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Endogenous risk premium and terms of trade shocks: evidence for developing countries☆

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Abstract

This paper assesses whether the increase in terms of trade provokes a reduction in the endogenous risk premium in developing countries. Following Gertler and Rogoff (1990) we suppose that the risk premium in economies affected by moral hazard in credit markets depends negatively on the size of the collateral (i.e. natural resources) that guarantee the liabilities. The hypothesis is that terms-of-trade shocks raise the value of this collateral. We alternatively apply five panel data estimation procedures (POLS, FGLS, RE, FE and FE-FGLS) to two alternative data sets. According to the World Bank procedure we classify countries into four income groups.

Keywords: Risk premium, terms-of-trade shocks, moral hazard; credit markets; Argentina; Latin America
JEL: Classification F32, F34, F41

1. Introduction

The debate regarding financial liberalization moves between those who argue that promoting capital account liberalization (and capital flows) is still an impediment to achieve global financial stability, and those who view the financial liberalization as a way to increase the welfare in poor countries. We highlight the problem of the scarce capital flows toward less developed countries and assess the incentives that determine that international capital flows are mostly directed to developed nations.

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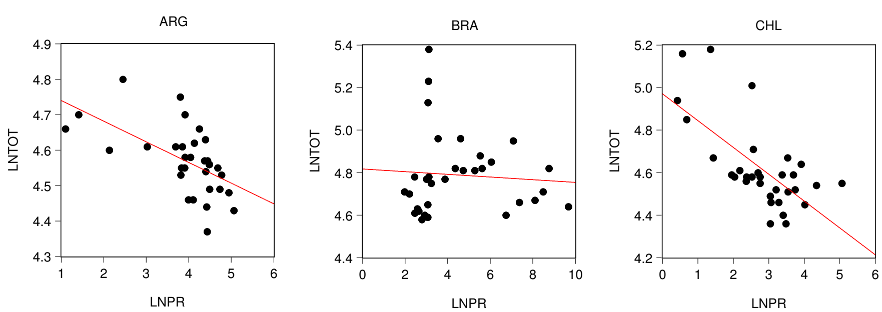
From a theoretical point of view our interest turns on to the so-called Lucas Paradox. Within a neoclassical setting, Lucas (1990) observed that capital did not flow from rich (i.e. those economies who have high levels of capital-labor ratio to poorer countries (economies with lower capital per worker). We tackle the general problem of scarce capital flow from poor to rich countries and specifically analyse the predictions of Gertler and Rogoff (1990) that depicts the behaviour of a less developed economy with moral hazard in capital markets. We test the structural relationship between risk premium and terms of trade arising from the Gertler and Rogoff (1990) model.

This paper assesses whether the terms of trade cause a reduction in the endogenous risk premium in developing countries. Developing countries have gone through a sharp increase in their terms of trade during the past decade. This work is aimed to study the effect of this upward trend on financial markets. The stated hypothesis is that terms-of-trade shocks raises the value of the collateral that the domestic economy posses to back their liabilities. As a consequence, as terms of trade increase the (endogenous) borrowing rate decreases and it encourages capital accumulation in developing economies. Figure 1 shows the (unconditional) relationship between these two variables for three Latin American Countries; at first sight, it looks like quite plausible hypothesis, even though for Brazil the relationship is less pronounced. The Gertler and Rogoff (1990) theoretical scheme establishes that an endogenous risk premium arises in poorer countries if the amount of collateral that these economies have to ensure the repayment of its debt is lower than the capital they need to invest in their projects. The model assumes the existence of moral hazard in credit markets: given that lenders can not verify if borrowers utilize the borrowed money to finance the project (in fact, they can secretly lend abroad the money the previously obtained funds), the payment structure is thought to depend on the state of nature (i.e. the amount of the debt payment is higher in *good times* than in *bad times*.

Figure 1: **Terms of Trade and Risk Premium. 1977-2008.**



Source: the Terms of trade and Risk Premium data are based on WDI and IFS. See Statistical Appendix

In a previous work Barone and Descalzi (2011) tackled this issue and analysed the relationship between risk premium and terms of trade for a group of Latin American Countries (we alternatively performed a regression analysis on two panel data: 9 countries during 1977-2008 and 14 countries during 1984-2008). We found that the hypothesis that states that the risk premium is negatively correlated to terms-of-trade shock cannot be rejected with the available data. Furthermore, the results suggested that the terms of trade are a better proxy of a country's wealth than the GDP, because when these two variables were jointly added to the regression equation the size of the coefficient of GDP decreased. Thus, we conclude that *in a world with moral hazard in capital markets, the capital does not flow to less developed economies because the collateral they have is not sufficient to ensure the repayment of their debts*.

In this paper we extent our analysis as follows. First, the data set was restructured by adding new countries and variables as well. Specifically, we deal with to data sets. The first set reports economic data for 75 worldwide countries during 1980-2009, while the second (that includes additional variables) contain 69 countries for 1980-2004. Second, in order to evaluate the relative impact of terms of trade on the risk premium in less developed countries we have classified the countries in the panel in four income groups (according to World Bank criterion) with the aim of comparing among countries with different levels of development. Then, four dummy variables were added to regression equation to evaluate the sign and statistical significance of the coefficients that measure the response of risk premium to terms of trade shocks across countries with different income levels.

Third, in this paper we alternatively run five estimation procedures to evaluate their performance. We apply Pooled Ordinary Least Squares ($POLS$) regression to obtain a first insight of the regression results. Next, a Feasible Generalized Least Square ($FGLS$) regression is carried out to account for the variability across time periods. In the next step, following Wooldridge (2002) we consider an unobserved effect model (UEM) to control for time-constant unobserved heterogeneity in panel data. On this basis, a Random Effects (RE) regression is run as a particular case of $FGLS$ when error autocorrelation is due to the time-constant unobserved variable. Next, the Fixed Effects analysis surges as an alternative method to deal with unobserved heterogeneity by applying the so-called *within transformation*. Finally, we run a Fixed Effect $FGLS$ regression to combine both FE and $FGLS$ analysis upsides. We expect the latter regression (Fixed Effect $FGLS$) to perform better, because it allows both to eliminate the unobserved random variable and to deal with heteroskedasticity as well. This statistical approach will foster the evaluation of stability of the estimated coefficients.

The rest of this paper is organized as follows. Section II reviews the Lucas Paradox. In section III we briefly describe the Gertler and Rogoff (1990) model. In section IV estimation strategy is depicted. In section V the regression results are shown. In section VI we conclude.

2. The Lucas Paradox and the direction of capital flows

Lucas (1990) explained that in a scheme with two economies (the rich country and the poorer one) producing the same good with the same constants returns to scale production function (that relates output with capital and labor inputs), the differences in production per worker between these economies are caused by differences in the level of capital per worker that they have. As a consequence, if trade in capital good is free and competitive, the capital will be allocated only in the poorer economy (where capital per worker is lower) until capital-labor ratio, and hence capital returns are equalized Lucas (1990).

Lucas (1990) mentions three possible reasons in order to explain why observed capital flows fall short of the flows predicted by neoclassical theory. First, capital returns (i.e. the marginal product of capital in terms of capital per worker) between countries are not equalized owed to differences in human capital between poor and rich countries. Lucas (1990) corrects labor input estimation for differences in human capital and found that the ratio of income per effective worker in the United States to the same variable in other countries diminishes [3].

Second, income per worker is additionally different between rich and poor countries because in developed economies there are external benefits associated to the country's stock of human capital: these *knowledge spillovers* are assumed to be affect producers within the country[4].

Finally, the third aspect refers to the failures in capital markets as determinants of capital misallocation in poorer countries. The proposition here is that if borrowing contracts (arising from the flow of capital goods to poor economies) can not be enforced, then rich countries will not lend poor countries because they have not the guarantee they will receive the rents of the capital invested in the developing economies. As a consequence, a "political risk" would appear[5].

Several policy issues arise. If either differences in human capital or local spillover (associated to human capital's stock) exist, then external capital flows would be fully offset by reductions in private foreign investment in poor countries, by increases in that country's investment abroad, or both Lucas (1990). In other words, the capital stock in poor countries will not change if foreign capital flows towards them as a consequence of differences in relative capital returns: considering either differences in human capital or in a level of technology that reflect human capital's externalities, the differences in income per worker would disappear and the foreign investment would be offset by a reduction in the invested capital.

In the same way, if differences in capital returns are maintained in order to secure monopoly rents, capital transfers to poor countries will also be fully offset by reductions in private investments.

Policy recommendations should be focused on the reduction of the *political risk* in order to promote the capital to flow toward poor countries. Additionally, the investment in human capital would reduce income per worker differentials between poor and rich countries encouraging investment in less developed economies.

Alfaro et al. (2005) classify the theoretical explanations of the Lucas Paradox in two groups. First, explanations that consider differences in fundamentals across countries are considered; the second group includes the analysis of the international capital market imperfections.

In the first group Alfaro et al. (2005) mention that differences in fundamental across countries are caused by (i) missing factors of production; (ii) government policies; and (iii) institutional structure and total factor productivity.

[3]Two remarks: first, after adjusting for differences in human capital, relative income per worker ratios (between U.S. and a given developing country) are still large in Lucas's work to expect capital flow much larger than observed. Second, constant returns equal capital returns imply equal wage rates for equally skilled labor, so if there were not incentives for capital to reallocate to poorer countries, there would not be motives for labor to flow either. However, empirical evidence against wage rate equalization between countries is found frequently

[4]Lucas (1990) assumes that the economy's technology level is the average level of its worker's human capital raised to a power. Then, if marginal products of capital are equalized, differences in the level of capital per worker are additionally caused by human-capital-stock's local spillovers.

[5]However, Lucas (1990) asks why the ratios of capital per effective worker were not equalized between economies before 1945, even though it could be expected that during this period the contracts between two countries (i.e. between the imperialist and her colony) would be enforced with the same effectiveness as a contract with a domestic borrower. He answers the question assuming that the imperialist has exclusive control over trade to and from a colony, but the labor market in the colony is free. Additionally, the colony has no capital of its own. The control over the capital gives to the imperialist the monopsony power over wages in the colony (this assumption would have been true in the case that a small part of the colonial labor force would have been skilled enough to work with capital; otherwise it would be difficult to imagine that imperialist would have had much monopsony power over general wage level in the colony). She maximizes the total production less wage payments at a competitively determined wage less the opportunity cost of capital. In equilibrium the imperialist choose a level of capital per worker lesser than the amount corresponding to a competitive labor market (wages are set at artificially low levels). In this case, notwithstanding that the borrowing contracts are enforced, the control of capital imports by the imperialist provokes that capital does not flow to poor countries.

The first explanation indicates that apparently capital returns are not equalized between countries then it would be an incentive of capital to flow toward poorer countries. However, the differences in capital returns are due to a miss specification of the neoclassical production function. Second, the lack of capital flows from rich to poor countries can be caused by differences across countries in government tax policies that imply substantial differences in capital-labor ratios (i.e. inflation operates as a tax that decrease the return to capital; additionally the government can impose capital control to limit external capital flows).

Finally, Alfaro et al. (2005) indicate that the quality of the country's institutions affects the capital flows toward poor countries. They assume that the institutions encourage investment decisions by ensuring property rights of entrepreneurs and preventing elites from blocking the adoption of new technologies. Under this view, the Solow's residual not only captures the differences in overall efficiency across countries but also the incentive that institutions offer to promote the foreign investment.

The second group of models tends to explain Lucas Paradox by considering the problem of imperfections in international capital markets. In order to tackle this subject it is necessary to distinguish between asymmetric information models from the theoretical frameworks aimed to analyse the sovereign risk[6]. Additionally, asymmetric information problems can be ex-ante (adverse selection), interim (moral hazard) or ex-post (costly state verification). Finally, the sovereign risk concept follows from Lucas (1990), who analysed the *political risk* stemming from the difficulties that the creditor could have to enforce the borrowing contracts; given the incentive that debtor has to avoid rent on capital payments once the foreign capital is sunk[7].

3. A model with endogenous risk premium with moral hazard in capital markets

In this section we summarize main conclusions of Gertler and Rogoff (1990). This theoretical framework will be useful to interpret the regression results in the following section. The content of this chapter is closely related to Barone and Descalzi (2011). The aim is to depict response of the risky rate to a permanent terms-of-trade shock. The model represents the case of a small open economy in the Southern cone borrowing from the North. There are two periods, one good, and a large number of identical individuals. The representative individual is risk-neutral and cares only about consuming in period 2.

The economy has an endowment of *W1* units of the consumption good in period *1* and of *W2* in period *2*. The individual has two investing possibilities in order to utilize *W1* . First, he can lend abroad at a risk-free (gross) rate *r*. Alternatively he could invest in a risky technology. Each

[6] This classification follows from Obstfeld and Rogoff (1996)

[7] Alfaro et al. (2005) point out that the statement related to the *political risk* is a matter of controversy nowadays. Lucas (1990) considers that *political risk* does not represent a motive for preventing foreign capital to flow to poor countries (as he explains that capital was reluctant to flow toward less developed countries even though there were not difficulties to enforce borrowing contracts between the imperialist nation and her colony before 1945). On the other side, Reinhart and Rogoff (2004) argue that sovereign risk is a quite likely explanation for the lack of capital from rich to poor countries: they find that so little funds are channelled through equity (this fact would imply that investors perceive a high probability that the government would prevent them from receiving the rent payment on previously invested capital), and that the overall private lending rises more than proportionately with wealth (this would indicate that there is no a problem of information asymmetries because de creditors do not ask for a collateral in order to secure the repayment of the loan).Reinhart and Rogoff (2004) additionally suggest that better institutions, human capital and other *new growth theory* elements tend to eliminate credit market imperfections. Alfaro et al. (2005) agree with this hypothesis in the sense that they assume that institutions may account for both weak fundamentals and capital market imperfections.

person in the country has a project. All projects are identical ex ante, and yield ex post returns as follows: k units of capital in period *1* yield $\emptyset$ units of second-period output y with probability $\pi(k)$ and zero units with probability $1 - \pi(k)$. $\pi(*)$ is increasing, strictly concave, and twice continuously differentiable, with $\pi(0) = 0$, $\pi(\infty) = 1$, and $\frac{r}{\emptyset} < \pi(0) < \infty$. Investment raises the probability that the individual's project will yield a high level of output, and the marginal expected return to investment is diminishing. It is supposed that the outputs are independent across the projects of the different individuals. The individual budget restriction in the first period is:

$$W1 + b \geq k \tag{1}$$

b is the amount that the economy borrows from the rest of the world. If the restriction is hold as an inequality, it means that the amount that the individual borrows from the rest of the world is higher than what he needs to finance the project: he lends abroad the difference between the total funds and the required investment.

With regard to the information structure, it is supposed that the lenders are able to observe endowments *W1*, *W2* , the production function $\pi(*)$ and the amount b that debtor country borrows. However, they can not observe what the borrower does with the funds he borrow from abroad: that is, creditors are not allowed to observe k and the borrower, for example, could secretly lend abroad rather than invest in the projects. Finally, the realized output is freely observed by lenders.

Given the existence of moral hazard in capital market the contracts will be conditioned only on realized output y, and not on k. More specifically, with the purpose of rising funds by an amount equal to b he issues a state-contingent security which pays Z^g in "good times", and Z^b in the event of the bad outcome. Then, given any output-contingent payoff, the borrower will choose k so that:

$$\pi^{'}[\theta - (Z^g - Z^b)] = r \tag{2}$$

Thus, in order to maximize her expected consumption the economy will equate her expected marginal gain from investing with her opportunity cost of (secretly) holding assets abroad. Insofar Z^g differs from Z^b , k will differ from its first-best optimum value k^* determined by the condition:

$$\pi^{'}(k^*)\theta = r \tag{3}$$

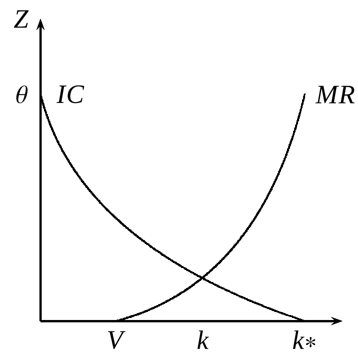
It should be noted that $Z^b \leq W_2$, given that the borrower's consumption must be nonnegative. The solution of the model is as follows. If the present value of the borrower's endowment stream $V = W_1 + \frac{W_2}{r}$ is less than $k^*(V < k^*)$, she will not offer lenders a riskless security. It can be shown that in equilibrium the contract pays lenders W_2 in the bad state ($Z^b = W_2$), and the lender does not secretly lend abroad. The solution for k and $\widehat{Z} = Z^g - Z^b$ is represented by the following equations:

$$\pi^{'}(k)(\theta - \widehat{Z}) = r \text{ IC curve} \tag{4}$$

$$\widehat{Z} = \frac{r(k - V)}{\pi(k)} \text{ MR curve} \tag{5}$$

Figure 2 represents IC and MR curve. The incentive constraint (IC) curve has a negative slope. It equates the expected gain from investing with the country's opportunity cost (given by the risk-free rate r) of (secretly) holding assets abroad. If $\widehat{Z}$ increases, then optimal k will fall because the (expected) profit from invested is reduced. It intersects the horizontal axis at k [8] . The market rate of return (MR) curve has a positive slope. This equation indicates that lenders must receive the market rate of return. When k increases, the poor economy increases her borrowing, then she has to offer to creditors a greater Z^g (and hence a greater $\widehat{Z}$ given that Z^b is fixed) to get additional funds. The curve intersects the horizontal axis at $k = V$.

Figure 2: Optimal capital stock with $V < k^*$



The Figure 2 shows that in this circumstance (i.e. when $V < k^*$) the optimal capital stock is below the level associated with the first-best allocation (k^*). As are result, the *ex post* per-capita output, $\theta\pi(k)$, must lie below its first-best value, $\theta\pi(k^*)$. In this model there is not aggregate risk as the productivity risk is independent across investment projects, and because the number of projects is large. The loan rate that paid to lenders is:

$$r^L = \frac{Z^g - W_2}{k - V} = \frac{r}{\pi(k)} > r \tag{6}$$

It represents the rate on the uncollateralized component of borrowing and is decreasing in k. On the other hand, if $V \geq k^*$ the collateral (the country's wealth) is sufficiently high to secure the payment of the debt, then the projects are financed at a rate r, and the capital corresponding with its first-best allocation is (k^*).

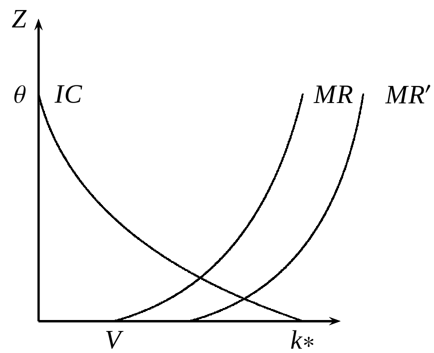
Figure 3 depicts the response of r^L to a permanent terms-of-trade shock. A rise in terms of trade increase the economy's wealth V. It causes MR curve to shift downward. As a result r^L diminishes and k decreases. A permanent shock is thought to affect r^L to a greater extent than a transitory one. Then per capita investment and per capita output will depend on the terms of trade (other things being equal).

4. Estimation strategy

In this section a simple empirical model is suggested to test the response of the risk premium to terms of trade shocks. We add to the regression equation a set of control variables and interpret their coefficient on the basis of the theoretical model. In section 3.1 we formulate two estimation equations, whereas in section 3.2 a brief explanation of estimation methods is carried out.

[8] it follows from the inspection of IC curve

Figure 3: Effects of a terms of trade shocks on Z



4.1. The regression equations

In Gertler and Rogoff (1990) model the risk premium rate (i.e. the difference between the endogenous risky rate and the risk-free rate) depends on capital: the higher the capital the lower is the risk premium required to raise fund to apply to investment. This prediction enables us to state the following structural relationship:

$$Pr = \gamma_0 + \gamma_1 K + \epsilon_{pr} \tag{7}$$

Equation (7) indicates that the risk premium PR depends on capital K as Gertler and Rogoff (1990) suggest. The hypothesis is that γ_1 is positive: as capital increases, a lower risk premium is needed to get additional borrowing from abroad. Despite of this expression could be inferred from the theoretical model, the equation (7) should not be intended as a theoretical representation of neither the demand of investment nor the supply of lending.

The second structural equation inferred from Gertler and Rogoff (1990) is:

$$k = \beta_0 + \beta_1 TOT + \epsilon_k \tag{8}$$

and states that the capital stock depends on the terms of trade TOT). Gertler and Rogoff (1990) indicate that when the wealth increases, the collateral that the poor economy posses to back her debt rises; then the borrowing costs diminish and the equilibrium capital stock finally increases. In Gertler and Rogoff (1990) model the wealth is the discounted value of the period endowment possibly related to natural resources and does not depend on capital.

Our hypothesis is that in developing countries the wealth is highly related to the terms of trade rather than to the capital. Thus, equation (8) represents the impact of the collateral on the capital stock (i.e. the terms-of-trade shocks can be seen as the changes in wealth in the case that they are represented by permanent innovations. So, a positive terms-of-trade shock pushes the collateral up, increases the credit supply for a given capital cost, and finally equilibrium capital stock increases). The second assumption then is that β_1 is positive.

Replacing (8) into (7) gives:

$$PR = \gamma_0 + \gamma_1\beta_1 TOT + \gamma_1\epsilon_k + \epsilon_{pr} \tag{9}$$

or

$$Pr = \alpha_0 + \alpha_1 TOT + \epsilon_{pr} \tag{10}$$

It is expected that terms of trade will be negatively correlated with premium risk, as the later variable increases the collateral. This leads to higher capital accumulation, which is associated to a lower risk premium. If we add a set of selected control variables we have the first equation to be estimated:

$$
\begin{aligned}
Pr &= \alpha_0 + \alpha_1 TOT + \alpha_2 RD + \alpha_3 M2GDP + \alpha_4 INFL + \alpha_5 DEGDP + \\
&\quad + \alpha_6 AC + \alpha_7 GROWTH + \epsilon_{pr} \qquad (11)
\end{aligned}
$$

RD is the dependency ratio. If the dependency ratio increases, the domestic saving should fall; then it would cause the supply of lending to decrease for a given return. It encourages the optimal capital to decrease. Finally, an increase in the rate of dependency should cause the premium risk to increase because then optimal capital stock diminishes (thus, it is expected that α_2 will be positive).

$M2GDP$ represents an index of financial deepness. The greater the financial deepness the higher is the supply of lending (given a fixed capital return) and equilibrium capital stock will increase if $M2GDP$ hikes; then the related risk premium should be lower. Thus the coefficient of this variable α_3 should be negative.

$INFL$ is the inflation rate. The higher the inflation rate the greater is the risk premium, given that according to the usual formula the domestic nominal interest rate is equal to the real interest rate plus the expected rate of inflation. As a consequence, it is expected that $INFL$ will be positively correlated with the risk premium.

$DEGDP$ is public debt-to-output ratio. In the Gertler and Rogoff model the meaning of this variable could be understood as follows. Given that in less developed countries the wealth depends only on the exogenous endowment, the amount that the economy posses to increase the investment hinges on the amount she borrows from abroad. Thus the higher is the external debt the greater is the investment (under the hypothesis that in equilibrium the economy only uses external borrowing for pushing capital up rather than to secretly lending abroad). A caveat for estimation proposes: $DEGDP$ could be endogenous in the estimation equation (i.e. a positive shock in external debt could give rise to an increase in risk premium as numerous empirical works suggest to depict the behaviour of less developed small open economies).

AC is the index of trade openness. The Literature on international finance suggests that the estimated coefficient of this variable should be negative. Finally, $GROWTH$ is the annual growth rate of Gross Domestic Product (GDP). Gertler and Rogoff (1990) suggest that this variable could be a proxy of a country's wealth. Thus, it should be negatively correlated to the risk premium. The question is the following: do the terms of trade as compared with the $GROWTH$ represent a more accurate measure of the collateral in less developed countries? It is expected that for low-income countries the coefficient of terms of trade will be negative while the corresponding coefficient of $GROWTH$ should be close to zero.

In previous papers Barone and Descalzi (2010), Barone and Descalzi (2011) we find evidence to assert that the growth trend Latin American countries could be closely correlated to the terms-of-trade performance. In fact, Barone and Descalzi (2011) found that when the permanent component of the terms of trade and the per capita GDP ($GDPPC$) were jointly included as regressors of the risk premium, the estimated coefficient of $GDPPC$ decreased. Thus, we expect that for less developed countries the estimated coefficient of this variable will be either zero or lesser than the corresponding coefficient estimated for more developed countries. This model is run for a data set with 75 countries for the period 1980-2009 (See statistical appendix for more details).

4.1.1. Adding dummies to control for income levels

In this section we add four dummy variables to assess the effect of the explanatory variables on risk premium across countries with different per-capita income levels. We classify the countries into four income groups following the World Bank criterion. ZL_i is a dummy variable that is equal to 1 if country i belong to the group of "low-income *low-income countries* according to the World Bank classification. ZM_i (ZUM_i) is equal to one for country i belonging to the group of *middle-income* (*upper-middle income*) nations. Finally, ZH_i is a dummy variable that is equal to 1 if country i belong to the group of *higher-income countries*. Now, if the chosen explanatory variables are allowed to interact with the variable dummy Z, we have a modified version of equation (11) given by:

$$\begin{aligned} PR = \alpha_0 &+ \sum \alpha_{1k} Z_{ki} TOT + \sum \alpha_{2k} Z_{ki} RD + \sum \alpha_{3k} Z_{ki} M2GDP + \sum \alpha_{4k} Z_{ki} INFL + \\ &+ \sum \alpha_{5k} Z_{ki} DEGDP + \sum \alpha_{6k} Z_{ki} AC + \sum \alpha_{7k} Z_{ki} GROWTH + \sum \alpha_{8k} Z_{ki} APF + \epsilon_{pr} \\ k &= L, M, UM, H \end{aligned} \tag{12}$$

It is expected that coefficient of terms of trade will be greater in lower-income (less developed) countries. According to the Gertler and Rogoff (1990) hypothesis are the poorest countries who rely on the values of her natural resources (i.e. terms of trade are used here as proxy of wealth changes) as collateral to back her liabilities.

APF is the index of *de facto* financial openness. It is expected that this index will be negatively correlated with the risk premium. Given that the variable *APF* is only available for 69 countries (with T=25) equation (12) will be first estimated with the original data set. Later, *APF* will be included as regressor and the model will be estimated for the reduced sample (N=69; T=25). See statistical appendix for further details.

4.2. Regression procedures

In what follows the estimation procedures used in this paper are summarized. We briefly stress its main features and explain why they represent a suitable procedure for obtaining adequate estimates.

i) Estimating unobserved effects models by Pooled OLS ($POLS$)

The model $Y_{it} = \beta X_{it} + U_{it}$ ($t = 1, 2, ..., T; i = 1, 2, ..., N$) so that $V_{it} = c_i + U_{it}$. Where c_i is a time invariant random variable (the unobserved effect). This model could be correctly estimated under the assumption that $E(X_{it}^{'} V_{it}) = 0$ (estimated beta would be consistent). However it should be stressed that even though the exogeneity condition is satisfied the compounded errors will probably be serially correlated due to the existence of c_i in each V_{it}. Thus, the estimation by $POLS$ is suitable when N is large.

ii) Random Effects estimation

Other possibility is to estimate the unobserved effect model by Feasible Generalized Least Squares ($FGLS$). Two assumptions should be hold: the zero conditional mean assumption and c_i should be independent of X_i as well. The Random Effect model finally requires to states that conditional variances of U_{it} are constant while conditional covariances for U_{it} are zero. Conditional variance of c_i is constant. Under these assumptions the random effect estimator is efficient within the class of consistent estimators. If the assumption of conditional homoskedasticity does not hold a robust variance estimator should be computed.

iii) General FGLS estimation

If U_{it} are expected to be heteroskedatic and serially correlated then a general version of $FGLS$ should be applied. That is, if the conditional homoskedasticity assumption does not hold, then Ω should be estimated without restrictions according to $N - 1 \sum_{i=1}^{N} \hat{V}_i \hat{V}_i'$, where $\hat{V}_i$are $POLS$ residuals.

iv) Fixed Effects estimations

In the fixed effects estimation c_i is allowed to be arbitrarily correlated with X_{it}. As Wooldridge (2002) remarks, Fixed Effects analysis is more robust that Random Effects (because it consistently estimates the partial effects in presence of time-invariant omitted variables). However, this robustness comes to a price: in Fixed Effects analysis is no longer possible to include time-constant factors in the estimation equation (because it is not possible to distinguish between observables and non observables variables). Only time-varying explanatory variables (each element of X_{it} varies along t at least for some cross sections units or countries in this case) are allowed.

v) Fixed Effect FGLS estimator

As Wooldridge (2002) Fixed Effects regression can fail for two reasons: a) Because the conditional homoskedasticity assumption does not hold; b) Even if conditional variance matrix is equal the unconditional variance matrix, the unconditional variance matrix may not be scalar. By using the residual of the Fixed Effect regression, a $FGLS$ can be performed (using time-demeaned variables). This analysis allows for an unrestricted, albeit constant, conditional covariance matrix. As Wooldridge (2002) states, *this is a natural route to follow if the robust standard errors of the fixed effects estimator are too large to be useful and if there is evidence of serial dependence or a time –varying variance in the uit*.

5. Regression results

Table 1 shows the results of the regression of (the log of) risk premium on (the log of) terms of trade, the dependency rate, the $M2$-to-GDP ratio, the index of financial deepness, the rate of inflation, the debt-to-GDP ratio, the trade openness index and the growth rate. The statistical appendix describes the sources as well as the procedures that have been utilized to construct these indicators. The table reports the estimated regression coefficients obtained by applying Pooled Ordinary Least Squares ($POLS$), Feasible Generalized Least Squares ($FGLS$), Random Effect (RE), Fixed Effects (FE) and $FE - GLS$ estimation.

In order to assess the significance of the estimated coefficients, a heteroskedasticity-robust variance is computed by considering that the conditional homoskedasticity assumption does not hold Wooldridge (2002). The table shows (in parenthesis) the resulting p-values (a two sided test is carried out to test parameters statistical significance). The statistical regression is carried out for the whole sample of seventy five countries. It is a first step to assess the overall fit of the selected variables, without distinguishing between developed and developing countries.

In all regressions, the estimated coefficient of the terms of trade is negative and significant different from zero as it was expected (the only exception is when a Fixed Effect regression is run, when the hypothesis that the coefficient is zero cannot be rejected with a 1% significance level using a hetersokedasticity-robust variance). The estimated coefficients of the RD and GROWTH variables have the expected negative sign as well, and these are significant different from zero.

The evidence is mixed when the sign and significance of the other coefficient is analyzed: the null hypothesis that the coefficient of $M2GDP$ is zero cannot be rejected with robust variances when FE, RE and $FE - GLS$ analysis are applied (although in all regression equations the estimated coefficient has the negative expected sign).

Table 1: **Determinants of the risk premium 1980-2009.**

Independent variable	***Dependent variable is the log of risk premium*** **POLS**	**FGLS**	**RE**	**FE**	**FEFGLS**
C	4.52398	2.64712	5.30787	6.31559	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
$LNTOT$	-0.46248	-0.21200	-0.48924	-0.47878	-0.22669
	(0.0099)	(0.0000)	(0.0042)	(0.0105)	(0.0000)
RD	-0.01214	-0.00536	-0.02898	-0.04713	-0.03347
	(0.0064)	(0.0008)	(0.0000)	(0.0000)	(0.0000)
$M2GDP$	-0.00835	-0.00450	-0.00077	0.00335	0.00025
	(0.0000)	(0.0000)	(0.6881)	(0.0679)	(0.6869)
$INFL$	0.00072	0.00066	0.00059	0.00060	0.00051
	(0.1097)	(0.0000)	(0.1396)	(0.1370)	(0.0000)
$DEGDP$	0.00098	0.00080	0.00153	0.00178	0.00100
	(0.5352)	(0.0177)	(0.1844)	(0.1854)	(0.0009)
AC	-0.00050	-0.00075	0.00171	0.00199	0.00114
	(0.6488)	(0.0243)	(0.3750)	(0.3729)	(0.0195)
$GROWTH$	-0.02550	-0.01199	-0.02832	-0.02813	-0.01260
	(0.0021)	(0.0000)	(0.0004)	(0.0004)	(0.0000)
$Cross-sectionrandom$			0.2306		
			0.46675		
$Idiosyncraticrandom$			0.7694		
			0.85264		
$Cross-section$	75	75	75	75	75
$Observation$	2250	2250	2250	2250	2250
$AdjustedR-squared$	0.122	0.272	0.145	0.448	0.447

Note: p-value between parentheses. Statistical tests were carried out by using heteroskedaticity-robust covariances. The dependent variable is the natural logarithm of risk premium. The list of explanatory variables includes the natural logarithm of terms of trade ($LNTOT$), the dependency ratio (RD), the quasi money to gross domestic product ratio ($M2GDP$), the rate of inflation ($INFL$), the debt to GDP ratio ($DEGDP$), the trade openness (AC) and the growth annual rate ($GROWTH$).

Finally, the estimated coefficients of $INFL$, $DEGDP$ and AC are statistically significant (and with the expected sign) only when $FGLS$ and $FE-FGLS$ are applied (eve more, the coefficient of AC is significant at a 5% confidence level).

Table 2 shows a regression that includes four dummies variables that represent the level of income that a particular country has. We distinguish between four groups of countries: those that have the lower (L), a medium (M), an upper medium (UM) and high (H) level of income. We allow these dummy variables to interact with all regressors to assess if the respective coefficients are different between groups with different income levels. The variables utilized in the regression are the same as in table 1.

The results indicate that there are no differences in the coefficients of TOT across countries with different levels of income. What is more important though, is the role that the dummy variables play when these interact with GROWTH. It can be seen in table 2 that the growth in the economies belonging to the group of lower level of income is not significant, while in the medium group is not significant at 1% level of confidence both in RE and FE regressions. Furthermore, in the two groups of higher level of income (UM and H groups) the coefficients of growth are significant (even though a heteroskedasticity-robust variance is used) while the estimated values display a greater size (in absolute value).

Table 3 displays the regression results when the dummy variables are set to interact with all the chosen explanatory variables in the statistical model and the APF variable is added as well. The $LNTOT$ coefficients remain significant at least at a 5 level in all regressions, excepting for the group of countries with medium income level ($LNTOTM$) where the coefficient is non significant at usual confidence levels. In countries with Lower, Medium and Upper Medium level of income the estimated coefficient of the rate of dependency (RD) remains significant; however in the case of countries with higher level of income this variable would not explain the behaviour of the risk premium at 1% level of significance.

Table 2: **Determinants of the risk premium 1980-2009.**

Independent variable	***Dependent variable is the log of risk premium*** POLS	FGLS	RE	FE	FEFGLS
C	4.92602	3.19991	5.85982	6.42434	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
$LNTOTL$	-0.45153	-0.23659	-0.43175	-0.43064	-0.20187
	(0.0232)	(0.0000)	(0.0324)	(0.0418)	(0.0000)
$LNTOTM$	-0.20906	-0.13766	-0.25154	-0.26840	-0.17073
	(0.2358)	(0.0012)	(0.1558)	(0.1682)	(0.0005)
$NTOTUM$	-0.26801	-0.16531	-0.47947	-0.55377	-0.31074
	(0.2262)	(0.0001)	(0.0297)	(0.0257)	(0.0000)
$LNTOTH$	-0.93543	-0.41915	-0.58677	-0.45973	-0.29737
	(0.0010)	(0.0000)	(0.0146)	(0.0315)	(0.0001)
RDL	-0.02243	-0.01182	-0.03664	-0.04993	-0.03281
	(0.0103)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
RDM	-0.02831	-0.01360	-0.04111	-0.05227	-0.03278
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$RDUM$	-0.02742	-0.01513	-0.03849	-0.04866	-0.03392
	(0.0074)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table 2 – ***Continued***

Independent variable	***Dependent variable is the log of risk premium***				
	POLS	**FGLS**	**RE**	**FE**	**FEFGLS**
RDH	0.00681	-0.00319	-0.04357	-0.05834	-0.03281
	(0.7413)	(0.6363)	(0.0050)	(0.0006)	(0.0000)
M2GDPL	-0.01082	-0.00648	-0.00186	0.00683	0.00018
	(0.1276)	(0.0001)	(0.8050)	(0.3741)	(0.9145)
M2GDPM	-0.00705	-0.00701	-0.00098	0.00411	-0.00014
	(0.0035)	(0.0000)	(0.7623)	(0.2734)	(0.9219)
M2GDPUM	-0.00711	-0.00447	0.00239	0.00696	0.00351
	(0.1334)	(0.0010)	(0.5917)	(0.1250)	(0.0147)
M2GDPH	-0.00095	-0.00137	0.00047	0.00184	0.00050
	(0.6235)	(0.0021)	(0.8355)	(0.4332)	(0.5293)
INFLL	0.00753	0.00463	0.00296	0.00271	0.00304
	(0.0053)	(0.0000)	(0.1066)	(0.1330)	(0.0000)
INFLM	0.00045	0.00029	0.00042	0.00043	0.00025
	(0.1363)	(0.0074)	(0.1396)	(0.1335)	(0.0000)
INFLUM	0.00287	0.00260	0.00269	0.00264	0.00242
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
INFLH	0.01260	0.01144	0.00589	0.00414	0.00597
	(0.0003)	(0.0000)	(0.1556)	(0.3381)	(0.0011)
DEGDPL	-0.00087	0.00072	-0.00005	-0.00021	0.00023
	(0.6434)	(0.0844)	(0.9693)	(0.8742)	(0.5805)
DEGDPM	0.00079	0.00114	-0.00036	0.00009	0.00071
	(0.6323)	(0.1424)	(0.8032)	(0.9613)	(0.2518)
DEGDPUM	0.00271	0.00395	0.00091	0.00333	0.00418
	(0.5667)	(0.0007)	(0.7722)	(0.3343)	(0.0000)
DEGDPH	-0.00243	-0.00201	0.00119	0.00377	0.00023
	(0.2725)	(0.0419)	(0.5649)	(0.0355)	(0.8320)
ACL	0.00874	0.00227	0.00652	0.00421	0.00100
	(0.0000)	(0.0001)	(0.0247)	(0.2600)	(0.1804)
ACM	-0.00380	-0.00113	-0.00352	-0.00506	-0.00114
	(0.2178)	(0.1778)	(0.3290)	(0.1529)	(0.1636)
ACUM	-0.00444	-0.00236	-0.00046	0.00212	0.00236
	(0.0621)	(0.0017)	(0.8584)	(0.4274)	(0.0056)
ACH	0.00262	0.00049	0.00285	0.00468	0.00373
	(0.0034)	(0.4741)	(0.1513)	(0.0085)	(0.0001)
GROWTHL	-0.00267	0.00020	-0.00171	-0.00048	0.00050
	(0.6965)	(0.8711)	(0.7340)	(0.9162)	(0.7082)
GROWTHM	-0.03600	-0.01896	-0.03470	-0.02760	-0.01525
	(0.0097)	(0.0000)	(0.0100)	(0.0511)	(0.0000)
GROWTHUM	-0.04619	-0.02923	-0.04572	-0.04334	-0.02463
	(0.0005)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GROWTHH	-0.12383	-0.03475	-0.14486	-0.14402	-0.03691
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table 2 – ***Continued***

Independent variable	**POLS**	***Dependent variable is the log of risk premium*** **FGLS**	**RE**	**FE**	**FEFGLS**
$Cross-Section$			0.17970		
			0.3768		
$Idiosyncratic$			0.82030		
			0.8050		
$Cross-Section$	75	75	75	75	75
$Obserbation$	2250	2250	2250	2250	2250
$AdjustedR-squared$	0.285	0.480	0.258	0.508	0.487

Note: p-value between parentheses. Statistical tests were carried out by using heteroskedaticity-robust covariances. The dependent variable is the natural logarithm of risk premium. The list of explanatory variables includes the natural logarithm of terms of trade ($LNTOT$), the dependency ratio (RD), the quasi money to gross domestic product ratio ($M2GDP$), the rate of inflation ($INFL$), the debt to GDP ratio ($DEGDP$), the trade openness (AC) and the growth annual rate ($GROWTH$).

Excepting for the case when a $FGLS$ regression is applied, the $M2GDP$ variable does not seem to explain the behaviour of the premium risk. When the significance of the rate of inflation is tested across countries with different level of income, a meaningful fact arises: it can be seen that in the group of Upper Medium countries the coefficient of the rate of inflation has the expected sign and this value is significant different from zero as well, using both non robust and heteroskedasticity robust variance estimator. Meanwhile in the other groups the estimated coefficient remains with the expected sign but not in all cases the null hypothesis (which states that the value of the coefficient is zero) can be rejected.

As in Table 2, it can be seen that the debt-to-GDP ratio does not seem to have enough explanatory power to explain risk premium movements (except for when a $FGLS$ regression is applied in both lower and upper medium income countries) when a hetoroskedasticity-robust variance is used to test the parameters significance. The evidence for the coefficients of trade openness (AC) is somewhat different to $DEGDP$: the estimate coefficients of AC have the negative expected sign and are significant different from zero as well in the case of upper-medium income countries (with the exception of the coefficient estimated by a Fixed Effect regression).

As in previous tables, it can be viewed that the significance of the $GROWTH$ variable depends on the country group: while in the poorer countries variable interaction of growth with the corresponding dummy variable is not significant, in the group of richest countries the growth explains risk premium movements. Finally, the Table 3 adds the index of financial openness (APF) as an explanatory variable. The estimated coefficient is only significant at 1% level for the group with lesser income levels.

Table 3: **Determinants of the risk premium 1980-2009.**

Independent variable	**POLS**	***Dependent variable is the log of risk premium*** **FGLS**	**RE**	**FE**	**FEFGLS**
C	5.07006	3.17794	5.48213	5.83592	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

Table 3 – ***Continued***

Independent variable	***Dependent variable is the log of risk premium***				
	POLS	**FGLS**	**RE**	**FE**	**FEFGLS**
LNTOTL	-0.59898	-0.23674	-0.48663	-0.47914	-0.21469
	(0.0125)	(0.0000)	(0.0220)	(0.0168)	(0.0002)
LNTOTM	-0.25448	-0.17207	-0.29823	-0.33955	-0.23287
	(0.1831)	(0.0000)	(0.0890)	(0.0780)	(0.0000)
LNTOTUM	-0.56350	-0.32261	-0.63559	-0.68582	-0.37583
	(0.0164)	(0.0000)	(0.0197)	(0.0277)	(0.0000)
LNTOTH	-1.00771	-0.54038	-0.76445	-0.60211	-0.35998
	(0.0005)	(0.0000)	(0.0038)	(0.0079)	(0.0000)
RDL	-0.02068	-0.01538	-0.03362	-0.04274	-0.03013
	(0.0244)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
RDM	-0.02974	-0.01472	-0.03606	-0.04335	-0.02709
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
RDUM	-0.01892	-0.01150	-0.02760	-0.03707	-0.02840
	(0.0199)	(0.0000)	(0.0000)	(0.0003)	(0.0000)
RDH	0.00466	0.00009	-0.02363	-0.04520	-0.02948
	(0.7996)	(0.9893)	(0.0942)	(0.0020)	(0.0000)
M2GDPL	-0.00921	-0.00925	-0.00258	0.00385	-0.00460
	(0.1798)	(0.0000)	(0.5906)	(0.4575)	(0.0304)
M2GDPM	-0.00933	-0.00934	-0.00593	-0.00093	-0.00397
	(0.0008)	(0.0000)	(0.0364)	(0.8099)	(0.0129)
M2GDPUM	-0.01162	-0.00878	-0.00479	0.00089	-0.00080
	(0.0053)	(0.0000)	(0.2274)	(0.8346)	(0.5909)
M2GDPH	-0.00338	-0.00266	-0.00119	0.00186	-0.00071
	(0.1597)	(0.0095)	(0.6468)	(0.3103)	(0.4630)
INFLL	0.00989	0.00493	0.00366	0.00324	0.00331
	(0.0001)	(0.0000)	(0.0223)	(0.0546)	(0.0000)
INFLM	0.00044	0.00031	0.00040	0.00039	0.00027
	(0.1363)	(0.0008)	(0.1473)	(0.1447)	(0.0000)
INFLUM	0.00304	0.00271	0.00272	0.00257	0.00236
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
INFLH	0.01346	0.00892	0.00659	0.00551	0.00335
	(0.0006)	(0.0000)	(0.0273)	(0.1242)	(0.0426)
DEGDPL	0.00484	0.00303	0.00199	0.00127	0.00142
	(0.0850)	(0.0000)	(0.4279)	(0.6220)	(0.0510)
DEGDPM	-0.00095	0.00052	-0.00087	0.00079	0.00120
	(0.6901)	(0.4281)	(0.7062)	(0.7257)	(0.1227)
DEGDPUM	0.00295	0.00451	0.00181	0.00407	0.00420
	(0.4188)	(0.0000)	(0.5020)	(0.0688)	(0.0000)
DEGDPH	0.00039	0.00156	-0.00026	-0.00005	0.00044
	(0.8729)	(0.1163)	(0.8961)	(0.9769)	(0.7025)
ACL	0.00511	0.00206	0.00406	0.00328	0.00145
	(0.1903)	(0.0288)	(0.3030)	(0.4514)	(0.2044)
ACM	-0.01197	-0.00610	-0.01007	-0.00638	-0.00407

Table 3 – ***Continued***

Independent variable	***Dependent variable is the log of risk premium***				
	POLS	**FGLS**	**RE**	**FE**	**FEFGLS**
	(0.0003)	(0.0000)	(0.0185)	(0.1246)	(0.0001)
$ACUM$	-0.00758	-0.00413	-0.00186	0.00481	0.00196
	(0.0151)	(0.0000)	(0.6401)	(0.3426)	(0.0560)
ACH	-0.00049	-0.00003	0.00038	0.00683	0.00412
	(0.5268)	(0.9631)	(0.7796)	(0.0137)	(0.0005)
$GROWTHL$	0.00506	0.00181	0.00519	0.00640	0.00221
	(0.4329)	(0.1120)	(0.2684)	(0.1477)	(0.1046)
$GROWTHM$	-0.01942	-0.01206	-0.01739	-0.01754	-0.01076
	(0.1334)	(0.0000)	(0.2318)	(0.2417)	(0.0000)
$GROWTHUM$	-0.01393	-0.01422	-0.01496	-0.01316	-0.01285
	(0.1747)	(0.0000)	(0.0869)	(0.1488)	(0.0000)
$GROWTHH$	-0.01643	-0.00489	-0.03835	-0.05225	-0.01589
	(0.2688)	(0.0750)	(0.0009)	(0.0002)	(0.0006)
$APFL$	-0.02629	0.06964	0.33111	0.36704	0.17038
	(0.8983)	(0.2252)	(0.1887)	(0.2049)	(0.0039)
$APFM$	0.70128	0.41811	0.70451	0.41542	0.26212
	(0.0024)	(0.0000)	(0.0107)	(0.1310)	(0.0000)
$APFUM$	0.80971	0.48803	0.47793	0.12206	0.11227
	(0.0243)	(0.0000)	(0.2264)	(0.7669)	(0.0668)
$APFH$	0.05521	0.01891	0.05856	-0.00279	0.00162
	(0.0208)	(0.2136)	(0.1034)	(0.9441)	(0.9413)
$Cross-sectionrandom$			0.21880		
			0.3407		
$Idiosyncraticrandom$			0.78120		
			0.6438		
$Cross-section$	69	69	69	69	69
$Observation$	1725	1725	1725	1725	1725
$AdjustedR-squared$	0.441	0.517	0.350	0.634	0.628

Note: p-value between parentheses. Statistical tests were carried out by using heteroskedaticity-robust covariances. The dependent variable is the natural logarithm of risk premium. The list of explanatory variables includes the natural logarithm of terms of trade ($LNTOT$), the dependency ratio (RD), the quasi money to gross domestic product ratio ($M2GDP$), the rate of inflation ($INFL$), the debt to GDP ratio ($DEGDP$), the trade openness (AC) and the growth annual rate ($GROWTH$).

6. Concluding Remarks

In this paper we perform a statistical analysis to shed light on the main determinants of the risk premium in developing countries. Following Gertler and Rogoff (1990) we state that capital does not flow to developing countries because an endogenous risk premium arises. As a consequence of asymmetries in the capital markets (i.e. moral hazard) borrowers have to pay a *risky* rate to lenders that exceed the international (*free risk*) rate. Gertler and Rogoff (1990) shows that the greater the level of collateral (i.e. natural resources) that the poor country has the lesser the (endogenous) risk premium that she has to pay to lenders. Thus, on the basis of this model we test the hypothesis that states that in developing countries the risk premium in negatively correlated to terms of trade. Additionally, we include in the regression equation a set of control variables widely used in the literature.

We apply a variety of regression procedures to evaluate the goodness of fit and the stability of estimated coefficients. Specifically, six estimation panel data methods are run. Pooled Least squares, Feasible Generalized Least Squares (GLS), Random Effect analysis, Fixed Effect analysis and Fixed Effect GLS are carried out, to account for different scenarios related to the correlation structure in regression errors. To evaluate the differences of the response of the risk premium among countries with different stages of development, we use a dummy variable to distinguish four groups of countries according to the country income level (Lower, Medium, Upper Medium and High income). Thus, the index constructed by the World Bank is used as proxy of the development stage of a given country.

The main results are the following (we report the obtained results under Fixed Effect $FGLS$ regression given that this estimation method give us the best fit, as it was expected). Firstly, we find that the risk premium is negatively correlated with the terms of trade in all country groups, although the estimated coefficients seem to be greater for the group of countries with higher income levels. Secondly, the estimated coefficient for the rate of dependency is negative, and is significant different from zero. Thirdly, the index of financial deepness is only significantly different from zero (and with the expected negative sign) in the group with lower and medium income (at least at a 5% level of significance). Fourthly, the inflation rate affects positively in all groups (although the coefficient significance is lesser in group of higher income economies). Fifthly, the debt-to-GDP ratio is significant only for both the group of low income (at 5% level) and the medium income group (at 1% level). Given that the sign of the estimated coefficient is positive, it seems that the level of the debt tends to push risk premium up. Sixthly, the estimated coefficient of trade openness is significantly different from zero both the group of upper medium and higher income groups. But in the first group its signs is positive whereas in the latter group is positive.

The $GROWTH$ variable is not significantly different to zero in the group of poorer countries. It would mean that in the less developing countries the growth trend would be leaded by the terms of terms cycle. In the rest of the countries this variable is significantly different to zero and has the expected negative sign. Finally, the results suggest that the index of financial deepness helps to explain the performance of risk premium in the group of countries with lower income levels (the coefficient is not significantly different from zero in the case of Higher income countries, while is significantly different to zero at a 5% level of significance in the group of upper medium income countries).

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Appendix A. Statistical Appendix

Annual data for years 1980-2009 for economic aggregates were obtained from World Development Indicators (WDI), International Financial Statistics (IFS), UNCTAD and The Worldwide Governance Indicators, 2011 Update.

TOT: is the terms of trade, serie code TT.PRI.MRCH.XD.WD serie name NET BARTER TERMS OF TRADE INDEX (2000=100), WDI. For Chad, Guinea-Bissau and India data were obtained from the UNCTAD.

RD: is the dependency ratio, serie code SP.POP.DPND serie name AGE DEPENDENCY RATIO (per cent of working-age population) WDI.

$M2GDP$: is the M2 to GDP ratio. M2 serie code FM.LBL.MQMY.CN serie name Money and quasi money (current LCU), WDI and Central Bank. GDP serie code NY.GDP.MKTP.CN serie name GDP (current LCU).

$INFL$: is the inflation rate serie code NY.GDP.DEFL.KD.ZG, serie name INFLATION, GDP DEFLACTOR (% annual).

$GROWTH$: serie code NY.GDP.MKTP.KD.ZG, serie name GDP GROWTH (% annual) WDI.

DEBTGDP: is the debt to GDP ratio and is obtained from Historical Public Debt Database Prepared by S. Ali Abbas, Nazim Belhocine, Asmaa ElGanainy, and Mark Horton. IFS.2010 WP/10/245. And WDI.

AC: Trade openness is calculated as the sum of exports and imports ratio to GDP. Serie code NE.EXP.GNFS.ZS serie name Exports of goods and services (% of GDP) and serie code NE.IMP.GNFS.ZS y serie name Imports of goods and services (% of GDP), WDI

APF: Financial openness the facto is calculated as the sum of gross international financial assets and liabilities ratio to GDP using Lane and Milesi-Ferretti dataset. 1980-2004.

PR Risk Premium is calculated as the difference between representative interest rate and international interest rate. the rate of interest of United State (code 11160CS.ZF .IFS) as the international free-risk rate

The representative interest rate for each country included in the panel data analysed the relationship between different definitions of interest rates available for the study period in each country. The following table shows the correlation coefficients between definitions alternative interest rates, this correlation between different rates is high. The lending rate is preferred in cases where it was available, since it reflects the opportunity cost of domestic investors.

Table A.4: **Correlation Coefficients**

Country	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Algeria(1980 2009)			0.8761			
Algeria(1994 2009)	0.9220	0.8761		0.9730		
Argentina(1994 2009)		0.9429				
Australia (1980 2009)				0.9821	0.9076	0.9173
Bolivia(1996 2009)	0.8964	0.7898		0.9265		
Brazil(1997 2009)	0.7236	0.7481		0.9784		
Cameroon(1980 2009)		0.9780				
Canada(1980 2009)	0.9313	0.9984		0.9268	0.9357	
Chile(1993 2009)		0.8149				
Colombia(1986 2009)		0.9760				
Costa Rica(1982 2009)		0.8402				
Denmark(1980 2002)		0.8866	0.8271			
Ecuador(1980 2007)		0.8167				
Egypt(1980 2009)		0.9068				
Gambia(1980 2008)		0.5789				
Germany(1980 2009)					0.8943	
Guinea Bissau(1990 2009)		0.9868				
Iceland(1987 2009)	0.8393	0.7990		0.9174	0.8626	
India(1980 2009)		0.8626				
Ireland(1980 2009)					0.9292	
Israel(1982 2009)		0.8760				
Italy(1980 2009)					0.9637	
Japan(1980 2009)	0.9862	0.9649		0.9784		0.8155
Jordan(1990 2009)		0.4434				
Kenya(1980 1999)		0.7379				
Korea, Rep.(1980 2009)	0.8257	0.7957		0.8576		

Table A.4 – ***Continued***

Country	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Kuwait(1980 2009)	0.6764	0.6620		0.6785		
Leshoto(1980 2009)		0.7672				
Malaysia(1987 2009)				0.7760		
Mali(1980 2009)	0.9489					
Mauritania(1980 2007)	0.8071	0.9332		0.8531		
Mexico(1993 2009)				0.9971		
New Zealand (1987 2009)	0.9310	0.8685		0.9645		
Niger(1980 2009)	0.9525					
Nigeria(1980 2008)				0.9108		
Norway(1980 2006)	0.8883	0.9764		0.9764		
Pakistan(1980 2009)	0.7283					
Peru(1986 2009)		0.4076				
Philippines(1985 2009)	0.8804	0.8730		0.8730		
Senegal(1980 2009)	0.9486					
Singapore(1980 2009)				0.9405		
South Africa(1980 2009)	0.8780	0.8704		0.9629		
Spain(1980 2009)					0.9338	
Sweden(1980 2003)	0.9266	0.9590		0.9417		
Thailand(1980 2009)	0.9476	0.9387		0.9472		
Togo(1980 2009)	0.9512					
Turkey(1987 2009)	0.7672					
United Kingdom(1980 2009)				0.9982	0.9123	0.9174
United States(1980 2009)	0.9410	0.9277		0.9907		
Uruguay(1981 2009)		0.9340				
Venezuela, Rep. (1984 2009)		0.9088				

Source: IFS. **(1)** Correlation between Discount and Money Market Rate. **(2)** Correlation between Discount and Lending Rate. **(3)** Correlation between Discount and Bond Yield.**(4)** Correlation between Money and and Lending Rate. **(5)** Correlation between Money and Bond Yield. **(6)** Correlation between Lending and Bond Yield.

The representative interest rate selected for each country was: **a)** Discount Rate (IFS) for Algeria, Benin, Burkina Faso, Colombia Costa Rica, Cote Dlvoire, Ecuador, Ghana, Jordan, Mali, Niger, Peru, Rwanda, Turkey and Venezuela. **b)** Lending Rate IFS or WDI for Australia, Bangladesh, Bolivia, Botswana, Burundi, Cameroon, Canada, Central African Republic, Chad, Chile, China, Congo Republic, Egypt, Gabon. Gambia, Guatemala, Honduras, Iceland, India, Israel, Kenya, Korea Republic, Lesotho, Malawi, Mauritania, Mauritius, Morocco, New Zealand, Nigeria Norway, Philippines, Singapore, south Africa, Thailand, United States, Uruguay and Zambia. **c)** Money Market Rate (IFS) for Argentina, Brazil, Guinea-Bissau, Indonesia, Madagascar, Malaysia, Mexico, Pakistan, Senegal, Sweden, Togo and Tunisia. **d)** Deposit rate (FR.INR.DPST) WDI for Hungry. **e)** Government Bond Yield IFS for Japan, Denmark, Germany, Ireland, Italy, Netherlands, Portugal, Spain and United Kingdom. **e)** Treasury Bill Rate, IFS for Greece.

In addition, the correlation between risk premium and the $EMBI+$ for the period and the countries which data were available is studied. The results show a high correlation between the

Table A.5: **Correlation between** $EMBI+$ **and lending rate minus international rate (2002-2008)**

Country	***Correlation Coefficient***
Argentina	0.6859
Brazil	0.6450
Bulgaria	0.8634
Colombia	0.9140
Mexico	0.9248
Morocco	0.8812
Nigeria	0.9089
Panama	0.8394
Peru	0.5339
Philippines	-0.7942
Poland	0.9165
South Africa	0.6858
Ukraine	0.3469
Venezuela, RB	0.6108

risk premium calculated as the difference between the rate of interest and international interest rate of each country and the annual average $EMBI+$.

Table A.6: **Countries included in the sample(*)**

Algeria	Cote d'Ivoire	Japan	Peru
Argentina	Denmark	Jordan	Philippines
Australia	Ecuador	Kenya	Portugal
Bangladesh	Egypt, Arab Rep.	Korea, Rep.	Rwanda
Benin	Gabon	Lesotho (*)	Senegal
Bolivia	Gambia (*)	Madagascar	Singapore
Botswana	Germany	Malawi	South Africa
Brazil	Ghana	Malaysia	Spain
Burkina Faso	Greece	Mali	Sweden
Burundi (*)	Guatemala	Mauritania (*)	Thailand
Cameroon	Guinea-Bissau	Mauritius	Togo
Canada	Honduras	Mexico	Tunisia
Central African Rep.(*)	Hungary	Morocco	Turkey
Chad	Iceland	Netherlands	United Kingdom
Chile	India	New Zealand	United States
China	Indonesia	Niger	Uruguay
Colombia	Ireland (*)	Nigeria	Venezuela, RB
Congo, Rep.	Israel	Norway	Zambia
Costa Rica	Italy	Pakistan	

(*) For these countries *APF* are not available.