A PPP Model of Real Appreciation

por
Luís Campos e Cunha
e
José António Ferreira Machado

Working Paper nº 210
Desembro de 1993
A PPP Model of Real Appreciation

Luís Campos e Cunha*
José Ferreira Machado*

Faculdade de Economia
Universidade Nova de Lisboa
Tr. Estevão Pinto, Campolide
1000 Lisboa, Portugal

December 15, 1993

Abstract

This paper presents a model of the real exchange rate. In the vein of Balassa (1964) it is shown how PPP can be reconciled with permanent differences in costs of living across countries and across regions inside the same country. This is true for the relative version of PPP, as well as, for the absolute version. Policy recommendations are underlined. At last, an empirical test is suggested.

* Faculdade de Economia, Universidade Nova de Lisboa, Tr. Estevão Pinto, 1000 Lisboa. A Tinker Foundation research grant is gratefully acknowledged.
A PPP Model of Real Appreciation

Luís Campos e Cunha
José Ferreira Machado

1. Introduction

There are two somewhat related issues that have concerned researchers for a long time. One is the fact that poor countries have a lower cost of living than rich countries. The other is related with real appreciation. The latter is generally analyzed as a monetary phenomenon, while the former is usually seen as a real one.

It is an uncontroversial fact that costs of living in general differ among countries raising problems to the absolute version of Purchasing Power Parity (PPP). More formally, consider that the international price relation is given by: \( P = \varnothing \times E \times P^* \), where the domestic (foreign) price level is denoted by \( P \) (\( P^* \)), \( E \) is the nominal exchange rate expressed in domestic currency and \( \varnothing \) is the so called real exchange rate. The absolute PPP hypothesis, stating that price levels should be identical among trading countries and implying that \( \varnothing \) has to be equal to one, does not fit reality. This is particularly so, when comparing countries with different levels of development. However, this fact does not necessarily raise problems to the relative version of PPP, as long as \( \varnothing \) is constant. The relative version basically states that \( \pi = \varepsilon + \pi^* \), where \( \pi \), \( \pi^* \) and \( \varepsilon \) are the rate of changes of \( P, P^* \) and \( E \).

This issue was raised in Balassa (1964), a widely quoted and pioneering paper. Balassa not only reappraised the PPP in relative terms, but also studied two other issues. First, he showed empirically that price levels or costs of living are unequivocally related with income per-capita. Secondly, and more important, B. Balassa suggested that productivity differences are the clue to the problem.
Balassa introduced a Ricardian model with two traded and one non-traded goods. Assuming that the poor country has an absolute technological disadvantage in the trading sector, it will entail a smaller wage than in the rich country. If, in addition, in the non-traded good sector the assumed technological inferiority is not as large as in the rest of the economy, the lower wage will determine a price for services that will be lower in the poor country than in the rich country. Therefore, since trading goods prices will be equalized by trade, the poorer the country is the lower will be its cost of living (an average of all three prices, services included). A similar explanation was provided by Kravis, Heston and Summers (1982).

For this explanation it is crucial not only the assumption of technological disadvantage, but also its particular differential impact between trading and non-trading sectors. Komyia (1967), in Heckscher-Ohlin-Samuelson (H-O-S) type of model with third non-traded good, shows that, as long as, the conditions spelled out in Samuelson (1949) are met, the price of services will be identical in both economies. Furthermore, for this result to hold it is not required identical preferences among countries since the price of the non-tradable is independent of demand conditions, mainly due constant returns to scale (CRS) assumption. Therefore, the Balassa result will vanish if the technological inferiority is identical for all sectors, non-traded goods included. The Balassa is a reasonable set-up for certain circumstances, but it fails to highlight other cases where technological differences are not large or do not necessarily go in the assumed direction.

As pointed out by Bhagwati (1984), the Balassa model can be extended to a sort of H-O-S framework. Just take the Komyia model and assume, for instance, a Hicks neutral technological difference between countries (somewhat similar to the one studied by Findlay and Grubert (1959)). Furthermore, let that difference be uniform in the trading sector and non-uniform (and lower) in relation to the service sector. This suffices to guarantee the Balassa result. Bhagwati stresses that this explanation has its shortcomings. The implication that both the wage-rental ratio and capital intensities are identical across countries might not be
a an interesting feature of this model, when comparing two countries with a large difference of economic development. Bhagwati argues for a different sort of explanation without resorting to any particular specification of productivity differences. As long as, factor endowments are sufficiently far apart, in a trade equilibrium the poor country will end up in complete specialization in terms of the tradables sector. This would imply the desired wage-rental ratio difference across countries, as well as lower capital intensities. With the traditional assumption on capital intensities of the services sector the result of cheaper services will emerge.

In this paper we are concerned with the same observed phenomenon of cost of living differences, but for countries that are somewhat similar in terms of economic development. That is, countries for which a complete specialization situation is not a palatable one and still exists the same problem of differences in costs of living. These cost of living differences might not be as striking as the situations envisage by Bhagwati, but nevertheless they remain to be explained.

As Dornbusch and Vogelgang (1991, p. 6) stress "It is true, as has been asserted, that haircuts are cheaper in poor countries, as are nontradables as a group. But, contrary to the received wisdom, luxuries are not cheaper in rich countries. Similarly, the law of one price was expected to hold for rich countries; it does not,...". For them trade barriers and distribution systems play a role. It not obvious how trade barriers would accomplish that, but an uncompetitive distribution system is certainly a possibility. However, it not clear that one would like to endorse such a rationalization to explain that a "significant number of Japanese goods were higher priced in Japan than in the United States".\(^1\) It is in fact striking the comparison of price levels between France and Germany, on one hand and the US and Japan, on the other (see Table 1).

---

\(^1\) Dornbusch and Vogelsang (1991, p. 8)
Other examples are enlightening: prices in the Southern European countries are significantly lower than the EC average, in which they are integrated. Does this mean that they will have to experience a real appreciation while their living standards will increase? If so, it is then unavoidable that these countries will have either an higher inflation rate or a nominal appreciation of their currencies, or a combination of both. In any case the Maastricht guidelines for inflation and exchange rate stability might result in incompatible targets. Therefore, the issue of cost of living differences has a theoretical relevance, as well as important policy implications.

Table 1

<table>
<thead>
<tr>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Ireland</th>
<th>Portugal</th>
<th>Spain</th>
<th>Greece</th>
<th>Japan</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>106</td>
<td>79</td>
<td>85</td>
<td>70</td>
<td>86</td>
<td>75</td>
<td>147</td>
<td>80</td>
</tr>
</tbody>
</table>

Source: OECD, Main Economic Indicators, June 1993

Price level differences within a given country, when comparing costs of living of a small town and large city, is just another instance of the problem we would like to address.

This problem was dealt in somewhat ad-hoc framework by Cunha and Machado (1991), which was empirically tested for the Portuguese case. Later, Rebelo (1992) proposes a growth model to study the same phenomenon. There he proposes a two commodities model with one traded good and a service, with two production factors and the usual assumption on capital intensities. Rebelo calls attention to the fact that an increase in capital (due to

\[ \text{Our present paper is a general equilibrium approach that intends to generalize this paper.} \]
foreign investment for instance) will result in a sort of Rybczynski effect on supply of services that will lead to an increase in its price. Since the tradable good price is anchored by the world market this will lead to a real appreciation. Of course, this result vanishes if the number of tradables is two (or more). This model would result in a Komyia type of framework. Our approach is quite different from previous attempts to answer the same question. First, we do not divide the commodities between tradables and non-tradables in the same way. From our view, at the final consumer all commodities are non-tradables, for the consumer location is a crucial attribute of the good to purchase. However, at the producer's level the same good is tradable. Location is not as relevant and international competition takes place at that stage. Therefore, PPP in levels makes sense for production prices. We consider that between production and consumption, the production good has to be transformed into a consumption good using the retail services. Our model resembles the work of Sanyal and Jones (1982) on trade in middle products. However, both the structure of our model and the issues studied are completely different.

Secondly, this paper incorporates several channels through which real appreciation can take place. Costs of living may differ due to several sorts of technological differences, as in Balassa; they may differ due to differences in public expenditure on services; and, finally, they may differ due some specific factor endowment difference, which we called "land". This factor comprises all immobile and fixed factors given by nature, which also includes land, but the "land" factor of production is more than that.

2. The model

Let us consider a world with two countries: the home country and the rest of the world or the foreign country (the * country). For simplicity reasons, the home country is a price taker in the world market. All market are competitive and both countries have identical Cobb-Douglas
type of preferences. There is free trade and no transport costs so that trading goods prices will always be equalized.

Countries will not have to have the same technologies. In fact, unlike Balassa, we will allow the foreign country to be uniformly more efficient. We will restrict, however, this technological superiority to be Hicks neutral.

There are five commodities produced with CRS technologies. There are two intermediate goods -X and Y- produced in both countries which can be internationally traded. There is a service denoted by Z that is a non-tradable. There are two consumption goods -x and y- which are produced combining the tradable goods X and Y and a retail service Z. This goods x and y are internationally non-tradable due to the nature of Z. The consumer does not consume Z directly, but the government might do so.

There are three factors of production: labor (L); capital (K); and land (T). All of them with inelastic supply. Goods X and Y are produced with K and L, while Z uses L and T. Consumption goods x and y use X and Y commodities as inputs. More specifically,

1. \[ X = F(K_X, L_X), \] where \( F \) is linear homogeneous, \( F_j > 0, F_{jj} < 0, \) for \( j=K, L \)

2. \[ Y = G(K_Y, L_Y), \] where \( G \) is linear homogeneous, \( G_j > 0, G_{jj} < 0, \) for \( j=K, L \)

3. \[ Z = H(T_Z, L_Z), \] where \( H \) is linear homogeneous, \( H_j > 0, H_{jj} < 0, \) for \( j=T, L \)

4. \[ x = J(X_X, Z_X), \] where \( J \) is linear homogeneous, \( J_j > 0, J_{jj} < 0, \) for \( j=X, Z \)

5. \[ y = I(Y_Y, Z_Y), \] where \( I \) is linear homogeneous, \( I_j > 0, I_{jj} < 0, \) for \( j=Y, Z \)

The assumptions on preferences are not strictly necessary in most instances, but it will make our lives much easier.
Throughout the paper we will assume that H, I and J technologies are Cobb-Douglas⁴. Therefore, (3) to (5) becomes

\[ Z = AL^\alpha \frac{(1-\alpha)}{L^\alpha} \text{, where } A \text{ and } \alpha \text{ are parameters;} \]

\[ x = Mx^m z_x^{(1-m)} \text{, where } M \text{ and } m \text{ are parameters;} \]

\[ y = N^{1-n} y^{(1-n)} \text{, where } N \text{ and } n \text{ are parameters;} \]

The supply of function factors is given by

\[ L^* = L_0 - L_k + L_y = k_y \text{ whose factor price is denoted by } \omega \]

\[ K^* = K_0 + K_k + K_y \text{ whose factor price is denoted by } \tau \]

\[ T^* = T_0 = T_2 \text{ whose factor price is denoted by } \gamma \]

Due to the assumed Cobb-Douglas utility function, demands will be

\[ x^d = x (1-\tau) x_k \text{ (demand for good } x) \]

\[ y^d = y (1-\tau) y_k \text{ (demand for good } y) \]

where \( \delta \) is utility parameter, \( \tau \) is the tax rate, \( x_k \) and \( y_k \) are \( x \) and \( y \) prices (i.e., prices at the consumer's level), and \( \delta \) denotes income. That is,

This assumption is not fundamental, but it is made for sake of simplicity.
(11) \[ R = P_x X + P_y Y + P_Z Z = P_x X + P_y Y + P_Z Z = wI_0 + rK_0 + r^T_0 \]

Demand for \( Z \) is equal to the derived demand of sectors \( x \) and \( y \) plus the final demand of the government \( (Z_g) \). That is,

(12) \[ Z^d = Z_x + Z_y + Z_g \]

By arbitrage, (producer) prices of \( X \) and \( Y \) are internationally linked so that:

(13) \[ P_x = E P_x^* \]

(14) \[ P_y = E P_y^* \]

where \( E \) denotes the nominal exchange rate, defined by the domestic price of the foreign currency. The exchange rate between the two moneys is fixed by the domestic central bank.

The consumer cost of living index is given by,

(15) \[ \Theta = \frac{P_x^*}{P_x} \left( \frac{P_y^*}{P_y} \right)^{(1-s)} \]

9
The policy variable $\tau$ is exogenously given. The budget policy is then

\begin{equation}
Z_{g} = \tau R P_{z}^{1}
\end{equation}

Considering (4') and (5'), the cost functions of $x$ and $y$ are

\begin{align}
(18.1) \quad C(x) &= x M P_{x}^{m} P_{z}^{(1-m)} \\
(18.2) \quad C(y) &= y N P_{y}^{n} P_{z}^{(1-n)}
\end{align}

In equilibrium, the supply functions will be

\begin{align}
(19) \quad F_{x} &= M P_{x}^{m} P_{z}^{(1-m)} \\
(20) \quad F_{y} &= N P_{y}^{n} P_{z}^{(1-n)}
\end{align}

2. The $Z$ market

Total demand for $Z$ is equal to the derived demand for $Z$ from sectors $x$ and $y$ plus the government demand $Z_{g}$. Taking into consideration (12) and (17) and (18), demand for $Z$ is
(21) \[ Z^d = \frac{\partial C(x)}{\partial P_z} + \frac{\partial C(y)}{\partial P_z} + \tau R P_z^{-1} \]

\[ = (1-m) x M P_z^m P_x^{-m} + (1-n) y N P_z^n P_y^{-n} + \tau R P_z^{-1} \]

making use of (19) and (20), then (21) becomes

\[ Z^d = (1-m) \frac{F_x}{P_z} + (1-n) \frac{F_y}{P_z} + \tau R P_z^{-1} \]

considering (9) and (10)

\[ Z^d = (1-m) a P_z^{-1} R (1-\tau) + (1-n) (1-a) P_z^{-1} R (1-\tau) + \tau R P_z^{-1} \]

After rearranging

\[ Z^d = P_z^{-1} R \{1 - (1-\tau) [(1-a)+am]\} \]

or

(22) \[ Z^d = P_z^{-1} R \mu, \quad \text{where } \mu = \{1 - (1-\tau) [(1-a)+am]\}, \text{ and } 0 < \mu < 1 \]

Note that an increase in public expenditures will increase demand for \( Z \), that is \( \frac{\partial Z^d}{\partial \tau} > 0 \).
The supply function of \( Z \) can be easily derived. Considering (7), the problem faced by a \( Z \) producer is

\[
\min \ w_1 z + y^T y
\]
\[
s.t. (3') \text{ and } (8)
\]

Total cost function derived from above is given by

\[
C(Z) = w \ (A^{-1} z)^{1/\alpha} \ (T_0^{-1})^{(\alpha-1)/\alpha} y^T y
\]

and the marginal cost function is

\[
C_m = w \ \alpha^{-1} \ (A^{-1}) \ (T_0^{-1} z)^{(1-\alpha)/\alpha}
\]

Therefore, the supply function of \( Z \) is

\[
Z^* = B \ (T_0 z)^{\alpha/(\alpha-1)}
\]

where \( B = (\alpha L)^{1/(1-\alpha)} > 0 \)
Noting that given the assumptions of the model and given foreign prices for tradables, factor prices for capital and labor are determined and given by,

\[(26) \quad w = w(E_P^*, E_y^*)\]
\[(27) \quad r = r(E_P^*, E_y^*)\]

The price of Z can now be determined by the market clearing condition $Z^L = Z^F$, which, considering (22) and (25), implies that the price that clears the Z market is

\[(28) \quad P_z = w^\alpha [(B_{zx}^1)^{-\frac{1}{\alpha}} X ]^{1-\alpha}\]

where $w$ is given by (26).

Now, we can compute the general price level $\Theta$ as defined in (15). That is, $\Theta = P_x^y P_y^z (1-\alpha)$, considering (19) and (20)

\[
\Theta = \Theta_{x} \Theta_{y} \Theta_{z} \Theta_{w}^{(1-\alpha)}
\]

or

\[(29) \quad \Theta = N_{x}^{(1-\alpha)} \Theta_{x}^{(1-\alpha)} \Theta_{y}^{(1-\alpha)} \Theta_{z}^{(1-\alpha)} \Theta_{w}^{(1-\alpha)}\]

or

5 We are implicitly assuming diversification in production of $X$ and $Y$.
\( (29') \quad \Theta = C P_x^{a_m} P_y^{n(1-a)} P_z^{[a(1-m)+(1-a)(1-n)]} \)

where \( C = N^{(1-a)} M^a \), \( P_x \) and \( P_y \) are given by (18) and (19) and \( P_z \) by (28). Furthermore, note that \( (am)+n(1-a)+[a(1-m)+(1-a)(1-n)] = 1 \), and \( 0 < [a(1-m)+(1-a)(1-n)] < 1 \).

3. The real exchange rate

Let us define the real exchange rate as the ratio, in domestic currency, of costs of living in the two countries: \( \frac{\Theta}{E \Theta} \).

For the foreign country we have the equivalent relation (29'), that is

\( (30) \quad \Theta^* = C^* P_x^{a_m^*} P_y^{n^*(1-a)} P_z^{[a(1-m^*)+(1-a)(1-n^*)]} \)

Note that the assumption initially made on identical preferences implies that the coefficient \( a \) is the same for both countries.

Clearly it is necessary to assume some specific type of technological difference. Here we assume the following:

\( (A.1) \quad m = m^*; \quad n = n^*; \)

\( (A.2) \quad M^* = h M; \quad N^* = h N; \quad \text{with } h \geq 1. \)
This amounts to consider the foreign country as more efficient (h>1) in transforming the inputs X, Y and Z into x and y. This technological superiority is uniform for both goods and Hicks neutral due to (A.1). Given those assumptions C^* = hC, and (30) can be written as

\[(31) \quad \Theta^* = h C P_x^a P_x^n P_y^a P_y^n P_z^a P_z^n [a(1-m)+(1-a)(1-n)]\]

Taking into consideration (29') and (31), the real exchange rate is

\[(32) \quad \frac{\Theta}{E \Theta^*} = \frac{C P_x^a P_x^n P_y^a P_y^n P_z^a P_z^n [a(1-m)+(1-a)(1-n)]}{E h C P_x^a P_x^n P_y^a P_y^n P_z^a P_z^n [a(1-m)+(1-a)(1-n)]}\]

considering (13) and (14),

\[(32) \quad \frac{\Theta}{E \Theta^*} = \frac{1}{h} \left( \frac{P_z}{P_z^*} \right) [a(1-m)+(1-a)(1-n)] \quad \text{(RR equation)}\]

This one of the fundamental relations to solve the model. Despite the PPP assumption made (see equations (13) and (14)), one may note that real exchange rate may differ from the unity if there are technological differences (h>1) or services prices are different between countries. This resembles the Balassa model, however, the channel through which the real exchange rate is not equal to one is quite different. In our case the technological impact is direct through h, while in the Balassa case is through a difference in the price of services, in relation to
which nothing was said as yet. We do not need had to obtain a difference in costs of living among countries.

Now, we ought to relate internationally the prices of services, which are a nontradable.

4. Relation between \( P_z^* \) and \( P_z^* \)

The relation between the price of services in both countries is very indirect, depending on supply and demand conditions. They are only directly related through the factor market for labor, where wages are determined by the price of tradables.

From (38) we know the equilibrium domestic price of \( Z \). The foreign price will be

\[
(33) \quad P_z^* = (\omega')^{\alpha^*} \left( B \omega^* T_0 \right)^{-1} R^* \left( 1 - \alpha^* \right) \quad \text{where } B^* = (\omega^* \omega^* A^*)^{1/(1-\alpha^*)}
\]

As assumed, the identical (across sections) technological differences take the following form for the \( Z \) technology:

(A.3) \( A^* = \Delta A \), \( (b \geq 21) \).

(A.4) \( \alpha = \alpha^* \).

The technological differences for \( X \) and \( Y \) imply that:

(A.5) \( \alpha^* E = \text{law} \)
Considering (20), (A.3) and (A.4) imply that

\[
B^* = \left(\alpha \frac{hA_0}{h_0} - 1\right)^{(1-\alpha)} = B, \frac{1}{1-\alpha}
\]

Considering the assumptions (A.3) to (A.5) above, (28), (33) and (34), then the Z price ratio can be written as

\[
\frac{P_x}{P^*} = \left(\frac{R}{\mu^* B^*} \right)^{\frac{1}{1-\alpha}}
\]

or

\[
\frac{P_x}{P^*} = \left(\frac{R}{\mu^* B^*} \right)^{\frac{1}{1-\alpha}}
\]

This relation is better understood in per capita terms. We may divide by \( L^0 \) and \( L^1 \) and get

\[
\frac{P_x}{P^*} = \left(\frac{R}{\mu^* B^*} \right)^{\frac{1}{1-\alpha}}
\]

where, \( \tau \) is the income per capita and \( t \) is the endowment per capita of the resource called "land".
To close the model one needs to specify in (36) the term on relative income per capita. Let us take as an approximation the following

\[ r = \Theta Q(k, t) \]

where \( Q \) is real income per capita. That is, nominal income per capita depends on capital \( k \) and "land" \( t \) per capita factor endowments and on the general price level \( \Theta \). A similar relation can be stated for the foreign country.

Furthermore, due to technological advantage \( h \) of the foreign country, the income function \( Q \) is related, so that

\[ Q^*(\cdot) = h Q(\cdot) \]

(37)

The above implies that the relation (33) can be rewritten as

\[ \frac{P_Z}{E P^*_Z} = \left[ \frac{\mu(t)}{\mu(t^*)} \left( \frac{Q(k, t)}{Q(k^*, t^*)} \right) \left( \frac{\Theta}{E^*} \right)^{1-\alpha} \right]^{1-\alpha} \]

where, as in (22), \( \mu(t) = \mu = (1 - (1-\tau) [n(1-n)+am]) \), with \( \mu > 0 \). This ZZ equation is the second fundamental equation of the model. Prices of services will be identical across countries under the following circumstances if: (i) technologies are identical \( (h=1) \); (ii) government has the same relative weight \( (\mu=\mu^*) \); finally, (iii) factor endowments per capita are identical \( (t=t^* \) and \( k=k^*) \). Only under those conditions prices of services will be equalized, however, countries need not to be of the same "size", but only of same the relative "size".
5. Solving the model

The model is now reduced to two equations: RR equation (32) and ZZ equation (38). These can be easily solved graphically as in figure 1. The equilibrium 1 is solved for the benchmark case where the countries are identical in relative terms. This means that real exchange rate as well as Z relative price is one. For this to happen it suffices: (i) identical technologies (h=1); (ii) identical per capita factor endowments (t=t*; k=k*); and (iii) identical tax rates or, in the model, identical current public expenditure shares (t=t*).

Simple comparative statics will allow us to determine to impact of several exogenous shocks. An inferior technology for the home country (h>1) will impinge on RR a rotation so that the equilibrium will be at 2, with the domestic country with cheaper services and a lower than one real exchange rate.

Any other change of any other exogenous variable will change only the ZZ line. Either an increase in the foreign stock of capital (k*>k) or an increase in the foreign tax rate (t*>t) will move the ZZ line inwards and the equilibrium will be similar to 3. In the former case, a larger stock of foreign capital will increase income per capita, thus leading to an increased demand for Z in the foreign country, to a lower relative (domestic) price of Z and will lower the real exchange rate. An increased tax rate will imply that the (direct) demand for services will be higher, the foreign price of Z will be higher, leading, again, to a situation depicted by equilibrium 3.

An increased supply of domestic "land" per capita will have a no clear cut impact on ZZ line. More "land" implies an higher domestic income leading to an higher demand of services and, thus, to an equilibrium similar to 4 in figure 2. However, due to the nature of the Ze technology more "land" also implies an increase in the supply of Z, thus moving inwards the ZZ line and the equilibrium would be at 3. Depending on relative impact of these two moves the price of Z and the real exchange rate will be higher or lower. Here we assume the later, the increase in
supply of services, to be more relevant and therefore both the price of Z and the real exchange rate will be lower, as in equilibrium 3.

An increase in the domestic population can be decomposed into two effects already analyzed: a reduction in the domestic capital stock per capita \((k^*<k)\) and a reduction in the "land" factor per capita \((t^*<t)\). The first reduces income per capita and, therefore, the domestic price of Z, moving the ZZ line inwards. The reduction in t, leads to conflicting results as seen above. If the impact on domestic income Q (through both lower k and t) dominates then the equilibrium will be at 3. However, if the direct impact on supply of Z dominates (through a lower t), making Z cheaper, then the new equilibrium will be at 4.

6. Concluding remarks

These results are interesting on several counts. First, we got a Balassa type of result, in the sense that if there are technological differences between countries then the price level is also different, even when those differences are uniform across sectors. Further, if both countries are technologically identical with identical wage rates\(^6\), then prices might be higher in a richer country (due to an higher capital stock per capita), that is, with an higher Q. Thirdly, land abundant countries might have lower price levels if the effect on supply of services is relatively higher than the effect on its demand, due to a higher income per capita. At last should be stressed that fiscal policies are incorporated and play a role in determining \(\Theta\), since, as assumed, the composition of public expenditure is biased towards non-traded goods when compared with the families' preferences. Then, an increase in tax financed public expenditure is equivalent to an increase of the share of non-traded goods in total expenditure and correspondingly it will increase its price and the real exchange rate. The general price level, therefore, can be affected by fiscal policies as long as public and private preferences

\(^6\)Equal wage rates is assured under free trade and production diversification. For more details see Samuelson (1949).
are not identical. Population growth will have a mixed impact as seen. However, it would be fair to assume that the pressure on scarce resources will dominate and will impinge an increase in Z relative price, as well as, in the real exchange rate.

These results are of policy relevance. There is a trend of increasing openness of country economies both to commodities trade and to factor movements, namely international investment. Due to improved technologies and rapid capital accumulation it is reasonable to expect that less developed economies engaged in this movement would experience a real appreciation of the sort we analyzed in this paper.

The problem is to distinguish this kind of real appreciation (for short equilibrium real appreciation) of other movements of real appreciation, usually related with speculative transient divergent paths of the exchange rate market, which often appear in these periods of transition between economic regimes. This second sort of disequilibrium real appreciation may even be triggered by inappropriate policy responses to an equilibrium real appreciation.

Suppose, for instance, that a country, with exchange rate stability, starts to experience a real appreciation due to faster economic growth, through an higher inflation rate vis à vis its trading partners. This should not call for any policy change, since it is a real phenomenon authorities should not (and in the long run, cannot) fight this sort of higher inflation. Suppose, that this is not understood and the authorities assuming that the inflation differential is due to excess demand and raise the interest rate. As long as prices are sluggish to adjust, this, at least in short run, will make the domestic currency to appreciate, leading to more real appreciation and speculative capital inflows, to which the central bank will try to sterilize, raising more the interest rate... An incorrect policy response triggered by an equilibrium real appreciation, will lead to a spiral of disequilibrium real appreciation until the exchange rate collapses, with all the reputation cost associated with it. This example makes clear, from the policy point of view, the utmost importance to be aware of the problems analyzed in this paper.
This equilibrium real appreciation can take place in several countries. Many examples come to mind. The most obvious are the Eastern European countries, which are economies moving very fast towards freer trade and foreign investment; Southern European countries which become members of the EC, not long ago, and are completely open to more developed economies. The Magreb countries, Mexico and even Canada, are other instances of countries for which this problem may be relevant.

Equilibrium real appreciation can take place either through an higher inflation rate or an appreciation of the domestic currency. The issue is to distinguish it from other sorts of real appreciation, originated in the monetary side of the economy.
References


OECD, Main Economic Indicators, June 1993.

