How is the dynamic impact of Undervaluation on Economic Growth in Latin American Countries?: A Panel VAR analysis

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Abstract

In this research, I analyze the dynamic effects of undervaluation on the economic growth per capita of Latin American countries with a period 1980-2018. To estimate these effects, I use a Panel Vector Autoregressive (PVAR) whose estimator is System GMM. The undervaluation variable is created from different measures of the real exchange rate and I also use various measures of GDP per capita to calculate economic growth per capita. I include as control variables macroeconomic and human capital variables to control the different channels of spread of undervaluation on economic growth per capita. The results show that there is a positive effect depending on the definition of the real exchange rate used to calculate the undervaluation. In the results I include the Granger causality test, stability test and impulse response graphs in which I project the response of per capita economic growth to an undervaluation shock.

JEL codes: F14, F47, C33, C53,

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1. Introduction:
There has been extensive debate in the macroeconomic literature about currency devaluation policies to expand the economy. For Asian countries, evidence is found that these policies were fundamental for their rapid economic growth, see Cottani, et al. (1990). Morrison and Labonte (2013) study these policies for the case of China. The theory behind this suggests that a devalued currency may serve to protect newly emerging companies, because it allows them to be more competitive in the world market, but may have negative effects on GDP, see Krugman and Taylor (1978). That is why an interest in studying the imbalances of the real exchange rate has arisen. However, these policies have their detractors, such as Williamson (1990), who points out that an undervaluation policy can produce unnecessary inflationary prices, damaging other productive sectors. Balassa (1982) points out that a devaluation can be interpreted as imposing tariffs and subsidizing exports. Empirical evidence finds scattered results about these impacts on economic growth. Yang et al. (2013) elaborates a global general equilibrium model to estimate the macroeconomic impacts of the appreciation of the Chinese currency in that country and the world, finding that appreciations of this currency can have positive effects on the GDP of the main countries with which it trades. In Latin America there have been some studies investigating the impact of exchange rate devaluations, for example, Mejía-Reyes, et al. (2010) studies the effects of changes in the exchange rate on GDP for five Latin American countries, dividing them into two groups, non-oil and oil countries, finding that for non-oil countries there are negative effects of a depreciation in the short term. Lamau (2017) studies the effects of depreciations of the real exchange rate on growth across sectors in Latin America, finding that a shock of 10% depreciation can increase growth in non-traditional sectors by 0.6 to 2% depending on the channel of transmission. Along this same line, Galindo et al. (2006) studies the effects of the depreciation of the real exchange rate on industrial sectors in Latin America, finding that there are positive effects except for industries with high industrialization. Globally, Kappler et al. (2011) studies the effects of an appreciation of the real exchange rate for a sample of 128 countries found that there are no significant effects on economic growth. Habib et al. (2017) studies the effects of a depreciation of the real exchange rate on growth for 150 countries after the Bretton Woods period, finding that a real appreciation significantly reduces real economic growth. Christopoulos (2004) studies the effects of a currency devaluation on economic growth using a cointegration test, finding insignificant results. As can be seen, there is a key importance in studying the movements of the real exchange rate, and the effects found by various studies are varied depending on the sample size and the methodology used. Our research contributes to the economic evidence in this field because we study the effects of undervaluation on economic growth per capita, but we use various measures to estimate undervaluation using various measures for undervaluation and also for GDP per capita that is used to calculate the economic growth per capita. The methodology that we use is also relatively new that serves to estimate dynamic impacts called the VAR Panel, proposed by Love and Zicchino (2006). The results we find depend on the undervaluation measure we use. If we use the third undervaluation measure, we find positive impacts that, over the time horizon, end up being offset while the first two measures have different effects. This research is presented as follows: Section 02 presents the literature review of studies estimating the effects of undervaluation on economic growth. Section 03 develops how we build our real exchange rate measures with which we estimate the undervaluation, we also develop ways to calculate GDP per capita that will serve to calculate economic growth per capita and, finally, we present our methodology to use to make the estimates, and in section 04 we show the conclusions found in this study. We also added the annexes where other tests developed in our research are shown, the definitions of the variables and their sources, and the countries we used in this study.

2. Literature Review:
The term undervaluation means that the price of a good in one country is low compared to the price of other countries, which can be the dollar, see Contractor (2019). Another definition is found in Guzmán, et al. (2012) who point out that they are deviations from a standard income
ratio of the real exchange rate based on the typical results of the Balassa-Samuelson effect, which proposes that richer countries exhibit more appreciated real exchange rates. So, it is worth asking, subject to these two definitions, what do undervaluations imply? Dollar (1992) studying the determinants of rapid growth in developing countries finds that imbalances in the real exchange rate could partly explain the rapid growth in those countries using 95 countries as a sample and for a period from 1976-1985. Sachs et al. (1995) that the liberalization of the exchange rate in developing countries allowed for a temporary rise in prices and a devaluation of the currency, which allowed a period of economic growth. Krugman (1989) argues that undervaluation has its channel in productivity to increase economic growth, but even the interest in finding links between undervaluation and economic growth comes from further back. Gylfason and Schmid (1983) develop a general equilibrium model in which they find that a devaluation positively influences real GDP through channels on the supply side, along the same lines, see Taylor and Rosenweig (1984). Although there is extensive literature studying the links between undervaluation and economic growth, the results found have been mixed. On the one hand, there have been those that have found positive effects, such as Aguirre and Calderón (2005), Levy-Yeyati and Sturzenegger (2007), Rodrik (2008) and Ribeiro et al. (2019), there are other authors who present opposite or null results of the undervaluation on economic growth, such as Chou and Chao (2001), Woodford (2009) and Henry (2008). Other studies that support the idea that undervaluation can have positive effects on economic growth are Hausman et al. (2005), who find that undervaluations, among other variables, were one of the factors for which there was an acceleration in growth for developing countries, Frankel and Romer (1999) find that an undervaluation is associated with a rapid growth of the exports. Now, while there is a debate on the effect that undervaluation can have on economic growth, another debate that has arisen is about which is the transmission channel, Mbaye (2013) who studies one of the mechanisms, argues that there are two channels widely studied, the first transmission channel is that of capital accumulation, which suggests that an undervaluation increases the capital stock, increases investments and therefore the economy, see Bhalla (2007) and Montiel, and Servén (2009). And the second transmission channel is through productivity, an undervaluation makes the currency more competitive compared to other countries, allowing us to export more and have an increase in economic growth, see Eichengreen (2008) and McLoed and Mileva (2011). Our contribution to the literature is that we focus on Latin America through two channels such as human capital and macroeconomic, in turn we use a new methodology that has been little explored to estimate the effects of undervaluation on economic growth and finally we use different Real exchange rate measures which allow us to calculate different undervaluation measures and we also use different GDP per capita measures which allow us to calculate different measures of economic growth. In the next section we go on to describe our methodology and our data.

3. Data and Methodology:
This section is divided into three sections, in the first we present the different estimates that we make of the real exchange rate to calculate the undervalluation and also the different variables that we use as GDP per capita. The second section presents the methodology that we use to obtain the different undervaluation measures and the methodology to estimate the dynamic impact of this variable on economic growth.

3.1 First Stage: Calculating the real exchange rate and undervaluation measures:
As mentioned in the beginning of the section, I will use different variables of the real exchange rate to estimate the undervaluation. The first definition that I will use as a real exchange rate is made up of two variables and is presented in the following equation (1):

\[ RER_{lt} = \frac{XRAT_{lt}}{PPP_{lt}} \]

Where i is the country at time t. \( RER_{lt} \) is the real exchange rate estimated from \( XRAT_{lt} \), which is the nominal exchange rate of the local currency compared to the US dollar, divided by \( PPP_{lt} \), which is the Purchasing Power parity. This first real exchange rate variable is also called an
enhanced purchasing power parity measure. It has been used to estimate the determinants from
the fundamental equilibrium exchange rate (FEER) approach and behavioral equilibrium
exchange rate (BEER) approach, Clark and MacDonald (1998) review these two approaches.
Other authors who have used this construction to estimate and predict the behavior of the real
exchange rate have been Froot and Rogoff (1996), who use this approach to estimate the
convergence to the equilibrium of the real exchange rate, Frankel (2006) examines the trends of
China's local currency from this approach, and others. This transformation is useful because it
allows us to adjust the real exchange rate by the Balassa-Samuelson effect, see Macdonald and
Ricci (2001) but it has also been criticized because, as Nouira and Sekkat (2012) and Ghura and
Gremmer (1993) point out due to this measure may differ from the definition used to find
macroeconomic equilibria.

The second definition of the real exchange rate that I use is made up of three variables and is
presented in the following equation 02:

\[ RER_{2it} = \frac{X_{i,t}^{R}P_{US}^{I}}{W_{i,t}^{I}} \]  

As already mentioned, \( RER_{i,t} \) is the real exchange rate of country \( i \) at time \( t \) and \( X_{i,t}^{R} \) is the
nominal exchange rate of the local currency compared to the US dollar. \( P_{US}^{I} \) is the producer
price index for the United States, and \( W_{i,t}^{I} \) is the sales price index of country \( i \) at time \( t \), but due
to the low availability of data on this variable, we can replace this variable with the \( C_{i,t}^{I} \) which
is the consumer price index. This methodology was used, among others, by Rodrik (2008) to
estimate the effects of undervaluation on growth using a data panel.

The third definition that we use is the inverse of the price level of the country compared to the
price level of the United States, this definition is presented in equation (3):

\[ RER_{3i,t} = \left( \frac{p_{i,t}}{P_{USA}} \right)^{-1} \]

Where \( p_{i,t} \) is the price level of the local economy expressed in dollars and \( P_{USA} \) is the
price of the US dollar. The advantage of this estimate is that it is expressed in dollars. Once all the
real exchange rate variables are presented, we will add the following variable which is GDP per capita,
this variable will be used as a proxy for the economy in the initial period to estimate the effects
of undervaluation on economic growth and also to estimate the undervaluation itself. The first
GDP per capita variable that we use is estimated from two variables and is presented in the
following equation (4):

\[ GDP_{percap,i,t} = \frac{GD_{P_{real},i,t}}{Population_{i,t}} \]

Where \( Real \ GDP_{i,t} \) is the PPP adjusted real output of country \( i \) at time \( t \) and \( Population_{i,t} \) is the
population level of country \( i \) at time \( t \). The following definition of GDP per capita that we use is obtained
from the World Bank, and the definition is the same as the variable in equation (4) but adjusted
to constant dollars based on 2010 and the last definition of GDP per capita is the same
as the previous ones but adjusted to current dollars. We will use these variables per capita to
calculate economic growth. Once all the definitions to be used in our modeling have been
presented. Our proposal to estimate undervaluation is presented in the following equation.

\[ \ln RER_{i,t} = \alpha + \beta \ln GDP_{percap,i,t} + f_i + \delta_t + v_t. \]  

Equation (5)\(^1\) is estimated with the fixed effects estimator to control any effect from
unobservable time-invariant and country-specific \( (f_i) \) or time-variant and country-invariant \( (\delta_t) \)
characteristics. The results are presented in table 01:

| Table 01: First Stage: Estimating Undervaluation |
|-------------------------------------------------|
| Real Exchange Rate: First GDP measure | (1) | (2) | (3) |

\(^1\) Todas las variables han sido transformadas en términos de logaritmo natural.
The results show us that the first definition of the real exchange rate finds positive coefficients for all the definitions of GDP per capita. The second definition of the real exchange rate has a poor adjustment and is positive in two of the three regressions with the different GDP per capita. The third definition of the real exchange rate is positive only in the first definition of economic growth and is the one with the greatest adjustment. Then, once our regressions are estimated, we calculate the undervaluation from the difference of the current real exchange rate with the real exchange rate predicted by our model, and it is presented in equation (6):

$$\ln Underval_{i,t} = \ln RER_{i,t} - \ln \overline{RER}_i.$$ (6)

Where $\ln \overline{RER}_i$ is the predicted value of equation (5). The interpretation of these undervaluation variables is presented as follows: If $Underval_{i,t}$ is greater than unity, it indicates that the exchange rate of country $i$ is cheaper in dollar terms compared to other countries, then the local currency is said to be undervalued. Otherwise, that is, in case $Underval_{i,t}$ is less than unity, the currency is overvalued. And if it is equal to unity, it is in equilibrium. So, now we turn to present our methodology that we will use to estimate the effects of undervaluation on economic growth.

### 3.2 Second Stage: Estimating the dynamics effects:

Our empirical methodology that we use is based on the previous work of Love and Zicchino (2006), who use this methodology to estimate the dynamic effects of investments on financial development. They use an Autoregressive Panel Vector (PVAR) that has the form of equation (7):

$$Y_{i,t} = A \sum_{p=1}^{k} Y_{i,t-p} + u_{i,t} + e_{i,t}. \quad (7)$$

Where $Y_{i,t}$ is a vector of dependent variables such as $[Economic\ Growth_{i,t}, GDP\ per\ capita_{i,t}, Underval_{i,t}]^2$, $u_{i,t}$ is the vector that contains the fixed and specific invariant effects over time of the dependent variable, $e_{i,t}$ is the term error or idiosyncratic error and finally A is the coefficient matrix of the impacts of the lagged values of the endogenous variables. In this estimation it is assumed that the idiosyncratic error is presented as follows: $E[e_{i,t}] = 0, E[e'_{i,t}e_{i,s}] = 0, \text{for all } t > s$. The estimator of this VAR

| GDP per capita_1 | -0.61*** | 0.87*** | 0.23** |
|-----------------|----------|---------|--------|
|                 | (-9.31)  | (4.51)  | (3.03) |
| N               | 418      | 418     | 418    |
| Adj. Rsquared  | 0.204    | -0.004  | 0.703  |

Real Exchange Rate: Second GDP Measure

| GDP per capita_2 | -0.78*** | 0.23 | -0.32*** |
|-----------------|----------|-----|----------|
|                 | (-8.24)  | (2.48) | (-4.04)  |
| N               | 418      | 418     | 418    |
| Adj. Rsquared  | 0.161    | -0.012  | 0.709  |

Real Exchange Rate: Third GDP Measure

| GDP per capita_3 | -0.65*** | -0.50*** | -0.50*** |
|-----------------|----------|----------|----------|
|                 | (-5.70)  | (-4.33)  | (-12.88) |
| N               | 418      | 418     | 418    |
| adj. R-sq       | 0.332    | -0.008  | 0.790  |

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

All estimates have been made with robust standard errors. Each column represents an estimate for each real exchange rate variable. And each row shows us the results for each measure of GDP per capita.

\(^2\) Only the Economic Growth variable is not in terms of natural logarithm.
Panel is the GMM system, proposed by Blundell and Bond (1998). Our model achieves a transformation when we add exogenous variables and it is presented in equation (8):

\[ Y_{i,t} = A \sum_{p=1}^{2} Y_{t-p} + B X_{i,t} + u_t + e_{i,t}. \]  

(8)

Where \( X_{i,t} \) is the vector of exogenous variables that we include in the model and \( B \) its matrix of coefficients. Our model presented in these equations has the presence of \( u_t \) hat may be correlated with the regressors due to the lags of our variables, we need to transform our variables with a technique known as forward orthogonal deviations or Helmert procedure, see Arellano and Bover (1995). This procedure consists of subtracting the average of all future observations of our dependent variables. This technique is presented in the following equation (9):

\[ y_{i,t+1} = c_{i,t}(y_{t+1} - \frac{1}{T_{i,t}} \sum_{s>t} y_{i,s}). \]  

(9)

Where the sum is taken from all the available observations, \( T_{i,t} \) is the number of the observations and \( c_{i,t} \) is a scale factor that takes the following form \( \sqrt{T_{i,t}} \). His transformation allows us to get variables independently and identically distributed. So, considering that the symbol \( \nabla \) means that the variable has been transformed with forward orthogonal deviations, our model takes the form of equation (10):

\[ \nabla Y_{i,t} = A \sum_{p=1}^{2} \nabla Y_{t-p} + B \nabla X_{i,t} + e_{i,t}. \]  

(10)

After presenting our methodology, we will show the results of our research in the next section.

3. Results:

Our section will be divided into four subsections, the first subsection shows the results considering only endogenous variables such as Economic Growth, GDP per capita and Undervaluation. The second subsection we add macroeconomic variables such as government spend, terms of trade and monetary aggregates. In the third subsection, we add human capital variables such as average hours worked, human capital index and productivity. And the fourth, and last, subsection we add both the macroeconomic and human capital variables. We also add three rows to the end of the table, the ante penultimate row shows the \( p \)-values of the overidentification test (J-statistics) whose null hypothesis proposes if the instruments we use are exogenous, the penultimate row shows the number of instruments we use and the last row shows if our model meets the stability condition.

3.1 Results without covariates: Considering the first measure of GDP per capita, the results are shown in table 02:

| Variables                  | First GDP per capita Measure |
|----------------------------|------------------------------|
|                            | (1)                         | (2)                          | (3)                          |
| Economic Growth\(_{i,t-1}\) | 0.13***                      | 0.07                         | 0.38***                      |
|                            | (2.33)                       | (1.63)                       | (6.829)                      |
| Economic Growth\(_{i,t-2}\) | -0.06                        | -0.09***                     | -0.08                        |
|                            | (-1.51)                      | (-2.95)                      | (-1.73)                      |
| GDP per capita\(_{i,t-1}\)  | 0.37***                      | 0.50***                      | 0.25***                      |
|                            | (11.21)                      | (19.34)                      | (7.7)                        |
| GDP per capita\(_{i,t-2}\)  | -0.37                        | -0.50                        | -0.25                        |
|                            | (11.17)                      | (19.52)                      | (7.78)                       |
| Undervaluation\(_{i,t-1}\)   | -0.01***                     | 0.02***                      | 0.18***                      |
|                            | (-2.17)                      | (3.42)                       | (7.54)                       |
| Undervaluation\(_{i,t-2}\)   | -0.00                        | -0.02                        | -0.19                        |
|                            | (-0.05)                      | (-3.70)                      | (-7.62)                      |
| Observations               | 385                          | 385                          | 385                          |
The results in Table 1 show that the first definition with which undervaluation is achieved has a negative impact on Economic Growth. The other two undervaluation variables have a positive impact. Figure 01 shows the response of Economic Growth to a shock of each undervaluation:

**Figure 01:**

**Undervaluation shocks on Economic Growth**

**Without covariates**

| Undervaluation 1 | Undervaluation 2 | Undervaluation 3 |
|------------------|------------------|------------------|
| ![Graph](image1) | ![Graph](image2) | ![Graph](image3) |

Figure 01 shows that an undervaluation shock 1 causes a negative response from Economic Growth. An undervaluation 2 shock causes a persistent positive response in Economic Growth and, finally, an undervaluation 3 shock causes an increase in Economic Growth in the first period and then begins to decline. Table 03 shows the results when we use the second measure of GDP per capita:

**Table 03: Second Stage: Estimating the impact without covariates**

| Variables          | Second GDP per capita Measure |
|--------------------|-------------------------------|
|                    | (1)  | (2)    | (3)    |
| Economic Growth_{t-1} | -1.12 | -3.14*** | -3.95*** |
The results show that the first two undervaluation variables have a negative impact on Economic Growth, while the last one has a positive impact. Figure 02 shows the impulse response graphs:

FIGURE 02:

| Variable                  | \( t \) Statistic | \( t \) Statistic | \( t \) Statistic |
|---------------------------|--------------------|--------------------|--------------------|
| Economic Growth\(_{it-2}\) | -1.15              | -4.96              | -2.74              |
| GDP per capita\(_{it-1}\)   | 0.02               | -0.11***           | -0.090             |
| GDP per capita\(_{it-2}\)   | 0.02               | 0.04***            | 0.05**             |
| Undervaluation\(_{it-1}\)   | -0.02              | -0.04***           | -0.05**            |
| Undervaluation\(_{it-2}\)   | -0.01              | -0.02**            | 0.21***            |

Observations: 385, 385, 385

Overidentifying Test (p-value): 0.183, 0.022, 0.897

Number of instruments: 72, 72, 72

Stability Condition: Yes, Not, Yes

\( t \) statistics in parentheses

* \( p<0.05 \), ** \( p<0.01 \), *** \( p<0.001 \)
Figure 02 shows that a shock of undervaluation 1 causes a negative response of Economic Growth without bequeathing to recover, undervaluation 2 causes a fall of a period of Economic Growth and then begins to increase. Finally, an undervaluation shock 3 causes an increase in the Economic Growth for two periods and then begins to fall. Table 04 shows the results when we use the third measure of GDP per capita:

Table 04: Second Stage: Estimating the impact without covariates

| Variables                  | Second GDP per capita Measure |
|----------------------------|-------------------------------|
|                            | (1)  | (2)  | (3)  |
| Economic Growth$_{t-1}$    | 0.123*** | 0.35*** | 0.43*** |
|                           | (3.23)   | (9.73)   | (9.17)   |
| Economic Growth$_{t-2}$    | -0.04    | -0.09**  | -0.13*** |
|                           | (-1.18)  | (-3.18)  | (-3.98)  |
| GDP per capita$_{t-1}$     | 0.10***  | 0.14***  | 0.05***  |
|                           | (11.40)  | (11.99)  | (4.43)   |
| GDP per capita$_{t-2}$     | -0.09*** | -0.13*** | -0.05*** |
|                           | (-11.15) | (-11.80) | (-4.40)  |
| Undervaluation$_{i,t-1}$   | 0.04***  | 0.10***  | 0.05**   |
|                           | (18.41)  | (10.19)  | (3.15)   |
The results in Table 02 show the coefficients of all undervaluation measures are positive in the first lag and all negative coefficients of the second lag period are negative. Figure 03 shows the impulse-response graphs using this measure of GDP per capita:

\[
\text{Undervaluation shocks on Economic Growth}
\]

\[
\begin{array}{lll}
\text{Undervaluation 1} & -0.04^* & -0.10^{***} & -0.08^{***} \\
& (-2.38) & (-10.14) & (-5.08) \\
\text{Observations} & 385 & 385 & 385 \\
\text{Overidentifying Test (p-value)} & 0.276 & 0.006 & 0.185 \\
\text{Number of instruments} & 72 & 72 & 72 \\
\text{Stability Condition} & Yes & Yes & Yes \\
\end{array}
\]

The t statistics in parentheses:

* p<0.05, ** p<0.01, *** p<0.001

All the impulse response graphs show a positive response of the Economic Growth from a shock of the Undervaluation measures, the first two are persistent while the third measure returns to zero in the third period. By way of conclusion of this subsection, we find that using the third measure of GDP per capita, all Undervaluation shocks are positive. The first two measures of GDP per capita show divided effects on Economic Growth. Looking at it from the other point of view, the third measure of undervaluation shows a positive impact in the first
periods and then falls. The other two undervaluation measures show different effects. Having presented the results, we move on to the next subsection where we add macroeconomic variables such as government spend, terms of trade and monetary aggregates.

3.2 Results with macroeconomics covariates:

Table 05 shows the results by adding macroeconomic variables in our model, using the same GDP per capita measure as Table 02:

Table 05: Second Stage: Estimating the impact with macroeconomics covariates

| Variables                    | First GDP per capita Measure |
|------------------------------|------------------------------|
|                              | (1)                          |
| Economic Growth$_{i,t-1}$    | 0.50***                      |
|                              | (3.35)                       |
| Economic Growth$_{i,t-2}$    | -0.10                        |
|                              | (-0.97)                      |
| GDP per capita$_{i,t-1}$     | -0.16                        |
|                              | (-1.28)                      |
| GDP per capita$_{i,t-2}$     | 0.18                         |
|                              | (1.40)                       |
| Undervaluation$_{i,t-1}$     | 0.01                         |
|                              | (1.07)                       |
| Undervaluation$_{i,t-2}$     | 0.01                         |
|                              | (0.79)                       |
| Government Spend$_{i,t}$     | -0.03                        |
|                              | (-1.27)                      |
| Terms of trade$_{i,t}$       | 0.02                         |
|                              | (0.51)                       |
| Monetary Aggregates$_{i,t}$  | 0.00                         |
|                              | (0.09)                       |
|                              | Observations                 |
|                              | 385                          |
|                              | 385                          |
|                              | 385                          |

|                              | Overidentifying Test (p-value) |
|------------------------------|--------------------------------|
|                              | 0.649                          |
|                              | 0.083                          |
|                              | 0.696                          |

|                              | Number of instruments          |
|------------------------------|--------------------------------|
|                              | 75                             |
|                              | 75                             |
|                              | 75                             |

|                              | Stability Condition            |
|------------------------------|--------------------------------|
|                              | Yes                            |
|                              | Yes                            |
|                              | Not                            |

* t statistics in parentheses
* * p<0.05, ** p<0.01, *** p<0.001

The results in Table 05 show that the first Undervaluation measure has a positive, but not significant impact on the first lag. The other two variables show significance in the coefficients for both their first and second lags. Figure 04 shows the impulse-response graphs of these estimates:

FIGURE 04
Figure 04 shows positive responses of Economic Growth to an undervaluation shock in all its measures. The first and third measures cause an increase in the first periods, but then decline while the second measure shows a persistent increase over time. Table 06 shows the results when considering the second measure of GPD per capita:

Table 06: Second Stage: Estimating the impact with macroeconomics covariates

| Variables             | Second GDP per capita Measure |
|-----------------------|-------------------------------|
|                       | (1)                          | (2)                          | (3)                           |
| Economic Growth\(_{i,t-1}\) | 5.19***                      | -4.48***                     | -5.41***                      |
|                       | (-3.78)                      | (-5.14)                      | (-4.38)                       |
| Economic Growth\(_{i,t-2}\) | -0.04                        | -0.08*                       | -0.05                         |
|                       | (-0.94)                      | (-2.38)                      | (-1.08)                       |
| GDP per capita\(_{i,t-1}\) | 5.49***                      | 4.83***                      | 5.83***                       |
|                       | (3.96)                       | (5.55)                       | (4.69)                        |
| GDP per capita\(_{i,t-2}\) | -5.45***                     | -4.77***                     | -5.78***                      |
|                       | (-3.94)                      | (-5.49)                      | (-4.65)                       |
| Undervaluation\(_{i,t-1}\) | -0.02                        | 0.00                         | 0.13***                       |
|                       | (-0.46)                      | (0.12)                       | (6.47)                        |
The results are varied, the second and third undervaluation measures find positive effects on Economic Growth, the last one having significance, while the first measure finds negative and not significant effects. Figure 05 shows the impulse response graphs of these undervaluation measures on Economic Growth.

**FIGURE 05:**

|                  | $Undervaluation_{i,t-2}$ | $Government Spend_{i,t}$ | $Terms of trade_{i,t}$ | $Monetary Aggregates_{i,t}$ |
|------------------|--------------------------|--------------------------|------------------------|-----------------------------|
|                  | $\beta$                  | $t$                      | $\beta$                | $t$                         |
|                  | -0.00                    | 0.01                     | -0.09***                | (-0.70) (0.84) (-5.20)      |
|                  | (-0.08***                | (-0.08***                | (-0.08***               | (-7.10) (-14.10) (-8.01)   |
|                  | 0.04***                  | 0.06***                  | 0.05***                 | (5.28) (9.17) (6.71)        |
|                  | 0.00                     | -0.02**                  | -0.00                   | (0.58) (-3.04) (-1.06)      |
| Observations     | 385                      | 385                      | 385                    |                             |
| Overidentifying Test (p-value) | 0.724                 | 0.229                     | 0.811                  |                             |
| Number of instruments | 75                    | 75                       | 75                     |                             |
| Stability Condition | Not                  | Not                      | Not                    |                             |

$t$ statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001
Figure 05 shows scattered results, a shock from the first undervaluation measure causes a drop in Economic Growth and then recovers without compensating for this effect. A shock from the second undervaluation measure causes persistent positive effects on Economic Growth while the last undervaluation measure causes an increase in the first period and then begins to decline, but without compensating for the impact. Table 07 shows the results considering the third measure of GDP per capita.

Table 7: Second Stage: Estimating the impact with macroeconomics covariates

| Variables            | Third GDP per capita Measure |
|----------------------|-----------------------------|
| Economic Growth<sub>i,t−1</sub> | 0.26*** 0.54*** 0.46***     |
|                      | (7.51) (11.54) (6.86)       |
| Economic Growth<sub>i,t−2</sub> | 0.03 -0.15*** -0.14**      |
|                      | (1.43) (-3.53) (-2.92)     |
| GDP per capita<sub>i,t−1</sub>  | 0.02* -0.12*** -0.03*      |
|                      | (2.23) (-8.07) (-2.03)     |
| GDP per capita<sub>i,t−2</sub>  | -0.01 0.15*** 0.05***      |
|                      | (-1.62) (9.80) (3.34)      |
| Undervaluation<sub>i,t−1</sub>  | 0.03*** -0.09*** 0.10***   |

With Macroeconomic Covariates

Undervaluation shocks on Economic Growth

Undervaluation 1

Undervaluation 2

Undervaluation 3
The results show that the first and third measure of undervaluation have a positive impact on Economic Growth, while the second measure has negative effects. Figure 06 shows the impulse-response graphs of all undervaluation measures:

|                                  | (17.08) | (-6.40) | (4.08) |
|----------------------------------|---------|---------|--------|
| Undervaluation\(_{i,t-2}\)      | 0.01*** | 0.11*** | -0.11*** |
|                                  | (4.47)  | (8.52)  | (-4.93) |
| Government Spend\(_{i,t}\)      | -0.09***| -0.13***| -0.09***|
|                                  | (-20.06)| (-15.25)| (-6.21) |
| Terms of trade\(_{i,t}\)        | 0.01*** | 0.07*** | 0.07***|
|                                  | (3.76)  | (10.31) | (7.89)  |
| Monetary Aggregates\(_{i,t}\)   | 0.03*** | -0.02** | -0.01   |
|                                  | (8.10)  | (-3.21) | (-1.53) |

| Observations                     | 385     | 385     | 385     |
|----------------------------------|---------|---------|---------|
| Overidentifying Test (p-value)   | 0.294   | 0.227   | 0.305   |
| Number of instruments            | 75      | 75      | 75      |
| Stability Condition              | Not     | Yes     | Not     |

* t statistics in parentheses
** p<0.05, *** p<0.01, **** p<0.001
Figure 06 shows the impulse-response graphs, a shock of the first and second measures elicit a positive response from Economic Growth, while the second measure has no impact until the fifth period where it begins to increase. Once the results for this subsection have been presented, by way of conclusion, the third undervaluation measure finds positive impacts on Economic Growth, while the other measures show scattered results. Now, we move on to the third subsection, in which we include human capital variables such as average worked hours, human capital index and productivity.

3.3 Results with human capital covariates:
Table 08 shows the results with the first GDP per capita measure:

| Variables                      | First GDP per capita Measure |
|--------------------------------|------------------------------|
|                                | (1)                          |
| Economic Growth\(t-1\)        | 0.12*                        |
|                                | (2.21)                       |
| Economic Growth\(t-2\)        | -0.14***                     |
|                                | (-4.03)                      |
| GDP per capita\(t-1\)         | 0.24***                      |

|                                | (2)                          |
| Economic Growth\(t-1\)        | 0.25***                      |
|                                | (5.25)                       |
| Economic Growth\(t-2\)        | -0.04                        |
|                                | (-0.97)                      |
| GDP per capita\(t-1\)         | 0.12**                       |

|                                | (3)                          |
| Economic Growth\(t-1\)        | 0.05                         |
|                                | (0.75)                       |
| Economic Growth\(t-2\)        | -0.03                        |
|                                | (-0.64)                      |
| GDP per capita\(t-1\)         | 0.04                         |
The results in Table 08 show that all the undervaluation measures have positive impacts on Economic Growth. Figure 07 shows the impulse-impulse response graphs of all undervaluation measures on Economic Growth.

FIGURE 07
Impulse-response graphs show a positive impact of undervaluation measures on Economic Growth up to the third period and then start to decline. The second and third measures compensate reach zero in the fourth and fifth period respectively, while the first measure compensates in the tenth period. Table 09 shows the results when we use the second measure of GDP per capita.

Table 09: Second Stage: Estimating the impact with human capital variables

| Variables          | Second GDP per capita Measure |
|--------------------|-------------------------------|
|                    | (1)   | (2)   | (3)   |
| Economic Growth$_{i,t-1}$ | 3.88*** | 5.05*** | 2.29  |
|                    | (3.37) | (3.70) | (1.31) |
| Economic Growth$_{i,t-2}$ | -0.06  | -0.12** | -0.08 |
|                    | (-1.70) | (-3.06) | (-1.74) |
| GDP per capita$_{i,t-1}$  | -3.42** | -4.80*** | -2.02 |
|                    | (-2.97) | (-3.47) | (-1.14) |
| GDP per capita$_{i,t-2}$  | 3.41**  | 4.65*** | 1.89  |
|                    | (2.96)  | (3.36)  | (1.07) |
| Undervaluation$_{i,t-1}$ | 0.02**  | 0.03*** | 0.09*** |
|                    | (2.87)  | (4.33)  | (4.55) |
The results show positive impacts of undervaluation measures on Economic Growth. Figure 08 shows the impulse response graphs.

**FIGURE 08**

### Undervaluation shocks on Economic Growth

With Human Capital Covaariates

|                      | Undervaluation\(i_{t-2}\) | Average Hours Worked\(i_{t}\) | Human Capital index\(i_{t}\) | Productivity\(i_{t}\) |
|----------------------|-----------------------------|--------------------------------|------------------------------|----------------------|
|                      | -0.02**                    | -0.02**                        | 0.01**                       | -0.01                |
|                      | (-3.00)                    | (-2.70)                        | (3.25)                       | (-1.59)              |
|                      | 0.01**                     | 0.01**                         | 0.01**                       | 0.08***              |
|                      | (2.70)                     | (-0.63)                        | (13.19)                      | (8.76)               |
|                      |                            |                                |                              |                      |
| Observations         | 385                        | 385                            | 385                          | 385                  |
| Overidentifying Test (p-value) | 0.354                   | 0.120                          | 0.747                        |                      |
| Number of instruments | 75                        | 75                             | 75                           | 75                  |
| Stability Condition  | Yes                       | Yes                            | Yes                          | Yes                 |

\(t\) statistics in parentheses

* \(p<0.05\), ** \(p<0.01\), *** \(p<0.001\)

*The results show positive impacts of undervaluation measures on Economic Growth. Figure 08 shows the impulse response graphs.*
The results in figure 08 show that the three undervaluation measures provoke a positive response in the Economic Growth until the third period and then begin to decrease below zero. Table 10 shows the results using the third measure of GDP per capita.

Table 10: Second Stage: Estimating the impact with human capital variables

| Variables               | Third GDP per capita Measure |
|-------------------------|------------------------------|
|                         | (1)  | (2)  | (3)  |
| Economic Growth_{i,t-1} | 0.36*** | 0.28*** | 0.30*** |
|                         | (7.27) | (9.62) | (6.16) |
| Economic Growth_{i,t-2} | 0.00 | -0.13*** | -0.05 |
|                         | (0.10) | (-6.42) | (-1.51) |
| GDP per capita_{i,t-1}  | 0.04*** | -0.13*** | 0.00 |
|                         | (4.16) | (-13.44) | (0.99) |
| GDP per capita_{i,t-2}  | -0.05*** | 0.13*** | -0.03*** |
|                         | (-5.16) | (13.83) | (-3.33) |
| Undervaluation_{i,t-1} | 0.02*** | -0.20*** | 0.09*** |
|                         | (9.52) | (-21.12) | (5.18) |
| Undervaluation_{i,t-2} | -0.00 | 0.26*** | -0.06*** |
|                         | (-1.20) | (25.29) | (-3.65) |
| Average Hours Worked_{i,t} | -0.01 | 0.26*** | -0.01 |
|                         | (-0.17) | (6.11) | (-0.10) |
| Human Capital index_{i,t} | 0.05** | 0.14*** | 0.12*** |
|                         | (3.13) | (9.80) | (6.54) |
| Productivity_{i,t}     | 0.01 | -0.00 | -0.02 |
|                         | (1.68) | (-0.26) | (-1.84) |

| Observations | 385 | 385 | 385 |
|--------------|-----|-----|-----|
| Overidentifying Test (p-value) | 0.328 | 0.330 | 0.263 |
| Number of instruments | 75 | 75 | 75 |
| Stability Condition | Yes | Yes | Yes |

* p<0.05, ** p<0.01, *** p<0.001

The results in Table 10 show that the first and third measures have positive impacts on Economic Growth, while the second measure has a negative impact. Figure 09 shows the impulse-response graphs.

FIGURE 09
Figure 09 shows that a shock of the first and second undervaluation measures has a positive response from Economic Growth, however, the first measure falls below zero while the third remains positive for the rest of the periods. The second measure has a negative impact below zero, but increasing until it is above zero for the rest of the periods. So, once this subsection is finished, by way of conclusion we find that the first and third measures have a positive impact on Economic Growth subject to all GDP per capita measures. While the second measure of undervaluation shows a positive impact on the first measure and second measure of GDP per capita, with the third measure we find that there is a negative impact in the first period, but then it has an increase staying above zero. The following subsection shows the results including all variables, that is, including government spend, terms of trade, monetary aggregates, average worked hours, human capital index and productivity.

3.4 Results with all covariates:

Table 11 shows the results considering all the variables and using the first measure of GDP per capita:

| Variables         | First Economic Growth Measure |
|-------------------|-------------------------------|
|                   | (1)  | (2)  | (3)  |
| Economic Growth<sub>t−1</sub> | 0.09 | 0.32*** | 0.17 |
|                   | (1.35) | (4.59) | (1.58) |
The results in Table 11 show that undervaluation has a positive impact on Economic Growth when the first measure of GDP per capita is used. Figure 10 shows the impulse-response graphs of the undervaluation measures on Economic Growth. Figure 10 shows the impulse-response graphs.

| Economic Growth_{t-2} | GDP per capita_{t-1} | GDP per capita_{t-2} | Undervaluation_{t-1} | Undervaluation_{t-2} | Average Hours Worked_{t} | Human Capital Index_{t} | Productivity_{t} | Government Spend_{t} | Terms of Trade_{t} | Monetary Aggregates_{t} |
|------------------------|----------------------|----------------------|----------------------|----------------------|--------------------------|------------------------|------------------|---------------------|-------------------|-------------------------|
| -0.21***               | 0.27***              | -0.17***             | 0.01**               | -0.20                | 0.00                    | -0.13*                 | -0.05            | -0.09***            | 0.05***            | -0.04***                |
| (-5.04)                | (6.09)               | (-5.01)              | (3.25)               | (-0.20)             | (0.28)               | (-2.54)               | (-1.92)         | (-6.86)             | (5.12)             | (-4.40)                  |
| -0.07                  | 0.10*                | -0.16***             | 0.15***             | 0.23***             | (2.96)               | (4.55)               | (3.17)         | (-1.76)             | (0.89)             | (0.23)                  |
| -0.05                  | 0.086**              | -0.02                | -0.02               | 0.01                | 0.01                   | 0.23***               | 0.01            | -0.01               | 0.01               | (0.89)                  |
| (-0.77)                | (0.61)               | (-3.85)              | (-0.36)             | 0.01               | **                      | (1.56)               | **              | (-0.58)             | **                | **                      |

Observations 385 385 385
Overidentifying Test (p-value) 0.476 0.151 0.870
Number of instruments 78 78 54
Stability Condition Yes Yes Yes

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001
Figure 10 shows that a positive shock from Undervaluation positively impacts Economic Growth, but the second and third measures are compensated until the fourth period for both, while the first measure is not compensated in the first 10 periods. Table 12 shows the results using the second measure of GDP per capita.

Table 12: Second Stage: Estimating the impact with all covariates

| Variables               | First GDP per capita Measure |
|-------------------------|-----------------------------|
|                         | (1)                         | (2)                         | (3)                         |
| Economic Growth\(_{t-1}\) | -7.85***                    | -6.84***                    | -5.42***                    |
|                         | (-4.86)                     | (-6.36)                     | (-3.88)                     |
| Economic Growth\(_{t-2}\) | -0.11**                     | -0.09*                      | -0.06                        |
|                         | (-2.61)                     | (-1.97)                     | (-1.42)                     |
| GDP per capita\(_{t-1}\)   | 8.12***                     | 7.00***                     | 5.69***                     |
|                         | (5.01)                      | (6.56)                      | (4.06)                      |
| GDP per capita\(_{t-2}\)   | -8.08***                    | -7.07***                    | -5.70***                    |
|                         | (-4.97)                     | (-6.60)                     | (-4.06)                     |
| Undervaluation\(_{t-1}\)   | 0.01                        | 0.05***                     | 0.11***                     |
|                         | (1.54)                      | (6.28)                      | (5.94)                      |
| Undervaluation\(_{t-2}\)   | -0.00                       | -0.03***                    | -0.04*                      |
The results in Table 12 show the estimates using the second measure of GDP per capita, we found positive results in all the estimates, but significant only in the second and third measure of undervaluation. Figure 11: Shows the impulse response graphs.

FIGURA 11

|                           | (-0.53) | (-4.38) | (-2.40) |
|---------------------------|---------|---------|---------|
| Average Hours Worked$_{i,t}$ | 0.01    | 0.01*** | 0.00    |
|                           | (1.24)  | (4.00)  | (0.07)  |
| Human Capital Index$_{i,t}$ | -0.04   | 0.21*** | 0.16*** |
|                           | (-1.16) | (6.58)  | (6.20)  |
| Productivity$_{i,t}$     | 0.06**  | 0.16*** | 0.06*** |
|                           | (3.24)  | (9.51)  | (3.67)  |
| Government Spend$_{i,t}$ | -0.05***| -0.01   | -0.05***|
|                           | (-4.16) | (-1.75) | (-4.58) |
| Terms of Trade$_{i,t}$   | 0.05*** | 0.08*** | 0.06*** |
|                           | (6.57)  | (10.27) | (6.07)  |
| Monetary Aggregates$_{i,t}$ | -0.01  | -0.02*  | -0.03***|
|                           | (-0.86) | (-2.43) | (-3.85) |

|                           | Observations | 385 | 385 | 385 |
|---------------------------|--------------|-----|-----|-----|
| Overidentifying Test (p-value) | 0.840          | 0.177 | 0.702 |
| Number of instruments      | 77            | 77   | 77   |
| Stability Condition        | Not           | Yes  | Yes  |

* p<0.05, ** p<0.01, *** p<0.001

The results in Table 12 show the estimates using the second measure of GDP per capita, we found positive results in all the estimates, but significant only in the second and third measure of undervaluation. Figure 11: Shows the impulse response graphs.

FIGURA 11
Figure 11 shows that a shock of all undervaluation measures causes an increase in Economic Growth, only the second and third measures are offset by reaching zero, while the first measure remains constant in all periods. And finally, Table 13 shows the estimates considering the third measure of GDP per capita.

| Variables                  | First GDP per capita Measure |
|----------------------------|-----------------------------|
|                            | (1)                         | (2)                         | (3) |
| Economic Growth<sub>i,t−1</sub> | 0.30***                     | 0.22***                     | 0.13** |
|                            | (5.70)                      | (6.52)                      | (2.62) |
| Economic Growth<sub>i,t−2</sub> | 0.03                        | -0.16***                    | -0.06 |
|                            | (0.83)                      | (-6.45)                     | (-1.48) |
| GDP per capita<sub>i,t−1</sub> | -0.06***                    | -0.17***                    | -0.02 |
|                            | (-6.45)                     | (-15.31)                    | (-1.56) |
| GDP per capita<sub>i,t−2</sub> | 0.05***                     | 0.19***                     | 0.01 |
|                            | (6.17)                      | (15.76)                     | (0.88) |
| Undervaluation<sub>i,t−1</sub> | -0.02**                    | -0.21***                    | 0.09*** |
|                            | (-3.28)                     | (-17.39)                    | (6.48) |
| Undervaluation<sub>i,t−2</sub> | 0.02**                     | 0.26***                     | -0.04*** |
Figure 11 shows that a shock of all undervaluation measures causes an increase in Economic Growth, only the second and third measures are offset by reaching zero, while the first measure remains constant in all periods. And finally, Table 13 shows the estimates considering the third measure of GDP per capita.
Figure 12 shows that the first and second undervaluation measures have negative impacts on the Economic Growth while the third measure has positive impacts increasing in the first period and then falling to below 0. So, the results of this section that only the third measure of undervaluation shows positive effects on all measures of GDP per capita, while the other measures show scattered results. In the next section, we present the conclusions of this study, and in the annex we present the Granger causality tests of all the estimates made in this investigation.

4. Conclusion

The results of this research show that there are positive effects of an undervaluation on Economic Growth, considering the third measure of Undervaluation for all definitions of GDP per capita, which is also used to construct the Economic Growth per capita. These significant effects find a change of 1% of undervaluation can positively impact between 5% and 19% of economic growth. While the other two undervaluation measures show dispersed effects depending on the measures of GDP per capita and the variables included.

If we look at the first measure of undervaluation, without considering macroeconomic and human capital variables, that is, considering the results of tables 02-04, we find that there is a positive effect only in one of the three measures of GDP per capita and we only find significance in the first measure of GDP per capita. Considering including macroeconomic variables, that is, considering the results of tables 05-07, we found positive effects in the first and third measure of GDP per capita, but only significance in the last measure. Considering the human capital variables, that is, considering the results of tables 08-10, we found positive effects on all measures
of GDP per capita, but only significance in the second and third measures. Lastly, considering all the macroeconomic and human capital variables, that is, considering the results in Tables 11-13, we found positive effects in the first and second measure of GDP per capita, but only significance in the first measure.

Turning to the second measure of undervaluation, without considering including variables, that is, the results of Table 02-04, we found positive and significant effects in the first and third measures of GDP per capita. Considering the macroeconomic variables, that is, the results in Table 05-07, we found positive effects in the first and second measure of GDP per capita, but only significance in the first. Considering the human capital variables, that is, the results in Table 08-10, we found positive effects and significance in the first and second measures of GDP per capita. Finally, considering all the variables, that is, considering Tables 11-13, we found positive effects and significance in the first and second measure of GDP per capita.

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Annex

Tabla 14: Panel VAR-Granger causality Wald test(without covariates)
### Table 15: Panel VAR-Granger causality Wald test (Macroeconomics variables)

| First Economic Growth measure | Second Economic Growth Measure | Third Economic Growth measure |
|------------------------------|--------------------------------|-----------------------------|
| First Undervaluation measure | 0.011                          | 0.000                       |
| Second Undervaluation measure| 0.001                          | 0.000                       |
| Third Undervaluation measure | 0.000                          | 0.000                       |

Ho: Excluded variable does not Granger-cause Equation variable  
Ha: Excluded variable Granger-causes Equation variable

### Table 16: Panel VAR-Granger causality Wald test (Human capital covariates)

| First Economic Growth measure | Second Economic Growth Measure | Third Economic Growth measure |
|------------------------------|--------------------------------|-----------------------------|
| First Undervaluation measure | 0.500                          | 0.247                       |
| Second Undervaluation measure| 0.000                          | 0.005                       |
| Third Undervaluation measure | 0.000                          | 0.000                       |

Ho: Excluded variable does not Granger-cause Equation variable  
Ha: Excluded variable Granger-causes Equation variable

### Table 17: List of countries

| Country     |
|-------------|
| Bolivia     |
| Brazil      |
| Chile       |
| Colombia    |
| Costa Rica  |
| Dominican Republic |
| Guatemala   |
| México      |
| Paraguay    |
| Perú        |
| Uruguay     |

### Table 18: List of Variables

| Variable                               | Definition                                                                 | Source                      |
|----------------------------------------|---------------------------------------------------------------------------|-----------------------------|
| First Economic Growth per capita       | Expenditure-side real GDP at chained PPPs, to compare relative living standards across countries and over time divided by population | Penn World Table v9.1      |
GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources divided by population. Data are in constant 2010 U.S. dollars.

Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).

Average change over time in the selling prices received by domestic producer for their output.
Consumer Price Index

Consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Data are period averages.

World Bank

Purchasing power parity conversion factor is the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as U.S. dollar would buy in the United States. This conversion factor is for GDP. For most economies PPP figures are extrapolated from the 2011 International Comparison Program (ICP) benchmark estimates or imputed using a statistical model based on the 2011 ICP. For 47 high- and upper middle-income economies conversion factors are provided by Eurostat and the Organisation for Economic Co-operation and Development (OECD).

World Bank

First Real Exchange Rate

The first RER is the Nominal Exchange Rate divided by PPP

Own Estimation

Second Real Exchange Rate

This RER is the multiplication of Nominal Exchange Rate and Producer Price Index divided by Consumer Price Index

Own Estimation

Third Real Exchange Rate

Inverse of Price level of CGDPo, price level of USA GDPo in 2011=1

Penn World Table v9.1
| Government Spend | World Bank |
|------------------|-----------|
| General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. |

| Terms of Trade | World Bank |
|----------------|-----------|
| The terms of trade effect equals capacity to import less exports of goods and services in constant prices. Data are in constant local currency. |

| Monetary Aggregates | World Bank |
|---------------------|-----------|
| Broad money (IFS line 35L..ZK) is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler’s checks; and other securities such as certificates of deposit and commercial paper. |

| Average Hours Worked | Penn World Table v9.1 |
|----------------------|-----------------------|
|Average annual hours worked by persons engaged |

| Human Capital Index | Penn World Table v9.1 |
|---------------------|-----------------------|
|Human Capital Index |

| Productivity | Penn World Table v9.1 |
|--------------|-----------------------|
|Welfare-relevant Total Factor Productivity at constant prices (2011 =1) |