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Oh, RER'ly? Effects of Real Exchange Rate Misalignments on Economic Modernization

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Abstract

The role of the real exchange rate in an economy's modernization process is an ambiguous matter and is not essential in the canonical models of neo-classical growth theory. This thesis tries to determine the role of the real exchange rate in a modernization process for Chile, Brazil and the Republic of Korea by applying the theory of a dual-sector approach to economic development by Lewis. By estimating individual equilibrium real exchange rates from 1970-2007, the methodology differ from recent literature on the subject which has focused on non-desirable homogenous assumptions between countries for estimating equilibrium real exchange rates. The results indicate that undervaluation fosters reallocation towards the modern sector of the economy, whereas overvaluation hampers the reallocation. No significant results could however be determined for the Republic of Korea.

Key words: Real exchange rate, Equilibrium real exchange rate, Economic development, Lewis model, Modernization.

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1. Introduction

Modernizing the economic structure and abandoning low-productive agricultural activities in favor of high-productive industrial activities and services has always been a central policy issue and is fundamental in economic growth theory. Creating capital and reallocate labor to high-productive sectors are intermediate targets to reach a more prosperous economy with higher income and more consumption. Mainstream neo-classical growth theory, with the Solow-Swan model as well as endogenous growth models in focus, fails to satisfactory explain the growth process for countries with surplus population and the canonical versions of the models assumes a closed economy that disregards the real exchange rate. But since the creation of capital is indispensible for the establishment of the industrial sector and that trade might act as an operative channel for capital, the real exchange rate is possible to play a central role in the modernization process. The theories established by Lewis (1954) and Ranis & Fei (1961) focus on a dual-sector economy with a low-productive agricultural sector with redundant labor and a high-productive industrial sector – an assumption which fits most of development countries that function in an early stage of modernization – and furthermore emphasize the move to an industrial economy which gives the real exchange rate a central role. When expanding the industrial sector and utilizing surplus labor from the agricultural sector, the misalignment of the real exchange rate may act as a bottleneck to further expansion of the industrial sector if the creation of capital is repressed by this misalignment.

This thesis departs from the theories by Lewis and Ranis & Fei in an effort to answer the question if the real exchange rate is one of the contributors to the relative expansion of the industrial sector in Chile, Brazil and the Republic of Korea in the time period 1970-2005. The choice of Chile, Brazil and the Republic of Korea as countries under study is motivated by these countries having undergone (or *is undergoing*) an economic transformation with large structural changes during the time period analyzed. Chile has become one of the most prosperous nations in Latin America and has had a remarkable GDP growth since the mid-1980s (World Development Indicators, 2013). Brazil is currently one of the largest economies in the world but has experienced large financial crises and the Republic of Korea is one of the countries that usually are referred to as “the Asian tigers”, with an export-led economy and specialization in manufacturing production (Page, 1994, p. 219). The selected countries have had different experiences of economic development and therefore can the analysis stretch over several aspects.

Equilibrium real exchange rates are estimated for Chile, Brazil and the Republic of Korea to determine the misalignment of the real exchange rate, and then a model – based on the theories by Lewis and Ranis & Fei – is developed to describe the relationship between development fundamentals and the ratio of employment in the industrial sector relative to the agricultural sector. The results indicate that the real exchange rate misalignment has had an effect on this development in Chile and Brazil, but in the case of Korea no significant relationship can be determined. Specifically indicates the results that undervaluation fosters the reallocation towards the industrial sector of the economy and that overvaluation hampers it. This indicates that the creation of capital is dependent upon the real exchange rate and that capital accumulation is encouraged when the real exchange rate is undervalued.

The thesis is disposed as follows: first, a description of the theories regarding the Lewis and Ranis & Fei approach to economic development is presented in section 2. This is connected with the real exchange rate and then the theoretical approach behind equilibrium real exchange rates is established along with the estimated misalignments of the real exchange rates. The empirical analysis of the connection between economic modernization and the real exchange rate is discussed in section 4, with the results obtained from the regressions and these results are discussed in this part as well. The last section gives a brief overview of the thesis and summarizes the results.

2. Theory

2.1. Neo-classical growth theory and an introduction to the Lewis-Ranis-Fei model

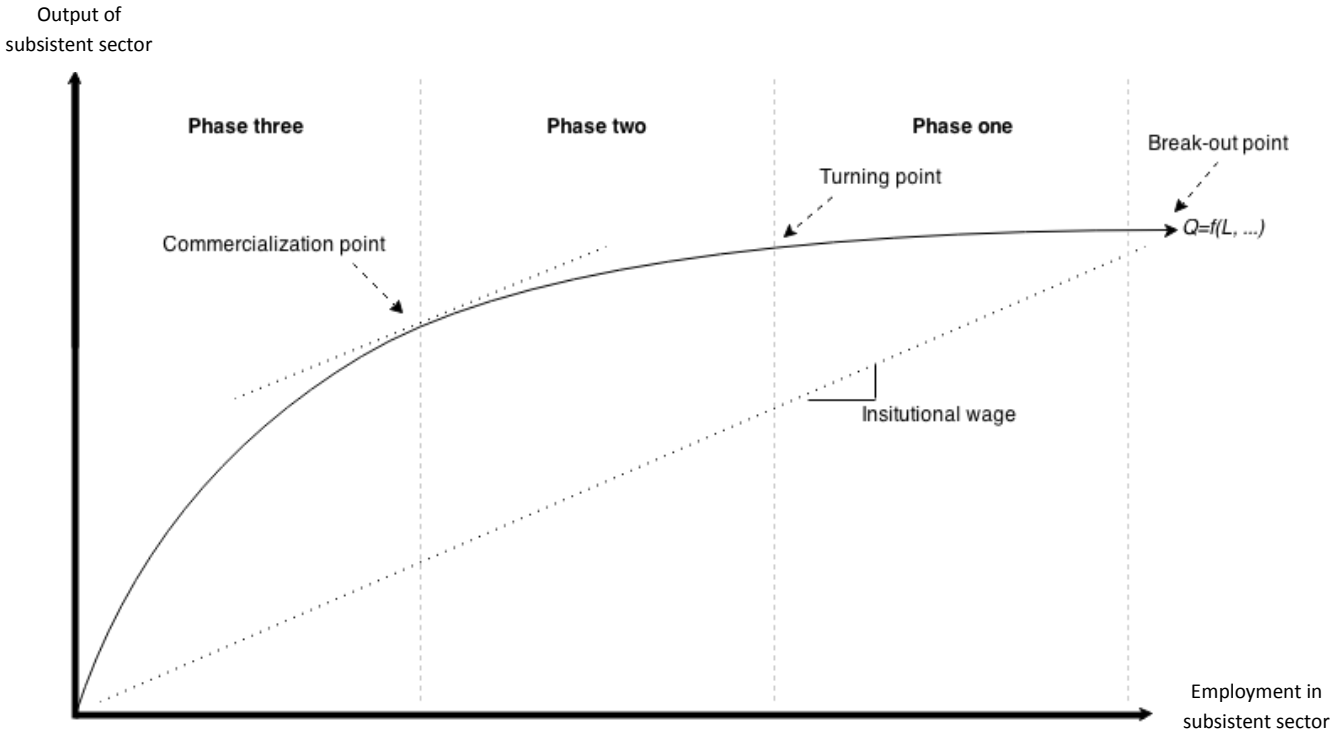
Neo-classical growth theory, with the Solow-Swan model (also known as the *exogenous growth model*) in center, tries to explain economic growth with focus on capital accumulation and technological progress. The Solow-Swan model builds on the neo-classical microeconomic foundations with a Cobb-Douglas production function and diminishing marginal productivity of capital and assumes that capital investments will increase the income level until the equilibrium so called "steady state" is reached (Solow, 1956). After this point must technological progress commence to initiate a progress towards a new, higher steady state. In other words is technological progress essential to achieve economic growth in the long run, and investments in sectors that intensively use capital essential as an intermediate target. The Solow-Swan model can be used to explain what factors that constitutes long-run economic growth but it does not explain the characteristics of development countries that undergo rapid economic growth (Fregert & Jonung, 2010, s. 156). Nor does it answer the question where technological progress is originated and what factors that contributes to the progress. *Endogenous growth models* within the neo-classical framework focus on learning-by-doing and the source of new knowledge through research and development to answer the question what factors that contributes to technological progress. However, these models also fail to answer the questions how developing countries that cannot assimilate technological progress can increase growth and how the threshold to a modern economy can be overcome in countries with surplus population. If the majority of the available workforce is involved in the agricultural sector, a fact which most Asian and Latin American developing countries experience or have experienced, there must exist mechanisms that draw workers to other more productive sectors of the economy during a growth process. Since neo-classical growth theory fails to answer a number of important questions, I will use other theories that incorporate some of the issues discussed.

The theories that lay the foundation of this thesis differ from the neo-classical theories in several ways and are based on the dual-sector approach to economic development made by Lewis (1954) and Ranis & Fei (1961). Lewis made the assumption that labor is unlimited in supply in a vast majority of developing countries, in especially Asia and Latin America, and that the neo-classical assumptions of inelastic labor supply did not hold in these countries (Lewis, 1954). Lewis rather argued that labor is infinitely elastic in its supply at an institutional wage level and thus available in an unlimited supply at this wage level. Hence is this analysis different from the neo-classical view of market forces that determine the wage

level based on marginal productivity. The low-productive, so called subsistent (or agricultural) sector is assumed to employ such a great amount of labor that the marginal productivity of labor is zero or even negative and does not contribute to the growth in the economy. The high-productive, so called capitalist (or industrial) sector takes advantage of this condition and absorbs the surplus labor at a wage rate higher than in the subsistence sector (approximately 30 per cent higher according to Lewis, 1954). When the capitalist sector expands, this facilitates the absorption of subsistence workers to the capitalist sector, where the marginal productivity of labor is higher. Hence, capital formation draws labor to the productive sectors of the economy and increases labor productivity concurrently with increased capital accumulation until the surplus labor is exhausted. A higher rate of capital creation will in other words increase the rate of industrialization. However, the lack of capital and market forces means that economic expansion cannot be taken for granted and the reallocation is thus dependent upon the creation of capital.

Lewis' theory was elaborated by Ranis & Fei (1961) who emphasized the development of the subsistent sector as a necessary requirement for self-sustaining growth. By defining three phases – based on Rostow (1956) – of economic development they formalize Lewis' model and introduce the concepts of the "break-out point" and the "turning point". Figure 1 illustrates the model with output of the subsistent sector on the vertical axis and employment in the subsistent sector on the horizontal axis. As the capitalist sector is established, this marks the break-out point from an underdeveloped economy to a modern economy. Initially, the economy consists of only the subsistent (agricultural) sector with a negligible marginal productivity. As the capitalist sector is established and starts to absorb labor from the subsistent sector, the capitalist sector's (constant) supply curve starts to slope upward. Contemporaneously is the marginal productivity of labor increasing in the subsistent sector due to the reallocation of workers and the turning point is initiated as the redundant labor in this sector disappears. However, it is not until the surplus labor has been fully absorbed that the marginal productivity of labor in the subsistent sector exceeds the institutional wage rate and the subsistent sector is said to become commercialized. The commercialization point indicates that the marginal productivity of labor and the real wage in the subsistent sector coincides and that this sector no longer holds any redundant labor. As a consequence constitutes this progress the development of the subsistent sector and it becomes characterized by market forces as the institutional wage level is abandoned in favor of competitive bid for labor (Ranis & Fei, 1961). To reach the third phase at an earlier stage, Ranis & Fei accentuate that a significant increase in the labor productivity of the subsistent sector will eventually lead to convergence between the turning point and the commercialization point.

Figure 1: The Lewis-Ranis-Fei model



Source: Ercolani & Wei (2010).

Since the Lewis-Ranis-Fei model highlight the creation of capital in order to foster reallocation of labor to the capitalist sector of the economy, it is possible that the real exchange rate plays a role in this development. A developing country is likely to lack the capital needed to expand the capitalist sector initially but could reduce the friction by absorbing capital from abroad. Countries like Korea, China and Taiwan are examples of export-led economies that successfully have adopted strategies that encourage capital creation by reallocating resources towards the high-productive export sectors. Literature on the subject points to the fact that export-led economies experience higher growth by a more optimal allocation of resources (see for example Balassa, 1978; Feder, 1982). However, the literature on this subject fails to give a comprehensive picture by disregarding several important variables, most notably the real exchange rate. If an export-led policy leads to higher growth, this should give the real exchange rate an important role. In a more recent study, Rodrik (2008) showed that the real exchange rate has a significant effect on economic growth in developing countries, but his study assumed homogeneity between countries when estimating real exchange rate misalignments, an issue that this thesis will avoid.

2.2. The real exchange rate and the Lewis-Ranis-Fei model

When considering the hypothesis that the real exchange rate (RER) influences capital creation through trade, the relationship between the Lewis-Ranis-Fei model and the role of the RER must first be determined, which is made in this section.

Using the British notation, the RER is defined as:

$$RER \equiv N \times \frac{P}{P^*} \tag{2.1}$$

where N is the nominal exchange rate and $\frac{P}{P^*}$ is the domestic price level relative to foreign price level.

Initially as the capitalist sector expands and labor is reallocated to this sector, capital accumulation commences which continues the progress towards production in the capitalist sector. This progress alters the relative price of the capitalist sector goods and hence creates the RER an incentive to reallocate resources towards the production of the tradable capital goods, since the production of these goods will improve the internal terms-of-trade, that is, the price of capital goods relative to subsistent goods. Production will in other words be more profitable in the capitalist sector. Lewis (1954) actually emphasized that "[…] *if surplus labour is put to capital formation and paid out of new money, prices rise, because the stream of money purchases is swollen while the output of consumer goods is for the time being constant*". This statement indicates an alteration of the relative price on tradable capital goods and non-tradable agricultural goods that inevitably will have a positive effect on the RER and result in a real appreciation. This effect is called the Balassa-Samuelson effect and takes into account that poor countries often have lower productivity in the sector that produces tradable goods, which translates into lower wages in both the tradable as well as the non-tradable sector and hence lower overall prices (Burda & Wyplosz, 2013, p. 391). When comparing RER across countries, this effect must be considered. Lewis further discussed what will happen in the closed economy when domestic surplus labor is exhausted. Capital accumulation will then come to an end if not the capital is exported to other countries that have surplus labor or if not immigration is encouraged. However, the export of capital is "a much easier way out for the capitalists", because of the widespread restrictions on immigration (Lewis, 1954, p. 177). Yet today is capital assumed to be more mobile than labor. Since the possibility of stagnation in the closed economy of the Lewis model is unambiguous and the development depends upon the movement to an open economy it thus follows that the reallocation of labor appears to be influenced by the RER. The move to an open economy with a competitive RER might additionally and

more importantly give a boost to national income with the aim to support savings that could enhance future investments in domestic production (Eichengreen, 2007). This could eventually lead to a more "automatic" growth process as capital creation transforms the economy and encourages production in the high-productive and tradable sectors. Trade is also likely to occur if the RER is at a "normal" and competitive level, but otherwise it might act as a bottleneck to further capital accumulation and hence labor absorption to the capitalist sector. The question is whether there is any empirical evidence to support this. Note that caution must be taken regarding the causality in this discussion. It is possible that reverse causality is involved and that the RER is influenced by the reallocation of resources to the capitalist sector. Some of the peril can be eluded by including the right variables when analyzing the relationship, which I will return to, but it is important to have this issue in mind. The RER can nonetheless be treated as an exogenous variable since policy makers actively are trying to influence the RER with different fiscal and monetary interventions (Rodrik, 2008).

3. Estimating the misalignment of the real exchange rate

3.1. Equilibrium real exchange rates and the empirical model

To empirically test the hypothesis that the RER influences reallocation towards the capitalist sector of the economy, the misalignment of the RER must be determined. By assessing equilibrium real exchange rates (ERERs) the misalignment can be computed. To depict the ERER used in this thesis it must be determined that the economy is in internal and external balance, in other words: in equilibrium. As Edwards (1989) set forth, internal balance denotes that the non-tradable goods market and the labor market clears in the current and future period and to achieve external balance the intertemporal budget constraint must be satisfied. This means that the country must be able to sustain long run balance in its current account. Edwards (1989) and Baffes et al. (1999) present several macroeconomic fundamentals that determine the RER and hence are a part of the ERER, fundamentals that will be used when computing the ERER in this thesis. Before the empirical model is presented, some methodology issues must be deliberated.

The literature on ERERs has to a large extent focused on panel data estimations. For example has this approach been used by the IMF (2006) and the ECB (2010) in their respective methodological assessment papers. This thesis employs individual time series analysis for each individual country. The reason is that if panel data is employed, an assumption of homogeneity between countries is inevitably made. Since the objective is to estimate ERERs for each individual country, the assumption of homogenous slope

coefficients is not satisfactory. Fixed individual effects in panel data estimations would only give new intercepts for each country and thus the dynamics of individual time series estimations would be lost. Since the time horizon of this analysis ranges over 1970-2007, the long run cross-country relationship homogeneity that panel data estimation conjectures could give misleading results. Schröder (2013) stresses this complex of problems and points to studies where the panel data estimates for ERERs have indicated significant undervaluation whereas individual country estimates have indicated significant overvaluation.

The methodology for estimating the ERER largely follows the IMF (2006) in question of variable choice and specification. Full specification of the variables is found in the Appendix, but an overview follows below.

- GDP per capita (GDP): Acts as a proxy for the Balassa-Samuelson effect. The increase in production in the tradable sector (here, the capitalist sector) is positively linked to the growth rate and hence an increase in this variable is expected to result in an ERER appreciation.
- Terms-of-trade index (TOT): An improvement in the terms-of-trade should increase real income as the country's exports are more valuable than its imports. However, according to Edwards (1989), this income effect may be offset by the substitution effect. Thus, an increase in this variable could lead to different outcomes.
- Government consumption (GOV): Higher government consumption on tradable goods should require a real depreciation to retain the external balance of the country, whereas higher government consumption on non-tradable goods should have the opposite effect, since it results in excess demand of these goods (Schröder, 2013).
- Net foreign assets (NFA): An increase in the country's hold of foreign assets should result in an ERER appreciation, since the country can afford running on a trade deficit.
- Foreign direct investments (FDI): If the flows of FDI increases, the effect on the ERER is ambiguous and dependent on whether the investments are made in the tradable or the non-tradable sector.
- Trade policy (θ): Liberalized trade should depreciate the ERER, since a reduction of barriers to trade results in lower prices of tradable goods.
- Exchange rate regime (ω): A controlled exchange rate that is pegged or managed floating could influence the ERER, but the effect is ambiguous and dependent on the fiscal policy practiced by the country.

The empirical model that is hypothesized to determine the RER is assumed to be:

$$RER'_{it} = c_{it} + \beta_1 GDP_{it} + \beta_2 TOT'_{it} + \beta_3 RER'_{it-1} + \beta_4 GOV_{it} + \beta_5 NFA_{it} + \beta_6 FDI_{it} + \beta_7 d\theta_i + \beta_8 d\omega_i + v_{it} \quad (3.1)$$

where prime denotes a logarithmic transformation. It should also be noted that the variables GDP, GOV, NFA and FDI are not transformed into logarithms since these are expressed as a ratio of GDP (in the case of GDP: relative to the U.S). The prefix d indicates a dummy variable and the error term v_{it} is defined as the natural logarithm of ε_{it} and assumed to be stationary with zero mean.

The exchange rate regime variable has earlier not been included in the theoretical framework, but is included here. The reason is that the choice of exchange rate regime is possible to influence the real exchange rate – especially when the country decides to peg its currency. As the currency is not allowed to float freely according to market forces, this will have a short-run effect on the external balance since the central bank must intervene on the open market to retain the value of the currency. Since the sample is relatively small and only stretches over the time period 1970-2007, it is reasonable to include this variable in the estimations to capture any possible effect. Any change of the exchange rate regime will furthermore affect the ERER due to the structural change in monetary policy. For example did Chile experience a large real depreciation of 119 per cent between 1981 and 1987 following the change of exchange rate regime to a crawling peg (Williamson, 1996, p. 15). It should also be noted that the nominal exchange rate is not a part of the model. This is because of the characteristics of nominal variables; they are all homogenous of degree zero which in this case implies that a change in the independent variable (nominal exchange rate) will not change the dependent variable (real exchange rate). Hence is a devaluation offset by increased inflation, which consequently only gives a temporary effect on the RER (Baffes et al, 1999, p. 411). What is more important is, according to Edwards (1988), the adjustment of macroeconomic fundamentals in achieving balance of the RER and this is exactly what the ERER incorporates. Otherwise will a devaluation only affect the external variables in the short run before they return to their previous levels and therefore is the real outcome dependent on the macroeconomic policy adjustment (Edwards, 1988).

3.2. Definition of under- and overvaluation

The definition of an under- or overvalued currency is a complicated matter. The most common example of approximating whether a currency deviates from its equilibrium value is to use the relative or absolute

purchasing power parity (PPP). The absolute PPP theory suggests that, in the long run, the (hypothesis of the) Law of One Price holds and therefore should the RER be equal to one. The Law of One Price proposes that the same good should cost equally much expressed in the same currency all over world (Burda & Wyplosz, 2012, p. 150). The more dynamic relative PPP theory suggests that inflation differences between the home country and abroad will affect the real exchange rate and eventually force the nominal exchange rate to adjust because of the change in competitiveness. If domestic inflation is higher than abroad and the nominal exchange rate remains unchanged, the real exchange rate appreciates which leads to a loss in competitiveness for domestic producers, since their goods and services now is relatively higher than abroad. Since a country must retain its competitiveness in the long run, the following can be stated:

$$\frac{\Delta RER}{RER} = \frac{\Delta N}{N} + (\pi - \pi^*) = 0 \tag{3.2}$$

Hence, the RER should remain constant in the long run (Ibid. p. 149). Using this theory empirically, the nominal exchange rate is divided by the PPP factor (commonly expressed in local currency relative to the U.S. dollar) to adjust for the purchasing power of the country and this ratio is then defined as the ERER. However, since this measure of the ERER depends upon the theory of PPP and thus is highly affected by various adjustment costs (such as inflexibility of labor and transportation costs) – which, as stated by Rogoff (1996), give a buffer within the nominal exchange rate to move without effect on domestic prices – this thesis uses another measure of the ERER. The choice is a matter of taste, but since the purpose of this thesis is to examine the role of the RER during a modernization process, it is not satisfying to use a non-universal approach similar to the PPP which do not include any real variables. I will define the misalignment of the RER with the following expression:

$$mis_{it} = \ln RER_{it} - \ln \widehat{RER}_{it} \tag{3.3}$$

The misalignment is the deviation of the estimated RER (denoted with a hat) from the actual RER. When the variable mis is positive, the RER is overvalued.

3.3. Stationarity and cointegration tests

Before any results can be drawn from the estimation, stability tests must be performed. To determine a long-run relationship between the variables it must first be determined that the variables are cointegrated. For this to be possible, all variables in the model need to be integrated of the same order.

Hence, the Augmented Dickey-Fuller (ADF) test is applied to determine their integration order. All variables in the RER model turn out to be integrated of first order, or I(1), and thus stationary by first differences. Table 1 presents the result.

Table 1: Stationarity test

Chile

Variable:	*Test-stat:*	*Crit. Value (5%):*	*Integrated of order*:*
ln RER	-1.1206	-3.5629	1
GDP	-3.1537	-3.5403	1
ln TOT	-2.0958	-2.9458	1
GOV	-1.6883	-2.9434	1
NFA	-1.1432	-1.9513	1
FDI	-1.9110	-2.9434	1

Brazil

Variable:	*Test-stat:*	*Crit. Value (5%):*	*Integrated of order*:*
ln RER	-1.1829	-2.9434	1
GDP	-3.3059	-3.5443	1
ln TOT	-2.2609	-3.5367	1
GOV	-0.4793	-2.9434	1
NFA	-1.1708	-1.9501	1
FDI	-1.3420	-2.9434	1

Korea

Variable:	*Test-stat:*	*Crit. Value (5%):*	*Integrated of order*:*
ln RER	-2.7257	-3.5366	1
GDP	-1.0401	-3.5367	1
ln TOT	-1.7580	-2.9434	1
GOV	-2.5466	-3.5367	1
NFA	-0.2387	-1.9504	1
FDI	-1.4559	-1.9501	1

Notes: *Integration test of higher orders not included here due to the extensive amount of tables needed. The critical values differ because of the different characteristics of the variables and the lag specification (based on SIC). Time trend and intercept has been included in the test when the variable possesses a time trend and appears to be slow-turning around the trend line. A variable that does not possess a time trend but is slow-turning around a non-zero value has only intercept included. Otherwise has no deterministic components been included in the test.

To determine cointegration between the variables, an ADF test is conducted on the residuals from the estimated relationship in Eq. 3.1. Since the OLS regression minimizes the sum of squares of the residuals when choosing coefficients and the mean of the residuals is by design zero, the time series for the residuals will have a tendency to appear more stationary compared to the error term. Due to this superconsistency property of the residuals, asymptotic critical values must be used (Dougherty, 2011, p.506). The critical values are retrieved from MacKinnon (2010) and the result is shown below.

Table 2: ADF unit root test

Null of no cointegration	τ-stat.	Critical val.
Brazil	-5.6400	-5.467
Chile	-6.2851	-5.467
Korea	-5.7583	-5.467

The test indicates cointegration between the variables for all countries since the $|\tau$-statistic$| > |$critical value$|$.

3.4. Estimation results

The estimation results from Eq. 3.1 are presented in Table 3 and determine the long-run cointegration relationship between the RER and the macroeconomic fundamentals that constitutes the ERER. Following the expected results, the coefficients in general perform as predicted. Although only statistically significant for Chile, the effect of an increase in the terms-of-trade index yields large effects on the RER. Since this is assumed to be one of the key fundamentals in the determination of the RER, the results are not surprising. Thus in the case of Chile, a 10 per cent increase in this variable appreciates the RER with 9.2 per cent.

The results for the dummy variables that adjust for the exchange rate regime are interesting. For all countries are these variables more or less significant and shows that in the presence of an active exchange rate policy, the RER will tend to have a higher value than when the exchange rate floats freely according to market forces. The high and positive effect of the exchange rate regime on the RER, and especially with a pegged currency, is possibly due to the fact that the fiscal and monetary policy has not been consistent with the exchange rate regime. To illustrate this, the case of Brazil is striking. Its debt led growth in the late 1960s and early 1970s, governed by low nominal interest rates but influenced by an overvalued RER, which yielded low export earnings, was not sustainable (Bulmer-Thomas, 2003, p. 350). Following the second oil crisis (OPEC II) in 1979, the situation became untenable and a debt crisis commenced (Ibid.). While obtaining a pegged currency above its market level during this period, Brazil thus seem to have caused imbalance between the macroeconomic policies and the exchange rate regime, which was unsustainable in any other time horizon than the short run. The difference between Chile and Brazil in this aspect is apparent. The debt crisis that hit Latin America in the 1970s forced the countries to cut imports and increase exports quickly while reducing aggregate demand to adjust for the import substitution (Bulmer-Thomas, 1994, p. 387). In Brazil, the public sector suffered from large

external debts while the majority of the trade surplus went to the private sector and thus the need for internal transfers to the public sector was urgent in order to restrain the rising debt. This was however a complicated process that required aggregate demand to fall fast in order to restrain increasing inflation, a fact that Brazil was not able to implement (Ibid.). Chile experienced a similar development, but not as severe due to high export earnings. The claim of a pegged currency during this period might have been one of the factors to macroeconomic imbalance as the internal adjustment process would have been easier with a lower RER and thus higher export earnings. This discussion might be considered to be somewhat superfluous, but it illustrates an example of when policy makers are actively pursuing an exchange rate policy that affects the whole economy and thus the ERER. This will have implications when considering the relationship between the misalignment of the RER and capitalist sector employment.

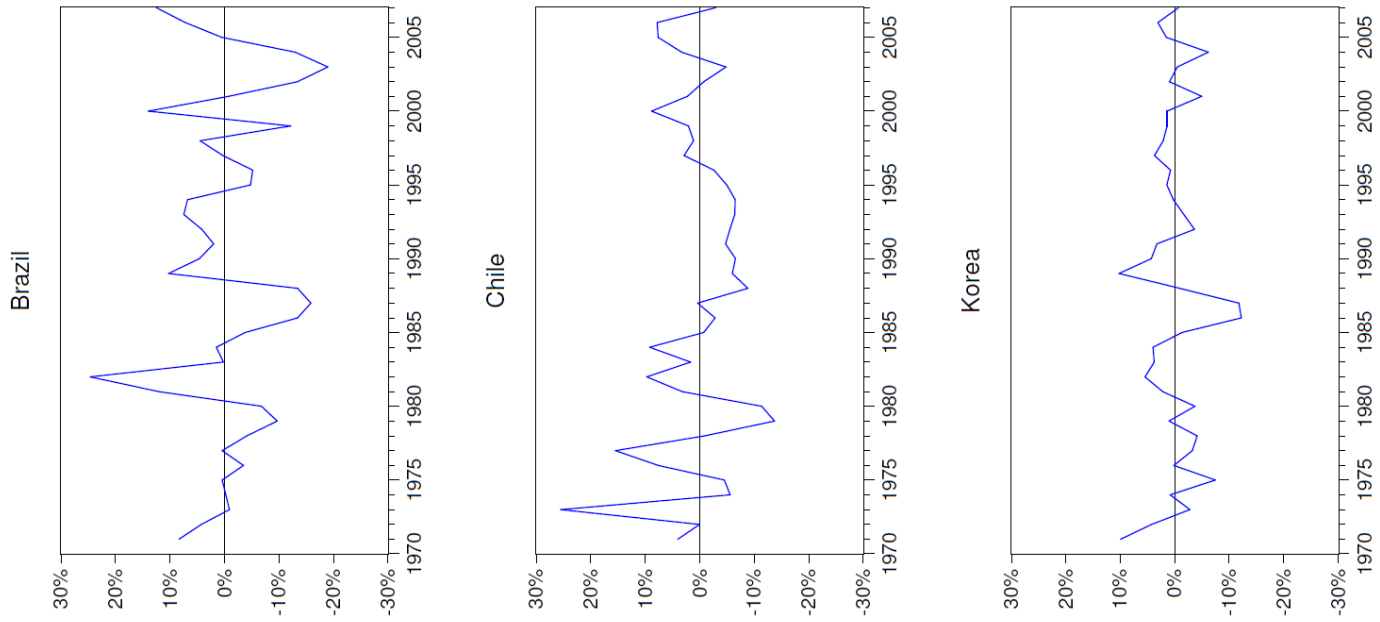
Table 3: Real exchange rate estimation

Country:	**CHILE**	**BRAZIL**	**KOREA**
Sample (adj.)	1971-2007		
Dep. Var:	RER'_{it}		
c_i	-0.0446	0.9232	1.5756
	(0.7094)	(0.6378)	(0.2253)***
GDP_t	1.6710	2.2097	0.2253
	(1.1057)	(1.7574)	(0.1865)
GOV_t	-0.0545	4.2169	1.8065
	(0.0882)**	(1.0363)***	(1.9902)
NFA_t	0.0729	0.1982	0.0142
	(0.1557)	(0.1662)	(0.3432)
TOT'_t	0.9193	-0.0679	-0.5567
	(0.3769)**	(1.4078)	(0.3662)
$d\theta_t$	0.2512	-0.0466	
	(0.1279)*	(0.0907)	
RER'_{t-1}	0.8732	0.5306	0.5651
	(0.1125)***	(0.1209)***	(0.1348)***
FDI_t	-1.6810	-4.3314	5.3924
	(1.3106)	(1.8631)**	(2.5413)**
$Outliers$			-0.2397
			(0.0425)***
$Pegged\ currency$	0.2430	0.1909	0.2171
	(0.0917)**	(0.1467)	(0.0660)***
$Managed\ floating\ currency$	0.1102	0.1210	0.1373
	(0.0304)*	(0.0693)*	(0.0409)***
Observations:	37	37	37
R-squared:	0.9579	0.8215	0.7793
Adj. R-squared:	0.9417	0.7620	0.7058

Notes: Standard errors in parentheses. ***, **, *, denotes statistical significance at 1%, 5% and 10% level respectively. Prime denotes a logarithmic transformation. The variable "Outliers" is a dummy variable that corrects for outliers, details are found in Appendix. The variables "Pegged currency" and "Managed floating currency" are part of the $d\theta$ (exchange rate regime dummy) variable.

Moving from the estimation results for the ERER, the misalignment of the RER can now be calculated. Figure 2 shows the results that are fairly consistent with the general opinion, for example that the Korean *won* was undervalued during the Korean government's export-oriented strategy in the early 1970s (Lee, 1997). According to the estimations, Brazil entered the 1970s with an overvalued RER but it then fell and moved in balance with the equilibrium level until the aftermath of OPEC II. The result here may seem inconsistent with the discussion regarding Brazil's import-led policy, but one must note that Brazil was able to sustain a high debt-export ratio because of a low nominal interest rate compared to the world market interest rate for at least ten years, and not encounter any growth problems (Bulmer-Thomas, 2003, p. 351). However, this would require a future large trade surplus to sustain the external balance of the country (that is: to service its debt), a fact that would involve a RER depreciation, *ceteris paribus*. In other words should the RER move below its equilibrium level to finance its foreign liabilities until the debt situation become sustainable again.

Figure 2: Real exchange rate misalignment, 1971-2007



4. Empirical analysis of economic modernization

4.1. The relationship between capitalist sector employment and the misalignment of the RER

The Lewis-Ranis-Fei model assumes a dual-sector economy and before the empirical analysis is presented, it is necessary to elucidate the limitation. The capitalist sector includes subsectors that generally are presumed to characterize a modern economy, whereas the subsistent sector includes sectors that fit into the assumptions of low-productive and over-employed in an underdeveloped economy. The division into these sectors should be viewed at a pre-developing level, since productivity in both sectors, according to the Lewis-Ranis-Fei model, coincidentally rises with economic development.

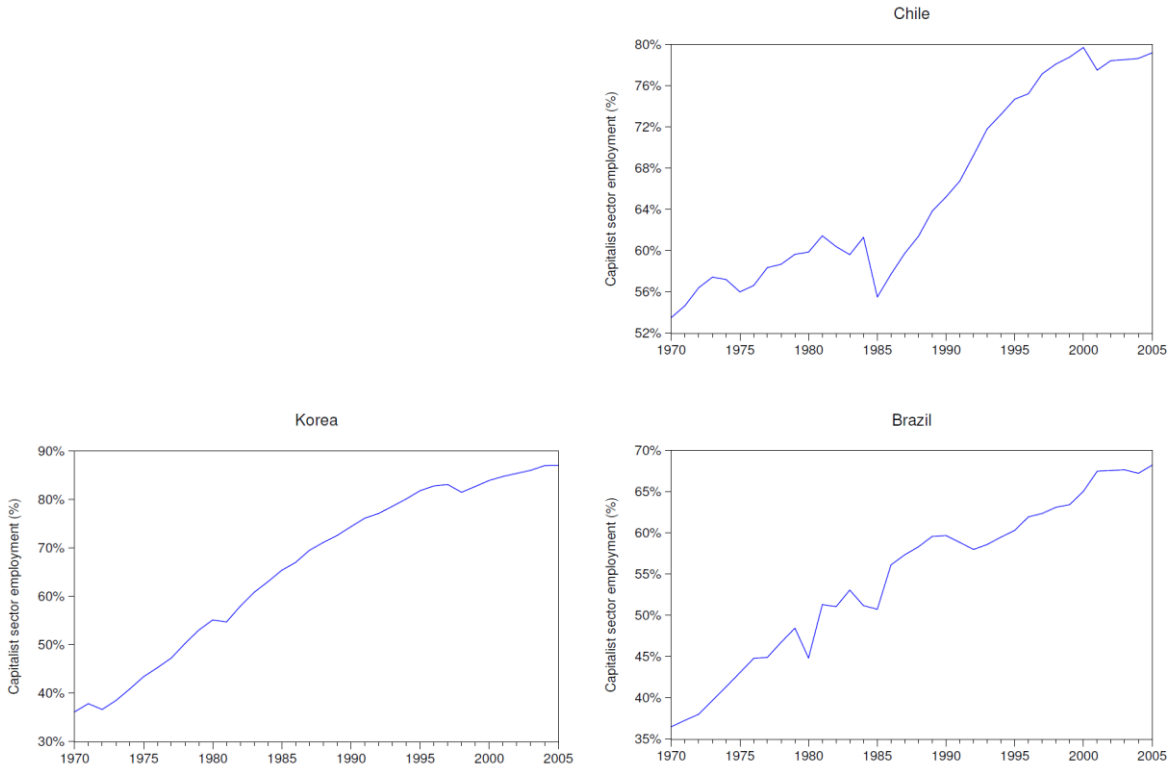
Table 4: Definition of capitalist and subsistent sector

Capitalist sector	**Subsistent sector**
Manufacturing	Agriculture, Forestry and Fishing
Finance, Insurance and Real estate	Mining and Quarrying
Wholesale and Retail Trade, Hotels and Restaurants	

Notes: Data on productivity and employment are collected from the GGDC dataset. More information is found under the title "Data description" in the Appendix.

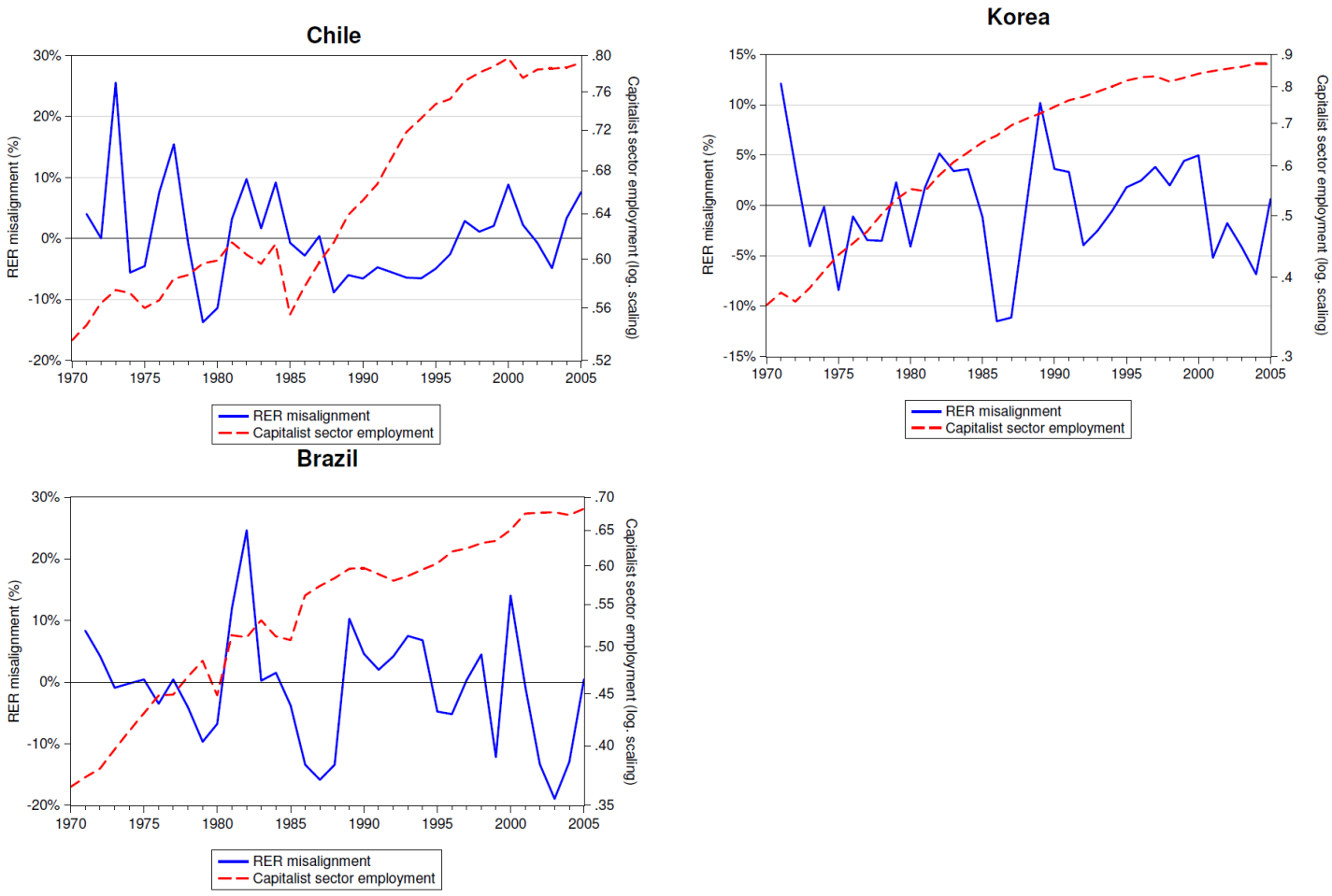
Since the reallocation of labor from the subsistent sector to the capitalist sector is the central part of the Lewis-Ranis-Fei model, the variable of interest in this thesis is the relative share of employment in the capitalist sector to the subsistent sector, hereinafter denoted as capitalist sector employment. Figure 3 shows the upward trend that the three countries under study – Chile, Brazil and Korea – have experienced since 1970.

Figure 3: Capitalist sector employment, 1970-2005



To connect this figure with the hypothesis that the RER influences on the development, Figure 3 and Figure 4 illustrate the estimated misalignment of the RER and the capitalist sector employment and the annual growth of employment in the capitalist sector respectively. During the period 1985-1996, the Chilean *peso* is estimated to have been undervalued and simultaneously did the capitalist sector enjoy a large growth in employment. Chile experienced a large real depreciation between 1981 and 1987 and in collaboration with an average tariff reduction from 36 per cent to 11.97 per cent between 1985 and 1992, which is shown to lead to a real depreciation, it appears that the ERER could sustain undervaluation for a long time (Li, 2004). Brazil on the other hand struggled in the early 1990s due to high inflation rates and focused on exchange rate stability after the introduction of the new *real* in 1994 instead of focus on macroeconomic policy variables (Loser, 2008, p. 32). The implications included swelling debt, external imbalances and public sector deficits which eventually switched the focus to public finances (Ibid.).

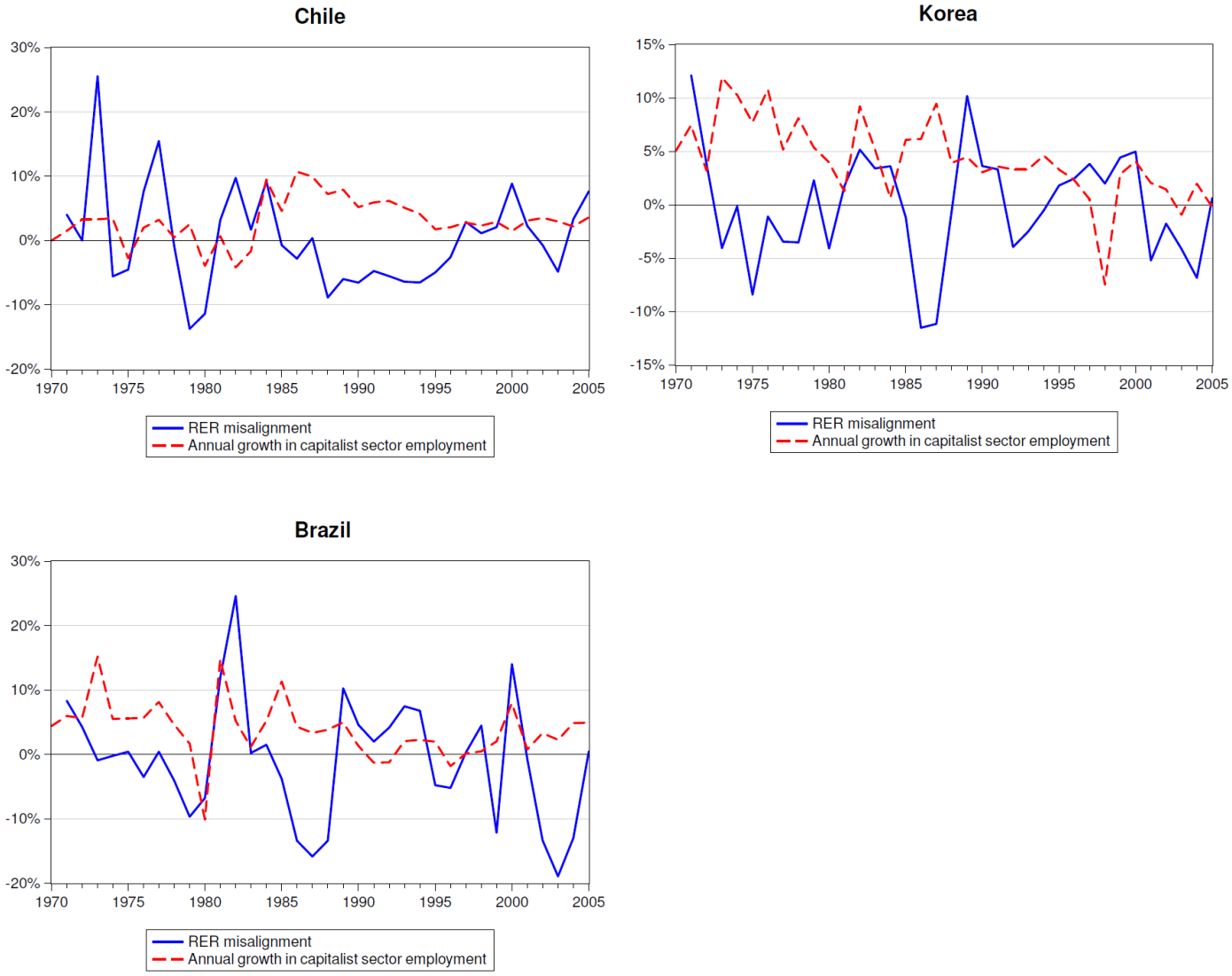
Figure 4: Real exchange rate misalignment and capitalist sector employment, 1970-2005



It is possible that this macroeconomic misalignment not only had a negative effect on the stability of the ERER, but most likely also on investment decisions and ultimately on the growth rate of the country. The incentives to reallocate labor to the capitalist sector of the economy are possible to be discouraged during periods with macroeconomic imbalance. With volatile misalignments of the RER, the tradable sector suffers on behalf of the non-tradable sector and, as Eichengreen (2007) argues, this is fueled by lobbying and political pressure from the non-tradable sector that wishes protectionist policies. If the RER is equal to its equilibrium level it is more likely that resources will flow to the tradable sector and hence facilitate absorption to this sector (Eichengreen, 2007). It is important to notice that if for example the mining sector in Chile is assumed to turn into a tradable sector during the development process, and it is reasonable to assume that the expansion of this sector facilitates the capitalist sector according to the Lewis-Ranis-Fei model, then the RER will act as a bottleneck towards reallocation to the capitalist sector as well as to the mining sector, despite the latter being defined as subsistent. Building the analysis on Figure 4, it appears that the connection is true. To make it even more visible, the relationship between

the RER misalignment and the annual growth of (absolute) employment in the capitalist sector is drawn in Figure 5. As earlier discussed was the rapid growth in employment of the capitalist sector during the mid-1980s to the mid-1990s in Chile characterized by a period of constant undervaluation. During periods of more volatile RER misalignment, the growth was not as high and even negative during some very volatile periods in the 1970s. Considering Brazil is the connection not as evident but throughout the 1970s it appears that the balanced RER might have fueled employment growth and *a contrario* during a period of overvaluation in the first half of the 1990s. A similar condition seems to apply in the case of Korea.

Figure 5: RER misalignment and annual growth of capitalist sector employment, 1970-2005



4.2. Capitalist sector employment regression

A connection appears to exist between the misalignment of the RER and the capitalist sector employment when looking at Figure 4 and Figure 5. To ascertain whether this is true, a model must be established that describes the factors affecting capitalist sector employment and determine if the RER really has an effect on the employment. It is assumed that the capitalist sector employment is determined by the following variables:

- Marginal productivity of labor in the subsistent sector (MPL^{sub}): According to Ranis & Fei (1961) should increased productivity of labor in the subsistent sector have a positive effect on capitalist sector employment.
- Marginal productivity of labor in the capitalist sector relative the world (MPL^{*}): Increased international competitiveness should have a positive effect on capitalist sector employment as domestic goods and services become more demanded on the world market.
- Foreign direct investments (FDI): Increased foreign direct investments should increase capitalist sector employment, if the investments are made in the capitalist sector. The effect is thus ambiguous.
- The misalignment of the RER (mis)
- Financial crisis (ρ): If the country experiences a financial crisis this is assumed to have a negative effect on capitalist sector employment.
- Trade policy (θ): Openness to trade should increase capitalist sector employment since the possibility of absorbing capital from abroad increases.

Since it is reasonable that the lagged values of the explanatory variables may impact on the actual period's value of capitalist sector employment, these are included in the unrestricted model to capture any stickiness of the changes. For example, increased investment in a domestic sector from a foreign enterprise may take time to incorporate before it has an effect on the employment. I include three lags to capture these effects that thus mean that the value of the explanatory variables three years ago and forward is assumed to have an impact today on the dependent variable.

The following model with capitalist sector employment as dependent variable is estimated:

$$y'_{it} = c_i + \sum_{j=0}^{3} \beta_{ij} X'_{it-j} + \sum_{j=1}^{3} \delta_{ij} y'_{it-j} + \sum_{j=0}^{3} \gamma_{ij} W_{it-j} + \beta_{12} d\rho_{it} + \beta_{13} d\theta_{it} + \\ + \beta_{14}(1/\psi) + v_{it} \tag{4.1}$$

where prime denotes a logarithmic transformation and the variables in vector $X' = \{\ln MPL^{sub}, \ln MPL^{*}\}$ and in vector $W = \{FDI, mis\}$. Since the dependent variable possesses a deterministic trend, that is, a time trend needs to be included in the regression to adjust for the growth over time, the variable $1/\psi$ is included (see details below).

Figure 6: Time trend

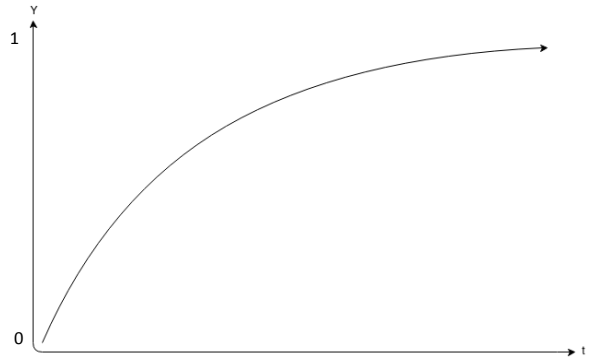


Figure 6 shows the time trend that is included in the model to adjust for the growth over time that the capitalist sector employment variable reflects for all three countries in Figure 3. Since capitalist sector employment is a ratio that takes a value between 0 and 1, the time trend cannot be linear and hence must the relationship follow a different trend, in this case is the fitting trend similar to Figure 6 and consequently is the variable $1/\psi$ included in the model.

Since several lags are included as explanatory variables in the model and the number of observations is low, the model becomes quite unstable because the degrees-of-freedom are reduced. Hence, the parameter estimations are limited to vary from a constrained set from where the sample is drawn, and it would be more satisfying if the number of observations was higher since this would lead to more precise estimates. Since there are no more observations to obtain, a reduced model is also estimated using the general-to-specific approach and hence with more degrees-of-freedom available. The general-to-specific approach builds upon the fact that including too many explanatory variables in a model may cause an

over fitting of the model (Dougherty, 2011, p. 457ff). Hence, the general model may not correspond to the true model and if the insignificant variables are removed, the model may be a better fit. There are some problems concerning this approach that also should be noted, with the most obvious due to the arbitrary decisions by the researcher regarding which variables to drop. In this case, I dropped the insignificant variables for each period and then continued the process until only significant variables were left. I cross-checked if any variables despite this process should be included in the reduced model and then reached the final specification. The general model for each country is found in the left column and the reduced model in the right column of Table 5. The Schwarz information criterion statistics (SBIC) indicate that the reduced models are of similar good specification as the general models. The SBIC adds a penalty term for including additional parameters and thus signal if the model specification is subject to information loss. If the statistic would have been obviously higher, this would indicate a bad specification with the need of including additional explanatory variables (Dougherty, 2011, p. 500).

Table 5: Capitalist sector employment estimation

Country:	**CHILE**		**BRAZIL**		**KOREA**	
Sample (adj.):	1974-2005		1974-2005		1974-2005	1972-2005
Dep. Var:	y'_{it}					
	Model 1	*Model 2*	*Model 1*	*Model 2*	*Model 1*	*Model 2*
c_i	-0.7623	-0.6719	-0.5902	-0.6925	0.6684	0.4183
	(0.2207)***	(0.1338)***	(0.4542)	(0.1009)***		(0.0674)***
$MPL'^{sub}{}_{t-1}$	0.1607		-0.0168		0.0122	
	(0.0865)*		(0.0698)		(0.0317)	
$MPL'^{sub}{}_{t-2}$	0.0964	0.1593	0.1445	0.2007	-0.0426	-0.0184
	(0.0694)	(0.0430)***	(0.0708)*	(0.0392)***	(0.0416)	(0.0057)***
$MPL'^{sub}{}_{t-3}$	-0.2308	-0.1569	0.0379		-0.0015	
	(0.0731)**	(0.0414)***	(0.1071)		(0.0306)	
$MPL'^{*}{}_{t}$	0.0376		-0.1239		0.0334	
	(0.0345)		(0.1114)		(0.0830)	
$MPL'^{*}{}_{t-1}$	-0.3276	-0.2707	-0.1526	-0.2741	0.1154	
	(0.0538)***	(0.0356)***	(0.1165)	(0.0654)***	(0.0967)	
$MPL'^{*}{}_{t-2}$	0.2457	0.2132	-0.0432		-0.0974	
	(0.0392)***	(0.0317)***	(0.2314)		(0.0787)	
$MPL'^{*}{}_{t-3}$	-0.1685	-0.1393	0.4300	0.3801	0.1013	
	(0.0338)***	(0.0256)***	(0.2481)	(0.1021)***	(0.0663)	
y'_{t-1}	-0.3539		-0.3146		0.2858	0.3940
	(0.2532)		(0.3428)		(0.3198)	(0.0895)***
y'_{t-2}	0.2408		-0.4129	-0.3947	0.0992	
	(0.1762)		(0.1828)**	(0.0878)***	(0.2862)	

[Table 5 continued]

y'_{t-3}	0.8645	0.9631	-0.0570		0.0083	
	(0.2542)***	(0.0739)***	(0.1995)		(0.2057)	
FDI_t	0.3864	0.4069	-0.9546	-1.0792	-1.7494	-1.1571
	(0.1852)*	(0.1427)**	(1.0271)	(0.2800)***	(1.4323)	(0.5840)*
FDI_{t-1}	0.5377	0.9162	0.0673		0.1021	
	(0.2869)*	(0.1768)***	(1.1552)		(1.7745)	
FDI_{t-2}	-0.0746		0.2019		-0.7708	
	(0.1695)		(1.3593)		(1.9868)	
FDI_{t-3}	0.1539		-0.0047		-1.0455	
	(0.1657)		(1.1413)		(1.7360)	
mis_t	-0.4913	-0.5018	-0.0969		-0.0242	
	(0.1322)***	(0.0615)***	(0.1280)		(0.0632)	
mis_{t-1}	-0.1070	-0.1496	-0.0268		0.0441	
	(0.0504)*	(0.0369)***	(0.0556)		(0.0864)	
mis_{t-2}	-0.2918	-0.2745	-0.0328		0.0385	
	(0.0748)***	(0.0370)***	(0.0740)		(0.0782)	
mis_{t-3}	-0.4394	-0.4655	-0.1018	-0.0460	0.0546	
	(0.1007)***	(0.0559)***	(0.0646)*	(0.0193)**	(0.0653)	
$d\theta_t$	0.0351	0.0564	-0.0150	-0.0310		
	(0.0203)	(0.0164)***	(0.0291)	(0.0100)***		
$d\rho_t$	-0.0093	-0.0240	-0.0006		0.0125	0.0083
	(0.0106)	(0.0071)***	(0.0269)		(0.0091)	(0.0046)*
$Time\ trend$	7.7369	11.4719	-32.7181	-24.3710	-21.0029	-21.3065
	(3.5948)*	(2.1627)***	(7.001)***	(1.9112)***	(10.6434)*	(3.3093)***
Observations:	32	32	32	32	32	34
R-squared:	0.9977	0.9960	0.9938	0.9895	0.9989	0.9981
Adj. R-squared:	0.9928	0.9923	0.9807	0.9858	0.9989	0.9978
Schwartz criterion:	-4.9397	-5.0569	-3.7147	-4.5887	-4.6944	-5.5008

Notes: Standard errors in parentheses. ***, **, *, denotes statistical significance at 1%, 5% and 10% level respectively.
Prime denotes a logarithmic transformation.

Standard errors for Brazil are adjusted for autocorrelation (HAC standard errors).

Diagnostics checks for the estimations includes test for heteroskedasticity and autocorrelation, the latter suffering the model specifications of Brazil. This suggests that additional lags should be included, but due to the already extensive amount of lags and the limited number of degrees-of-freedom available, this is disregarded and to deal with the inference of the standard errors, the model is estimated with robust (HAC Newey-West) standard errors. To determine cointegration for the variables in the general model, an Engle-Granger cointegration test is performed. The result is displayed in Table 6 in the Appendix and indicates that the null hypothesis of no cointegration cannot be rejected for Korea. Thus, the model is subject to a spurious regression and hence can no relationship between the variables in the long run be

determined. The results for Korea in Table 5 are of no meaning and no significant conclusion can therefore be made.

The misalignment of the RER has a significantly negative effect on the employment in the capitalist sector in Chile and Brazil. This is expected and indicate that when the variable increases with one unit (that is, one percentage point in this case), employment in the capitalist sector decreases. The effect is very large and highly significant in the estimations for Chile, but for Brazil the effect is small and only significant when lagged three periods. The estimation for Chile suggests that an increase in the RER misalignment variable with one unit decreases capitalist sector employment by 5.4 percentage points in the long run[1].

Some further interesting results can be derived from Table 5. The capitalist sector employment in Chile is negatively affected by an increase in its competitiveness compared to U.S. productivity in the capitalist sector. The long-run effect is approximately an 8.5 per cent decrease when the competitiveness increases with 10 per cent. In the case of Brazil, this effect is positive and a 10 per cent increase results in a 0.6 per cent increase in capitalist sector employment. The intuitive hypothesis is that the effect should be positive but the results vastly differ. One answer to the peculiar results could be that Chile is a country abundant in natural resources. McMillan & Rodrik (2011) discussed that the growth in productivity due to structural change is negatively affected when a country is abundant in natural resources, which gives incentives to specialization in the sectors that intensively use these resources. Chile has a large mining sector due to its abundance in different metals and this sector is supposed to be one of the subsistent sectors in my model. Increased capitalist sector competitiveness may then give incentives to reallocate the gains to the sectors where the country has a comparative advantage. This would give an answer to the peculiar results from the estimation. Another explanation could be due to frictions on the labor market that raise costs for employers in the capitalist sector to hire the necessary labor. Education, at least in the short run, is also possible to play a role.

The notion that increased productivity in the subsistent sector is an important factor to capitalist sector labor reallocation, as denoted by Ranis & Fei (1961), can also be observed from Table 5. The effect of increased subsistent sector productivity in Brazil increases the capitalist sector employment significantly. The results are surprisingly not as clear when looking at the estimations for Chile and the effect is small. Since investments in the subsistent sector in Chile and especially the mining sector have increased,

[1] The long-run effect on the dependent variable $\bar{Y} = \frac{\beta_1+\beta_2+\cdots+\beta_n}{1-(\gamma_1+\gamma_2+\cdots+\gamma_n)}\bar{X}$ where β is the point estimates of the explanatory variable and γ is the point estimates of the lagged dependent variable (Dougherty, 2011, p. 403).

productivity has almost five-folded in the subsistent sector since 1970. The specialization in the mining industry generates jobs and income and should, in theory, influence capitalist sector employment due to increased retail trade and demand for financial services. This should generate increased capitalist sector employment, but the estimations suggest that other factors are more essential. Indeed does Ranis & Fei (1961) state that the subsistent sector does not on its own contribute to the investments made in the economy but this builds on the assumptions of a closed economy and that subsistent sector output is just sufficient to meet the consumption requirements of the workers. The subsistent sector in Chile stands for the majority of the exports from the country and thus is the theory inadequate in explaining the results. The specialization argument may though make sense here and it is possible that there is reverse causality involved. The strong development of the capitalist sector may presumably be due to the specialization in the subsistent sector and expansion of the same. The capitalist sector employment is the share of employment relative to the subsistent sector and thus gives the almost negligible net effect that the estimations suggest some proof that the specialization and increased subsistent productivity not alters the employment in either direction; the employment ratio remains unchanged. If the subsistent sector really is the pioneer to further development it is plausible that a facilitation of the capitalist sector will positively influence the productivity in the subsistent sector. Hence is the development of the capitalist sector a necessary condition for the subsistent sector to grow; if the services that the capitalist sector supplies are not available, then the subsistent sector cannot grow.

This argumentation highlights what Ranis & Fei (1961) put emphasis on when they discuss the commercialization of the subsistent sector. But if resources flow to the subsistent sector after its commercialization due to specialization and this development is facilitated by the capitalist sector services, then the growth of the capitalist sector is a pre-requisite for the subsistent sector to grow. The capitalist sector may oil the wheels for further growth of the subsistent sector, but could be influenced by other factors than increased subsistent productivity. Nevertheless, the estimation only tells us whether an increase in subsistent productivity, *ceteris paribus*, has an effect on the capitalist sector employment. On the contrary is it possible that increased capitalist sector employment will have a positive effect on subsistent productivity. This would mean that the growth of the two sectors goes hand in hand, but more important that if the capitalist sector cannot provide the services needed for the subsistent sector to grow, then growth for the whole economy will stagnate.

The estimates of FDI also give ambiguous results that could be due to different economic structures. The estimations suggest positive effects on capitalist sector employment for Chile and negative effects for

Brazil. Comparing the data on industry level FDI, both countries have had large inward FDI flows in the 'Mining and quarrying' sector; Chile because of the abundance in metals and Brazil because of petroleum resources. Chile and Brazil have also had large inflows in the service sectors during the last 20 years and the majority of FDI has been to these sectors (UNCTAD, 2004; Hiratuka, 2008). The results differ and one possible explanation is that the increased competition that occurred for Brazilian firms has led to scale losses that in turn lower marginal productivity in these firms. If the low-productive firms are able to stay on the market instead of being forced a market exit, the increase in FDI inflows could have had a negative effect on capitalist sector employment. After all, the high-productive national firms that directly are competing with foreign firms on the domestic market may experience a loss of scale due to the inflows of FDI and therefore a decline in profits. It is possible that the gains have been seized by low-productive firms instead. Hiratuka (2008) points to this possibility and hence would this mean that positive productivity spillovers from foreign firms have not been absorbed by the high-productive firms as you would expect. The full answer to this question is beyond the scope of this thesis, but this might be a reasonable explanation.

4.3. Estimating the effects of undervaluation and overvaluation

Earlier it was introduced that volatile misalignments of the RER could have a negative impact on capitalist sector employment. But the question remains whether undervaluation promotes reallocation of labor to the capitalist sector or if misalignments in either direction from the equilibrium level of the RER discourage the reallocation. To answer this, additional regressions have been made with interaction variables for under- or overvaluation. The interaction variable $Undervaluation$ takes the value zero when the variable mis is positive and takes the negative value of mis otherwise. Vice versa for the variable $Overvaluation$. If the point estimates of *both* variables are negative, this supports the notion that RER undervaluation (RER overvaluation) has a positive (negative) effect on capitalist sector employment[2]. Hence can the effect of the RER misalignment be illustrated and determine which effect that originates from either an undervaluation or an overvaluation; effects that could not be determined when looking at the mis variable since it only explains what the effect will be when the variable increases with one – not whether it concerns under- or overvaluation. Table 6 shows the estimations with a general model in the left column and a reduced model in the right.

[2] Since the variable $Undervaluation \leq 0$ and the regressions only tells us the effect on the dependent variable when $Undervaluation$ increases with one, a negative point estimate would mean that a *less* undervalued RER has a negative effect on the dependent variable.

The results for Chile give support for the fact that undervaluation fosters capitalist sector employment and that overvaluation harms it. The positive effect of an undervaluation is also significant in the reduced model estimations for Brazil, but the interaction variables for overvaluation are not significant from zero in this case. This suggests that during periods of overvaluation in Brazil, this has not affected capitalist sector employment and there is not any support for the hypothesis that overvaluation has had a negative effect on the employment in this sector. The other variables in the regression perform similar as in earlier regressions, with no large differences in the net effect.

The fact that Chile experienced large structural change in employment during a period with significant undervaluation of its currency points to the possibility that this facilitated the aforementioned development. However, this is no evidence that the development actually depends upon the undervaluation. The estimations that has been presented points to the fact that, during the sample period, undervaluation has had a *positive* effect on capitalist sector employment. To retain the currency under its equilibrium level and reduce volatile misalignments will be the most optimal policy in order to modernize the economy. The RER is expected to be a determinant factor but other factors are important as well. The financial sector expansion with a strong banking system in the front position is likely to play a large role and Chile was a pioneer in Latin America regarding this development, whereas Brazil acted later (Smith et al., 2008, p. 81). It is feasible that when the financial infrastructure is sound, with well-working markets and instruments to lower risk available, the volatility of the RER will be lower. If economic actors are able to hedge themselves towards the risk that originates from a volatile RER, there is a possibility that long term investments in the tradable sector are more encouraged than when there exists a risk of large fluctuations. The circular connection between these factors would then generate a more stable RER, and furthermore when considering the analysis stating that the macroeconomic performance not only influences, but decides, the RER. Nevertheless gives the results a hint that RER misalignment may act as a bottleneck towards the adjustment to “modern” production but moreover that an undervaluation could foster the development.

Table 6: Estimations on the effect of under- and overvaluation

Country:	**CHILE**		**BRAZIL**	
Sample (adj.):	1974-2005		1974-2005	
Dep. Var:	y'_{it}			
	Model 1	*Model 2*	*Model 1*	*Model 2*
c_i	-0.3753	-0.0407	0.6651	-0.6907
	(0.4498)	(0.0856)	(0.9350)	(0.918)***
$MPL'^{sub}{}_{t-1}$	0.1344	0.1177	0.0392	
	(0.1328)	(0.0272)***	(0.2321)	
$MPL'^{sub}{}_{t-2}$	-0.0069		0.1586	0.2000
	(0.1197)		(0.1064)	(0.0372)***
$MPL'^{sub}{}_{t-3}$	-0.1323	-0.1417	0.0375	
	(0.1178)	(0.0238)***	(0.1112)	
$MPL'^{*}{}_{t}$	0.0318	0.0774	-0.1313	
	(0.0439)	(0.0225)***	(0.1676)	
$MPL'^{*}{}_{t-1}$	-0.2277	-0.1980	-0.1069	-0.2684
	(0.1112)*	(0.0311)***	(0.2243)	(0.0602)***
$MPL'^{*}{}_{t-2}$	0.2318	0.2394	-0.1212	
	(0.0505)***	(0.0314)***	(0.2427)	
$MPL'^{*}{}_{t-3}$	-0.1879	-0.2060	0.5951	0.4227
	(0.0428)***	(0.0222)***	(0.3072)*	(0.0943)***
y'_{t-1}	0.0106		-0.3221	
	(0.4948)		(0.5117)	
y'_{t-2}	0.4250	0.5003	-0.3881	-0.3963
	(0.2482)	(0.1017)***	(0.3317)	(0.0746)***
y'_{t-3}	0.5186	0.3713	-0.2782	
	(0.4246)	(0.1137)***	(0.3314)	
FDI_t	0.0920		-1.3165	-0.8877
	(0.3825)		(1.1194)	(0.2618)***
FDI_{t-1}	0.1283		0.5040	
	(0.5249)		(1.6382)	
FDI_{t-2}	-0.0681		0.1359	
	(0.2295)		(2.9380)	
FDI_{t-3}	0.0968		-0.4346	
	(0.2152)		(2.2315)	
$Undervaluation_t$	-0.3675	-0.2940	-0.1982	-0.1007
	(0.2526)	(0.0731)**	(0.2928)	(0.0346)***
$Undervaluation_{t-1}$	0.0393		0.2741	
	(0.1875)		(0.2846)	
$Undervaluation_{t-2}$	-0.1167		-0.2328	-0.1196
	(0.2946)		(0.3852)	(0.0418)***
$Undervaluation_{t-3}$	-0.0632		-0.0331	
	(0.3362)		(0.2533)	
$Overvaluation_t$	-0.2486		0.0253	
	(0.3449)		(0.3473)	

[Table 6 continued]

Country:	**CHILE**		**BRAZIL**	
Sample (adj.):	1974-2005		1974-2005	
Dep. Var:	y'_{it}			
	Model 1	*Model 2*	*Model 1*	*Model 2*
$Overvaluation_{t-1}$	-0.1556		-0.1960	
	(0.2377)		(0.2824)	
$Overvaluation_{t-2}$	-0.3104	-0.1921	0.0807	
	(0.1809)	(0.0431)***	(0.4320)	
$Overvaluation_{t-3}$	-0.4249	-0.2677	-0.1216	
	(0.1590)**	(0.0450)***	(0.1970)	
$d\theta_t$	0.0344		0.0028	
	(0.0278)		(0.0474)	
$d\rho_t$	-0.0030		-0.0556	
	(0.0168)		(0.0622)	
$Time\ trend$	5.6258	-1.0258	-35.2228	-22.7408
	(6.2018)	(0.9145)	(12.5683)***	(1.2800)***
Observations:	32	32	32	32
R-squared:	0.9982	0.9965	0.9938	0.9913
Adj. R-squared:	0.9906	0.9943	0.9807	0.9885
Schwartz criterion:	-4.7544	-5.4993	-3.7147	-4.6871

Notes: Standard errors in parentheses. ***, **, * denotes statistical significance at 1%, 5% and 10% level respectively. Prime denotes a logarithmic transformation. Standard errors for Brazil are adjusted for autocorrelation (HAC standard errors).

5. Conclusion

The results in this thesis indicate that in a dual-sector model, the RER is a significant driver of economic development and that an undervaluation of the RER fosters the adjustment to a modern economy. Furthermore that an overvaluation hampers the development and the results also give some support for the notion that volatile misalignments of the RER have a negative effect on the adjustment. The reason is that when the RER misalignment is volatile, the tradable sector of the economy suffers on behalf of the non-tradable sector which inevitably has a negative effect on the labor reallocation to the tradable sector. In Chile, the persistent undervaluation during a period in the 1990s has had a large positive effect on the growth in employment of the capitalist sector. The estimations suggest that the Brazilian capitalist sector has experienced a similar injection from an undervalued RER. However, in the case of Korea, no cointegration between the variables could be determined and thus no significant conclusion be made regarding those estimations.

Established on the results, policy makers should thus focus on achieving internal and external balance to reduce volatile misalignments, but to retain the RER under its equilibrium level may give a boost to the

capitalist sector and fuel reallocation to this sector. In order to achieve this, it is important with a fiscal policy that is in balance with the exchange rate regime and that public finances are sound. Lessons from Brazil indicate that it is not possible, in the long run, to have a high debt-export ratio and an overvalued RER to finance a large amount of imports. For developing countries, an undervalued RER could encourage a "big push" towards modernization and foster the absorption of labor to the modern sectors of the economy. For example will a country like China, with millions of people in the agricultural sector, be likely to gain from an undervaluation in this aspect. When practicing an export-led economic policy, the contribution of an undervalued currency is possible to promote an optimal allocation of resources that could enhance growth and the results also indicate that an overvaluation would depress such a development.

The results are consistent with the study by Rodrik (2008) who claimed that undervaluation fostered growth and that overvaluation harmed it. However, the result is inconsistent with the recent study by Schröder (2013) that indicated that misalignments in either direction harmed growth. Future research on this subject should involve additional countries under study, longer time periods and more advanced methods to give a comprehensive picture of which role the RER plays in the modernization process of a country. However, the use of Lewis' theory and especially a departure from the neo-classical assumptions to economic development is desirable to capture additional dynamics to this process that get lost in a static neo-classical analysis with the closed economy in focus.

The importance of technology improvements, organizational structures and the need of well-functioning institutions are some factors that have not been discussed in this thesis. It is most likely that these factors are among the most important when considering long run development and it is important to remark this. Macroeconomic indicators as the RER are possible to play some role when concerning the short and medium run, but if a country is to sustain permanent development, the social structure must change. Reforms in the short run could facilitate the development and give way to more important changes in the long run and it is in this aspect the results must be seen. Some final words by Ranis & Fei (1961) give a clear analogy: "[…] *it is not sufficient for a plane to achieve an initial velocity permitting it to escape the earth's gravitational push; it must be able to carry enough fuel to enable it to get over the surrounding mountains and reach its destination at a speed dictated by the ambitiousness of the pilot"*.

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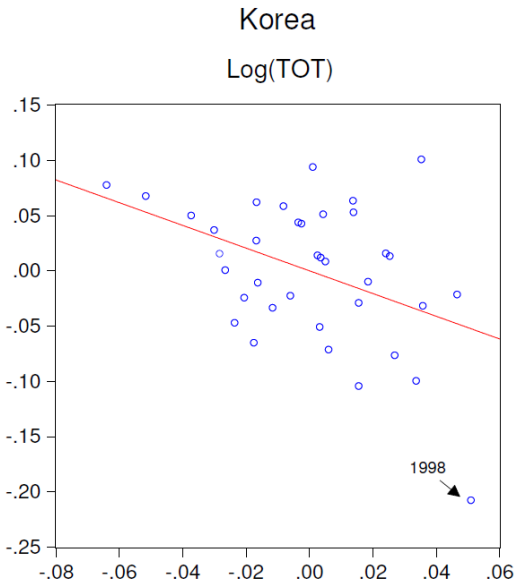
7. Appendix

7.1. Outliers



KOREA

Dependent Variable: Log(RER)
Method: Least Squares
Date: 12/10/13 Time: 12:20
Sample (adjusted): 1971 2007
Included observations: 37 after adjustments
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.656634	0.700410	2.365234	0.0252
Log(GDP)	0.019778	0.051594	0.383343	0.7044
GOV	-0.262010	2.678266	-0.097828	0.9228
NFA	0.461629	0.453782	1.017293	0.3177
Log(TOT)	-1.026537	0.487711	-2.104804	0.0444
Log(RER(-1))	0.577486	0.155860	3.705161	0.0009
FDI	1.754460	3.895311	0.450403	0.6559
PEG	0.194520	0.087906	2.212831	0.0352
MANAGEDFLOAT	0.159695	0.061526	2.595580	0.0149

R-squared	0.667359	Mean dependent var	4.502272
Adjusted R-squared	0.572318	S.D. dependent var	0.099353
S.E. of regression	0.064974	Akaike info criterion	-2.421879
Sum squared resid	0.118206	Schwarz criterion	-2.030034
Log likelihood	53.80475	Hannan-Quinn criter.	-2.283735
F-statistic	7.021841	Durbin-Watson stat	2.237786
Prob(F-statistic)	0.000045	Wald F-statistic	8.781414
Prob(Wald F-statistic)	0.000006		

The above figures show, at the left, outliers and, at the right, the estimations without including a dummy that corrects for these outliers. There is not any rule of thumb to these problems concerning outliers, but to foster the intersubjectivity of the thesis, my motivation and approach will be presented.

The coefficient for TOT is significant at the 5 per cent level in the estimation above. The 1998 observation gives a perceived strong negative relationship which, according to the figure above, is not true. The figures are examples from the estimations to motivate the drop of observations. Compare these results with those in Table 3. The explanation to why the results are extreme is likely to the large financial crisis which struck Korea in 1998. If these observations were included, it would likely change the final results. Since the observations alters the coefficient estimations and because of their “extreme” nature, they are dropped to not give “false” final results that are dependent upon their presence.

7.2. Estimation tests

Table 6: Engle-Granger cointegration tests

Engle-Granger Cointegration Test

CHILE

Sample (adjusted): 1974 2005
Included observations: 32 after adjustments
Null hypothesis: Series are not cointegrated
Cointegrating equation deterministics: C 1/@TREND
Automatic lags specification based on Schwarz criterion (maxlag=6)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
Log(CAP_EMP)	-8.720395	0.0057	-44.06817	0.0055

*MacKinnon (1996) p-values.

Engle-Granger Cointegration Test

BRAZIL

Sample (adjusted): 1974 2005
Included observations: 32 after adjustments
Null hypothesis: Series are not cointegrated
Cointegrating equation deterministics: C 1/@TREND
Automatic lags specification based on Schwarz criterion (maxlag=6)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
Log(CAP_EMP)	-7.657457	0.0300	-40.89014	0.0273

*MacKinnon (1996) p-values.

Engle-Granger Cointegration Test

KOREA

Sample (adjusted): 1974 2005
Included observations: 32 after adjustments
Null hypothesis: Series are not cointegrated
Cointegrating equation deterministics: C 1/@TREND
Automatic lags specification based on Schwarz criterion (maxlag=6)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
Log(CAP_EMP)	-5.771828	0.3396	154.9823	0.9999

*MacKinnon (1996) p-values.

7.3. Data description

Data	Notes	Source
National total trade	Total CIF imports and FOB exports.	Brazil: MDIC Chile: Banco de Chile Rep. of Korea: KOSIS
Commodity trade	Imports and exports of agricultural goods, fuels, metals and gold.	COMTRADE

Variable	Notes	Source
RER	Real effective exchange rate. See formula below.	Bruegel dataset. Ver. Sep 2013
Terms-of-trade index	See formula below.	IMF, 2006.
GDP per capita	PPP-adjusted in constant 2005 international dollars, relative to U.S. GDP per capita.	World Development Indicators (WDI)
Net foreign assets	As ratio of GDP.	Ibid.
Government expenditure	As ratio of GDP.	Ibid.
FDI	Inward flows as ratio of GDP.	UNCTADStat
Trade policy	Dummy variable which is 1 if country has liberalized trade.	Sachs & Warner, 1995.
Financial crises	Dummy variable which is 1 if country suffers from a financial crisis.	Reinhart & Rogoff, 2011.
Exchange rate regime	Dummy variables of the following categories: - PEG = de facto pegged currency - MANAGEDFLOAT = managed floating currency - FREE = freely floating currency The last dummy is dropped to avoid perfect multicollinearity (dummy variable trap).	Ibid.
Sector productivity and employment	10-sector data.	Groningen Growth and Development Center (GGDC)

From the GGDC dataset have the productivity and employment variables been compiled. To denote the marginal productivity of labor has the gross value added as a ratio of people employed in that sector been applied:

$$MPL = VA/EMP \quad \text{(A1)}$$

Value added is expressed in real U.S. Dollars in year 2000 prices and employment in thousands.

A measurement problem should also be noted. An observation on the FDI flows for Korea in 1972 has been adjusted since its value was not plausible and a revised value has been retrieved from a dataset by Lane & Milesi-Ferretti (2006).

Real effective exchange rate (REER)[3]

The REER is calculated as:

$$REER_t = \frac{NEER_t \cdot CPI_t}{CPI_t^{(foreign\ )}}$$

where $REER_t$ is the real effective exchange rate of the country under study against a basket of currencies of trading partners, CPI_t is the consumer price index of the country under study, $NEER_t = \prod_{i=1}^{N} S(i)_t^{w^{(i)}}$ is the nominal effective exchange rate of the country under study, which is in turn the geometrically weighted average of $S(i)_t$, the nominal bilateral exchange rate between the country under study and its trading partner i (measured as the foreign currency price of one unit of domestic currency), $CPI_t^{(foreign\ )} = \prod_{i=1}^{N} CPI(i)_t^{w^{(i)}}$ is the geometrically weighted average of CPI indices of trading partners, $CPI(i)_t$ is the consumer price index of trading partner i, $w^{(i)}$ is the weight of trading partner i, and N is the number of trading partners considered. The weights sum to one, i.e. $\sum_{i=1}^{N} w^{(i)} = 1$.

Commodity terms-of-trade index[4]

The index is constructed by measuring the prices of agricultural goods, fuels, metals and gold against the manufacturing unit value index (MUV). These relative commodity prices are weighted by the time average (over 1970-2007) of import and export shares of each commodity category in total trade (exports and imports of goods and services). The commodity terms-of-trade index is the ratio of aggregated indexes of commodity exports and imports, as follows:

$$TOT_j = \prod_i \left(\frac{P_i}{MUV}\right)^{X_j^i} \Big/ \prod_i \left(\frac{P_i}{MUV}\right)^{M_j^i}$$

where i represents the four commodity categories; X_j^i is the share of exports of commodity i in country j's total trade, averaged over 1970-2007; and M_j^i is the share of imports of commodity i in country j's total trade, averaged over 1970-2007.

The prices and MUV are obtained from the World Bank Commodity Price Data and prices are expressed in real 2005 U.S. dollars.

[3] This part is based on Darvas (2012).
[4] This part is based on IMF (2006).