.460) |
| Curr. saving/curr. GDP | 0.011*** | 0.009 | 0.014** | 0.008 | 0.022** |
| | (2.740) | (1.640) | (2.090) | (1.000) | (2.410) |
| Const. consumption/const. GDP | −0.008* | −0.011* | −0.006 | −0.007 | −0.011 |
| | (1.710) | (1.840) | (0.850) | (0.780) | (1.010) |
| Const. invest/const. GDP | −0.002 | 0.003 | 0.006 | 0.005 | 0.009 |
| | (0.630) | (0.540) | (0.970) | (0.690) | (0.990) |
| Const. exports/const. GDP | −0.011* | −0.010 | −0.018** | −0.007 | −0.006 |
| | (1.950) | (1.350) | (2.050) | (0.650) | (0.460) |
| Const. imports/const. GDP | −0.021*** | −0.019** | −0.018* | −0.009 | −0.008 |
| | (3.370) | (2.220) | (1.780) | (0.710) | (0.570) |
| Const. saving/const. GDP | 0.008* | 0.011* | 0.006 | 0.007 | 0.011 |
| | (1.710) | (1.840) | (0.850) | (0.780) | (1.010) |

Robust $t$ statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

may be exogenous factors or exogenous interventions, and we do not fully factor out exogenous factors by controlling with time and country fixed effects. The results should therefore be interpreted as signaling the relevant channels through which *either* factors or policies operate.

At any rate, the lack of effect on the tradable side, suggests a more limited role for the more recent incarnations of export-led strategies such as self discovery or learning by doing (see Hausmann and Rodrik (2005) or Aizenman and Lee (2008)), although the consequences in terms of their potential to foster growth by improving the quality of the export mix (Hausmann et al., 2005) remain to be tested. Our results also seem at odds with previous findings on the effects of overvaluation on the tradable sector (Prasad et al., 2006) that, conceivably, may reflect the valuation effect of a change in relative prices on the output of sectors with varying degrees of exchange rate exposure.[12]

[12] Notice that Rajan and Subramanian use as a dependent variable the annual average rate of growth of value added of industry $i$ in country $j$ over a ten-year

**Table 5**
Emerging countries, coefficient of undervaluation.

| | Emerging countries: coefficient of lagged ln *UNDERVAL* | | | | |
|---|---|---|---|---|---|
| | $T = 1$ | $T = 2$ | $T = 3$ | $T = 4$ | $T = 5$ |
| GDPpc growth | 0.017*** | 0.017*** | 0.020*** | 0.018** | 0.022*** |
| | (3.300) | (2.880) | (3.010) | (2.440) | (3.160) |
| Curr. consumption/curr. GDP | −0.043*** | −0.039*** | −0.041*** | −0.033** | −0.054*** |
| | (6.900) | (4.610) | (3.720) | (2.430) | (3.450) |
| Curr. invest/curr. GDP | 0.036*** | 0.037*** | 0.043*** | 0.049*** | 0.059*** |
| | (5.210) | (3.880) | (3.740) | (3.660) | (4.140) |
| Curr. exports/curr. GDP | 0.022*** | 0.015 | 0.016 | 0.001 | 0.007 |
| | (2.640) | (1.280) | (1.170) | (0.040) | (0.370) |
| Curr. imports/curr. GDP | 0.015* | 0.013 | 0.018 | 0.016 | 0.013 |
| | (1.750) | (1.070) | (1.240) | (0.960) | (0.630) |
| Curr. saving/curr. GDP | 0.043*** | 0.039*** | 0.041*** | 0.033** | 0.054*** |
| | (6.900) | (4.610) | (3.720) | (2.430) | (3.450) |
| Const. consumption/const. GDP | −0.039*** | −0.039*** | −0.043*** | −0.026* | −0.013 |
| | (6.020) | (4.150) | (3.540) | (1.720) | (0.760) |
| Const. invest/const. GDP | 0.009 | 0.018* | 0.029** | 0.030** | 0.032* |
| | (1.330) | (1.780) | (2.340) | (2.090) | (1.840) |
| Const. exports/const. GDP | −0.065*** | −0.064*** | −0.057*** | −0.051*** | −0.046** |
| | (6.820) | (4.700) | (3.510) | (2.720) | (2.060) |
| Const. imports/const. GDP | −0.095*** | −0.086*** | −0.070*** | −0.047* | −0.028 |
| | (8.860) | (5.470) | (3.580) | (1.760) | (0.900) |
| Const. saving/const. GDP | 0.039*** | 0.039*** | 0.043*** | 0.026* | 0.013 |
| | (6.020) | (4.150) | (3.540) | (1.720) | (0.760) |

Robust $t$ statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

**Table 6**
Effect on employment, coefficient of undervaluation.

| | | Coefficient of lagged ln *UNDERVAL* | | | | |
|---|---|---|---|---|---|---|
| | | $T = 1$ | $T = 2$ | $T = 3$ | $T = 4$ | $T = 5$ |
| Employment growth | All | 0.014*** | 0.008** | 0.005 | −0.005 | −0.008** |
| | | (4.240) | (2.270) | (1.310) | (1.040) | (2.140) |
| | Developed | 0.019** | 0.020* | 0.007 | 0.000 | −0.005 |
| | | (2.420) | (1.900) | (0.550) | (0.040) | (0.440) |
| | Developing | 0.014*** | 0.008* | 0.005 | −0.006 | −0.006 |
| | | (3.520) | (1.830) | (1.160) | (1.060) | (1.290) |
| | Emerging | 0.018*** | 0.014** | 0.012** | −0.006 | −0.004 |
| | | (3.640) | (2.270) | (2.210) | (0.900) | (0.510) |
| Change (employment/adult pop.) | All | 0.750*** | 0.416* | 0.373* | −0.175 | −0.394* |
| | | (3.940) | (1.840) | (1.720) | (0.660) | (1.930) |
| | Developed | 1.255*** | 1.209** | 0.644 | −0.290 | −0.433 |
| | | (2.810) | (2.060) | (1.120) | (0.550) | (0.880) |
| | Developing | 0.694*** | 0.370 | 0.379 | −0.109 | −0.239 |
| | | (2.990) | (1.320) | (1.450) | (0.350) | (0.950) |
| | Emerging | 0.946*** | 0.656* | 0.654** | −0.364 | −0.280 |
| | | (3.190) | (1.940) | (2.000) | (1.090) | (0.620) |

Robust $t$ statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Rodrik (2008) uses constant shares to avoid the valuation effect and he finds a positive effect of undervaluation on the industrial share, and this result holds for a large sample of developed and developing countries. As an additional exercise we replicate regressions of Table 5, but using as dependent variable the share of agriculture, industry and services in terms of GDP, respectively (always constructing constant shares), and we found that for the case of emerging countries the effect of undervaluation is positive on services, negative on agriculture and not significant on industry.[13]

The results regarding the tradable sector are somewhat disappointing given the importance attributed in the literature to the tradable channel. Rodrik (2008) proposes two institutional reasons why tradable production may be below optimal: bad institutions tax tradables more heavily, and market failures are more prevalent in the tradable sector. A devaluation that alleviates the burden of these distortions would allow for higher productivity

period, obtained by normalizing the growth in nominal value added by the GDP deflator. But this means that a sector that sees its relative price fall with an overvaluation will automatically see a decline in its value added deflated by the GDP deflator, thus producing the results even in the absence of real effects.

[13] All Coefficients are significant at 1%, from $T = 1$ to $T = 5$. Tables are available upon request.

and, potentially, higher growth.[14] However, the argument is far from obvious: telecommunications, air travel, financial sectors, infrastructure provision, electricity production, health services, and educational services are all non-tradables that are nonetheless dramatically affected by the institutional and regulatory quality of a country. Moreover, as Hausmann et al. (2007) argues, non-tradable sectors tend to be more skills intensive than tradable sectors and may, therefore, be more affected by institutional quality. In fact, it is not uncommon for firms to use the export sector to "escape" poor domestic institutions by diverting part of the production process overseas where institutional constraints are not so taxing. For example, it is typical to find countries with extractive industries and poor infrastructure, i.e. where the tradable segment gets produced, but the non-tradable segment – much more dependent on regulatory conditions at home – lags behind. Baily and Solow (2001) also suggest that it is the non-tradable sector which is the one overburdened by weak institutions.

By contrast, our results point at two alternative channels by which devaluations may contribute to growth. The first one is a labor market-enhancing effect reminiscent of the channels identified in classical models of economies with unlimited supply of labor (Lewis, 1958; Ranis and Fei, 1961). In those models, the development challenge was to move workers from unproductive subsistence agricultural jobs into high-productivity industrial jobs. The effects are fairly large; as we find that for developing countries a 10% intervention leads to a 0.07% change in the employment rate (and a 0.14% increase in employment).

A second, alternative channel relates to the benign effect of lower labor costs on the availability of internal funds for financially constrained enterprises,[15] an aspect that has been highlighted as a source of the rapid recovery in the aftermath of recent emerging market crises (Calvo and Talvi, 2006) and, more generally, as a source of growth in developing economies (Aghion et al., 2005, 2009a,b)—a channel that should be particularly relevant for low and middle income economies where financial constraints are more prevalent. In this light it is interesting to note the strong effect found for emerging countries and that lack of effect for developed economies.[16]

The combination of savings and greater internal funds (due to an income transfer to high-income households or to firms, respectively) and financial constraint reconciles Diaz Alejandro's (1965) earlier, contractionary version of the undervalued currency story, with the modern, expansionary one. Diaz Alejandro's early view, embedded in the Keynesian framework, revolved around the question of how the income transfer from a devaluation was ultimately spent. Because Diaz Alejandro was thinking of an agricultural society (his 1965 piece was inspired by Argentina), he did not see these increased savings translating into sources of domestic finance, but rather going abroad in the form of foreign assets; hence, the depressed aggregate demand that explained the drop in output. However, in more developed non-industrial economies it is easy to conceive a simpler story where these funds, which in the earlier version were spent abroad, bring about productive investment previously postponed due to insufficient financing. The empirical characterization of the undervaluation-growth link reported in this paper provides preliminary support to this version of the story.

## Appendix

Definitions and sources of variables used in regression analysis

| Variable | Definitions and sources |
|---|---|
| *XRAT* | Exchange rate from PWT(6.3) |
| *PPP* | Purchasing power parity from PWT(6.3). ("*PPP*" in PWT is the national currency value of GDP divided by the real value of GDP in international dollars) |
| ln *RER* | Is computed as $\ln RER = \ln\left(\frac{XRAT}{PPP}\right)$ |
| ln $\hat{RER}$ | Is the predicted value of ln *RER* |
| ln *UNDERVAL* | Is computed as $\ln UNDERVAL = \ln RER - \ln \hat{RER}$ |
| *RGDPCH* | Real GDP per capita (Chain) from PWT(6.3) |
| GDPpc growth | Proportional change in "*RGDPCH*", computed as $(RGDPCH_{it} - RGDPCH_{it-1})/RGDPCH_{it-1}$ |
| Curr. consumption/curr. GDP | Current consumption as share of current GDP computed as $(CHCUR_{it} + GCUR_{it})/(CGDP_{it} * POP_{it} * PPP_{it})$ *CHCUR*, *GCUR* from National Account Data of PWT 6.3 *CGDP* and *POP* from PWT 6.3 |
| Curr. invest/curr. GDP | Current gross capital formation as share of current GDP computed as $(ICUR_{it})/(CGDP_{it} * POP_{it} * PPP_{it})$ *ICUR* from National Account Data of PWT 6.3 |
| Curr. exports/curr. GDP | Current exports as share of current GDP computed as $(EXPC_{it})/(CGDP_{it} * POP_{it} * PPP_{it})$ *EXPC* from National Account Data of PWT 6.3 |
| Curr. imports/curr. GDP | Current imports as share of current GDP computed as $(IMPC_{it})/(CGDP_{it} * POP_{it} * PPP_{it})$ *IMPC* from National Account Data of PWT 6.3 |
| Curr. saving/curr. GDP | Current savings as share of current GDP computed as $1 - (Curr.Consumption/Curr.GDP)$ |
| Const. consumption/const. GDP | Constant consumption as share of constant GDP computed as $[(CHKON_{it} + GKON_{it})/(POP_{it} * PPP05_{it})]/RGDPL2_{it}$ Where *PPP*05 is *PPP* value of year 2005 *CHKON*, *CHKON* from National Account Data of PWT 6.3 *RGDPL*2 from PWT 6.3 |
| Const. invest/const. GDP | Constant gross capital formation as share of constant GDP computed as $[IKON_{it}/(POP_{it} * PPP05_{it})]/RGDPL2_{it}$ *IKON* from National Account Data of PWT 6.3 |
| Const. exports/const. GDP | Constant exports as share of constant GDP computed as $[EXPK_{it}/(POP_{it} * PPP05_{it})]/RGDPL2_{it}$ *EXPK* from National Account Data of PWT 6.3 |
| Const. imports/const. GDP | Constant imports as share of constant GDP computed as $[IMPK_{it}/(POP_{it} * PPP05_{it})]/RGDPL2_{it}$ *IMPK* from National Account Data of PWT 6.3 |
| Const. saving/const. GDP | Constant savings as share of constant GDP computed as $1 - (Const.Consumption/Const.GDP)$ |

[14] Rodrik (2008) uses data provided by Nathan Nunn showing that tradable firms use a higher share of relationship-specific intermediate inputs as a justification for the higher burden of poor institutions on tradables.

[15] As noted, this increase in savings could alternatively reflect the resulting income redistribution to higher income households with a greater savings propensity.

[16] In fact, Aghion et al. (2009b) find that overvaluations tend to be detrimental to growth and that the effect is stronger in less financially developed economies. However, rather than highlighting the availability of greater internal funds as we do here, their mechanism relies on the complementarities of domestic and foreign savings (a link that they verify empirically by showing an association between domestic savings and foreign direct investment).

| | |
|---|---|
| Employ growth | Proportional change in quantity of employees, computed as $(Employ_{it} - Employ_{it-1})/Employ_{it-1}$ where $Employ = Labforce\_tot - [(Unemp\_pLabforce/100) * Labforce\_tot]$ Labforce_tot is the total labor force, "SL.TLF.TOTL.IN" from WDI Unemp_pLabforce is the unemployment rate "SL.UEM.TOTL.ZS" from WDI |
| Change (employ/adult pop.) | Change in the Employment rate, computed as $(EmploypTPA_{it} - EmploypTPA_{it-1})$ where $EmploypTPA = \{Employ/[(TPAdult/100) * TOTPOP]\} * 100$ TPadult is the share adult population, "SP.POP.1564.TO.ZS" from WDI |

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