Explaining How Real Exchange Rates Move in Growing Economies Using Labor Surplus

Kue Peng Chuah*

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Abstract

There are robust empirical evidence that the Balassa-Samuelson hypothesis (BSH) is not satisfied in the developing countries. To explain this empirical fact, this paper makes two contributions. First, I propose a simple two-sector model that dampens the BSH by introducing a countervailing channel driven by "labor surplus" (the large supply of low-wage workers in the traditional sector). The reallocation of labor surplus to the productive tradable sector leads to rapid growth while containing the appreciation of the real exchange rate. This captures an essential feature of the growth process in developing countries. However, the dampening effect diminishes over time because labor surplus is exhausted as the economy grows. A testable implication of the model is that the BSH depends on the labor surplus. Second, I present empirical evidence consistent with the model. The BSH is suppressed when there is a sizeable pool of labor surplus to draw from, whereas the BSH is effective when this factor diminishes below a certain level. Additionally, I find that capital controls may help dampen the BSH. The theoretical and empirical results suggest that the nature of the relationship between the real exchange rate and income depends on the stage of development, which follows from the changing structure of the economy.

Keywords: Real exchange rates, growth, labor surplus, Balassa-Samuelson effect
JEL classification: E31, F31, J6, O1, O4

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1 Introduction

There are empirical studies that conclude that developing countries deviate from the Balassa-Samuelson hypothesis (BSH). With growth driven by the productivity catch-up in the tradable sector, the BSH predicts a positive relationship between the real exchange rate and income, that is real appreciation accompanies economic growth.[1] On the contrary, the real exchange rate in developing countries recorded limited appreciation or none at all as income expanded rapidly over the last 30 years. In my earlier paper (Chuah, 2012), I call this empirical fact the anti-Balassa effect and provides robust evidence that low-income countries deviate from the BSH. Instead, the BSH is borne out when the level of income advances above a certain threshold. In other words, the level of development seems to matter for the nature of the relationship between the real exchange rate and income.

This raises the question of what structural factor makes the relationship between real appreciation and growth different in developing countries. To address this question I examine the role of "labor surplus", defined as a large supply of low-wage workers in the traditional sector.[2] My theoretical and empirical findings suggest that labor surplus can explain deviations from the BSH. The reallocation of the labor surplus from the traditional sector to the modern sector – the more productive and expanding tradable sector – is an essential feature of the growth process in developing countries. The expected real appreciation is mitigated by the presence of a large labor surplus that keeps wages and prices low. Consequently, this dampening effect diminishes when the labor surplus is exhausted as the economy grows. Hence, this study implies that the structure of the economy could be central in determining the relationship between the real exchange rate and income, and policymakers should pay more attention to this factor when evaluating long-run real exchange rates.[3]

While the idea that labor surplus might weaken the BSH is not entirely new, this paper offers a first step in showing that this factor is theoretically valid and empirically relevant.[4] More specifically, this study makes two contributions relative to the analysis presented in Chuah (2012). First, I develop a two-sector model in which the BSH is dampened by the presence of a labor surplus in the economy. While the model remains simple, I show through a calibration exercise that the sensitivity of the real exchange rate to growth is lower if the economy has a larger surplus of labor. Second, I show that the model receives some empirical support. Indeed, the data suggest that a surplus of labor in the traditional sector has a systematic impact

[1] If growth is instead driven by productivity improvements in the non-tradable sector, the BSH predicts a real exchange rate depreciation.

[2] This is a common characteristic in developing countries, often masked as hidden unemployment in which workers in the rural sector engage in unproductive jobs.

[3] Independently, Hassan (2012) makes a similar argument, claiming that the process of structural transformation may provide a "natural" depreciation of the real exchange rate in developing countries.

[4] When surveying the literature on the BSH, some papers allude to the idea of labor surplus as a means to weaken the BSH but no work has covered this formally.

on the co-movements between the real exchange rate and income. In cross-section data, the BSH is mitigated when there is a sizeable pool of labor surplus to draw from, and panel data provide evidence that the BSH holds more tightly when the labor surplus diminishes below a certain level. In addition, I conduct a "horse race" analysis to assess if alternative factors can suppress the BSH. My results suggest that capital controls could provide another channel to dampen the BSH.

Theorizing how labor surplus impacts the relationship between the real exchange rate and income seems like a natural approach. The growth process in developing countries usually starts with the movement of low-wage workers from the traditional sector to more productive modern sectors, namely manufacturing.[5] The model proposed in this study draws heavily from the ideas developed in Lewis (1954 and 1979), who offered important insights on the role of labor surplus in economic development.[6] In the Lewis model, a two-sector economy – modern and traditional – creates a dualistic labor market. Growth is driven by the expansion of the modern sector that generates increasing demand for labor.[7] The traditional sector, which does not contribute to growth, has abundant labor supply; at a given wage rate more labor is being offered than is demanded by the modern sector. Lewis describes this surplus as a form of "unlimited" labor supply for the modern sector.[8] Intersectoral labor movements tend to be prolonged: without an integrated labor market, it takes time to move and to absorb the labor surplus. This setup captures the situation of rapidly growing developing countries in which the modern sector is the expanding manufacturing sector, whereas the traditional sector corresponds to the rural or agriculture sector. Conceivably, during the transition period from 1980s to the 2000s, the BSH remained suppressed in these economies because the labor surplus had yet to be fully absorbed.

Among the developing countries, China stands out as a good illustration of the Lewis model given the large labor surplus in the rural sector.[9] For example, Dooley, Folkerts-Landau and Garber (2004a) claim that hundreds of millions of workers in China are kept in under-

[5]For further discussions, see Rodrik (2013), McMillan and Rodrik (2011), Rodrik (2006), and Dooley, Folkerts-Landau and Garber (2004c).

[6]For further interpretations of the Lewis model, recent papers include Swinnen, Dries, and Macours (2005), Fields (2004), Tignor (2004), and Kirkpatrick and Barrientos (2004). For earlier discussions, see Kindleberger (1988), Reynolds (1965), Enke (1962), and Ranis and Fei (1961).

[7]In the Lewis model the modern sector accumulates capital by reinvesting the profit and this generates growth over time. In contrast, the traditional sector makes no contribution to economic growth. Examples of the traditional sector given in Lewis (1954) include self-employed labor in family farms, petty trades and domestic help.

[8]Lewis (1954) notes that the abundance of labor is a common condition in the low-income countries, which tend to have population growth of 2-3 percent per annum. In particular, surplus of labor is common in most of Asia, and Lewis cites countries like China, India, and Egypt as examples. Chuah (2012) provides robust empirical evidence that these countries are anti-Balassa countries.

[9]Vietnam is another example, as discussed in Rodrik (2013). Rodrik notes that Vietnam started with labor surplus in the countryside and the labor reallocation to the modern sector provided huge gains in terms of productivity.

productive jobs in the rural sector, a form of disguised employment. Similarly, Brooks and Tao (2003) estimate that China has a labor surplus amounting to about 150 million people from the rural sector and the authors point out the policy challenges associated with the absorption of the surplus.[10] Another rough gauge of labor surplus in China is the level of employment in the agriculture sector. In 1980, this sector accounted for nearly 75 percent of total employment. Although this ratio declined to 45 percent in 2005, it still remains relatively high by international standards.[11] Therefore, the mobilization of workers from the traditional sector *à* la Lewis is expected to be a drawn out process that could take place over several decades.[12] I calibrate the proposed model using data from China to provide an interesting case study.

The remainder of this paper is organized as follows. In Section 2, I discuss the models proposed in the literature to explain deviations from the BSH. In Section 3, I present my model with imperfect labor mobility while Section 4 carries out the calibration exercise. Section 5 provides the empirical analysis and results in support of the model. Section 6 concludes.

2 Related Literature

This section reviews the theoretical explanations that have been proposed in the literature to account for deviations from the BSH. I discuss the existing models and explain how the model in this paper is different. Broadly speaking, the theoretical literature has followed three approaches, with each removing a key assumption that underpins the BSH: (i) relaxing the law of one price for the tradable good, which is the most widely used approach; (ii) relaxing perfect capital mobility; and (iii) relaxing perfect labor mobility. In the paper, I propose a model that keeps the first assumption, abstracts from capital flows, and assumes imperfect labor mobility.

Starting in the mid-1990s, empirical papers like Isard and Symansky (1996) highlighted the puzzle that real exchange rates in some rapidly growing developing countries do not move according to the BSH. This motivated Devereux (1999) to propose a model that explains two empirical facts. First, the real exchange rate trend seems to be dominated by movements in the price of the tradable good (relative to the price of the non-tradable good), and second, economies in Asia recorded real depreciations or limited real appreciations despite rapid

[10] The authors note that controls on labor movements impede the reallocation process despite reforms taking place, especially since the 2000s. For more studies about the labor market in China, see Meng (2012), Whalley and Zhang (2007), Au and Henderson (2006), Fleisher and Yang (2003), Rozelle, Guo, Shen, Hughart, and Giles (1999), and Zhao (1999).

[11] Between 1980 and 2005, the share of employment in the agriculture sector in the high-income, middle-income, and low-income countries averaged at 8 percent, 31 percent, and 69 percent, respectively.

[12] Anecdotal evidence about the plentiful labor in China suggests that the reallocation of labor could take between 20 to 30 years as the economy reduces the labor share in the agriculture sector to match the structure of advanced economies, which have less than 10 percent of labor in the subsistence sector. See article in The Economist dated June 12, 2010 (page 86) and the article by Gang in http://www.project-syndicate.org/commentary/is-low-wage-china-disappearing- dated August 30, 2010.

growth (anti-Balassa). In Devereux's model, the main mechanism is the endogenous productivity growth in the distribution sector that is needed to produce the final tradable good. The productivity increase in the tradable sector deepens the productivity in the distribution sector to lower the distribution cost, which in turn reduces the cost of the tradable good at home. As a result, the anti-Balassa effect comes from the decline in the home price of the tradable good relative to the world price. In other words, his model is relaxing the law of one price for the tradable good. Although the operating channel outlined by Devereux has not been quantified, it does not seem persuasive for three reasons.[13] First, it is hard to imagine that the prolonged real exchange rate depreciation in most developing countries is due to greater efficiency in the distribution sector alone since these poor economies have only just started their growth takeoff. Second, to explain the non-linear relationship between the real exchange rate and income, as shown in Chuah (2012), the distribution cost would need to increase over the long run to explain the real appreciation that is observed when the country grows richer. Third, productivity growth in the distribution sector does not explain why the relationship between the real exchange rate and income is different for developing countries and for advanced countries as this factor does not seem less applicable to the latter than to the former.[14]

Another approach to relax the law of one price for the tradable good is to introduce a terms of trade channel such that real exchange rate movements are now driven by the relative price of the tradable good. This is commonly carried out in the literature covering a class of dynamic general equilibrium models known as new open economy macroeconomics (NOEM). In this literature, the transmission of productivity shocks to the real exchange rate operates through the terms of trade channel.[15] Productivity improvements in the tradable sector create either a real appreciation – if the Balassa-Samuelson effect outweighs the terms of trade effect – or a real depreciation – if the latter outweighs the former. For example, given a positive productivity shock in the tradable sector, the anti-Balassa effect occurs when the increase in the supply of the tradable good worsens the terms of trade and is large enough to more than offset the increase in the relative price of the non-tradable good (in terms of the tradable good). The net effect is a real exchange rate depreciation if the terms of trade channel is stronger than the relative price channel. It is unclear, however, why the terms of trade effect would dominate in poor countries and not in the advanced economies.

Another approach to explain deviations from the BSH is to introduce frictions – natural or policy-induced. For instance, Gente (2006) develops a model with imperfect capital mobility to explain how Asian countries deviate from the BSH. She assumes that the developing coun-

[13]Devereux cites Singapore and Hong Kong as examples in line with his model.

[14]MacDonald and Ricci (2001) propose a model which augments the Balassa-Samuelson framework with a distribution sector: their model predicts a real appreciation when there in an improvement in the relative productivity of the distribution sector. The authors present empirical evidence from the advanced countries that is supportive of their model.

[15]Studies include Pancaro (2010), Choudhri and Schembri (2010), Benigno and Thoenissen (2003), and Corsetti, Dedola, and Leduc (2008).

try must pay a risk premium to offset the negative domestic conditions, and this constraint causes the domestic return on capital to exceed the world return.[16] In particular, Gente's model predicts that an increase in productivity in the tradable sector leads to a real depreciation or limited appreciation despite high growth because these countries also had an increase in the working-age population. Essentially, the increase in productivity is, in part, offset by the large labor supply; akin to the point made by the paper at hand, although my model is based on imperfect labor mobility. Another type of friction related to capital mobility is capital controls: Jeanne (2012) highlights this factor for "structural undervaluers" like China. Following the BSH, the rapid growth in China in the 2000s should have resulted in the appreciation of the real exchange rate. Nonetheless, Jeanne's model shows that the authorities curtailed domestic demand through foreign reserve accumulation and controls on capital inflows, resulting in real depreciations or limited appreciations over a prolonged period of time.[17]

Of relevance are two recent papers that analyze how frictions in the labor market affect the BSH. Sheng and Xu (2011) incorporate job search costs to show that the degree of job matching efficiency across sectors and across countries can influence the relationship between the real exchange rate and sectoral productivity. In particular, if the tradable sector in the home country undergoes faster productivity growth but has a less efficient labor market than the benchmark country, the real exchange rate would not appreciate over time. This is because part of the increase in productivity is used to offset labor market frictions. Hence, this supply-side model predicts that the BSH may not hold when job matching frictions are high. However, the authors do not calibrate their model to show the co-movements between the real exchange rate and income, and search costs are hard to measure due to limited data, especially for developing countries. Similarly, Cardi and Restout (2011) consider two types of labor market frictions when they study the transmission process of productivity shocks. Specifically, labor reallocation costs across sectors or job matching frictions limit the amount of labor moving into the tradable sector from the non-tradable sector, in turn dampening the BSH. Essentially, these two papers and my model are relaxing the assumption of perfect labor mobility to generate deviations from the BSH. However, unlike the paper at hand, these two papers do not focus on developing countries.[18]

Independently, Hassan (2012) develops a model to explain the relationship between the real

[16] Calibration of the model seems to match the empirical evidence for China, Hong Kong, Indonesia, Malaysia, Thailand and Singapore for the sample period between 1970 and 1992.

[17] Although capital controls have been in place for a prolonged period of time in a handful of developing countries, large-scale purchases of foreign assets are more recent. Ghosh, Ostry, and Tsangarides (2012) find that starting in the 2000s intentional undervaluation of the real exchange rate is an important factor determining reserve accumulation.

[18] Sheng and Xu (2011) show empirical evidence supporting their model using a time series data set from the advanced economies (US, Japan, and UK), and a cross-country data set covering over 100 countries in 2004. In Cardi and Restout (2011), the empirical analysis is based on OECD data, while their calibration exercise is based on a general case using parameter values from the literature.

exchange rate and income.[19] His model links the real exchange rate to the process of structural transformation that takes place as the economy moves from an agriculture-based economy towards manufacturing and later services. On one hand, this paper and Hassan's paper share the broad theme that the level of development matters for the relationship between the real exchange rate and income. On the other hand, the analysis in this paper differs from Hassan's along three aspects. In Hassan's model, productivity growth occurs first in the non-tradable sector (which corresponds to the agriculture sector). This causes the real exchange rate to depreciate in low-income countries because they are agriculture-based economies.[20] In contrast, my model studies the takeoff in growth that stems from the increase in productivity in the tradable sector.[21] Next, Hassan claims that – but does not show how – when the economy transitions from an agriculture-based to a manufacturing-based economy, productivity gains are now driven by the tradable sector. This is at odds with the data. Despite moving from an agriculture-based to a manufacturing-based economy, most of the low-income developing countries continued to record high growth with limited real appreciation or none at all. Put differently, Hassan's model does not explain why developing countries deviate from the BSH, even when the source of their growth is in the manufacturing sector. Lastly, to test his model with data, Hassan relies on a cross-section data set for 2005. In this paper, I carry out the testable implications of the model using both cross-section and panel data from 1980 to 2005.

3 Model

I consider a simple two-sector model producing a tradable (T) and a non-tradable (N) good.[22] Time is continuous and is denoted by t. The production function is linear, and labor (L) is the only factor of production.

$$Y_{T,t} = A_{T,t} L_{T,t} \ , \tag{1}$$

$$Y_{N,t} = A_{N,t} L_{N,t} \ , \tag{2}$$

where Y_T is output in the tradable sector; Y_N is output in the non-tradable sector; A_T is labor-augmenting productivity in the tradable sector; and A_N is labor-augmenting productivity in the non-tradable sector.[23]

[19] Hassan's model covers three sectors: agriculture, manufacturing and services. The model provides a good fit to the cross-section data in 2005 when plotting the real exchange rate level against the income level: the BS line is flat at low levels of income but turns positive at higher levels of income.

[20] This is consistent with the BSH when productivity gains occur in the non-tradable sector.

[21] More specifically, unlike Hassan's static model, I present a dynamic model to study how productivity growth in the tradable sector impacts the real exchange rate, income and the sectoral allocation of labor.

[22] I use a model that is entirely real.

[23] The paper abstracts from having capital in the model. The omission is for simplicity since the objective of the model is to focus on labor movements. It is not hard to imagine that capital in the tradable sector

The first order conditions from profit maximization yield

$$A_{T,t}P_{T,t} = W_{T,t} \ , \tag{3}$$

and

$$A_{N,t}P_{N,t} = W_{N,t} \ , \tag{4}$$

which implies

$$P_t = \frac{P_{N,t}}{P_{T,t}} = \frac{\frac{W_{N,t}}{A_{N,t}}}{\frac{W_{T,t}}{A_{T,t}}} = \frac{A_{T,t}}{A_{N,t}}\frac{W_{N,t}}{W_{T,t}} \ , \tag{5}$$

where P, which I call the relative price, is the price of the non-tradable good (P_N) relative to the price of the tradable good (P_T); W_T is the wage in the tradable sector; and W_N is the wage in the non-tradable sector.

Wages in both sectors will equalize instantaneously if there is perfect labor mobility between the two sectors and we have

$$P_t = \frac{A_{N,t}}{A_{T,t}} \ , \tag{5'}$$

which gives the standard result in the BS model: the relative price is determined by relative productivity, meaning that only supply-side factors matter for the determination of the relative price.[24] Motivated by Lewis (1954 and 1979), the model deviates from the BS model by relaxing the perfect labor mobility assumption during the transition process so that $W_T \neq W_N$.

I call "labor surplus" the difference between the level of $L_{N,t}$, and the counterfactual level of $L_{N,t}$ that would lead to wage equalization following an improvement in A_T. If there is perfect labor mobility, there is by definition no labor surplus, and the BSH holds. If labor takes time to move from the non-tradable sector to the tradable sector, there is conceivably a labor

is more productive compared to the non-tradable sector, which contributes positively through higher labor productivity in the tradable sector.

[24] W_N is equal to W_T and the ratio $\frac{W_N}{W_T}$ drops out of equation (5).

surplus in the economy, and the question is how this labor surplus impacts the real exchange rate following an improvement in A_T.

I now turn to describe the household sector. The representative household maximizes a CES consumption index (C_t) of the tradeable good and the non-tradable good:

$$C_t = \left[\eta^{\frac{1}{\theta}} \, C_{T,t}^{\frac{\theta-1}{\theta}} + (1-\eta)^{\frac{1}{\theta}} \, C_{N,t}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} , \tag{6}$$

where η is the share of the tradable good in the consumption basket and θ is the elasticity of substitution between the tradable good and the non-tradable good. C_T and C_N denote the consumption of the tradable good and non-tradable good, respectively.

Solving the consumer's optimization problem yields[25]

$$P_t = \frac{P_{N,t}}{P_{T,t}} = \left[\frac{1-\eta}{\eta} \; \frac{C_{T,t}}{C_{N,t}}\right]^{\frac{1}{\theta}} . \tag{7}$$

Furthermore, we have the following market clearing conditions:

$$C_{T,t} = A_{T,t} L_{T,t} \ , \tag{8}$$

$$C_{N,t} = A_{N,t} L_{N,t} \ . \tag{9}$$

Equation (8) comes from the absence of borrowing and lending so all the tradable good must be consumed in each period. Equation (9) comes from the fact that the non-tradable good is produced and consumed domestically.[26]

I assume that the household consumes all income at each point in time because there is no financial sector, and the trade balance is always equal to zero.[27] What happens if the household can save or dissave through the current account? Incorporating this feature into the model creates an additional channel such that a productivity improvement in the tradable sector can influence the relative price. This demand channel operates as follows. Growth in the tradable

[25] See Chapter 4 of Obstfeld and Rogoff (1996).

[26] The model assumes that the tradable good at home and in the rest of the world are identical and share the same price, that is there is no terms of trade channel in the model.

[27] There is no investment in the model. For simplicity, I also assume that the same good is exported and imported, and abstract from imperfect competition in the goods market.

sector raises future income relative to current income. Given the consumer's willingness to smooth his consumption over time, this leads to an increase in the current demand for both goods. The higher demand for the tradable good can be met by a rise in imports such that the economy runs a current account deficit. But the higher demand for the non-tradable good then results in an increase in its price, that is, a real exchange rate appreciation. Hence, introducing the current account channel should strengthen the BSH. However, low-income countries typically have repressed financial systems, and it is plausible – at least to a first order approximation – to assume that domestic consumers cannot finance consumption by borrowing abroad.

Next, substituting equations (8) and (9) into (7) gives

$$P_t = \Big[\frac{1-\eta}{\eta} \; \frac{A_{T,t}}{A_{N,t}} \; \Lambda_t\Big]^{\frac{1}{\theta}} , \tag{10}$$

where $\Lambda_t = \frac{L_{T,t}}{L_{N,t}}$ is the ratio of labor employed in the tradable sector to labor employed in the non-tradable sector.

I can now compare equations (5) and (10), assuming in the short run that Λ is fixed.[28] When labor is not perfectly mobile, the supply channel of the BS model is replaced by a demand side. An increase in A_T raises Y_T proportionately, and so increases P. If $\theta = 1$, the rise in P is proportional to the rise in A_T, like in the BS model. However, if $\theta > 1$, the increase in P is less than proportionate with the rise in A_T. Thus, imperfect labor mobility reduces the impact of relative productivity on the relative price if (and only if) the elasticity of substitution between the tradable good and the non-tradable good is larger than 1 ($\theta > 1$).

To specify how labor flows between the two sectors I use the assumption in equation (11):

$$\frac{1}{\Lambda_t} \; \frac{d\Lambda}{dt} = \sigma \ln(\frac{W_{T,t}}{W_{N,t}}) , \tag{11}$$

which is represented in log form (denoted by lower case) in equation (12):[29]

$$\frac{d\lambda}{dt} = \sigma(w_{T,t} - w_{N,t}) = \sigma(a_{T,t} - a_{N,t} - p_t) . \tag{12}$$

A key feature of the model is to introduce imperfect labor mobility using equation (12). When

[28] Equations (5) and (10) correspond to the supply side and the demand side, respectively.
[29] This assumption is similar to the one considered in Cardi and Restout (2011).

a productivity increase is biased towards the tradable sector, the wage will rise in that sector, and the wage differential attracts labor inflows from the non-tradable sector. The variable σ captures the sensitivity of labor flows to the wage differential.[30] As explained earlier, a developing country with a sizeable labor surplus has a dualistic labor market. Although the low-wage workers in the traditional (non-tradable) sector would readily respond to the wage differential, reallocating labor at a large scale is a drawn out process – as illustrated by China – all the more so if the speed of adjustment is smaller. By contrast, a large σ corresponds to an integrated labor market where the labor flow is sensitive to wage differentials and wages equalize quickly between the two sectors. As $\sigma \to \infty$, labor flows are immediate and wages equalize instantaneously, like the BS model.

Next, I derive how the relative price moves over time. Expressing equation (10) in log form, we have

$$p_t = \kappa + \frac{a_{T,t} - a_{N,t} + \lambda_t}{\theta} \, , \tag{13}$$

where κ is a constant equal to $\frac{1}{\theta}\ln(\frac{1-\eta}{\eta})$.

Differentiating equation (13) with respect to time and substituting out $\frac{d\lambda}{dt}$ using equation (12) gives a first-order linear differential equation in p_t:

$$\frac{dp}{dt} = \frac{1}{\theta}\Big[\frac{d(a_T - a_N)}{dt} \;+\; \sigma(a_{T,t} - a_{N,t} - p_t)\Big] \, . \tag{14}$$

The solution to equation (14) is given by equation (15):

$$p_t = \frac{1}{\theta}\Big[(a_{T,t} - a_{N,t}) \;+\sigma\Big(1 - \frac{1}{\theta}\Big)\int_{-\infty}^{t}(a_{T,s} - a_{N,s})e^{\frac{\sigma}{\theta}(s-t)}ds\Big] \, . \tag{15}$$

How should we interpret equation (15)? Firstly, if $(a_T - a_N)$ is constant, then p_t converges towards $(a_T - a_N)$, which corresponds to the standard result in the BS model. Convergence takes time if σ is finite, but it is immediate if $\sigma = +\infty$ (the case of perfect labor mobility). Secondly, equation (15) implies the same outcome as the BS model if $\theta = 1$, as explained earlier. Thirdly, the model with imperfect mobility of labor together with the assumption that $\theta > 1$ imply that a productivity shock in the tradable sector is not fully transmitted to the relative price in the short run, which creates a deviation from the BSH. Parameters σ and

[30] Unlike the model in this paper, Cardi and Restout (2011) assume a fixed cost of moving between the tradable sector and the non-tradable sector. Workers will only move if the wage differential is large enough to cover this cost. The adjustment cost is difficult to quantify, especially for developing countries.

θ determine the extent to which the model is able to dampen the increase in the relative price stemming from a productivity increase in the tradable sector.

The per capita income (y), expressed in terms of the price of tradable goods, is given by

$$y_t = \ln\left(\frac{A_{T,t}L_{T,t} + P_t A_{N,t} L_{N,t}}{L_t}\right) = \ln\left(\frac{\Lambda_t A_{T,t} + P_t A_{N,t}}{1+\Lambda_t}\right). \tag{16}$$

Taking the productivity paths for $(A_{T,t})_{t\geq 0}$ and $(A_{N,t})_{t\geq 0}$ as given, the joint dynamics of the relative price and income per capita can be characterized using equations (13), (15) and (16).

In the long run, the model simplifies to

$$p_t = a_{T,t} - a_{N,t}, \qquad y_t = a_{T,t}\ . \tag{17}$$

Assuming a constant level of productivity in the non-tradable sector, a positive shock to the productivity in the tradable sector results in a proportionate increase in income and the relative price of the non-tradable good. In other words, the long-run prediction of the model is for the economy to move along the 45 degree line in the $p - y$ space (the BSH).

4 Calibration and Results

In this section I use the model to analyze the impact of a productivity increase in the tradable sector. This is carried out by calibrating the model using the parameters in Table 1. The share of the tradable good in the consumption basket (η) is set to 0.4. Typically, η is set to be less than 0.5 because non-tradables commonly take up a larger share than tradables in the consumer price index (CPI).[31] In the literature, the estimations for θ range from 0.44 to 3.5.[32] For the calibration exercise I set θ to 2 as the baseline case and check the sensitivity of the results to increasing values of θ ($\theta = \{1, 2, 3, 4, 5\}$).[33] Meanwhile, there is not a large literature to gauge the value of σ, the sensitivity of labor flows to the wage differential, and

[31] In the CPI, housing, health, transportation, and education are commonly viewed as non-tradables, whereas tradables consist of food, beverages, and apparel. Alternatively, Lane (1997) considers imports as a share of GDP to be a good measure of the share of tradables in consumption. Although not reported here, varying the values of η between 0.4 and 0.2 do not change the main results.

[32] For a sample of five advanced economies (US, UK, Canada, New Zealand and Australia), Cashin and McDermott (2003) estimate θ between 0.6 to 3.5 (mean is 2.2). For developing countries across Africa, Asia and Latin America, Ostry and Reinhart (1992) estimate θ to be about 1.3. For a group of advanced and developing countries, Stockman and Tesar (1995) estimate θ to be 0.44.

[33] Recall that the model collapses to the BS model when $\theta = 1$, and that the BSH is mitigated by larger values of θ.

I estimate this parameter from the data. First, I obtain the relative wage (W_T/W_N) and the allocation of labor in each sector (L_T/L_N) using data from the manufacturing and agriculture sector in China.[34] Next, following equation (11), I regress $\Delta \ln(L_T/L_N)$ on $\ln(W_T/W_N)$ to obtain $\widehat{\sigma} = 0.1$.[35]

Finally, sectoral productivity is measured using the average productivity of labor.[36] The paths for a_T and a_N are set as follows. I assume that the developing economy starts from a steady state and undergoes a productivity increase in the tradable sector while productivity in the non-tradable sector remains constant throughout. This follows from Lewis (1954 and 1979) in which the tradable (modern) sector is driving growth in the developing country and the non-tradable (traditional) sector makes no contribution. More specifically, I assume that productivity in the tradable sector grows at 10 percent per annum for 20 years and then plateaus.[37] The trajectory for a_T is shown in the top panel of Figure 1 where time is measured annually on the horizontal axis. Meanwhile, a_N is constant throughout.[38] The initial values of a_T and a_N are based on labor productivity in the manufacturing and agriculture sector in 1991.

After setting the productivity paths for each sector, I derive the predictions of the model for p, λ and y using equations (15), (2.13), and (2.16). The results are presented in Figures 1 and 2 for varying values of θ. The horizontal axis for all the panels in Figure 1 is time measured annually.[39] The top panel in Figure 1 illustrates the linear trajectory set for a_T, and the next three panels show the predicted trajectory for the endogenous variables. In what follows, I first discuss the results for the case when $\theta = 1$. As expected, the model predicts an increase in all three endogenous variables following the productivity improvement. For example, in the first year when a_T grows by 10 percent, p and y also rise by 10 percent. The relative price and

[34] Manufacturing represents the tradable sector while agriculture represents the non-tradable sector. Due to limited data availability and changes in data collection in China, estimates are based on annual data between 2003 and 2010. Data for China are obtained from the National Bureau of Statistic Survey 2011 (Table 4.6 and Table 4.16).

[35] The OLS regression is based on seven observations, and the regression specification does not include a constant.

[36] Dividing value added by the number of workers gives the average productivity of labor. Data for China are obtained from the WDI. See Table 3 for further details. The initial values for sectoral productivity are taken from the data in 1991 due to data availability.

[37] This is broadly in line with Chinese data.

[38] This assumption is for simplicity. Assuming that a_N grows at a slower pace than a_T do not change the findings and arguments in the paper. Unlike the advanced countries, the agriculture sector in the developing countries often lag in terms of productivity when compared to the manufacturing sector. Moreover, empirical evidence in developing countries often show that the typical worker in the manufacturing sector is multiple times more productive than the typical worker in the agriculture sector.

[39] For simplicity, I focus on the relative price between the tradable good and the non-tradable good, rather than the real exchange rate. In order to define the real exchange rate, I would need to introduce a foreign benchmark country and compute the price of consumption in the home country relative to the foreign country. The impact of imperfect labor mobility on the real exchange rate can be inferred from the results for the relative price. Namely, the appreciation of the real exchange rate would be slowed down at first by imperfect labor mobility.

income have the same linear trajectory as a_T, growing at the constant rate of 10 percent per annum. In other words, the improvement in a_T is reflected one for one in the relative price and in income. In Figure 2, I combine the results for the relative price and income to show the paths for p and y in the $p - y$ space; the path followed by the economy is the 45 degree line.[40] Note that the economy initially starts from the equilibrium point where the relative price is $p = 7 - 6.5 = 0.5$ and income is $y = a_T = 7$. Consequently, the economy reaches the new equilibrium point in 20 years whereby $p = 9 - 6.5 = 2.5$ and $y = a_T = 9$. These values are computed from equation (17).

In the baseline case when $\theta = 2$, in the first year when a_T grows by 10 percent, p rises by 5 percent, and y increases by 8 percent. According to equation (15), the change in the relative price is dampened by θ and σ: the productivity improvement is not fully transmitted to the relative price. Meanwhile, the reallocation of labor to the tradable sector is very small in the first year. As more workers are reallocated to the tradable sector, λ increases slowly until the economy reaches the new equilibrium point. Over the next 20 years, all three endogenous variables display an increasing trajectory, but do not follow the linear trajectory of a_T. Moving on to the $p - y$ space in Figure 2, the path is now below the 45 degree line: as the economy moves to the right there is limited increase in the relative price as income grows over the long run. Over the long run the economy eventually transitions to a steeper path before converging to the new equilibrium point.

Increasing θ leads to larger deviations from the BSH. As θ increases, the impact of productivity on the relative price is dampened significantly. However, the predicted values for income do not change much when θ increases. As a result, increasing θ markedly alters the path in the $p - y$ space. As θ increases, the economy deviates more from the 45 degree line to reflect the dampening of the BSH. When θ takes on a very large value ($\theta = 20$) the relative price remains almost unchanged for a long time (yellow line in Figure 2).

How far does the model go in explaining the observed deviations from the BSH? For reasonable parameter values, I have shown that the model can dampen the BSH to varying degrees. At the same time, the model does not generate real exchange rate *depreciations* as income grows. Although the model is closer to the data than the standard BS model, it does not generate the U-shaped path for the co-movements between the real exchange rate and income, which follows from the data revealed in Chuah (2012). Put differently, imperfect labor mobility goes in the direction of explaining the anti-Balassa effect but does not fully explain it.[41]

Notwithstanding the limitations of the model, the main conclusion is that the relationship

[40] Recall that when $\theta = 1$, the labor ratio (λ) plays no role and is not affected by the productivity increase.

[41] Other countervailing channels that could dampen the real exchange rate appreciation as the economy grows include surplus savings, demographic changes, and capital controls. See, for example, Jeanne (2012), and Tyers and Zhang (2011).

between the real exchange rate and income may depend on the labor surplus. The model suggests that the BSH is less likely to hold in countries with a large labor surplus. In the model, a large labor surplus corresponds to low labor ratio (λ) – the share of employment in the tradable sector to the non-tradable sector. Other things equal, a lower labor ratio represents a larger labor surplus that remains to be reallocated to the expanding tradable sector. In the model, the labor ratio increases as the country grows richer, that is there is relatively more employment in the tradable sector. In other words, as the economy advances, the dampening effect for the BSH diminishes as the labor surplus in the non-tradable sector falls. Hence, there is a threshold level for the labor surplus such that the BSH becomes effective.

In the next section, I bring the model to the data. Specifically, I evaluate the model by examining the relationship between the real exchange rate, which is the dependent variable, and two explanatory variables from the model, namely per capita income, and labor surplus, which is measured using the share of employment in the tradable sector to the non-tradable sector.

5 Empirical Analysis and Results

To provide empirical support for the model, the analysis in this section is structured around three testable implications from the model in which I consider a variety of standard regressions based on cross-section, time series and panel data. First, for the cross-section data in levels, I use sample splits to show that there is no relationship between the real exchange rate and income in a sample of countries with a large labor surplus, whereas a positive relationship (BSH) is evident in a sample of countries with a small labor surplus. The second testable implication is that the BSH is effective only if the labor surplus is below a threshold level. I check this by including an interaction term in the cross-section regression, namely by interacting income with the labor surplus. I then analyze these two testable implications using a panel data set in levels. The third testable implication is that the relationship between the change in the real exchange rate and the change in income – the Dynamic Penn Effect (DPE) – is stronger if the labor surplus is smaller.[42]

In addition, I conduct a "horse race" analysis between the labor surplus and three alternative factors that can potentially generate deviations from the BSH; following the literature I examine capital controls, the change in reserves, and the dependency ratio. This robustness exercise examines what other factors could weaken the BSH.

In what follows, I first describe the data set (Section 5.1), and then turn to the empirical analysis using the cross-country data in levels (Section 5.2), which I subsequently extend to a panel data set in levels (Section 5.3). Lastly I examine a panel data set in first difference

[42]Note that the empirical analysis in this section follows the outline of Section 4 in Chuah (2012).

to test the DPE (Section 5.4). All the regressions in this paper are estimated using OLS and robust standard errors are reported.[43]

5.1 Data Description

The data set covers the sample period from 1980 to 2005 and spans a maximum of 142 countries (see Tables 2 and 3). The main variables are the real exchange rate and income. The former is given by three common measures used in the literature (RER_1, RER_2, and RER_3), and the latter is measured using per capita income adjusted for PPP (Y_{rgdpch}). These variables are described in more detail in Chuah (2012) while the paper at hand will focus on the following six variables.

While it is not straightforward how we should measure labor surplus, the model presented in this paper and the discussion in Lewis (1954 and 1979) suggest the following three proxies. From the model, the measure of labor surplus corresponds to the labor ratio (λ) – the level of employment in the tradable sector divided by the level of employment in the non-tradable sector. Specifically, the tradable sector and the non-tradable sector correspond to the manufacturing sector and the agriculture sector, respectively.[44] To measure the degree of tradability of each sector, I follow the approach in De Gregorio, Giovannini, and Wolf (1994) to examine total exports as a share of production in each sector.[45] We would expect the manufacturing sector to record a higher ratio than the agriculture sector.[46] Indeed, these results are borne out in the developing countries: for the middle-income countries, the ratio is 72 percent and 13 percent for manufacturing and agriculture, respectively, and for the low-income group, the ratio is 38 percent and 9 percent, respectively. In contrast, data for the high-income countries show that both sectors have a high degree of tradability: the ratio is 126 percent and 30 percent, respectively.[47] For robustness, I examine two other variables that indirectly capture the size of labor surplus: the share of population living in rural areas ($rural$), and the share of employment in the agriculture sector ($agri$). These two measures are motivated by Lewis

[43] For the cross-section regressions, I report standard errors that are robust to heteroscedasticity. For the panel data regressions, I report the cluster-robust standard errors (clustered by country): this is the White standard errors adjusted to account for heteroscedasticity and possible correlation within a country, assuming independence across countries.

[44] Roughly speaking, the non-tradable sector would involve the services sector but in this paper I focus only on the agriculture sector. The assumption that the agriculture sector is a non-tradable sector seems reasonable and is commonly used in theoretical arguments. Hassan (2012) provides additional support for this assumption.

[45] I compute the average of this ratio between 1980 and 2005. Production is based on value added data from the WDI. Results are robust if I use the sum of total exports and total imports.

[46] In their sample of 14 OECD countries between 1970 and 1985, De Gregorio, Giovannini, and Wolf (1994) report that exports amount to 45 percent of production in the manufacturing sector; 24 percent in the agriculture sector; and 4 percent in the services sector. The authors define a sector as tradable if more than 10 percent of total production is exported and conclude that manufacturing is the most tradable sector.

[47] For the US, the ratio is above 100 percent for both sectors while data for China show a ratio of 47 percent for the manufacturing sector and 2 percent for the agriculture sector.

(1954 and 1979). A higher value for each variable corresponds to a larger amount of labor surplus that is present in the traditional sector.

Apart from labor surplus, I examine three alternative factors that may weaken the BSH. Real exchange rate depreciations could stem from capital controls and foreign reserve accumulation, or they could result from high savings due to the demographic structure. I assess these alternative factors using three variables: (i) the de-jure capital controls index provided in Quinn and Toyoda (2008) (*capcon*), where a higher value captures a more liberalized capital account; (ii) the change in the amount of reserves as a share of GDP (*reserve*); and (iii) the dependency ratio (*depend*), which is the share of the population that is younger than 15 or older than 64.

I motivate the alternative factors as follows. The variables *capcon* and *reserve* capture the mercantilist policies that undervalue the real exchange rate through reserve accumulation and capital controls.[48] Although accumulating reserves became more evident in the 2000s, capital controls have been in place for a prolonged period of time in most developing countries.[49] High savings can also come from a demographic structure with a large share of population that is middle-aged and working. In sum, a higher degree of capital controls, a larger increase in reserves, and a lower dependency ratio are expected to suppress the BSH.[50]

5.2 Cross-country Data in Levels

For countries that recorded a positive increase in income between 1980 and 2005, I plot the cross-country data in levels for each sub-sample to compare the BS lines in 1980 (red dashed) and 2005 (blue).[51] For example, the sample is split into two sub-samples to represent countries

[48]Both policies depreciate the real exchange rate by removing the tradable good from the economy, which raises the price of the tradable good. This is analogous to forcing the domestic economy to save and to repress domestic demand such that the real exchange rate is more depreciated. For this export-led strategy to be effective, we would need adequate restrictions on the capital account and adequate sterilization to ensure that this policy is not offset by inflation or private capital flows. The mercantilist-type argument is discussed in Jeanne (2012), Ferguson and Schularick (2011), Korinek and Servén (2010), Eichengreen (2007), Rodrik (2008), and Dooley, Folkerts-Landau and Garber (2003, 2004a and 2004b). Meanwhile, other papers like Levy-Yeyati and Sturzenegger (2007) and Prasad, Rajan, and Subramanian (2007) point out that policymakers use reserve accumulation together with capital controls to limit appreciation of the real exchange rate. For instance, strong capital inflows lead to real appreciations and developing countries would avoid the loss of competitiveness by using controls on capital inflows.

[49]Ghosh, Ostry, and Tsangarides (2012) provide evidence that the motivation for accumulating reserves shifted from precautionary to undervaluation since the 2000s. Jeanne (2012) present evidence that between 2002 and 2008, the Chinese authorities were resisting currency appreciation by accumulating reserves and repressing domestic demand.

[50]Following Bernanke (2005), depressing domestic demand and imports through high savings can keep the real exchange rate depreciated. Bernanke argues that high savings causes real depreciations.

[51]Recall that this data set is based on the PWT (RER_1), in which the level of the real exchange rate is comparable across countries.

with a low labor ratio and high labor ratio.[52] Figures 3 to 5 present the cross-country view in 1980 and 2005. A negative BS line in 1980 shows up clearly for countries with a low labor ratio, a high share of rural population, and a large share of employment in the agriculture sector. Although the slope turned positive in 2005 in each sub-sample, the BS line remains somewhat flat. This seems to suggest that countries with these features have limited real exchange rate appreciations as income grows. Conversely, countries with limited labor surplus show a BS line in 1980 that is clearly sloping upwards, and in 2005 this line steepened and shifted to the right, with most countries following a positive trajectory over time, as posited by the BSH.

The contrasting results between the sub-samples suggest that labor surplus can systematically differentiate the co-movements between real exchange rates and income. On one hand, Figures 6 and 7 show that countries with high capital controls and a large increase in reserves report a negative BS line in 1980.[53] On the other hand, Figure 8 shows that countries with a low dependency ratio (high savings) recorded a positive BS line but the slope is much flatter compared to countries with a high dependency ratio (low savings). In 2005, the slopes for the BS lines in these sub-samples are strongly positive. Taken together, the plots in Figures 3 to 8 provide prima-facie evidence consistent with the model, that is a lager surplus of labor weakens the BSH.

For each of the cross-section in 1980 and 2005, I now turn to estimate the BS line using equation (18):[54]

$$\ln RER_i = \alpha + \beta \ln Y_i + \epsilon_i \; . \tag{18}$$

The first testable implication of the model holds up in the data in view of the robust regression results in Table 4, which confirm the observations in Figures 3 to 8. In sub-samples with a large labor surplus, there is no relationship between the real exchange rate and income, as expected. In the top panel of Table 4, in the sub-samples with low labor ratio, large rural population, and high employment in the agriculture sector, the estimated slope for the BS line, $\widehat{\beta}$, is not significantly different from zero in 1980 and in 2005. While these countries grew rapidly over 25 years, the BSH was suppressed. For the sub-samples with the opposite characteristics, the estimations for $\widehat{\beta}$ are positive and statistically significant, in line with the

[52] To create the sample splits, I compute the average value for λ between 1980 and 2005. Countries below the 25th percentile have a low λ and countries above the 75th percentile have a high λ. I repeat this for each factor.

[53] The change in reserves are computed by taking the difference between two sub-periods, 1980:1985 and 2000:2005.

[54] This is the baseline specification in the literature when testing the BSH, first shown in Balassa (1964). All the cross-section regressions in this paper are based on the variable RER_1, which is the price level from PWT7. For the measure of income, I focus on Y_{rgdpch}, from PWT7. The results are robust to Y_{WDI}, but is not reported in the interest of space.

BSH.[55] In the bottom panel of Table 4, this contrast is shown for the alternative factors when estimating the cross-country regressions in 1980, but not in 2005.

A natural next step is then to investigate if the BSH displays the threshold effect, which is carried out by estimating specifications (19) and (20):

$$\ln RER_i = \alpha + \beta \ln Y_i + \gamma \ln Y_i.f_l + \epsilon_i \ , \tag{19}$$

$$\ln RER_i = \alpha + \beta \ln Y_i + \gamma \ln Y_i.f_l + \zeta \ln Y_i.f_a + \epsilon_i \ , \tag{20}$$

where $f_l = \{\lambda, rural, agri\}$ and $f_a = \{capcon, depend\}$. Not included in this exercise is the change in reserves, which affects the movements of the real exchange rate but not the level.

If the interaction terms are significant, it means that the BSH is only effective when the factor (f) is above a threshold level. Indeed, this result is borne out in the cross-section regression results for equation (19) in 1980 (Table 5), and 2005 (Table 6). Column (1) in Table 5 shows that the interaction term is positive and significant for $f_l = \lambda$, indicating that a lower value of λ gives a more depreciated real exchange rate level, as predicted by the model. For example, in 1980, the real exchange rate in China is more depreciated than in Japan because $\lambda = 0.26$ in China, whereas $\lambda = 3.4$ in Japan. In particular, the regression predicts that $\ln \widehat{RER}_{Japan,1980} = 4.6$ and $\ln \widehat{RER}_{China,1980} = 4.0$, which means that the real exchange rate (the general price level) in China is 60 percent lower. Similarly, columns (5) and (9) show that the interaction term is negative and significant for $rural$ and $agri$, suggesting that a country with a larger rural population and more employment in the agriculture sector would have a more depreciated real exchange rate level. Nonetheless, the results for 2005 in Table 6 show that only the interaction term for λ is positive and significant (column (1)); the result predicts that the 2005 real exchange rate level (the general price level) in China is about 66 percent lower.[56] Between 1980 and 2005 the Japanese economy was mostly stagnating, relative to the US, and the real exchange rate level remained flat, as expected. What is surprising is that China grew rapidly during this period and yet the real exchange rate did not really catch up in the last three decades. Although this may be a consequence of the macroeconomic policies in China, structural factors can play an equally – or an even more – important role.

The horse race regression results in equation (20) are mixed. In 1980, *capcon* is a positive and significant determinant that outperforms λ and $rural$. A lower degree of capital controls

[55] On one hand, for countries with the large labor surplus, the slope of the BS line is 0 in 1980 and 2005. On the other hand, for countries with the small labor surplus, the slope averaged at 0.2 in 1980 and averaged at 0.4 in 2005. See Table 4 for more details.

[56] In particular, $\ln \widehat{RER}_{Japan,2005} = 4.5$ and $\ln \widehat{RER}_{China,2005} = 3.9$.

(higher value *capcon*) corresponds to a more appreciated real exchange rate level, as expected (columns (2), (6) and (10)). But in 2005 the interaction term for *capcon* is not significant in any of the regressions. This presumably reflects the increasing efforts to liberalize the capital account over the last 25 years. The dependency ratio shows the opposite results (columns (3), (7) and (11)). In 1980, none of the interaction terms are significant, but all the interaction terms are negative and significant in 2005. A higher dependency ratio (which should imply lower savings) is associated with a more depreciated real exchange rate, which is not in line with theory. Columns (4), (8) and (12) in Tables 5 and 6 report the regression results which combine all the interaction terms, namely, labor surplus, capital controls and the dependency ratio. On one hand, only *capcon* shows a positive and significant interaction term in 1980. On the other hand, only *depend* shows a significant interaction term in 2005, but the negative sign is not in line with theory.

5.3 Panel Data in Levels

I now incorporate more information using a panel data set in levels to estimate specifications (2.21) and (2.22), which are analogous to (2.19) and (2.20):

$$\begin{aligned}\ln RER_{i,t} = \alpha + \beta\ \ln Y_{i,t} + \gamma \ln Y_i.f_l \\ + country_i + time_t + \epsilon_{4,i,t}\ ,\end{aligned} \tag{21}$$

$$\begin{aligned}\ln RER_{i,t} = \alpha + \beta\ \ln Y_{i,t} + \gamma \ln Y_i.f_l + \zeta \ln Y_i.f_a \\ + country_i + time_t + \epsilon_{i,t}\ ,\end{aligned} \tag{22}$$

where i denotes the country and t represents the time period index.[57] Equations (21) and (22) are estimated using the fixed-effects model.[58] Unlike the cross-section analysis, I can now estimate the regressions using all three real exchange rates ($RER = \{RER_1, RER_2, RER_3\}$). The estimations are carried out at two different frequencies: t = 5-year average; and t = 1 year.[59]

[57]Like the preceding subsection, the change in reserves affects the movements of the real exchange rate and not the levels, and is not included in this exercise. The regressions are based on a balanced panel for the real exchange rate and income.

[58]See Chuah (2012) for more details.

[59]The data set has five 5-year time periods from 1980:84 to 2000:04. All the regressions are estimated using a balanced panel. One country dummy and one time dummy is dropped to avoid perfect collinearity. Although not reported here, the results are robust when using the income measure from the WDI (Y_{WDI}).

Although the results in Tables 7 to 9 are somewhat weak, I discuss the following three points. Firstly, the results for λ in Table 7 show that some of the interaction terms are positive and significant. Namely, the BSH is only effective for high values of λ and this is consistent with the cross-country regression results discussed earlier (columns (1) to (3)). Secondly, in the horse race regression results, the interaction terms for λ outperform *capcon* at the 5-year frequency, whereas at the annual frequency the interaction terms given by these two variables are positive and significant (columns (4) to (12)). In other words, the BSH is dampened for countries with a lower λ (more labor surplus) and a lower *capcon* (more controls). Lastly, the results for *rural* and *agri* (Tables 8 and 9) are less favorable compared to λ. In the horse race analysis, *capcon* tends to outperform these two proxies for labor surplus.[60]

Another approach to show that the relationship between the real exchange rate and income is different under different settings is to use dummy variables shown in equations (23) and (24):

$$\begin{aligned}\ln RER_{i,t} = \alpha + \beta \ \ln Y_{i,t} \\ &+\gamma_H \ln Y_i.Dummy_H f_l + \gamma_L \ln Y_i.Dummy_L f_l \\ &+country_i + time_t + \epsilon_{i,t} \ , \end{aligned} \tag{23}$$

$$\begin{aligned}\ln RER_{i,t} = \alpha + \beta \ \ln Y_{i,t} \\ &+\gamma_H \ln Y_i.Dummy_H f_l + \gamma_L \ln Y_i.Dummy_L f_l \\ &+\theta_H \ln Y_i.Dummy_H f_a + \theta_L \ln Y_i.Dummy_L f_a \\ &+country_i + time_t + \epsilon_{i,t} \ , \end{aligned} \tag{24}$$

where $f_l = \{\lambda, rural, agri\}$ and $f_a = \{capcon, depend, reserve\}$. This analysis involves several steps. I first split the full sample into two sub-samples. For instance, I compute the average value for λ between 1980 and 2005 and countries below the 25th percentile have a low λ ($Dummy_L\lambda = 1$) and countries above the 75th percentile have a high λ ($Dummy_H\lambda = 1$). I repeat this for each factor and create the interaction terms. Essentially, the regressions are estimating the bivariate relationship between the real exchange rate and income for different sub-samples. For example, when estimating the regressions for λ, we would expect $\widehat{\gamma_H}$ to be positive – countries with high λ displays the BSH – but would expect $\widehat{\gamma_L}$ to be negative – countries with low λ deviate from the BSH. This approach, albeit crude, mitigates endogeneity bias when introducing too many explanatory variables.

[60]The coefficient estimated for *capcon* is usually positive and significant.

The results presented using the 5-year data in Tables 10 to 12 are robust.[61] In Table 10, the estimations based on λ are in line with the model: the BSH is borne out for high values of λ, but low values of λ show the opposite outcome. In the horse race, λ remains robust, but at the same time I observe the BSH under the different settings for *capcon* and *depend*, both which are in line with theoretical expectations (columns (4) to (15)). In particular, countries with high values of *capcon* and *depend* display the BSH, whereas countries with low *capcon* and *depend* do not support the BSH. The results for *reserve* are less robust. The results in Table 11 show that the conclusions drawn for λ broadly follows through to *rural*. In Table 12, the results for *agri* are robust but the horse race regressions show mixed results. Again, the long-run relationship between the real exchange rate and income is poorly linked to the change in reserves.

5.4 Panel Data in First Difference

The last empirical analysis examines the relationship between the change in the real exchange rate and the change in income, known as the Dynamic Penn Effect (DPE) following Ravallion (2010). Using a panel data set in first difference, I assess if the DPE is associated with labor surplus based on equation (25):

$$\Delta\ \ln RER_{t,i} = \alpha + \beta\, \Delta \ln Y_{t,i} + \gamma\, \Delta \ln Y_{t,i}.f_l + time_t + \epsilon_{t,i}\ , \tag{25}$$

where $f_l = \{\lambda_{t-1,i}, rural_{t-1,i}, agri_{t-1,i}\}$, and I use equation (26) to assess the relationship between the DPE and the alternative factors:

$$\Delta\ \ln RER_{t,i} = \alpha + \beta\, \Delta \ln Y_{t,i} + \gamma\, \Delta \ln Y_{t,i}.f_l + \zeta\, \Delta \ln Y_{t,i}.f_a + time_t + \epsilon_{t,i}\ , \tag{26}$$

where $f_a = \{\ln Y_{rgdpch,t-1,i}, capcon_{t-1.i}, depend_{t-1,i}, reserve_{t,i}\}$.

I start by discussing the results in Tables 13 based on the 5-year data followed by results using the annual data. The results for λ are in line with the model as estimations for the interaction terms are positive and significant. This indicates that the DPE displays a threshold effect, whereby the DPE is stronger for higher values of λ (lower labor surplus). In columns (4) to (6), the first horse race shows that initial income outperforms λ. Moving on to columns (7) to (9), λ outperforms *capcon*. In columns (10) to (12), results are mixed when comparing λ to *depend*.

[61] Although not reported here, the results based on annual data are in line with 5-year data.

In columns (13) to (15), λ outperforms the contemperaneous change in reserves.[62] All these results follow through to *rural* in Table 14. For Table 15, the DPE is stronger for lower values of *agri*, as expected. In the horse race, *agri* tends to outperform all the alternative factors.

At the annual frequency, not all the regression results from the 5-year data follow through. In columns (1) to (3) for Table 13, λ is not associated with the DPE as the interaction terms are not significant. In the horse race, except for the change in reserves, all the other alternative factors outperform λ. In Table 14, the results for *rural* remain robust when using annual data. The DPE is stronger for countries with a smaller share of rural population and this variable outperforms the change in reserves in the horse race. However, initial income again outperforms *rural* but the horse race results against *capcon* and *depend* are mixed. In Table 15, the results for *agri* show that the DPE is stronger for lower values of *agri*, as expected. However, in the horse race using annual data, the results are different compared to the 5-year data. Except for the change in reserves, all the other alternative factors tend to outperform *agri*.

I estimate the horse race regressions by putting together all the variables and present the results in Tables 16 to 18.[63] For all three tables, starting with the 5-year data in columns (1) to (3), which exclude the initial income, the results show that the interaction terms for the labor surplus variables and *depend* tend to be significant. But when I include initial income in columns (4) to (6), the labor surplus variables are no longer associated with the DPE, whereas the interaction terms for initial income are significant. Moving on to annual data, both labor surplus and the initial income have no impact on the DPE. Unlike in the 5-year data, *capcon* now impacts the DPE: often, the interaction terms are significant and of the expected sign. This suggests that the DPE is stronger when there are less restrictions on the capital account, as expected. Again, the results provide evidence to suggest that the change in reserves plays no role in the DPE.

The horse race analysis is crucial to stress the following. If deviations from the BSH were driven only by the labor surplus variables, the level of initial income and the alternatives factors would not matter. The fact that the interaction terms involving the initial income are usually significant and robust suggests that there are other variables that can influence the DPE but are not accounted for in this exercise.

[62] Results are robust to using the lag variable, $reserve_{t-1,i}$.

[63] It is worthwhile to note that this exercise introduces too many interaction terms that may confound the estimation of the coefficients because of multicollinearity, namely initial income is a "catch-all" variable for the level of development that would be highly correlated with structural factors. Presumably, there is more variation in the level of initial income compared to the slow moving structural factors which also have limited data availability. Hence, it would not be surprising if this approach does not produce statistically significant results in favor of the latter.

In sum, the empirical results in Sections 5 indicate that a large labor surplus seems to weaken the BSH, and that capital controls are also potentially important to explain deviations from the BSH.

6 Conclusions

The Balassa-Samuelson model is fundamental in understanding the relationship between the real exchange rate and income. However, the theoretical explanation provided by this textbook model – which is nearly 50 years old – is not in line with the growth experience in most developing countries. Despite the takeoff in growth since the 1980s, most developing countries deviate from the BSH as the real exchange rate recorded limited appreciation or none at all.[64]

To resolve this, the paper at hand builds on the Balassa-Samuelson framework to develop a model in which the BSH is dampened by the presence of a labor surplus in the economy. The simple model captures the salient feature of the industrialization process taking place in the developing countries. In particular, the growth process starts with the mobilization of a large supply of low-wage workers from the traditional sector to the more productive modern sector. The exodus of workers generates a countervailing effect to dampen the appreciation of the real exchange rate in response to growth. Absorbing this surplus, which spans over a prolonged period of time, drives the rapid expansion of the economy while containing the rise in wages and prices. In other words, because of this "inherent" feature the country can experience high growth with limited real appreciation, especially at the early stage of development. Subsequently, the labor surplus is exhausted, and the BSH comes into effect as the economy grows to become an advanced country. Two testable implications of the model are that the BSH is suppressed for a prolonged period of time if there is a sizeable amount of labor surplus, and that the BSH holds when the labor surplus falls below a threshold level. Standard regression results using cross-section data and panel data offer evidence supporting these two implications.

One contribution of the paper is to stress the following. The relationship between the real exchange rate and income seems to move in line with the level of development. Hence, this study offers a first step in explaining how a structural factor like labor surplus can influence the way real exchange rates change in growing developing countries, and behave in a way that is inconsistent with the BSH. Accounting for the structure of the economy can also reconcile why the BSH is suppressed in poor countries but is satisfied in rich countries; this threshold effect follows from the changing structure of the economy.

[64] Robust empirical evidence provided in Chuah (2012) and earlier papers confirm that this is indeed a long-run feature in developing countries.

The model presented in this paper dampens the real appreciation but does not reverse the BSH to depreciate the real exchange rate as the economy grows. On one hand, this means that the model is not completely successful in fully replicating the findings presented in Chuah (2012).[65] On the other hand, this is consistent with the horse race analysis which suggests that other factors – such as capital controls – could impact the co-movements between the real exchange rate and income. A more complete explanation of the anti-Balassa effect probably involves more countervailing channels than the one considered here.

Going forward, the following three directions for further research are worth considering. One extension is to augment the model with additional countervailing channels operating through capital controls or structural factors leading to high savings.[66] For instance, building on Jeanne (2012) and this paper, we could introduce a government that imposes capital controls and accumulates foreign assets. Presumably, the real exchange rate will react differently to each channel. It will be worthwhile to compare the strength of these different channels, and compute the net effect. Additionally, it would be interesting to incorporate monetary policy into the model. This follows from the popular view that developing countries could be using distortive monetary policies to keep their currencies undervalued.[67] Calibrating this richer model would show how this channel limits real exchange rate adjustments to suppress the BSH, if at all.[68] Another extension is to introduce exports and imports in the model as real exchange rates play an important role in the level of external competitiveness in developing countries. In a three sector model – exports, imports and non-tradable – the terms of trade would provide an additional channel to dampen the BSH. Finally, future work should extend the model such that it pins down the threshold level for each explanatory factor; this captures the turning points that govern the relationship between the real exchange rate and income. In doing so, we can use these thresholds, also known as the Lewisian turning point, to characterize the development stage of the economy and when the BSH is effective. This would help policymakers identify the amount of slack present in the economy, and examine policies on how to sustain growth.

[65] Robust evidence for the anti-Balassa effect is provided in Chuah (2012). It refers to the flat BS line in cross-country data and the non-linear path in the panel data set, in which the real exchange rate depreciates or recorded limited appreciation as the economy grows rapidly. But this relationship turns around to follow the BSH at a later stage of development when income advances further.

[66] See, for example, Jeanne (2012), Tyers and Zhang (2011), Golley and Tyers (2007), Rodrik (2008), and Isard and Symansky (1996).

[67] For further discussion, see Jeanne (2012).

[68] There is a debate, notably among policymakers, that developing countries are using monetary policies to manipulate their currencies such that they remain undervalued. The empirical evidence in this paper suggests that this may not likely be the case in the long run. In the paper at hand, I show that the change in reserves does not play a role in weakening the BSH.

Table 1: Parameter Values for a Developing Country (baseline calibration)

	Parameter	Value
η	share of the tradables in the consumption basket	0.40
θ	elasticity of substitution between tradables and non-tradables	2.00
σ	sensitivity of labor flows	0.10
$a_{T,initial}$	initial productivity level in tradable sector	7.00
$a_{N,initial}$	initial productivity level in non-tradable sector	6.50

Table 2: Country List by Income Groups

High-income (33)		Middle-income (73)				Low-income (36)	
Australia	AUS	Albania	ALB	Latvia	LVA	Afghanistan	AFG
Austria	AUT	Algeria	DZA	Lebanon	LBN	Bangladesh	BGD
Belgium	BEL	Angola	AGO	Lesotho	LSO	Benin	BEN
Canada	CAN	Argentina	ARG	Libya	LBY	Burkina Faso	BFA
Croatia	HRV	Armenia	ARM	Lithuania	LTU	Burundi	BDI
Cyprus	CYP	Azerbaijan	AZE	Macedonia, FYR	MKD	Cambodia	KHM
Czech Rep.	CZE	Belarus	BLR	Malaysia	MYS	Central African Rep.	CAF
Denmark	DNK	Bolivia	BOL	Mauritius	MUS	Chad	TCD
Estonia	EST	Bosnia & Herzegovina	BIH	Mexico	MEX	Congo, Dem. Rep.	ZAR
Finland	FIN	Botswana	BWA	Moldova	MDA	Eritrea	ERI
France	FRA	Brazil	BRA	Mongolia	MNG	Ethiopia	ETH
Germany	DEU	Bulgaria	BGR	Morocco	MAR	Gambia, The	GMB
Greece	GRC	Cameroon	CMR	Namibia	NAM	Ghana	GHA
Hong Kong	HKG	Chile	CHL	Nicaragua	NIC	Guinea	GIN
Hungary	HUN	China	CHN	Nigeria	NGA	Guinea-Bissau	GNB
Ireland	IRL	Colombia	COL	Pakistan	PAK	Haiti	HTI
Israel	ISR	Congo, Rep.	COG	Panama	PAN	Kenya	KEN
Italy	ITA	Costa Rica	CRI	Papua New Guinea	PNG	Kyrgyz Rep.	KGZ
Japan	JPN	Cte d'Ivoire	CIV	Paraguay	PRY	Lao PDR	LAO
Korea	KOR	Dominican Rep.	DOM	Peru	PER	Liberia	LBR
Netherlands	NLD	Ecuador	ECU	Philippines	PHL	Madagascar	MDG
New Zealand	NZL	Egypt, Arab Rep.	EGY	Romania	ROM	Malawi	MWI
Norway	NOR	El Salvador	SLV	Russia	RUS	Mali	MLI
Poland	POL	Gabon	GAB	Senegal	SEN	Mauritania	MRT
Portugal	PRT	Georgia	GEO	Serbia	SRB	Mozambique	MOZ
Singapore	SGP	Guatemala	GTM	South Africa	ZAF	Myanmar	MMR
Slovak Rep.	SVK	Honduras	HND	Sri Lanka	LKA	Nepal	NPL
Slovenia	SVN	India	IND	Sudan	SDN	Niger	NER
Spain	ESP	Indonesia	IDN	Swaziland	SWZ	Rwanda	RWA
Sweden	SWE	Iran, Islamic Rep.	IRN	Syrian Arab Rep.	SYR	Sierra Leone	SLE
Switzerland	CHE	Jamaica	JAM	Thailand	THA	Tajikistan	TJK
Taiwan	TWN	Jordan	JOR	Tunisia	TUN	Tanzania	TZA
United Kingdom	GBR	Kazakhstan	KAZ	Turkey	TUR	Togo	TGO
				Turkmenistan	TKM	Uganda	UGA
				Ukraine	UKR	Zambia	ZMB
				Uruguay	URY	Zimbabwe	ZWE
				Uzbekistan	UZB		
				Venezuela	VEN		
				Vietnam	VNM		
				Yemen	YEM		

Notes: Total number of countries is 142 (ex-USA). Countries with population less than 1 million in 2005, based on WDI data, are excluded. Source: WDI 2011 (October). The number of countries are reported in the parentheses. Developing countries are defined as the middle- and low-income group combined.

Table 3: Data Description

Variable	Source	Description
Main data set		
RER_1	PWT	Price Level of GDP from PWT7. Defined as PPP (over GDP) divided by the nominal exchange rate. PPP and the exchange rate are expressed as national currency per USD. The value for the United States is equal to 100.
RER_2	IFS	Bilateral real exchange rate (relative to the USD). Defined as the nominal exchange rate deflated using the CPI.
RER_3	IFS	Real effective exchange rate index. Defined as the trade-weighted real exchange rate deflated using the CPI.
Y_{rgdpch}	PWT	PPP converted GDP per capita at constant prices from PWT7.
$\frac{A_T}{A_N}$	WDI	Labor productivity defined as output per worker. Measured using value added (VA) data from the industrial or manufacturing sector (tradable) and agriculture sector (non-tradable). $A_T = \frac{\text{VA industry at constant USD}}{\text{Employment in industry}}$ and $A_N = \frac{\text{VA agriculture at constant USD}}{\text{Employment in agriculture}}$
λ	WDI	Ratio of employment in the industrial to the agriculture sector.
$rural$	WDI	Share of population living in rural areas.
$agri$	WDI	Share of total employment in the agriculture sector.
$capcon$	Quinn & Toyoda (2008)	De-jure capital controls index. A high value indicates a low degree of capital controls.
$depend$	WDI	Ratio of dependents (younger than 15 or older than 64) to the working-age population.
$reserves$	Lane & Milesi-Ferretti (2007)	Change in foreign exchange reserves ex-gold (share of GDP).

Table 4: Regression Results for Cross-country Data in Levels (1980 and 2005)

	Labor ratio (λ)		Rural population		Agriculture employment	
	Low	High	High	Low	High	Low
	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$
	(1)	(2)	(3)	(4)	(5)	(6)
1980						
$\ln Y_{rgdpch}$	-0.161	0.179**	-0.216	0.306**	-0.256**	0.181***
	(0.113)	(0.078)	(0.159)	(0.121)	(0.088)	(0.066)
R^2	0.030	0.406	0.112	0.288	0.098	0.139
Countries	15	18	17	25	17	41
2005						
$\ln Y_{rgdpch}$	0.099	0.306***	-0.004	0.423***	0.013	0.331***
	(0.087)	(0.104)	(0.059)	(0.049)	(0.058)	(0.067)
R^2	0.054	0.636	0.000	0.729	0.002	0.574
Countries	15	18	17	25	17	41

	Capital controls		Change in reserves		Dependency ratio	
	High	Low	High	Low	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
1980						
$\ln Y_{rgdpch}$	-0.087	0.393***	-0.077	0.088*	0.070	0.404*
	(0.138)	(0.089)	(0.062)	(0.045)	(0.109)	(0.202)
R^2	0.020	0.600	0.077	0.149	0.036	0.318
Countries	14	19	20	31	14	22
2005						
$\ln Y_{rgdpch}$	0.220**	0.484***	0.127***	0.287***	0.264**	0.525***
	(0.082)	(0.048)	(0.035)	(0.028)	(0.119)	(0.089)
R^2	0.215	0.778	0.325	0.824	0.439	0.592
Countries	14	19	20	31	14	22

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Robust standard errors are reported in the parentheses. Source: PWT7 and WDI.

Table 5: Regression Results for Cross-country Data in Levels (1980)

	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\ln Y_{rgdpch}$	0.125*	0.093	0.127	0.203*	-0.054	-0.114	-0.052	-0.065	0.123	0.117	0.171	0.287**
	(0.071)	(0.076)	(0.150)	(0.107)	(0.052)	(0.084)	(0.080)	(0.119)	(0.074)	(0.088)	(0.149)	(0.128)
$\ln Y_{rgdpch} \times \lambda$	0.007*	0.002	0.007*	0.003								
	(0.004)	(0.004)	(0.004)	(0.004)								
$\ln Y_{rgdpch} \times rural$					-0.095***	-0.064	-0.096**	-0.065				
					(0.035)	(0.041)	(0.037)	(0.041)				
$\ln Y_{rgdpch} \times agri$									-0.091*	-0.061	-0.090*	-0.048
									(0.051)	(0.040)	(0.052)	(0.047)
$\ln Y_{rgdpch} \times capcon$		0.073*		0.071*		0.066**		0.070**		0.028		0.041
		(0.037)		(0.035)		(0.028)		(0.027)		(0.033)		(0.032)
$\ln Y_{rgdpch} \times depend$			-0.000	-0.030			-0.001	-0.017			-0.012	-0.045
			(0.036)	(0.027)			(0.021)	(0.023)			(0.028)	(0.028)
R^2	0.502	0.653	0.502	0.673	0.066	0.123	0.066	0.129	0.502	0.585	0.506	0.638
adjusted-R^2	0.464	0.608	0.442	0.614	0.0444	0.0846	0.0335	0.0768	0.470	0.540	0.457	0.584
Observations	29	27	29	27	91	72	91	72	34	32	34	32

Notes: The labor ratio ($\frac{L_T}{L_N}$) is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Robust standard errors are reported in the parentheses (clustered by country). Source: PWT7, IFS, WDI and Quinn and Toyoda (2008).

Table 6: Regression Results for Cross-country Data in Levels (2005)

	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$	$\ln RER_1$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\ln Y_{rgdpch}$	0.231***	0.252***	0.459***	0.482***	0.223***	0.225***	0.462***	0.456***	0.302***	0.308***	0.526***	0.530***
	(0.043)	(0.048)	(0.047)	(0.067)	(0.030)	(0.047)	(0.050)	(0.066)	(0.059)	(0.055)	(0.057)	(0.057)
$\ln Y_{rgdpch} \times \lambda$	0.004***	0.003**	0.003**	0.002*								
	(0.001)	(0.001)	(0.001)	(0.001)								
$\ln Y_{rgdpch} \times rural$					-0.026	-0.026	-0.009	-0.001				
					(0.024)	(0.023)	(0.022)	(0.021)				
$\ln Y_{rgdpch} \times agri$									-0.008	0.027	0.003	0.034
									(0.038)	(0.037)	(0.032)	(0.031)
$\ln Y_{rgdpch} \times capcon$		0.004		-0.015		0.019		0.005		0.017		0.002
		(0.022)		(0.022)		(0.018)		(0.019)		(0.019)		(0.020)
$\ln Y_{rgdpch} \times depend$			-0.056***	-0.050***			-0.057***	-0.047***			-0.057***	-0.048***
			(0.010)	(0.012)			(0.010)	(0.010)			(0.009)	(0.010)
R^2	0.684	0.709	0.772	0.777	0.528	0.665	0.633	0.724	0.648	0.689	0.753	0.764
adjusted-R^2	0.675	0.693	0.762	0.761	0.519	0.652	0.623	0.709	0.639	0.674	0.744	0.748
Observations	76	60	76	60	111	78	111	78	83	67	83	67

Notes: The labor ratio ($\frac{L_T}{L_N}$) is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Robust standard errors are reported in the parentheses (clustered by country). Source: PWT7, IFS, WDI and Quinn and Toyoda (2008).

Table 7: Interacting Labor Ratio with Income,
Regression Results for Panel Data in Levels Using 5-year Data

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
5-year data												
$\ln Y_{rgdpch}$	0.254*	-0.158	0.363	0.208	-0.167	0.355	-0.330	0.185	0.328	0.119	-0.382*	0.319
	(0.132)	(0.149)	(0.319)	(0.126)	(0.152)	(0.329)	(0.200)	(0.152)	(0.357)	(0.156)	(0.222)	(0.373)
$\ln Y_{rgdpch} \times \lambda$	0.002	0.004***	0.002	0.002	0.004***	0.001	0.004***	0.002	0.002	0.002	0.004***	0.002
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
$\ln Y_{rgdpch} \times capcon$				0.026	0.028	0.009				0.026	0.030	0.009
				(0.021)	(0.024)	(0.025)				(0.021)	(0.023)	(0.025)
$\ln Y_{rgdpch} \times dependent$							0.037	0.015	0.010	0.019	0.044	0.010
							(0.027)	(0.018)	(0.027)	(0.016)	(0.029)	(0.028)
R^2	0.146	0.235	0.220	0.152	0.254	0.221	0.250	0.150	0.221	0.159	0.275	0.221
adjusted-R^2	0.127	0.211	0.196	0.128	0.226	0.191	0.223	0.127	0.193	0.131	0.243	0.187
Observations	270	202	201	251	192	192	202	270	201	251	192	192
Avg. Observations	3.600	3.483	3.792	3.862	3.692	4	3.483	3.600	3.792	3.862	3.692	4
Countries	75	58	53	65	52	48	58	75	53	65	52	48

Notes: The labor ratio $(\frac{L_T}{L_N})$ is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time and country dummies. Source: PWT7, IFS, WDI and Quinn and Toyoda (2008).

Table 7: Interacting Labor Ratio with Income,
Regression Results for Panel Data in Levels Using Annual Data

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Annual data												
$\ln Y_{rgdpch}$	0.285**	-0.093	0.290	0.264**	-0.082	0.283	0.218*	-0.035	0.296	0.215	-0.031	0.294
	(0.130)	(0.132)	(0.322)	(0.123)	(0.134)	(0.336)	(0.130)	(0.161)	(0.357)	(0.139)	(0.174)	(0.375)
$\ln Y_{rgdpch} \times \lambda$	0.001	0.002**	0.001	0.001	0.002**	0.001	0.001	0.002**	0.001	0.001	0.002**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\ln Y_{rgdpch} \times capcon$				0.020	0.035*	0.007				0.020	0.035*	0.007
				(0.020)	(0.019)	(0.024)				(0.020)	(0.019)	(0.024)
$\ln Y_{rgdpch} \times dependent$							0.014	-0.011	-0.002	0.010	-0.009	-0.003
							(0.013)	(0.018)	(0.022)	(0.013)	(0.019)	(0.023)
R^2	0.195	0.224	0.178	0.202	0.252	0.179	0.198	0.226	0.179	0.203	0.253	0.179
adjusted-R^2	0.176	0.196	0.154	0.181	0.222	0.152	0.178	0.196	0.153	0.181	0.222	0.151
Observations	1,152	772	933	1,098	745	905	1,152	772	933	1,098	745	905
Avg. Observations	14.77	14.57	17.60	16.39	15.52	18.85	14.77	14.57	17.60	16.39	15.52	18.85
Countries	78	53	53	67	48	48	78	53	53	67	48	48

Notes: The labor ratio ($\frac{L_T}{L_N}$) is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time and country dummies. Source: PWT7, IFS, WDI and Quinn and Toyoda (2008).

Table 8: Interacting Rural Population with Income,
Regression Results for Panel Data in Levels Using 5-year Data

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
5-year data												
$\ln Y_{rgdpch}$	0.366***	0.194*	0.440***	0.283***	0.054	0.477**	0.198	-0.021	0.483**	0.090	-0.152	0.523**
	(0.113)	(0.109)	(0.159)	(0.101)	(0.123)	(0.202)	(0.183)	(0.193)	(0.194)	(0.138)	(0.226)	(0.238)
$\ln Y_{rgdpch} \times rural$	-0.045	-0.017	0.143	-0.021	-0.002	0.129	-0.016	0.023	0.131	0.018	0.035	0.114
	(0.068)	(0.076)	(0.126)	(0.067)	(0.081)	(0.130)	(0.068)	(0.067)	(0.121)	(0.061)	(0.070)	(0.124)
$\ln Y_{rgdpch} \times capcon$				0.039**	0.030	0.017				0.034*	0.028	0.018
				(0.017)	(0.023)	(0.026)				(0.017)	(0.023)	(0.026)
$\ln Y_{rgdpch} \times depend$							0.043*	0.049	-0.012	0.046**	0.047	-0.013
							(0.025)	(0.032)	(0.032)	(0.022)	(0.037)	(0.035)
R^2	0.239	0.340	0.332	0.205	0.279	0.315	0.257	0.359	0.333	0.230	0.297	0.316
adjusted-R^2	0.229	0.328	0.318	0.190	0.261	0.297	0.246	0.345	0.317	0.212	0.277	0.295
Observations	455	340	305	370	285	265	455	340	305	370	285	265
Avg. Observations	5	5	5	4.933	5	5	5	5	5	4.933	5	5
Countries	91	68	61	75	57	53	91	68	61	75	57	53

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y while data availability for λ. All regressions include time and country dummies. Source: PWT7, IFS, WDI and Quinn and Toyoda (2008).

Table 8: Interacting Rural Population with Income,
Regression Results for Panel Data in Levels Using Annual Data

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Annual data												
$\ln Y_{rgdpch}$	0.345***	0.225**	0.394***	0.271***	0.089	0.409**	0.221	0.165	0.425**	0.126	0.081	0.452**
	(0.106)	(0.103)	(0.144)	(0.094)	(0.118)	(0.182)	(0.167)	(0.159)	(0.168)	(0.124)	(0.182)	(0.207)
$\ln Y_{rgdpch} \times rural$	-0.047	0.035	0.156	-0.021	0.050	0.148	-0.024	0.044	0.146	0.010	0.051	0.133
	(0.064)	(0.066)	(0.112)	(0.062)	(0.066)	(0.115)	(0.066)	(0.066)	(0.106)	(0.058)	(0.067)	(0.108)
$\ln Y_{rgdpch} \times capcon$				0.040**	0.049**	0.014				0.037**	0.049**	0.015
				(0.016)	(0.020)	(0.024)				(0.016)	(0.021)	(0.024)
$\ln Y_{rgdpch} \times depend$							0.033	0.014	-0.009	0.036*	0.002	-0.012
							(0.022)	(0.027)	(0.026)	(0.019)	(0.029)	(0.028)
R^2	0.239	0.325	0.293	0.217	0.290	0.275	0.249	0.326	0.293	0.230	0.290	0.276
adjusted-R^2	0.230	0.313	0.281	0.205	0.274	0.260	0.240	0.314	0.281	0.218	0.274	0.260
Observations	2,366	1,560	1,586	1,925	1,326	1,378	2,366	1,560	1,586	1,925	1,326	1,378
Avg. Observations	26	26	26	25.67	26	26	26	26	26	25.67	26	26
Countries	91	60	61	75	51	53	91	60	61	75	51	53

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y while data availability for λ. All regressions include time and country dummies. Source: PWT7, IFS, WDI and Quinn and Toyoda (2008).

Table 9: Interacting Agriculture Employment with Income, Regression Results for Panel Data in Levels Using 5-year Data

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
5-year data												
$\ln Y_{rgdpch}$	0.315**	-0.039	0.441	0.282**	-0.037	0.440	0.289**	-0.131	0.461	0.251*	-0.148	0.466
	(0.129)	(0.153)	(0.292)	(0.120)	(0.157)	(0.297)	(0.138)	(0.184)	(0.317)	(0.137)	(0.202)	(0.322)
$\ln Y_{rgdpch} \times agri$	-0.005	-0.035	-0.012	-0.007	-0.034	-0.011	-0.004	-0.031	-0.013	-0.007	-0.029	-0.012
	(0.022)	(0.047)	(0.057)	(0.024)	(0.050)	(0.058)	(0.022)	(0.048)	(0.057)	(0.024)	(0.052)	(0.058)
$\ln Y_{rgdpch} \times capcon$				0.024	0.021	0.004				0.024	0.021	0.005
				(0.017)	(0.023)	(0.024)				(0.017)	(0.023)	(0.023)
$\ln Y_{rgdpch} \times depend$							0.006	0.021	-0.007	0.007	0.025	-0.008
							(0.016)	(0.023)	(0.025)	(0.015)	(0.025)	(0.025)
R^2	0.149	0.183	0.212	0.156	0.194	0.212	0.149	0.189	0.212	0.157	0.201	0.212
adjusted-R^2	0.132	0.160	0.190	0.135	0.166	0.185	0.129	0.162	0.187	0.133	0.169	0.181
Observations	305	219	223	286	209	214	305	219	223	286	209	214
Avg. Observations	3.720	3.590	3.912	3.972	3.800	4.115	3.720	3.590	3.912	3.972	3.800	4.115
Countries	82	61	57	72	55	52	82	61	57	72	55	52

Notes: The labor ratio ($\frac{L_T}{L_N}$) is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time and country dummies. Source: PWT7, IFS, WDI and Quinn and Toyoda (2008).

Table 9: Interacting Agriculture Employment with Income,
Regression Results for Panel Data in Levels Using Annual Data

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Annual data												
$\ln Y_{rgdpch}$	0.334**	-0.018	0.359	0.320***	-0.000	0.360	0.316**	0.100	0.401	0.324**	0.130	0.409
	(0.130)	(0.141)	(0.296)	(0.119)	(0.144)	(0.301)	(0.127)	(0.160)	(0.316)	(0.128)	(0.172)	(0.321)
$\ln Y_{rgdpch} \times agri$	-0.006	-0.009	-0.009	-0.006	-0.012	-0.008	-0.006	-0.013	-0.010	-0.006	-0.016	-0.008
	(0.023)	(0.040)	(0.043)	(0.024)	(0.042)	(0.044)	(0.023)	(0.038)	(0.043)	(0.024)	(0.041)	(0.044)
$\ln Y_{rgdpch} \times capcon$				0.022	0.033*	0.002				0.022	0.033*	0.004
				(0.017)	(0.019)	(0.023)				(0.017)	(0.019)	(0.022)
$\ln Y_{rgdpch} \times depend$							0.004	-0.024	-0.013	-0.001	-0.026	-0.015
							(0.012)	(0.016)	(0.021)	(0.012)	(0.017)	(0.021)
R^2	0.196	0.187	0.165	0.209	0.210	0.164	0.196	0.195	0.166	0.209	0.219	0.166
adjusted-R^2	0.179	0.160	0.142	0.191	0.182	0.140	0.179	0.167	0.143	0.190	0.190	0.141
Observations	1,322	826	1,039	1,268	799	1,011	1,322	826	1,039	1,268	799	1,011
Avg. Observations	15.55	15.02	18.23	17.14	15.98	19.44	15.55	15.02	18.23	17.14	15.98	19.44
Countries	85	55	57	74	50	52	85	55	57	74	50	52

Notes: The labor ratio ($\frac{L_T}{L_N}$) is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time and country dummies. Source: PWT7, IFS, WDI and Quinn and Toyoda (2008).

Table 10: Interacting Dummies for Labor Ratio with Income,
Regression Results for Panel Data in Levels

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
5-year data															
$\ln Y_{rgdpch}$	0.455***	0.276**	0.537***	0.409***	0.292***	0.467**	0.327***	0.149	0.414**	0.423*	0.377	0.846***	0.403*	0.404	0.687***
	(0.104)	(0.110)	(0.200)	(0.108)	(0.103)	(0.215)	(0.112)	(0.127)	(0.183)	(0.215)	(0.319)	(0.262)	(0.205)	(0.339)	(0.206)
$\ln Y_{rgdpch} \times Dum_H \lambda$	0.797***	0.893***	1.084***	0.562***	0.664***	0.899***	0.681***	0.865***	0.894***	0.581***	0.734***	0.773***	0.338*	0.458	0.414
	(0.162)	(0.211)	(0.287)	(0.172)	(0.245)	(0.264)	(0.161)	(0.203)	(0.308)	(0.185)	(0.260)	(0.261)	(0.183)	(0.284)	(0.273)
$\ln Y_{rgdpch} \times Dum_L \lambda$	-0.830***	-1.057***	-0.735	-0.692**	-1.038***	-0.610	-0.573*	-1.105***	-0.107	-0.892***	-1.169***	-0.780*	-0.540*	-1.204***	-0.316
	(0.260)	(0.328)	(0.500)	(0.268)	(0.325)	(0.516)	(0.318)	(0.291)	(0.539)	(0.277)	(0.322)	(0.433)	(0.319)	(0.325)	(0.508)
$\ln Y_{rgdpch} \times Dum_H capcon$				-0.162	-0.360*	-0.210							-0.164	-0.310*	0.184
				(0.184)	(0.190)	(0.440)							(0.180)	(0.174)	(0.412)
$\ln Y_{rgdpch} \times Dum_L capcon$				0.457***	0.445**	0.418*							0.223	0.347*	0.374
				(0.132)	(0.204)	(0.239)							(0.142)	(0.199)	(0.235)
$\ln Y_{rgdpch} \times Dum_H depend$							0.453***	0.350**	0.600**				0.423***	0.302**	0.684**
							(0.141)	(0.169)	(0.297)				(0.116)	(0.136)	(0.278)
$\ln Y_{rgdpch} \times Dum_L depend$							-0.232	0.231	-0.730				-0.331	0.152	-0.349
							(0.330)	(0.299)	(0.503)				(0.318)	(0.339)	(0.538)
$\ln Y_{rgdpch} \times Dum_H reserve$										-0.078	-0.179	-0.781**	-0.204	-0.331	-0.961**
										(0.208)	(0.316)	(0.357)	(0.193)	(0.296)	(0.381)
$\ln Y_{rgdpch} \times Dum_L reserve$										0.383**	0.157	-0.011	0.253	0.103	-0.176
										(0.181)	(0.288)	(0.251)	(0.174)	(0.281)	(0.215)
R^2	0.327	0.433	0.383	0.345	0.455	0.393	0.351	0.445	0.403	0.345	0.441	0.409	0.376	0.471	0.437
adjusted-R^2	0.317	0.422	0.368	0.332	0.440	0.374	0.338	0.430	0.385	0.332	0.426	0.391	0.358	0.450	0.411
Observations	460	340	305	460	340	305	460	340	305	460	340	305	460	340	305
Avg. observations	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Countries	92	68	61	92	68	61	92	68	61	92	68	61	92	68	61

Notes: The labor ratio ($\frac{L_T}{L_N}$) is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time and country dummies. Subscript H and L denotes high and low, respectively. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 11: Interacting Dummies for Rural Population with Income, Regression Results for Panel Data in Levels

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
5-year data															
$\ln Y_{rgdpch}$	0.377***	0.214	0.517***	0.346***	0.211	0.370*	0.329**	0.234	0.481***	0.215	0.390	0.585**	0.368	0.437	0.643**
	(0.129)	(0.150)	(0.185)	(0.123)	(0.151)	(0.207)	(0.138)	(0.177)	(0.168)	(0.227)	(0.326)	(0.290)	(0.226)	(0.351)	(0.250)
$\ln Y_{rgdpch} \times Dum_H rural$	-0.516**	-0.491**	-0.936***	-0.385	-0.531	-1.036**	-0.308	-0.385*	-0.667***	-0.476**	-0.467**	-0.489	-0.001	-0.198	-0.006
	(0.218)	(0.232)	(0.338)	(0.279)	(0.321)	(0.456)	(0.206)	(0.200)	(0.238)	(0.207)	(0.224)	(0.447)	(0.246)	(0.254)	(0.638)
$\ln Y_{rgdpch} \times Dum_L rural$	0.369**	0.397*	0.538	0.161	0.134	0.386	0.155	0.291	0.354	0.325**	0.435**	0.503*	-0.057	-0.053	0.115
	(0.172)	(0.216)	(0.323)	(0.140)	(0.179)	(0.289)	(0.190)	(0.235)	(0.347)	(0.141)	(0.181)	(0.287)	(0.148)	(0.228)	(0.249)
$\ln Y_{rgdpch} \times Dum_H capcon$				-0.128	0.120	0.392							-0.359	-0.143	0.191
				(0.314)	(0.323)	(0.443)							(0.294)	(0.274)	(0.594)
$\ln Y_{rgdpch} \times Dum_L capcon$				0.548***	0.566**	0.485*							0.324**	0.536**	0.423*
				(0.145)	(0.216)	(0.259)							(0.155)	(0.217)	(0.229)
$\ln Y_{rgdpch} \times Dum_H depend$							0.440**	0.130	0.590*				0.473***	0.342	0.748**
							(0.192)	(0.235)	(0.349)				(0.149)	(0.206)	(0.283)
$\ln Y_{rgdpch} \times Dum_L depend$							-0.469	-0.410	-0.550				-0.703**	-0.589	-0.571
							(0.285)	(0.360)	(0.333)				(0.305)	(0.391)	(0.472)
$\ln Y_{rgdpch} \times Dum_H reserve$										0.070	-0.303	-0.577	-0.174	-0.393	-1.002**
										(0.208)	(0.280)	(0.435)	(0.219)	(0.294)	(0.449)
$\ln Y_{rgdpch} \times Dum_L reserve$										0.500**	-0.022	0.124	0.321	0.025	-0.135
										(0.200)	(0.313)	(0.325)	(0.202)	(0.310)	(0.246)
R^2	0.295	0.394	0.378	0.315	0.407	0.389	0.322	0.402	0.399	0.317	0.403	0.394	0.361	0.432	0.431
adjusted-R^2	0.285	0.381	0.363	0.302	0.391	0.370	0.308	0.386	0.380	0.303	0.387	0.375	0.343	0.409	0.406
Observations	460	340	305	460	340	305	460	340	305	460	340	305	460	340	305
Avg. observation	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Countries	92	68	61	92	68	61	92	68	61	92	68	61	92	68	61

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time and country dummies. Subscript H and L denotes high and low, respectively. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 12: Interacting Dummies for Agriculture Employment with Income, Regression Results for Panel Data in Levels

	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$	$\ln RER_1$	$\ln RER_2$	$\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
5-year data															
$\ln Y_{rgdpch}$	0.227	0.110	0.278	0.228	0.091	0.157	0.268*	0.158	0.352	0.164	0.256	0.369	0.345	0.333	0.203
	(0.145)	(0.162)	(0.384)	(0.147)	(0.158)	(0.337)	(0.149)	(0.187)	(0.356)	(0.233)	(0.301)	(0.458)	(0.255)	(0.357)	(0.314)
$\ln Y_{rgdpch} \times Dum_H agri$	-0.391*	-0.508**	-0.494	-0.410	-0.552*	-0.702	-0.320	-0.478**	-0.394	-0.388	-0.451*	-0.108	-0.210	-0.415	-0.310
	(0.222)	(0.253)	(0.447)	(0.259)	(0.295)	(0.542)	(0.215)	(0.228)	(0.367)	(0.234)	(0.267)	(0.582)	(0.210)	(0.293)	(0.628)
$\ln Y_{rgdpch} \times Dum_L agri$	0.567***	0.523**	0.693	0.409**	0.405*	0.576	0.363*	0.508*	0.379	0.492***	0.578***	0.757	0.071	0.375	0.599
	(0.162)	(0.220)	(0.419)	(0.177)	(0.216)	(0.402)	(0.197)	(0.294)	(0.413)	(0.154)	(0.214)	(0.488)	(0.194)	(0.284)	(0.383)
$\ln Y_{rgdpch} \times Dum_H capcon$				0.045	0.172	0.551							-0.186	0.049	0.882
				(0.274)	(0.251)	(0.466)							(0.239)	(0.279)	(0.616)
$\ln Y_{rgdpch} \times Dum_L capcon$				0.432**	0.469*	0.520							0.279*	0.431**	0.427*
				(0.181)	(0.235)	(0.320)							(0.154)	(0.198)	(0.237)
$\ln Y_{rgdpch} \times Dum_H depend$							0.280	-0.046	0.630*				0.385**	0.048	0.715***
							(0.211)	(0.285)	(0.324)				(0.161)	(0.223)	(0.265)
$\ln Y_{rgdpch} \times Dum_L depend$							-0.370	-0.257	-0.444				-0.568*	-0.343	0.142
							(0.290)	(0.351)	(0.428)				(0.305)	(0.402)	(0.497)
$\ln Y_{rgdpch} \times Dum_H reserve$										-0.001	-0.298	-0.759*	-0.138	-0.328	-1.033***
										(0.211)	(0.252)	(0.439)	(0.218)	(0.275)	(0.368)
$\ln Y_{rgdpch} \times Dum_L reserve$										0.373*	-0.012	0.005	0.318*	-0.029	-0.182
										(0.190)	(0.260)	(0.323)	(0.190)	(0.264)	(0.230)
R^2	0.325	0.427	0.374	0.337	0.440	0.389	0.336	0.430	0.393	0.338	0.436	0.399	0.364	0.451	0.437
adjusted-R^2	0.314	0.415	0.359	0.323	0.424	0.370	0.323	0.414	0.374	0.325	0.421	0.380	0.345	0.429	0.412
Observations	460	340	305	460	340	305	460	340	305	460	340	305	460	340	305
Avg. observation	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Countries	92	68	61	92	68	61	92	68	61	92	68	61	92	68	61

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time and country dummies. Subscript H and L denotes high and low, respectively. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 13: Interacting Labor Ratio with Income Growth,
Regression Results for Panel Data in First Difference Using 5-year Data

	Δ $\ln RER_1$ (1)	Δ $\ln RER_2$ (2)	Δ $\ln RER_3$ (3)	Δ $\ln RER_1$ (4)	Δ $\ln RER_2$ (5)	Δ $\ln RER_3$ (6)	Δ $\ln RER_1$ (7)	Δ $\ln RER_2$ (8)	Δ $\ln RER_3$ (9)	Δ $\ln RER_1$ (10)	Δ $\ln RER_2$ (11)	Δ $\ln RER_3$ (12)	Δ $\ln RER_1$ (13)	Δ $\ln RER_2$ (14)	Δ $\ln RER_3$ (15)
5-year data															
$\Delta \ln Y_{rgdpch,t}$	0.261*	-0.100	0.482	-3.341***	-2.266	-3.907**	0.393	-0.194	0.859	-1.301***	-0.064	-1.620**	0.198	-0.074	0.383
	(0.147)	(0.171)	(0.350)	(0.931)	(1.745)	(1.548)	(0.297)	(0.323)	(0.766)	(0.451)	(0.477)	(0.668)	(0.137)	(0.187)	(0.335)
$\Delta \ln Y_{rgdpch,t}$ $\times \lambda_{t-1}$	0.125***	0.155**	0.135**	-0.030	0.059	-0.010	0.155***	0.132**	0.187**	0.059	0.157***	0.075	0.115***	0.151**	0.152**
	(0.037)	(0.058)	(0.060)	(0.055)	(0.087)	(0.058)	(0.050)	(0.064)	(0.080)	(0.040)	(0.054)	(0.078)	(0.038)	(0.059)	(0.067)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.448***	0.273	0.533**									
				(0.116)	(0.214)	(0.202)									
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$							-0.457	0.166	-0.903						
							(0.480)	(0.572)	(1.071)						
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$										1.022***	-0.025	1.339**			
										(0.300)	(0.249)	(0.556)			
$\Delta \ln Y_{rgdpch,t}$ $\times reserce_t$													-0.000	-0.008	0.042
													(0.023)	(0.023)	(0.026)
R^2	0.135	0.099	0.167	0.182	0.111	0.202	0.137	0.082	0.175	0.187	0.099	0.201	0.167	0.100	0.174
adjusted-R^2	0.113	0.0679	0.139	0.157	0.0747	0.170	0.109	0.0415	0.140	0.162	0.0615	0.168	0.142	0.0627	0.141
Observations	204	152	155	204	152	155	190	144	148	204	152	155	202	152	155
Countries	68	52	48	68	52	48	60	47	44	68	52	48	68	52	48

Notes: The labor ratio ($\frac{L_T}{L_N}$) is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 13: Interacting Labor Ratio with Income Growth,
Regression Results for Panel Data in First Difference Using Annual Data

	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Annual data															
$\Delta \ln Y_{rgdpch,t}$	0.531***	0.502**	0.699**	-3.654***	-1.977	-0.918	-0.108	-0.402	-0.068	-1.073***	0.084	1.185	0.443***	0.471**	0.715**
	(0.167)	(0.237)	(0.327)	(0.773)	(1.782)	(2.681)	(0.276)	(0.327)	(0.556)	(0.325)	(0.685)	(1.424)	(0.143)	(0.233)	(0.327)
$\Delta \ln Y_{rgdpch,t}$ $\times \lambda_{t-1}$	-0.021	-0.016	-0.029	-0.091**	-0.060	-0.051*	-0.070	-0.063	-0.086**	-0.019	-0.020	-0.028	-0.019	-0.012	-0.031
	(0.052)	(0.065)	(0.051)	(0.040)	(0.063)	(0.029)	(0.050)	(0.054)	(0.038)	(0.046)	(0.065)	(0.051)	(0.049)	(0.066)	(0.051)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.503***	0.302	0.190									
				(0.093)	(0.206)	(0.286)									
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$							1.457***	1.773***	1.646**						
							(0.482)	(0.528)	(0.727)						
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$										0.974***	0.266	-0.294			
										(0.215)	(0.399)	(0.789)			
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_{t}$													0.022	0.018	-0.017
													(0.046)	(0.060)	(0.031)
R^2	0.229	0.164	0.065	0.252	0.172	0.067	0.238	0.179	0.076	0.247	0.166	0.066	0.252	0.164	0.065
adjusted-R^2	0.211	0.133	0.0372	0.233	0.140	0.0379	0.218	0.146	0.0464	0.228	0.134	0.0367	0.233	0.132	0.0360
Observations	1,092	731	890	1,092	731	890	1,041	706	863	1,092	731	890	1,079	729	888
Countries	75	51	53	75	51	53	65	47	48	75	51	53	75	51	53

Notes: The labor ratio ($\frac{L_T}{L_N}$) is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 14: Interacting Rural Population with Income Growth,
Regression Results for Panel Data in First Difference Using 5-year Data

	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$	Δ $\ln RER_1$	Δ $\ln RER_2$	Δ $\ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
5-year data															
$\Delta \ln Y_{rgdpch,t}$	1.253***	1.037***	1.526***	-2.808**	-3.096	-3.508*	1.273***	0.958**	2.030**	-0.340	0.680	-0.652	1.082***	1.054***	1.513***
	(0.207)	(0.246)	(0.358)	(1.263)	(2.497)	(1.850)	(0.461)	(0.415)	(0.850)	(0.630)	(0.681)	(1.202)	(0.174)	(0.239)	(0.361)
$\Delta \ln Y_{rgdpch,t}$ $\times rural_{t-1}$	-1.738***	-1.683***	-1.977***	-0.196	-0.161	-0.040	-1.706***	-1.812***	-2.345***	-0.887*	-1.489***	-0.841	-1.535***	-1.641***	-2.007***
	(0.319)	(0.381)	(0.531)	(0.531)	(0.981)	(0.823)	(0.426)	(0.476)	(0.865)	(0.448)	(0.514)	(0.945)	(0.283)	(0.382)	(0.590)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.395***	0.404*	0.488**									
				(0.121)	(0.239)	(0.190)									
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$							-0.222	0.036	-0.571						
							(0.412)	(0.387)	(0.708)						
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$										0.749***	0.166	1.042*			
										(0.283)	(0.282)	(0.606)			
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$													-0.001	-0.009	0.012
													(0.008)	(0.008)	(0.020)
R^2	0.144	0.119	0.155	0.163	0.133	0.175	0.150	0.124	0.170	0.162	0.120	0.173	0.164	0.121	0.156
adjusted-R^2	0.132	0.102	0.137	0.149	0.113	0.154	0.132	0.100	0.146	0.148	0.100	0.152	0.150	0.101	0.134
Observations	364	272	244	364	272	244	295	228	212	364	272	244	353	272	244
Countries	91	68	61	91	68	61	75	57	53	91	68	61	91	68	61

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 14: Interacting Rural Population with Income Growth,
Regression Results for Panel Data in First Difference Using Annual Data

	Δ $\ln RER_1$ (1)	Δ $\ln RER_2$ (2)	Δ $\ln RER_3$ (3)	Δ $\ln RER_1$ (4)	Δ $\ln RER_2$ (5)	Δ $\ln RER_3$ (6)	Δ $\ln RER_1$ (7)	Δ $\ln RER_2$ (8)
Annual data								
$\Delta \ln Y_{rgdpch,t}$	0.840*** (0.216)	0.869*** (0.258)	0.816*** (0.179)	-2.021** (0.972)	-0.157 (1.400)	-1.643 (1.227)	0.964** (0.444)	0.391 (0.491)
$\Delta \ln Y_{rgdpch,t}$ $\times rural_{t-1}$	-1.303*** (0.323)	-0.921** (0.382)	-1.025*** (0.382)	-0.139 (0.495)	-0.509 (0.657)	-0.002 (0.477)	-1.436*** (0.480)	-0.731 (0.553)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.284*** (0.096)	0.101 (0.131)	0.242* (0.128)		
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$							-0.025 (0.411)	0.710 (0.472)
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$								
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$								
R^2	0.170	0.147	0.054	0.175	0.148	0.057	0.169	0.128
adjusted-R^2	0.161	0.132	0.0379	0.165	0.132	0.0402	0.157	0.110
Observations	2,275	1,500	1,525	2,275	1,500	1,525	1,850	1,275
Countries	91	60	61	91	60	61	75	51

	Δ $\ln RER_3$ (9)	Δ $\ln RER_1$ (10)	Δ $\ln RER_2$ (11)	Δ $\ln RER_3$ (12)	Δ $\ln RER_1$ (13)	Δ $\ln RER_2$ (14)	Δ $\ln RER_3$ (15)
Annual data							
$\Delta \ln Y_{rgdpch,t}$	0.247 (0.373)	-0.842 (0.580)	0.475 (0.697)	0.312 (0.746)	0.782*** (0.212)	0.856*** (0.264)	0.818*** (0.177)
$\Delta \ln Y_{rgdpch,t}$ $\times rural_{t-1}$	-1.003 (0.690)	-0.406 (0.469)	-0.727 (0.521)	-0.757 (0.503)	-1.247*** (0.321)	-0.911** (0.389)	-1.028*** (0.379)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$							
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$	0.972*** (0.363)						
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$		0.884*** (0.263)	0.212 (0.303)	0.264 (0.394)			
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$					0.028 (0.028)	0.015 (0.033)	-0.006 (0.020)
R^2	0.063	0.181	0.148	0.055	0.190	0.147	0.054
adjusted-R^2	0.0432	0.171	0.132	0.0379	0.180	0.132	0.0371
Observations	1,325	2,275	1,500	1,525	2,209	1,498	1,523
Countries	53	91	60	61	91	60	61

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 15: Interacting Agriculture Employment with Income Growth, Regression Results for Panel Data in First Difference Using 5-year Data

	$\Delta \ln RER_1$	$\Delta \ln RER_2$	$\Delta \ln RER_3$	$\Delta \ln RER_1$	$\Delta \ln RER_2$	$\Delta \ln RER_3$	$\Delta \ln RER_1$	$\Delta \ln RER_2$	$\Delta \ln RER_3$	$\Delta \ln RER_1$	$\Delta \ln RER_2$	$\Delta \ln RER_3$	$\Delta \ln RER_1$	$\Delta \ln RER_2$	$\Delta \ln RER_3$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
5-year data															
$\Delta \ln Y_{rgdpch,t}$	0.869***	0.775***	1.428***	-3.840**	0.901	-0.366	1.174**	0.950*	2.786***	-0.589	1.164*	0.625	0.777***	0.783***	1.392***
	(0.176)	(0.260)	(0.420)	(1.499)	(2.230)	(1.827)	(0.472)	(0.523)	(1.032)	(0.578)	(0.582)	(0.865)	(0.152)	(0.267)	(0.406)
$\Delta \ln Y_{rgdpch,t}$ $\times agri_{t-1}$	-1.206***	-1.693***	-2.392***	0.441	-1.735*	-1.683*	-1.534***	-1.835***	-3.793***	-0.569	-1.871***	-2.024***	-1.136***	-1.682***	-2.444***
	(0.360)	(0.481)	(0.600)	(0.664)	(0.895)	(0.844)	(0.533)	(0.666)	(1.298)	(0.446)	(0.529)	(0.711)	(0.358)	(0.478)	(0.675)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.485***	-0.013	0.182									
				(0.151)	(0.224)	(0.189)									
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$							-0.470	-0.294	-1.707*						
							(0.451)	(0.513)	(0.925)						
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$										0.752**	-0.200	0.409			
										(0.301)	(0.236)	(0.486)			
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$													-0.000	-0.004	0.025
													(0.021)	(0.022)	(0.030)
R^2	0.193	0.162	0.214	0.224	0.162	0.216	0.203	0.149	0.243	0.220	0.165	0.218	0.231	0.163	0.217
adjusted-R^2	0.175	0.136	0.191	0.203	0.131	0.188	0.181	0.115	0.215	0.200	0.133	0.190	0.210	0.131	0.189
Observations	232	166	173	232	166	173	218	158	166	232	166	173	230	166	173
Countries	75	55	52	75	55	52	67	50	48	75	55	52	75	55	52

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 15: Interacting Agriculture Employment with Income Growth,
Regression Results for Panel Data in First Difference Using Annual Data

	Δ $\ln RER_1$ (1)	Δ $\ln RER_2$ (2)	Δ $\ln RER_3$ (3)	Δ $\ln RER_1$ (4)	Δ $\ln RER_2$ (5)	Δ $\ln RER_3$ (6)	Δ $\ln RER_1$ (7)	Δ $\ln RER_2$ (8)	Δ $\ln RER_3$ (9)	Δ $\ln RER_1$ (10)	Δ $\ln RER_2$ (11)	Δ $\ln RER_3$ (12)	Δ $\ln RER_1$ (13)	Δ $\ln RER_2$ (14)	Δ $\ln RER_3$ (15)
Annual data															
$\Delta \ln Y_{rgdpch,t}$	0.764*** (0.169)	0.738*** (0.183)	0.776*** (0.175)	-2.535** (1.141)	0.717 (2.389)	1.062 (2.621)	0.706 (0.483)	-0.078 (0.503)	-0.029 (0.682)	-0.264 (0.473)	0.708 (0.706)	1.464 (0.988)	0.685*** (0.151)	0.723*** (0.182)	0.777*** (0.174)
$\Delta \ln Y_{rgdpch,t}$ $\times agri_{t-1}$	-0.856* (0.446)	-0.923* (0.529)	-0.760 (1.200)	0.127 (0.548)	-0.916 (0.872)	-0.870 (1.236)	-0.846 (0.645)	-0.282 (0.633)	0.126 (1.521)	-0.644 (0.493)	-0.913 (0.580)	-0.959 (1.081)	-0.892** (0.444)	-0.972* (0.532)	-0.735 (1.207)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.352*** (0.119)	0.002 (0.245)	-0.030 (0.272)									
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$							0.221 (0.517)	1.057* (0.564)	1.049 (0.797)						
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$										0.581** (0.250)	0.017 (0.338)	-0.378 (0.537)			
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$													0.033 (0.041)	0.022 (0.052)	-0.010 (0.023)
R^2	0.233	0.171	0.068	0.241	0.171	0.068	0.232	0.173	0.072	0.240	0.171	0.070	0.255	0.172	0.068
adjusted-R^2	0.217	0.143	0.0433	0.224	0.141	0.0424	0.214	0.142	0.0457	0.223	0.141	0.0437	0.238	0.142	0.0421
Observations	1,255	783	992	1,255	783	992	1,204	758	965	1,255	783	992	1,242	781	990
Countries	82	53	57	82	53	57	72	49	52	82	53	57	82	53	57

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 16: Interacting Labor Ratio with Income Growth,
Horse Race Regression Results for Panel Data in First Difference

	$\Delta \ln RER_1$ (1)	$\Delta \ln RER_2$ (2)	$\Delta \ln RER_3$ (3)	$\Delta \ln RER_1$ (4)	$\Delta \ln RER_2$ (5)	$\Delta \ln RER_3$ (6)
5-year data						
$\Delta \ln Y_{rgdpch,t}$	-1.159**	-0.068	-1.278*	-3.791***	-2.820	-6.659**
	(0.466)	(0.643)	(0.690)	(1.133)	(2.111)	(2.481)
$\Delta \ln Y_{rgdpch,t}$ $\times \lambda_{t-1}$	0.070	0.135**	0.122*	0.001	0.048	0.052
	(0.043)	(0.064)	(0.061)	(0.056)	(0.101)	(0.068)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.481**	0.459	1.000**
				(0.189)	(0.315)	(0.421)
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$	-0.247	0.096	-0.574	-1.128**	-0.708	-2.515**
	(0.517)	(0.645)	(1.199)	(0.553)	(0.760)	(1.186)
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$	0.923***	-0.047	1.241**	0.342	-0.423	-0.107
	(0.285)	(0.267)	(0.555)	(0.352)	(0.311)	(0.624)
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$	-0.005	-0.009	0.025	-0.001	-0.008	0.042
	(0.023)	(0.026)	(0.026)	(0.024)	(0.026)	(0.026)
R^2	0.229	0.083	0.206	0.263	0.103	0.258
adjusted-R^2	0.195	0.0289	0.160	0.226	0.0430	0.210
Observations	189	144	148	189	144	148
Countries	60	47	44	60	47	44
Annual data						
$\Delta \ln Y_{rgdpch,t}$	-1.606***	-0.749	0.604	-2.985***	-1.474	-0.036
	(0.418)	(0.754)	(1.393)	(0.943)	(1.862)	(2.887)
$\Delta \ln Y_{rgdpch,t}$ $\times \lambda_{t-1}$	-0.081**	-0.061	-0.087**	-0.102**	-0.072	-0.094***
	(0.037)	(0.054)	(0.039)	(0.039)	(0.057)	(0.031)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.243	0.125	0.113
				(0.163)	(0.267)	(0.317)
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$	1.515***	1.756***	1.723**	1.160**	1.561**	1.541
	(0.431)	(0.526)	(0.748)	(0.488)	(0.625)	(0.926)
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$	0.818***	0.202	-0.429	0.531	0.075	-0.572
	(0.262)	(0.361)	(0.799)	(0.342)	(0.411)	(0.662)
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$	0.017	0.020	-0.000	0.018	0.019	-0.001
	(0.044)	(0.057)	(0.026)	(0.046)	(0.058)	(0.025)
R^2	0.279	0.180	0.077	0.281	0.181	0.078
adjusted-R^2	0.258	0.145	0.0450	0.260	0.145	0.0442
Observations	1,033	704	861	1,033	704	861
Countries	65	47	48	65	47	48

Notes: The labor ratio $(\frac{L_T}{L_N})$ is represented by λ. The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 17: Interacting Rural Population with Income Growth, Horse Race Regression Results for Panel Data in First Difference

	$\Delta \ln RER_1$ (1)	$\Delta \ln RER_2$ (2)	$\Delta \ln RER_3$ (3)	$\Delta \ln RER_1$ (4)	$\Delta \ln RER_2$ (5)	$\Delta \ln RER_3$ (6)
5-year data						
$\Delta \ln Y_{rgdpch,t}$	-0.539	0.417	-0.070	-4.101***	-5.339*	-5.104**
	(0.684)	(0.827)	(1.350)	(1.349)	(2.830)	(2.343)
$\Delta \ln Y_{rgdpch,t}$ $\times rural_{t-1}$	-0.749	-1.463**	-1.351	0.211	0.278	-0.063
	(0.473)	(0.634)	(1.126)	(0.511)	(1.064)	(1.051)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.475***	0.681**	0.697**
				(0.175)	(0.301)	(0.334)
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$	-0.186	0.108	-0.835	-0.817*	-0.421	-1.661*
	(0.377)	(0.451)	(0.806)	(0.471)	(0.552)	(0.913)
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$	0.810***	0.234	1.130*	0.441	-0.115	0.423
	(0.279)	(0.302)	(0.651)	(0.295)	(0.254)	(0.713)
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$	-0.002	-0.009	-0.011	0.000	-0.010	0.019
	(0.010)	(0.009)	(0.028)	(0.008)	(0.008)	(0.021)
R^2	0.192	0.128	0.190	0.212	0.157	0.210
adjusted-R^2	0.169	0.0962	0.158	0.187	0.122	0.174
Observations	294	228	212	294	228	212
Countries	75	57	53	75	57	53
Annual data						
$\Delta \ln Y_{rgdpch,t}$	-0.368	0.215	-0.028	-1.031	0.546	-2.099
	(0.677)	(0.743)	(0.663)	(1.107)	(1.695)	(1.541)
$\Delta \ln Y_{rgdpch,t}$ $\times rural_{t-1}$	-0.828	-0.667	-0.854	-0.589	-0.785	-0.077
	(0.523)	(0.581)	(0.605)	(0.567)	(0.654)	(0.602)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.082	-0.039	0.256
				(0.154)	(0.202)	(0.176)
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$	-0.059	0.666	0.968**	-0.092	0.687	0.924**
	(0.358)	(0.463)	(0.372)	(0.360)	(0.509)	(0.358)
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$	0.683**	0.112	0.143	0.608	0.136	-0.117
	(0.279)	(0.298)	(0.411)	(0.368)	(0.331)	(0.430)
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$	0.029	0.013	0.003	0.028	0.014	0.001
	(0.032)	(0.039)	(0.023)	(0.033)	(0.038)	(0.023)
R^2	0.189	0.129	0.063	0.189	0.129	0.065
adjusted-R^2	0.176	0.108	0.0416	0.176	0.108	0.0429
Observations	1,836	1,273	1,323	1,836	1,273	1,323
Countries	75	51	53	75	51	53

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Table 18: Interacting Agriculture Employment with Income, Horse Race Regression Results for Panel Data in First Difference

	$\Delta \ln RER_1$ (1)	$\Delta \ln RER_2$ (2)	$\Delta \ln RER_3$ (3)	$\Delta \ln RER_1$ (4)	$\Delta \ln RER_2$ (5)	$\Delta \ln RER_3$ (6)
5-year data						
$\Delta \ln Y_{rgdpch,t}$	-0.361	1.306*	2.027*	-3.961***	0.362	-3.025
	(0.675)	(0.738)	(1.125)	(1.483)	(2.462)	(3.023)
$\Delta \ln Y_{rgdpch,t}$ $\times agri_{t-1}$	-0.758	-1.980***	-3.452**	0.222	-1.741*	-1.964
	(0.579)	(0.687)	(1.397)	(0.624)	(0.913)	(1.392)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t-1}$				0.482**	0.123	0.664*
				(0.185)	(0.290)	(0.391)
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$	-0.369	-0.260	-1.701*	-0.877*	-0.397	-2.389**
	(0.423)	(0.483)	(0.958)	(0.487)	(0.566)	(1.039)
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$	0.709**	-0.194	0.383	0.348	-0.265	-0.118
	(0.313)	(0.272)	(0.448)	(0.308)	(0.296)	(0.443)
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$	-0.010	-0.002	0.002	-0.006	-0.002	0.021
	(0.023)	(0.025)	(0.023)	(0.022)	(0.024)	(0.023)
R^2	0.276	0.152	0.247	0.301	0.153	0.264
adjusted-R^2	0.248	0.106	0.209	0.271	0.101	0.222
Observations	217	158	166	217	158	166
Countries	67	50	48	67	50	48
Annual data						
$\Delta \ln Y_{rgdpch,t}$	-0.173	-0.033	0.738	-1.983	0.580	0.185
	(0.765)	(0.892)	(0.790)	(1.442)	(2.354)	(2.350)
$\Delta \ln Y_{rgdpch,t}$ $\times agri_{t-1}$	-0.587	-0.337	0.034	-0.058	-0.517	0.234
	(0.688)	(0.658)	(1.356)	(0.786)	(0.849)	(1.236)
$\Delta \ln Y_{rgdpch,t}$ $\times \ln Y_{rgdpch,t}$				0.251	-0.084	0.076
				(0.169)	(0.275)	(0.269)
$\Delta \ln Y_{rgdpch,t}$ $\times capcon_{t-1}$	0.307	1.094**	1.204	0.169	1.145**	1.164
	(0.523)	(0.540)	(0.876)	(0.535)	(0.563)	(0.925)
$\Delta \ln Y_{rgdpch,t}$ $\times depend_{t-1}$	0.385	-0.054	-0.492	0.130	0.022	-0.571
	(0.299)	(0.344)	(0.596)	(0.335)	(0.379)	(0.535)
$\Delta \ln Y_{rgdpch,t}$ $\times reserve_t$	0.027	0.026	0.000	0.027	0.026	-0.000
	(0.042)	(0.052)	(0.020)	(0.043)	(0.052)	(0.020)
R^2	0.257	0.174	0.074	0.259	0.174	0.074
adjusted-R^2	0.238	0.141	0.0456	0.240	0.140	0.0447
Observations	1,196	756	963	1,196	756	963
Countries	72	49	52	72	49	52

Notes: The significance of the coefficient, based on the t test, is reported using asterisks at the 10%(*), 5%(**) 1%(***) significance level, respectively. Cluster-robust standard errors are reported in the parentheses (clustered by country). All regressions are based on a balanced panel for RER and Y. All regressions include time dummies. Source: PWT7, IFS, WDI, Quinn and Toyoda (2008) and Lane and Milesi-Ferretti (2007).

Figure 1: How Productivity Improvements in the Tradable Sector Affects the Developing Economy for Different Values of θ

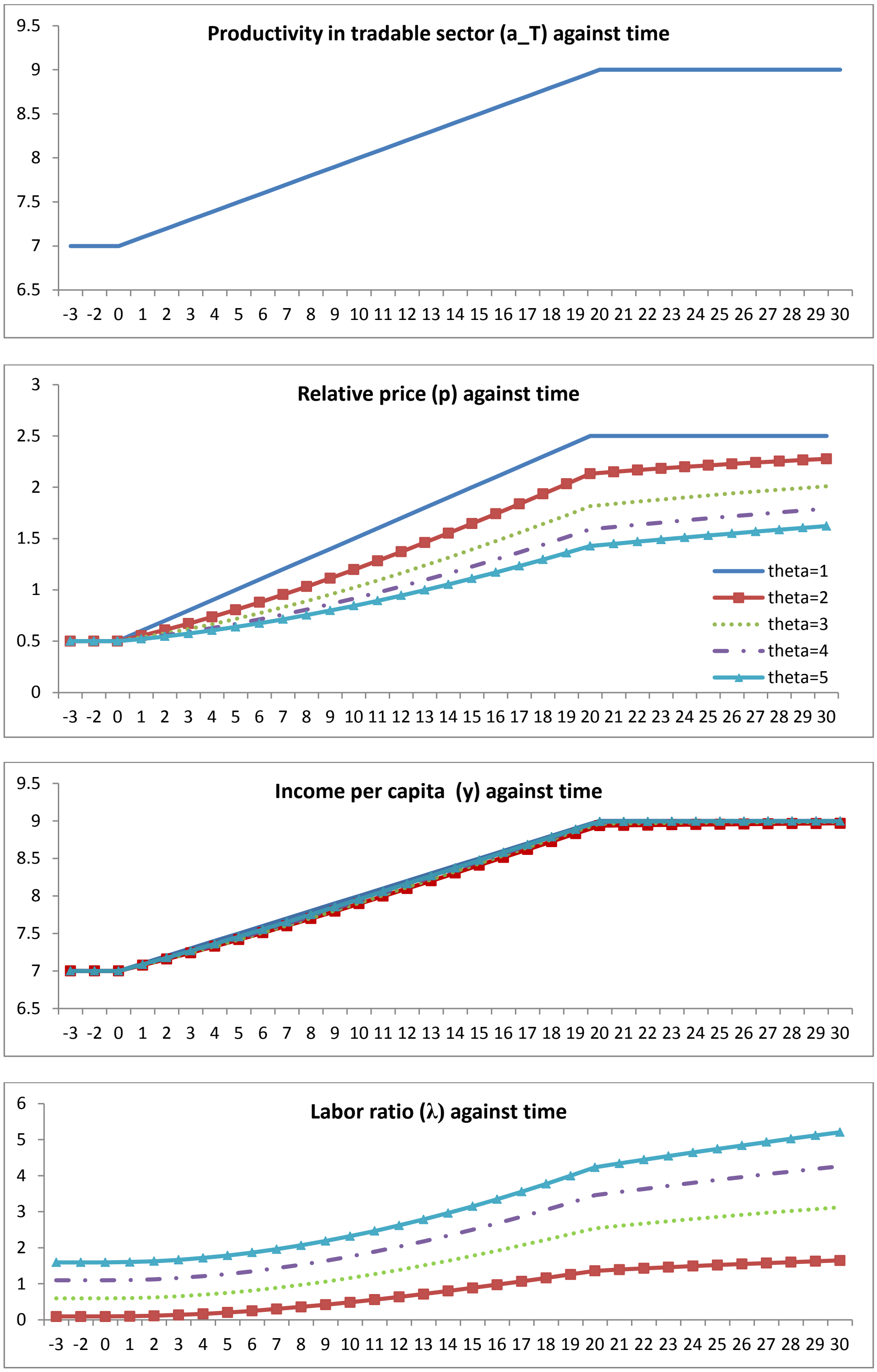


Figure 2: How the Relative Price Moves with Income in the Developing Economy for Different Values of θ

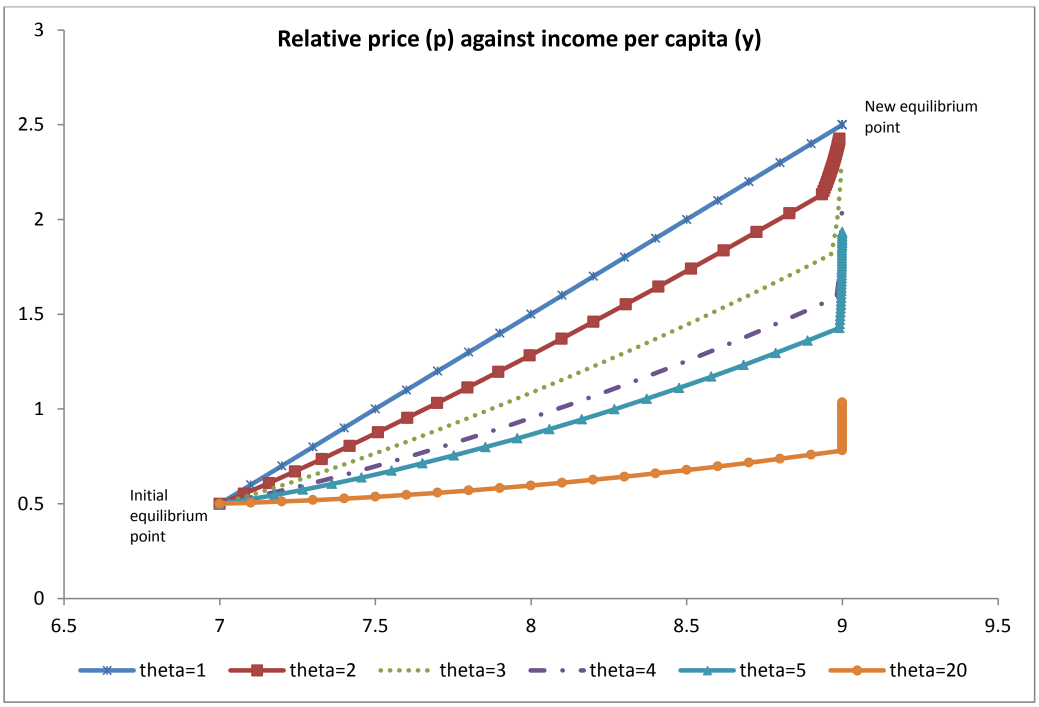
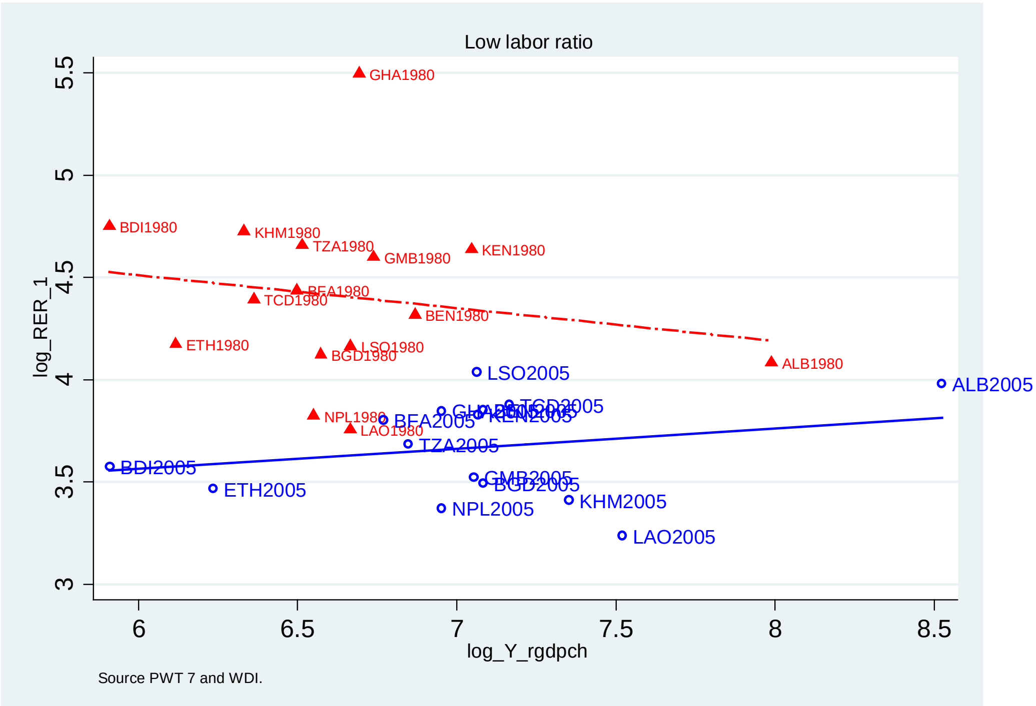


Figure 3: Sample Splits by Labor Ratio (λ)
Cross-country Data in Levels for 1980 and 2005



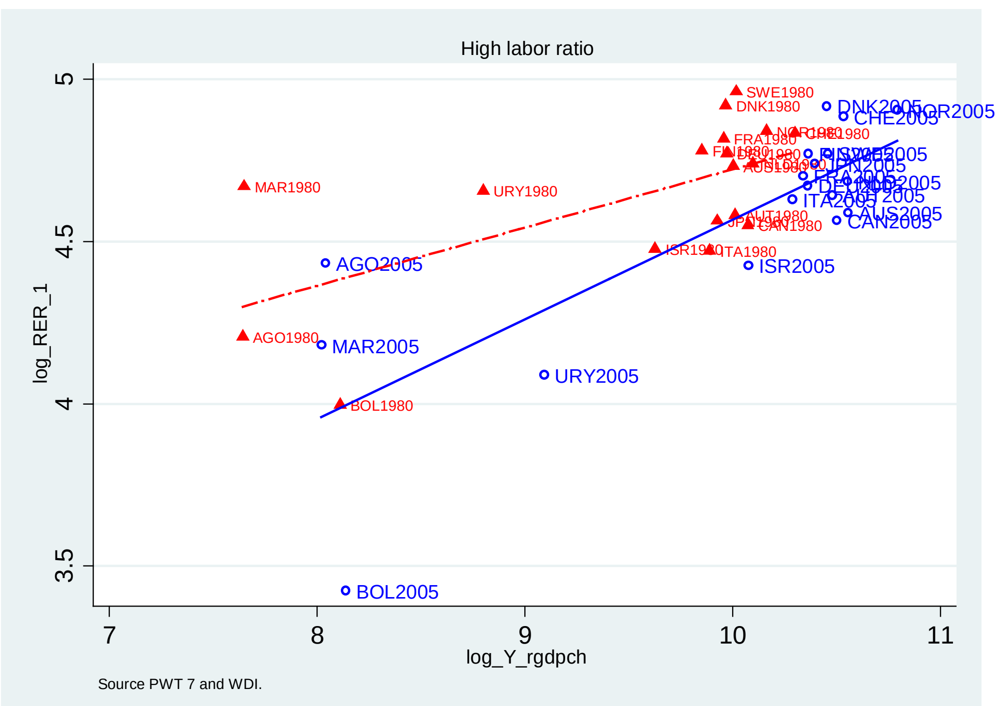
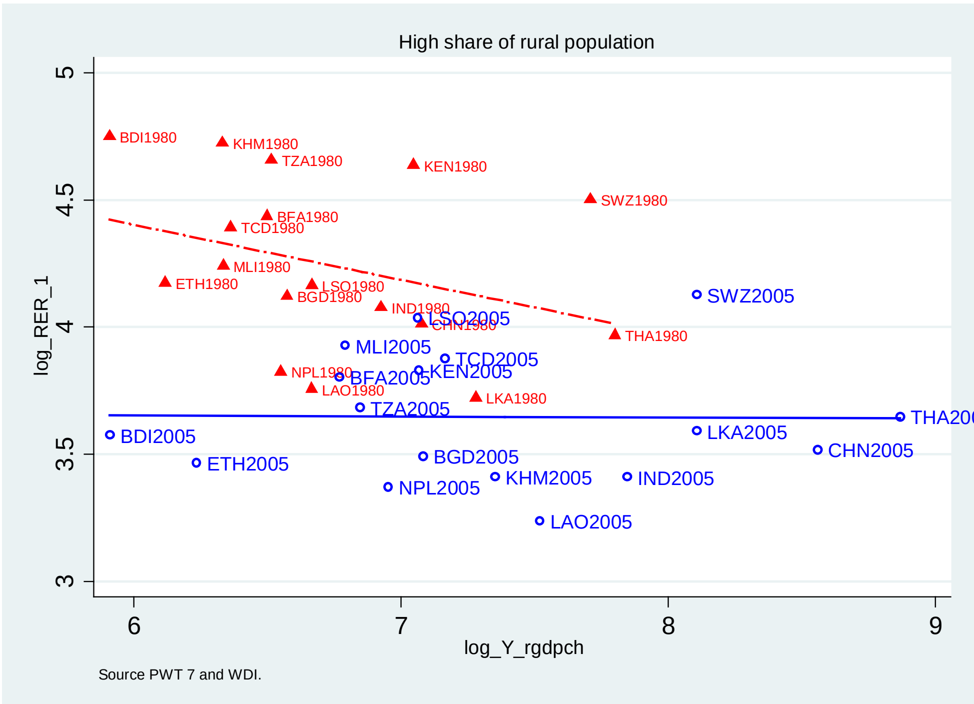


Figure 4: Sample Splits by Rural Population
Cross-country Data in Levels for 1980 and 2005



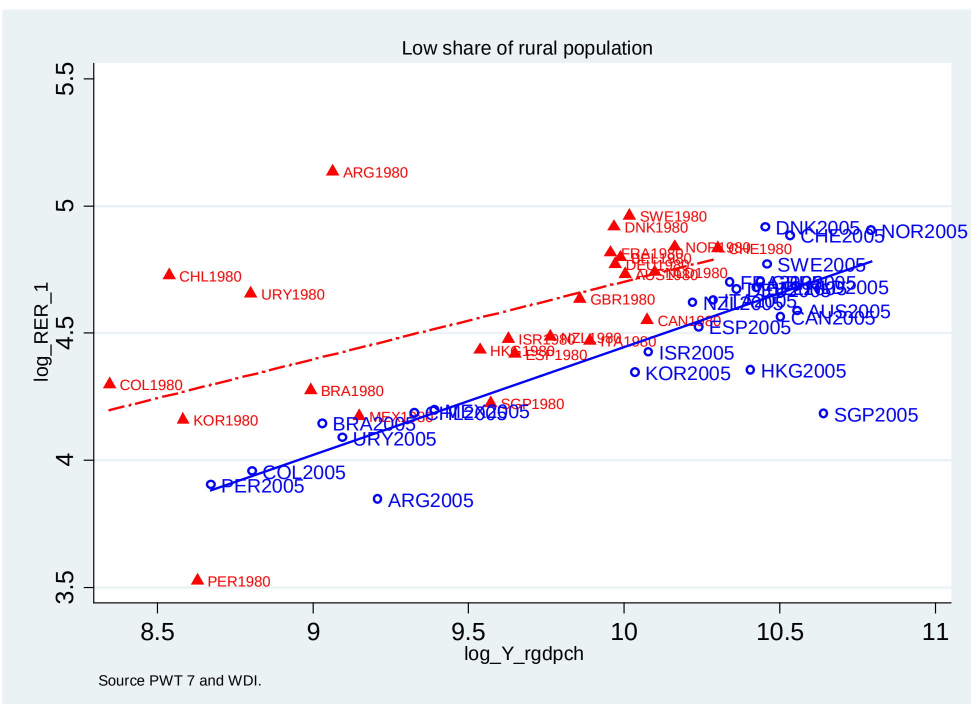
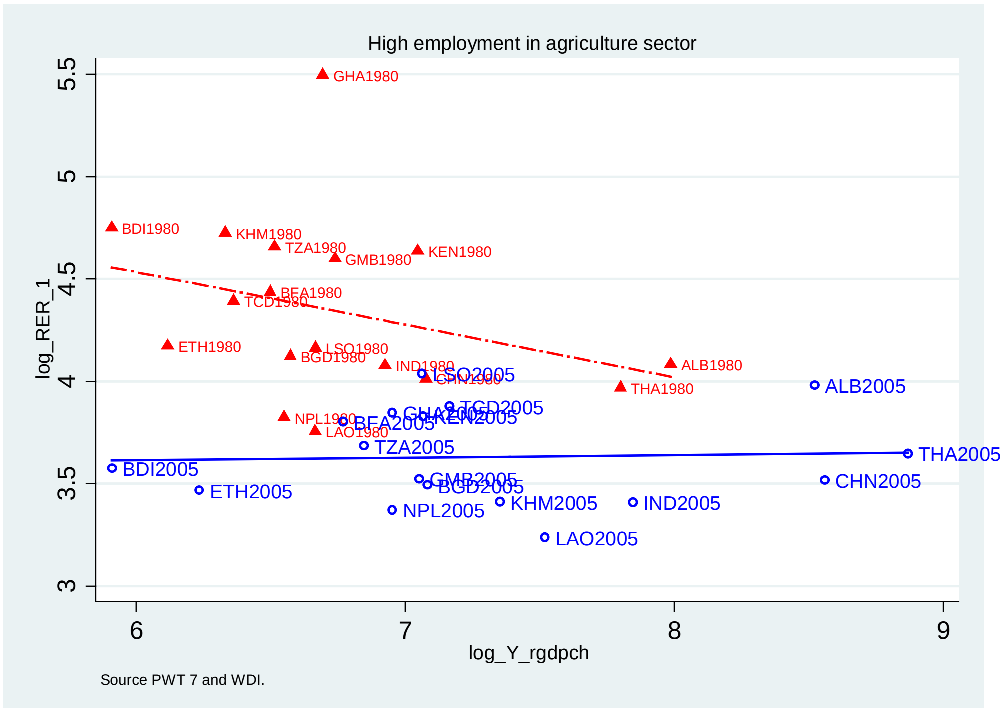


Figure 5: Sample Splits by Agriculture Employment
Cross-country Data in Levels for 1980 and 2005



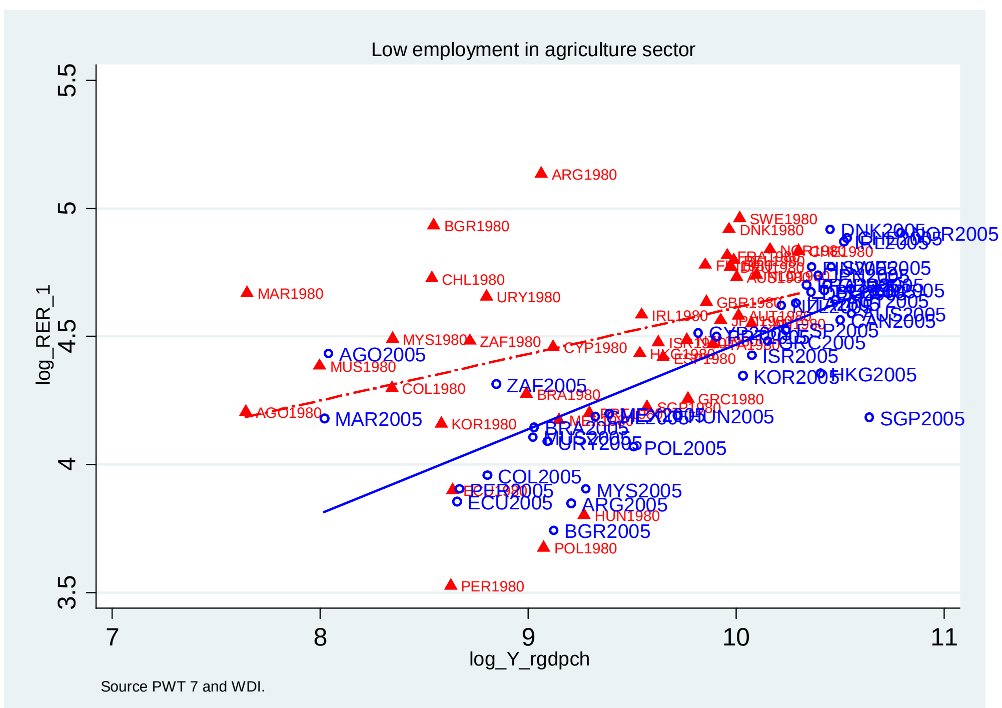
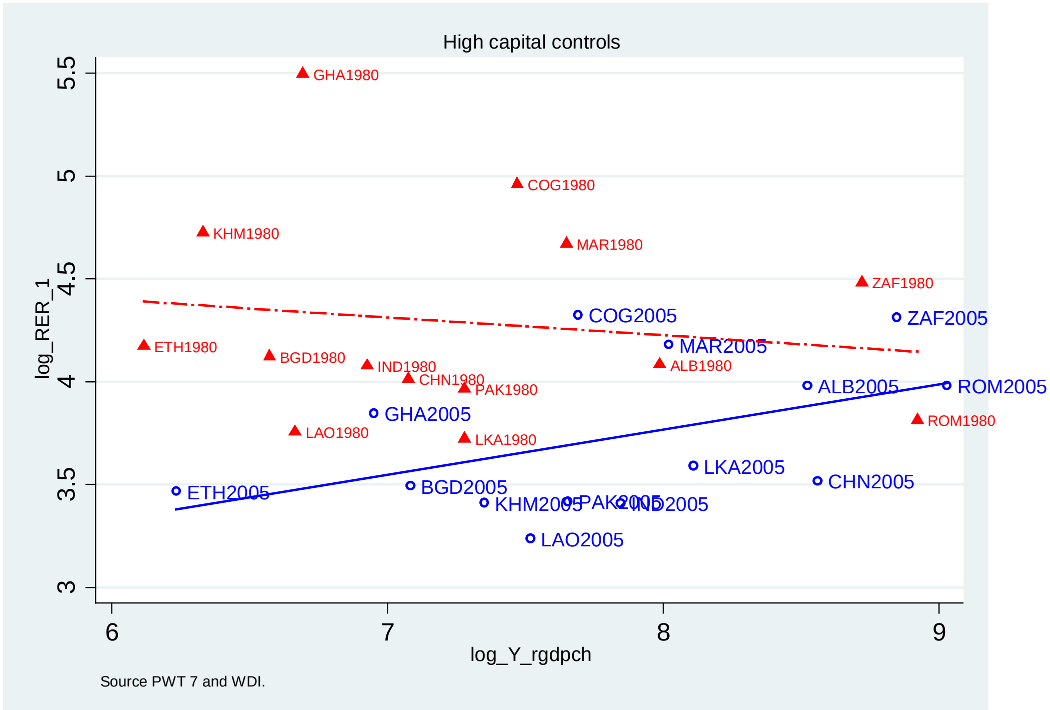


Figure 6: Sample Splits by Capital Controls
Cross-country Data in Levels for 1980 and 2005



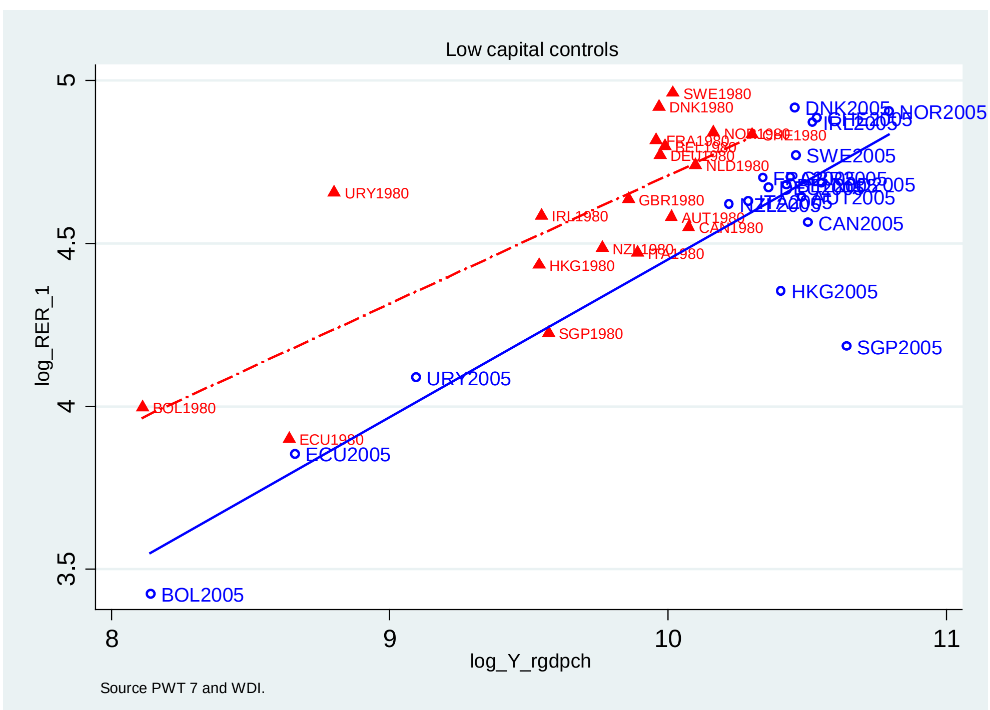


Figure 7: Sample Splits by Change in Reserves
Cross-country Data in Levels for 1980 and 2005

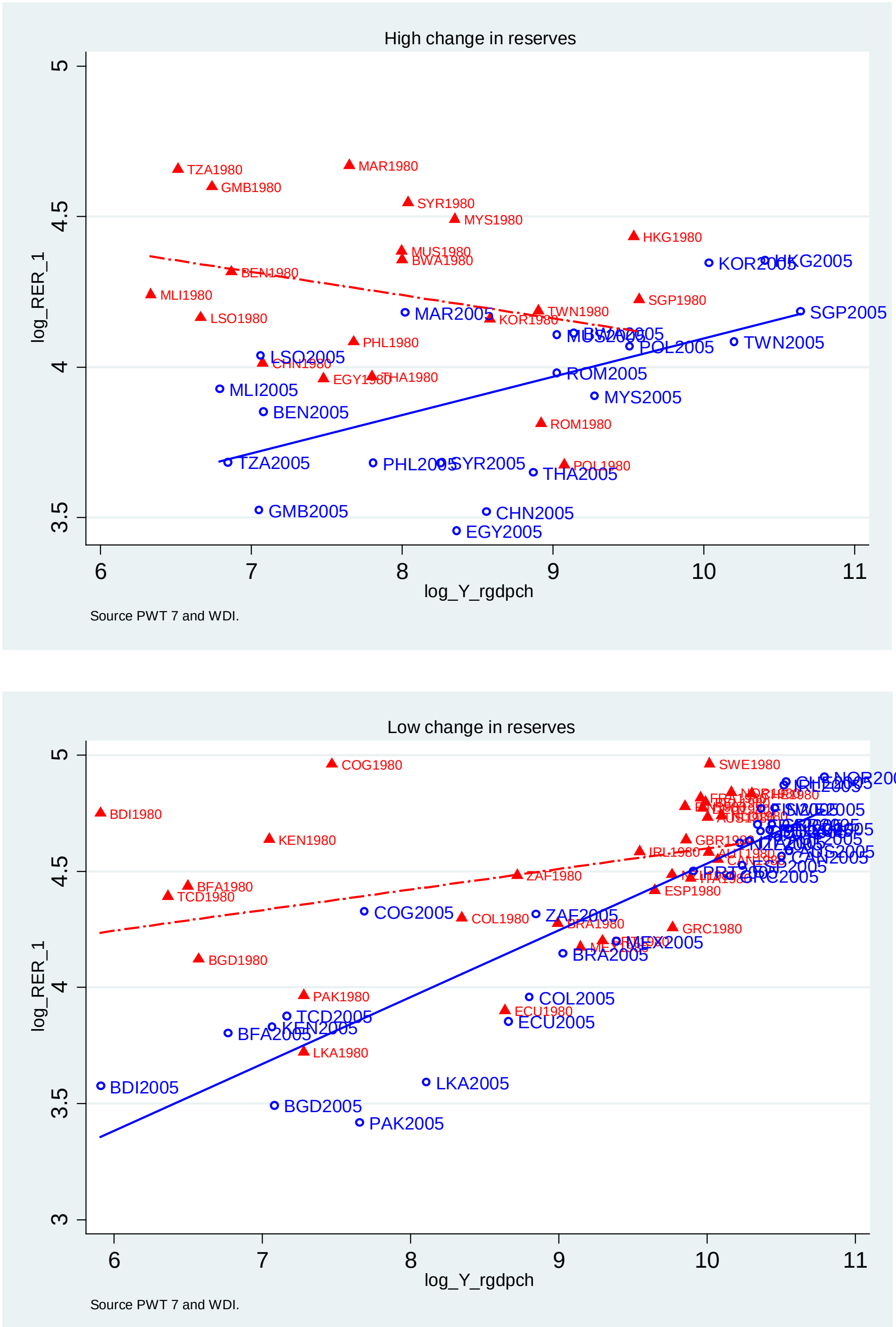
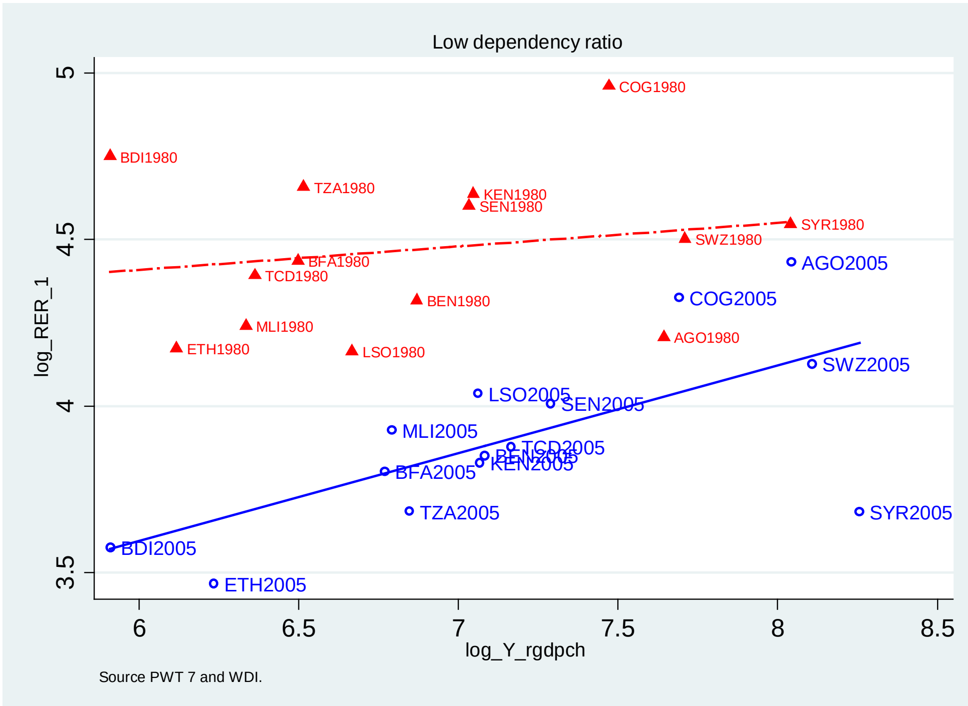
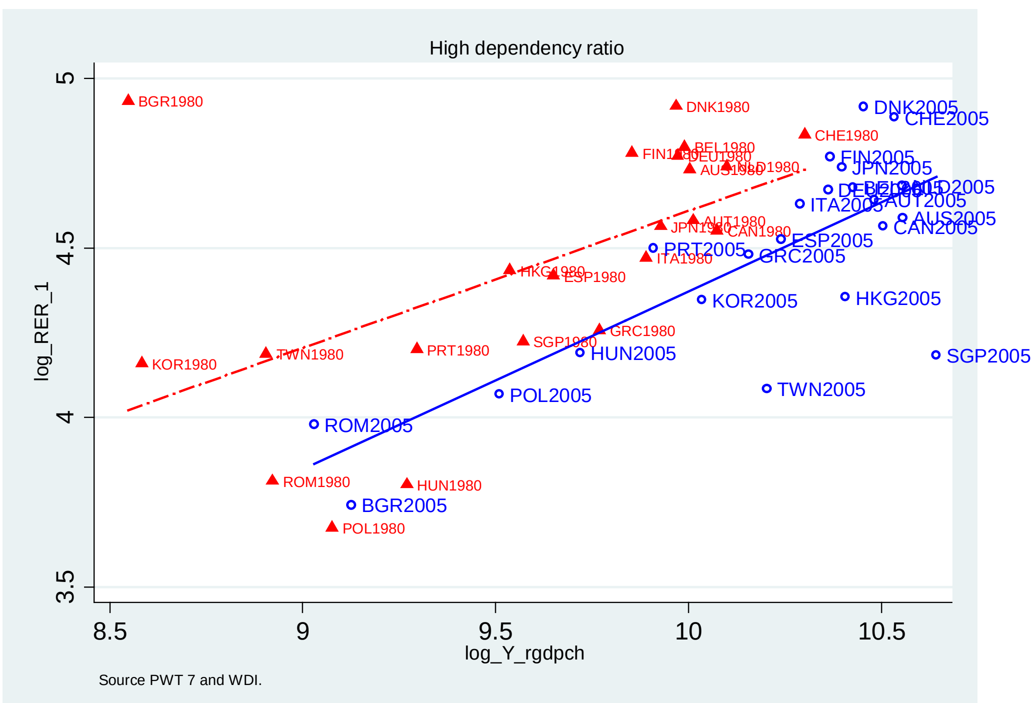


Figure 8: Sample Splits by Dependency Ratio
Cross-country Data in Levels for 1980 and 2005





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