Determinants of the time varying risk premia

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Abstract

This paper generates monthly risk premia data using zero coupon government treasury bills for 43 countries over the period of 1994-2006. The measure of risk premia is based on the ARCH-in-Mean (ARCH-M) model introduced by Engle, Lilien and Robins (1987). We show that the risk premia are time varying and also vary considerably across sample countries. Countries with better financial development and higher income generally have lower risk premia of government assets. This study also examines the macroeconomic and political determinants of the risk premia by using cross-section and dynamic panel regression analyses. The results show that the risk premia are significantly affected by macroeconomic circumstances, especially economic growth and the real effective exchange rate. The results are robust across the majority of countries in our study.

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1 Introduction

This paper studies the behavior of the risk premia of short term government assets (treasury bills). The paper makes 2 contributions to the literature. Firstly, we generate monthly risk premia data using zero coupon government treasury bills for 43 countries over the period of 1994-2006. The risk premia measure is based on the ARCH-in-Mean (ARCH-M) model introduced by Engle, Lilien and Robins (1987). The estimation of the risk premia in this paper can perform the same function as the agencies' credit ratings as it allows us to extract the market perceptions of the risk in holding government assets. Moreover, the risk premia data generated in this study are somewhat more continuous and more time varying measure of risk in holding government asset than the risk indices based on credit ratings. We …nd that the risk premia are time varying and also vary considerably across countries. The second contribution of this paper is that we examine the macroeconomic and political determinants of the risk premia by using cross section and dynamic panel regression analyses. The results show that the risk premia are signi…cantly a¤ected by macroeconomic circumstances, especially economic growth and the real e¤ective exchange rate. The results are robust across the majority of countries in our study.

The risk premia series in this study are proxied by the time series volatility of the excess holding yields for short- and long-term treasury bills. Thus the risk premia in this study correspond to the term premia in the theory of the term structure of interest rates, I will use these two terms interchangeably. The process used to construct risk premia data follows the argument of Engle, Lilien and Robins (1987), and associates the mean of the excess returns on holding long-term comparing to short-term government bills to the volatility of the excess returns. It focuses on the fundamental trade-o¤ between expected returns and their volatility. The theoretical appeal of this model is that it provides microeconomics foundations by measuring the response of risk averse economic agents to uncertainty using the time series data. Estimating the risk premia from the treasury bills data is relevant to previous studies which have documented that the treasury bills rates contain time varying term premia[1].

There is an abundance of work on the term structure of interest rate but this focuses mainly on the validity of the expectations hypothesis. Empirical evidence of time varying risk premia in government asset returns is frequently interpreted as evidence against the expectations hypothesis. However, we need a better understanding of the determinants of the term premia. This will in turn give clearer explanation for the rejection of expectations hypothesis.

The literature has not yet fully identi…ed the determinants of risk premia in government assets. There are a few works that attempt to relate the term structure to movements in macroeconomic variables such as Wu (2002), Hordahl, Tristani, and Vestin (2003), and Rudebusch and Wu (2003). However, these works ignore the role of time-varying risk premia which is an important component in explaining movements in yields over time. Ang and Piazzesi (2003) suggest that macroeconomic factors (in‡ation and economic growth factors) have an important explanatory role for the dynamics of the yield curve, and that including these variables in a term structure model can improve its one-step ahead forecasting performance[2]. They …nd that macro factors explain up to 85% of the observed variation in bond yields. Hordahl, Tristani and Vestin (2004) employ macroeconomic variables to indirectly explain the risk premia. Their paper explains how macroeconomic factors (in‡ation, output gaps and

[1] Many papers provide evidence that the risk (term) premium in term structure of interest rate varies over time instead of being constant. Parts of this evidence consist of repeated rejection of the expectation hypothesis [Shiller, 1979; Startz, 1982; Shiller, Campbell and Schoenholtz, 1983; Fama, 1984; Mankiw, 1986; Mankiw and Miron, 1986; Shiller, 1986; Campbell, 1987; Engel, Lilien and Robins, 1987; Fama and Bliss, 1987; Shiller and McCulloch, 1987; Hardouvelis, 1988; Froot, 1989; Simon, 1989; Campbell and Shiller, 1991 and others]

[2] Their two stage estimation methods is based on the asssumption that short term interest rates do not a¤ect macroeconomic variables.

the short term policy interest rates) drive movements in the term structure of interest rates and how they affect the behavior of the risk premia embedded in observed yields. Their paper utilises a dynamic term structure model based on macroeconomic factors, which allows for an explicit feedback from the short term policy rates to macroeconomic outcomes. At the same time, the explicit modelling of risk premia captures dynamics of the entire term structures. They conclude that the dynamics of risk premia can ultimately be attributed to underlying macroeconomic dynamics[3].

This paper can be divided into two main parts. In the first part, we generate measures of the risk premia of government securities for 43 countries over the period 1994-2006. In the latter part, we find the determinant of the risk premia using the data generated from the fist part. In examining the determinants of risk premia, we carefully deal with the characteristics of small sample sizes in our study. In the cross section regression analysis, we use the small sample version of the heteroskedasticity consistent covariance matrix estimates (HC3) suggested by MacKinnon and White (1985) to improve the performance of the analysis in small samples. In the dynamic panel regression, the determinants of risk premia are estimated using a Least Squares Dummy Variable Corrected (LSDVC) procedure proposed by Bruno (2005). This estimator is a recently proposed panel data technique that is suitable for small samples in unbalanced panels.

The result from the cross section analysis can be briefly summarised as follows. On average, over the period 1994-2006, the risk premia for holding government assets required by risk averse investors is positively associated with the level of inflation and the budget deficit as a percentage of GDP (both variables are significant at the 1 percent level), and is negatively affected by the country's

[3] Anyhow, the paper did not include the foreign variables or exchange rate, which will provide fully satisfactory account of macroeconomic dynamics in the country of study e.g. Germany.

economic growth (signi…cant at the 5 percent level). Additionally, low income countries are estimated to have risk premia about 19 percent higher than in the high income countries outside the Eurozone, holding other variables constant. In the high income countries outside the Eurozone, the risk premia on holding government assets is predicted to be 10 percent more than those in Eurozone.

Using panel data analysis, we found that economic growth and the volatility of real e¤ective exchange rates are the main determinants of the risk premia in the full sample. Risk averse investors require lower risk premia for holding government assets in countries with good economic performance i.e. high economic growth and a stable external price competitive position i.e. low volatility of real e¤ective exchange rate. If we split the sample by income group, economic growth remains the main determinant of the risk premia. However, we also …nd that the real e¤ective exchange rate plays an interesting and important role: in high income countries, devaluations bring favorable results to the economy as consistent with the Mundell-Fleming model. There is a better price competitiveness which in turn reduces the country risk premia. The opposite relationship is found in the sample of low income countries. One possible mechanism explaining this may be that in …nancial vulnerable countries, weaker local currency can exacerbate the external debt service di¢ culties. Devaluations therefore raise the country risk premia. This corresponds to the results from Cespedes, Chang and Velasco (2000).

The paper is organised as follows. The following section …rst outlines the de…nition of the risk premia and the departure from the existing literature. We then present a theoretical model for the ARCH-M methodology of time varying risk premia following Engle, Lilien and Robins (1987). Next, we construct measures of the time varying risk premia for 43 countries over the period of 1994 to 2006. The results show that, in general, term premia exist, are time varying and di¤erent between countries. After deriving measures of the term premia, we then ask what factors determine the movements in risk premia and what makes it vary across countries and through time[4]. Using cross sectional and panel data regression analysis. Our main aim is to establish how macroeconomic, …nancial and political conditions determine the di¤erences in risk premia. The …nal section concludes.

2 Risk premia and related literatures

In this section, we …rst discuss the concept of the risk premia. We explain the rationale for estimating the risk premia from the term structure of interest rates. We also explain why the risk premia estimated here provides an alternative to those used in previous literatures. Lastly, we brie‡y discuss the rationale for using the ARCH-M model to estimate the risk premia.

The risk premium is the di¤erential in the expected rate of return on a risky asset as compared with a safe asset. The risk associated with holding government assets can be classi…ed into 2 aspects; the pure time factor of the risk, and the risk of default.

The pure time factor of risk refers to the term or maturity risk, and this is directly related to the term structure of interest rates in monetary economics through the expectation hypothesis. This hypothesis states that the interest rate on the long term asset must equal the average of the expected future interest rate on short term assets plus the term premium [Campbell and Schiller, 1991]. Hence, this term premium is simply an increment of return required to induce investors to longer term securities. The longer maturities entail greater risks for

[4] Assuming that investors form their expectations concerning movements in the interest rate using all available information, perfect capital mobility no longer implies that interest rates on the same asset class are equal across countries. The widely used measure of risk in …nance is the volatility, however, in an arbitrage free economy; the risk perceived corresponds to the relevant information available to an investor as well.

the investor. With longer maturities, more catastrophic events might occur that may impact the investment, hence the need for a risk (term) premium[5]. This pure time factor of risk premia series can be directly estimated by the ARCH-M model by Engle et. al. (1987).

The risk of default refers to the likelihood of the loan not being repaid. Although it is generally recognised that securities issued by governments are relatively safer than other types of assets, the risk associated with holding them as perceived by international investors, varies according to the economic and political conditions of the country of issuer[6]. This risk is thus country specific and is regarded as a country's credit-risk.

Previous literature addressing cross country comparison of risk premia includes Alesina, DeBroek, Prati and Tabellini , 1992; Lemmen and Goodheart , 1999; Giavannini and Piga, 1994; Favero, Giavazzi and Spaventa, 1996; IMF, 1997; Mc Cauley, 1996; Eijffinger, Huizinga and Lemmen, 1998 . However, these works examine risk premia based on the credit risk of government debt. I believe that the measure of the risk premia in my study is a somewhat better measure of risk in holding government assets than the government defaulted risk constructed by previous literatures in several ways as follows.

Alesina et. al. (1992) study the default risk on government debt in OECD countries. The risk is derived by comparing the return from holding government debt with the return from holding corporate debt denominated in the same currency. However, the drawback is that the measure of default risk tends to be sensitive to significant changes in private risk. Additionally, Alesina et. al.

[5] This explanation depends on the distant future being more uncertain than the near future, and risk of future adverse events (such as default and higher short-term interest rates) being higher than the chance of future positive events (such as lower short-term interest rates).

[6] This concept is quite similar to the asset market and portfolio balance approach in international economics which states that domestic and foreign bonds are not perfect substitutes and foreign bonds carry some additional risk with respect to domestic bonds. However, in some countries with less financial stability, the domestic bonds may be relatively more risky than the government bonds in developed countries.

(1992) consider a variety of di¤erent maturities for both public and private yields. However, di¤erences in the maturity between the public and private yields may lead to inaccurate measurement of the magnitude of government default risk.

Lemmen and Goodheart (1999) …nd the determinants of credit risk in the European government bond markets using …xed e¤ects estimation. The risk speci…ed in their work is the default risk (credit risk) proxy by the spread of 10-year benchmark government bond yields over the corresponding swap yield of the same 10-year maturity denominated in the same currency. Although the risk speci…ed in Lemmen et. al. o¤er an improvement to the one used by Alesina et. al. (1992), the risk measure still has several problems. Firstly, the risk premia may not be a good proxy for country risk if the government private bonds interact with each other. According to Lemmen et. al. (1999), uncertainty about government debt servicing will a¤ect private sector risks particularly when bank or other …nancial institutions hold large proportion of their assets in government debt, leading private and public risks to move in a lockstep fashion. Secondly, Lemmen et. al. consider government bond redemption yield data. The use of redemption yields introduces coupon reinvestment risks in the default risk measure. The redemption yield depends on the coupon size. To solve this problem, we use zero coupon yields data to calculate the risk premia.

Other works employ the credit risk of sovereign debt, which can be assessed by comparing yields on domestic government bonds with high quality private risk represented by interest rate swap yields [Giavannini and Piga, 1994; Favero, Giavazzi and Spaventa, 1996; IMF, 1997; Mc Cauley, 1996; Eij…nger, Huizinga and Lemmen, 1998]. The risk premia measures in these literatures cannot distinguish between credit risk and liquidity risk. The measure of the risk premia in these studies requires the assumption that variations in liquidity are negligible. However, liquidity e¤ects may play a central role in government assets return. In my study, the liquidity e¤ect is automatically taken into account in the risk premia estimation.

3 Methodology: Measuring risk premia

This section describes the construction of our risk premia data. Section 3.1 describes the source of data for calculating the excess holding yield for 6 month treasury bills over 3 month treasury bills in 43 countries over the sample period of 1994:12 to 2006:2. Due to the limited availability of the zero coupon yield data, there are 43 countries in our studies. These include both developed and developing countries. See table 1.1 for a list of countries, data de…nition and the period of observation. Section 3.2 presents the theoretical derivation of the time varying risk premia. Section 4.1 uses the calculated excess holding return to generate the risk premia data by applying the ARCH-M methodology. The formulation closely follows Engle, Lilien and Robins (1987). The risk premia is the dependent variables in the cross section regression and the panel data analysis in sections 5 and 6, respectively.

3.1 The data

The term structure data available in each country start in di¤erent years and was collected from Bloomberg L.P. We use monthly observations of the yield on short term assets, i.e. 3 month- and 6-month treasury bills, to calculate the excess holding yield. We use the volatility of excess holding yield to generate the risk premia.

Instead of using the outstanding coupon treasury securities to calculate the excess holding yields, we use the calculated zero coupon instruments (…xed income) instead. This methodology is the same as Dotsey and Otrok (1995) and Harris (2004)[7]. The zero coupon instruments make a single payment at the maturity date. The size of the payment is the face value of the instruments. The advantage of the zero coupon bills is that it is free of liquidity and coupon effects that are common in outstanding treasury securities. The data is, therefore, of the same type as that is analyzed in Campbell and Schiller (1991). This type of data is suitable for the analysis of term structure of interest rate since they have no effects from different coupons and compounding methods. To interpret a zero coupon yield index, the zero coupon yields are derived by stripping the par coupon curve. For example, the USD Government Agency (FMC84) Zero Coupon Yield is the zero coupon rate derived by stripping FMC[8] curve84. Most of the yield indices are denominated in national currencies except Turkey, Brazil and Uruguay. These 3 countries are denominated in US Dollars. The dataset we obtained here is daily reported, and the last observation of each month is therefore chosen to serve as the end of month observation. Naturally, the 30th or 31st data of each month is used except for national Holidays or other non-trading days.

In estimating the term premia, we first define the excess holding yield. The formula for constructing the excess holding yield of 6-month over 3-month zero coupon treasury bills is analogous to Engle, et. al. (1987), Dotsey et. al. (1995) and Harris (2004). To set the notation, $y_t^{6,3}$ is defined as the excess holding return from holding a 6-month treasury bill compared to the return from holding consecutive 3-month treasury bills. R_t is the 6-month zero coupon treasury bill rate and r_t is the zero coupon yield of the treasury bill with maturity of 3 months. The excess holding period yield can therefore be calculated as:

[7] Engle, et. al. (1987) uses the treasury bills rate to calculate the riks premia. However, the US treasury bills are zero coupon bills in that they do not pay interest prior to maturity; instead they are sold at a discount of the par value to create a positive yield to maturity.

[8] FMC stands for Fair market value curve. The fair market value indices are derived from data points on Bloomberg's option free market curves. The yield at each maturity point represents the composite yield of securities around that maturity.

$$y_t^{6,3} = \left[(1 + R_t)^2 / (1 + r_{t+1}) \right] - (1 + r_t) \,, \qquad (1)$$

and following Engle et. al (1987), the linear approximation of equation (1) is used to calculate the excess holding yield as follow,

$$y_t^{6,3} = 2R_t - r_{t+1} - r_t.$$

Prior to generating the risk premia, it is useful to briefly explain the descriptive statistics of the excess holding yield in the different countries. This will help in visualising the expected characteristics of risk premia.

Table 2.1 illustrates descriptive statistics of the excess holding yield generated from equations (1). The standard deviation of the return measures the average deviations of the return series from its mean, and is often used as a measure of risk. A large standard deviation implies that there have been large swings in the return series of assets. The number of observations is represented by number of months observed. The main findings are summarised as follows.

Firstly, the mean of the excess holding yield for 6 months vs 3 months of our sample countries is positive in sign with value between 0 to 1 per cent per annum. Argentina and Uruguay are exceptions, the mean of the excess return is -3.95 and -0.99 percent per annum, respectively. This means that an investor would be better off if he keeps investing in a shorter term asset (3-month bill) for a year than buying a single 6-month treasury bill which gives less return in time $t + 1$. Additionally, the excess holding yield of government securities in these 2 countries is extremely volatile with standard deviations of 18.09 and 9.73 in Argentina and Uruguay[9], respectively. The data available for Argentina

[9] The volatility of excess return is also increasing with maturity of longer term bonds. $\left(s.d.^{12,3} > s.d.^{6,3}\right)$. In table 2.2, the standard deviation of excess return in Argentina and Uruguay are 48.96 and 35.15, respectively. The excess holding yield in these 2 countries are also the most volatile among 43 countries in this study.

is from 1998:07 to 2002:03. Hence, it includes the time of economic crisis in Argentina in 2001-2002. This entailed output falling by 20 percent over 3 years, high in‡ationary pressure, a severe devaluation of Argentine peso, government debt default, and lastly, a stagnant banking system. Over the period of study, the excess holding yield in Argentina hit its low at -71.716 per cent per annum in late 2001. This probably re‡ects the lack of con…dence in economic prospects as investors do not want to take a risk in longer term assets. From Figure 1.1, thanks to the currency board, we can see a period of stability in the excess holding yield from late 1998 to late 2000. The volatility coincides with the time of crisis[10].

In 2003, Uruguay (see Figure 1.41) went through a similar economic and …nancial crisis which developed mostly from external factors, not least the crisis in Argentina. The crisis started by the devaluation in Brazilian Reais in 1999 made Uruguayan exports relatively less competitive. In late 2000, the situation was exacerbated by the economic crisis in Argentina, which is Uruguay's major trading partner. Subsequently in mid 2002 there was a bank run due to massive withdrawals from Uruguayan banks. The bank run was unfortunately overcame by massive borrowing from international …nancial institutions which in turn, led to a serious debt sustainability problem. Unsurprisingly, there was considerable volatility in the excess holding period return during late-2001 to mid-2002. Although Uruguay's economy recovered in 2003 through improving its export performance and a more positive investment climate, the excess holding yield swung wildly over the studied period. This re‡ects a persisting unstable …nancial system.

At the other extreme is the excess holding return of government securities in the Philippines which has a mean value of 1.91 percent per annum. It is also highly volatile with a standard deviation of 2.10. Figure 1.32 shows that

[10] Unfortuantely, we cannot obtain the zero coupon yield data for Argentina after 2002:03.

the excess holding yield ‡uctuates wildly throughout the period of study. The excess holding yield is especially volatile with the sharp spikes in 1997-1998 and in late 2000 owing probably to the Asian …nancial crisis and oil price shocks, respectively. On the other hand, the Philippines was less severely a¤ected by the Asian …nancial crisis of 1998 than its neighbors, aided in part by its high level of annual remittances from overseas workers, and no sustained run up in asset prices or foreign borrowing prior to the crisis. The impact from surging petroleum prices shock during late 2000 was more serious since the Philippines is an oil importer. Overall, we …nd that the excess rates of return from holding Philippines' securities are highly erratics.

Apart from the countries already mentioned, there have also been large swings in the excess return series in Brazil, with a standard deviation of 4.27 (see table 2.1). This is probably because Brazil was also a¤ected by the South American economic crisis of 2002. Like other emerging market economies in general, Brazil was susceptible to contagion e¤ects. In Brazil's case, it was contagion from Argentina's economic melt down causing a crisis of con…dence among investors and lenders who were demanding higher interest rates. That put increasing pressure on the Brazilian economy to come up with those higher interest rates. Figure 1.5 shows that the excess holding yield series is again extremely volatile.

Our second …nding is that the average excess holding return is statistically not di¤erent from zero over the period of observation in all 43 countries. However, we cannot yet conclude that the excess holding yield has a zero mean in the long run. This basically highlights the fact that there is a lot of noise. The high standard deviations distort the result and cause the mean to be statistically equal to zero over the short sample period. The extreme examples are Argentina, Uruguay and Brazil as we have discussed.

Thirdly, the excess holding yield series which are less volatile relate to economies with stable …nancial systems and better economic development. For example, the mean of the excess return is relatively lower but exhibits much less variation over time in the majority of countries in the EU, compared to the rest of the world.

Additionally, among EU member countries, the excess return series of government assets in Turkey, Poland, and Hungary are highly volatile with the standard deviation of 1.63, 1.48 and 1.40. The mean excess holding yield of these countries ranges from 0.02 to 0.46 percent annually.

Among countries in the Asia Paci…c region (excepting the Philippines), the average excess holding yield is between 0.11 to 0.59 percent per annum. The volatility of excess returns is not much higher than those in the EU countries, except in the Philippines and Hong Kong. The excess return in the Philippines is highly volatile with a standard deviation of 2.10, and mean return of 1.91 percent per annum.

Lastly, the excess return of 12-month over 3-month zero coupon rate is constructed to test the robustness of the econometric results. $y_t^{12,3}$ is de…ned as the excess holding period returns from holding 12-month treasury bills for 3 months compared to the return from holding 3-month treasury bills. The unit of time period in t stands for every 3 months[11]. Following the same fashion as (1), the excess holding yield of 12-month versus 3-month treasury bill can be generated as

$$y_t^{12,3} = \left[\frac{(1+R_t)^4}{(1+r_{t+3})(1+r_{t+2})(1+r_{t+1})} - (1+r_t) \right], \tag{2}$$

and the linear approximation is

[11] Thus, the time t is actually 3 months ahead of time $t+1$.

$$y_t^{12,3} = 4R_t - r_{t+3} - r_{t+2} - r_{t+1} - r_t.$$

Table 2.2 illustrates descriptive statistics of the excess holding yield generated from equation (2). The results show that mean and volatility of excess return are increasing with maturity of longer term bonds. There is higher uncertainty associating with the longer horizon, thus investors require more excess return. The excess return series are also more fluctuate with longer maturity spread. In table 2.2, the standard deviation of excess return in Argentina and Uruguay are 48.96 and 35.15, respectively. The excess holding yield in these 2 countries are also the most volatile among 43 countries in this study.

The next section describes how the excess holding yield data can be used to construct risk premia.

3.2 The theoretical derivation of time varying risk premia

Engle, et. al. (1987) construct an ARCH-M model where the conditional variance of excess return determines the current risk premium. They then test their model by applying it to quarterly data on 3-month comparing to 6-month US treasury bill rates from 1960:Q1 to 1984:Q2. The data are obtained from Salomon Brothers. The results shows that the risk premia vary systematically over time with agent's perceptions of underlying uncertainty.

In this section we generate measures of the term premium by estimating the ARCH-M model of excess holding yields for 6 month treasury bills over 3 month treasury bills over the sample period of 1994:12 to 2006:2. The formulation closely follows Engle, et. al. (1987) and specifies that the contemporaneous expected conditional standard deviation of the error term be included in the mean equation of the excess holding yield. This specification follows from a micro-founded model with risk averse agents.

Firstly, the excess holding yield can be decomposed:

$$y_t = \mu_t + \varepsilon_t, \qquad (3)$$

where (y_t) is the excess holding yield on 6 month zero coupon treasury bills. The non-stochastic term μ_t is the risk premium or the expected return that the risk averse investor would demand for holding the (riskier) long-term asset. In contrast, ε_t is the difference between the ex ante and ex post rate of return which is unforecastable in an efficient market. This means that the expected excess return from holding the longer-term asset is just equal to the risk premium $[E_{t-1} y_t = \mu_t]$.

The equation for risk premium is expressed as

$$\mu_t = \beta + \delta h_t, \qquad \delta > 0, \qquad (4)$$

where h_t is the conditional standard deviation of the unforecastable shocks (ε_t) to the excess return on the long term asset. The term δ is the coefficient of relative risk aversion. The risk premium is assumed to be an increasing function of the conditional standard deviation of the unforecastable shocks (ε_t).

The conditional variance of the error term is h_t^2 and is a function of the information set available to investors.

$$h_t^2 = Var(\varepsilon_t | \text{ all available information}) \qquad (5)$$

We note here that the model takes the mean as a linear function of the standard deviation (h_t) instead of the variance $\left(h_t^2\right)$. This represents the assumption that changes in the variance are reflected less than proportionally in the mean. This specification has been widely used by other papers such as Domowitz and

Hakko (1985), and Bollerslev, Engle and Wooldridge (1988).

Following Engle, et. al. (1987), it is assumed that the conditional variance is a weighted sum of past squared innovations, ε^2_{t-i}. This conditional variance follows an ARCH(p) process as follows:

$$h_t^2 = \alpha_0 + \alpha_1 \sum_{i=1} w_i \varepsilon^2_{t-i}. \tag{6}$$

Here, the variance of the error term depends on the intercept α_0 and the weighted average of past squared innovations, where w_i are the weighting parameters. Using monthly observations[12], the ARCH specification has 12 months lags[13] as we assume that information from the past year is useful for predicting the mean. We discount the older information using a linearly declining weight scheme where $w_i = (13 - i)/78$, and $i = 1 - 12$. This declining weight scheme on lag structures also helps cope with the collinearity of the past square innovation terms,ε^2_{t-i} [see Engle (1982)]. The equation can therefore be written as[14]

$$h_t^2 = \alpha_0 + \alpha_1 \left(\frac{12}{78}\varepsilon^2_{t-1} + \frac{11}{78}\varepsilon^2_{t-2} + .. + \frac{1}{78}\varepsilon^2_{t-12} \right). \tag{7}$$

From the specification above (equation (3)-(5)), we can conclude that the conditional mean of the excess holding yield $E(y_t)$ depends on the conditional standard deviation of the unforecastable error term. Given that the variation of return measures riskiness, as $E_{t-1}y_t = \mu_t$, the risk premium is an increasing function of the conditional standard deviation of the returns.

The model specification above is used to generate risk premia for our entire sample.

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[12] ELR use quarterly formulation and use four lags.

[13] The conditional variance follows a 12-order autoregressive process.

[14] We use monthly data and assume that the useful information for predicting the mean comes from the past year. Thus, in the conditional variance equation, we specify the declining weight on lag structure of past square innovations as in equation (7). However, Engle, Lilien, and Robins (1987) use quaterly data, the lag structure is instead characterised by $h_t^2 = \alpha_0 + \alpha_1 \left(\frac{4}{10}\varepsilon^2_{t-1} + \frac{3}{10}\varepsilon^2_{t-2} + \frac{2}{10}\varepsilon^2_{t-3} + \frac{1}{10}\varepsilon^2_{t-4} \right)$.

4 The variables

This section describes characteristics of the dependent variable, the risk premia and the explanatory variables.

4.1 Dependent variable: Risk premia

This section describes the risk premia data which is the dependent variable in the cross section regression and the panel data analysis sections. The risk premia generated from volatility of excess holding yield is referred to as the ex-post term premia or liquidity premia since the excess holding yield represents the realised or expost premium from holding the long-term as compared to short-term securities.

In this section, we present the estimation of the risk premia for 43 countries derived from the ARCH-M model. The estimated risk premia (together with the excess holding yield) are presented in …gures 1.1 to 1.43. This is to illustrate their characteristics over time and across countries. We …rst provide some descriptive statistics of the estimated risk premia.

Table 2.3 gives descriptive statistics of the risk premia of 6 month versus 3 month treasury bills across the sample period of 1994-2006. …gure 2.1 shows average risk premia over the period of 1994-2006 for all 43 countries. The table and …gures show that the risk premia is highest in the Philippines. The risk premia here are also highly volatile with standard deviation of 0.58, and with average risk premium of 1.98 percent annually.

In the Latin American countries, the risk premia are highly volatile with standard deviations between 0.52 (Mexico) to 1.94 (Uruguay). The risk premia is relatively low in almost all European countries and the series are much less volatile. Excluding the Czech Republic, the average risk premia in the EU ranges from 0.06 to 0.27 percent annually with standard deviations ranging from 0.10

to 0.23. Hence, there seems to be a relationship between economic as well as financial development and the risk premia.

Table 3.1 illustrates estimated coefficients and their t-statistics for each of the 43 countries. The notation of parameters corresponds to equations (3) and (4). The results from table 3.1 can be summarised as follows. Firstly, there is an ARCH in mean relationship in 16 out of the 43 countries. The ARCH in mean relationship exists when the disturbances are heteroscedastic and the standard deviation of each observations is found to affect significantly the mean of that observation ($\alpha_1 \neq 0$ and $\delta \neq 0$). Additionally, the ARCH-M coefficient shows the correct sign ($\delta > 0$) in 34 out of the 41 countries; the risk premia is an increasing function of the conditional variance of returns[15].

Secondly, from the result of ARCH-M estimation in table 3.1, the conditional variance of ARCH (12) process is constant (i.e. $\alpha_1 = 0$ and thus $\delta = 0$) in China, Hungary, Indonesia, Korea, and Sri Lanka. The models show relatively flat and less volatile risk premia in Indonesia and Sri Lanka as are illustrated in figures 1.19 and 1.26, respectively. However, this does not imply that the risk premia of government assets in these countries are constant.

From the plots of the excess holding yields and estimated risk premia, the series of excess holding yield in these five countries are so noisy[16] that a systematic pattern of conditional heteroscedasticity does not hold given the quite short time-horizon under consideration. Thus, the conditional variance cannot be predicted by the past squared innovations as is suggested by Engle, et. al. (1987). We also find that the excess return series shows extreme volatility in

[15] We can conduct the sign test to see whether there is a significant positive relationship between the risk premia and the conditional variance of return. The null hypothesis to be tested here is that there is no significant positive relationship between them. This hypothesis implies that both the positive and negative of δ in equation (4) are equally likely to be larger than the other. The results show zero p-value, which indicates that there is a strong positive relationship between the risk premia and the volatility [Pr (k $>=$ 34) = 0.000013, Pr (k $<=$ 34) = 0.999998, given N=41, k=34].

[16] There is no variation in volatility of the excess holding yield. In other words, the series are constantly highly-volatile.

Hungary (Figure 1.18) and Korea (Figure 1.25). The excess return swings wildly (with periods of both negative and positive excess return) without any systematic pattern in Indonesia and Sri Lanka. We cannot …nd information for the risk premia in China (Figure 1.8) and Slovak Republic (Figure 1.36). Again, this can be attributes to the short horizon of the observations in China and Slovak Republic. (see table 1.1 for data appendix)

Lastly, for some countries, although the disturbance is heteroscedastic ($\alpha_1 \neq 0$) , the data are not suggestive of an ARCH-M process i.e. the conditional standard deviation does not a¤ect the mean. These countries are Norway, Sweden, Finland, Greece, Ireland, Turkey, South Africa, Argentina, Uruguay, Israel, Hong Kong and Hungary. From …gures, there is no period of stability in the excess holding yield in any of these countries. Hence, the estimated risk premium is characterised by a relatively ‡at line. Good examples here are the excess holding return series in Sweden, South Africa, Israel and Ireland. In Sweden, the variance of the excess return is very stable as illustrated in Figure 1.37. The excess return series in South Africa (see Figure 1.43) ‡uctuates around the constant mean with a brief shock in 1998. In Ireland, the excess return is also volatile throughout (see Figure 1.21). The excess return in Israel is severely volatile around the constant mean (see Figure 1.22), the series distributed evenly between positive and negative values. This re‡ects a fairly unstable …nancial condition in this country. The risk premia is unsurprisingly high throughout. The problem therefore is that the time period under consideration is not long enough to observe both periods of stability and volatility e.g. Engle, et. al. (1987) look at the risk premia in USA during 1960-1985, wherein there is a period of stability followed by a volatile period. In order to …nd an ARCH-M process, the samples must contain both.

The excess holding yield in some other countries swings unsystematically and the past innovation does not contain information of the risk premia such as Turkey and Uruguay (see Figure 1.39 and 1.41). For Argentina (see Figure 1.1), there is too large shock in 2001 following period of stability, thus it mimics the predictive ability of the past innovations. Similarly, surrounded by periods of stability in excess holding yield, there is a large shock 1997-1998 in Hong Kong (see Figure 1.17) according to the Asian …nancial crisis.

In Finland, there is a negative time trend during late 20th century (see Figure 1.14). The mean and variance of the excess return are trending downward over the period of studies. On the other hand, there is no trend in the excess return in Greece and Norway, but the series is highly volatile that the risk premia is unpredictable.

As mentioned above, there is a signi…cant ARCH in mean relationship in 26 countries ($\alpha_1 > 0$ and $\delta > 0$) in our study. The characteristics of the excess return is quite similar to the case of the USA during 1960-1985. From Engle, et. al. (1987)'s work, over the period of analysis there are a few interesting shocks in the US economy. There was an oil price shock in 1973 and 1980, and the severe economic recessions in early 1982. During these periods, there was instability in …nancial and economic conditions, and people lost con…dence in the assets markets. They were unable to forecast future returns and demanded more return from holding long-term assets. The volatility in the excess holding yield produces a higher risk premium in these periods, However, during the more stable period (1960-1967), we …nd that the risk premium is quite low and the long run value of the excess return is constant. In our work, the excess returns of 6 month treasury bills in France (Figure 1.15), Mexico (Figure 1.27), Malaysia (Figure 1.28), New Zealand (Figure 1.31) follow the same pattern as the USA case in Engle, et. al. (1987): there is a period of tranquility followed by a period of volatility. Brazil (Figure 1.5) also follows this pattern, but the volatility in the excess holding return is more drastic.

In Australia (Figure 1.2), Austria (Figure 1.3), Belgium (Figure 1.4), Czech Republic (Figure 1.10), the excess holding return is characterised by a negative time trend in short run (during late 20th century) and fluctuates around the constant mean in the long run. In Spain (Figure 1.13), the mean of excess return fluctuates up and down but the variances have large swing. There are time trends in the excess return and its variance is not constant throughout the period of studies with shocks in some periods in Germany (Figure 1.11), Switzerland (Figure 1.7), Canada (Figure 1.6), Colombia (Figure 1.9), Denmark (Figure 1.12), India (Figure 1.20).

Figures 1.1-1.4 illustrates the average risk premia for all 43 countries over the period of 1994-2006. Figure 2.1 is the average risk premia for holding 6 month treasury bills (comparing to 3-month treasury bills). Figure 2.2 is the average risk premia for holding 12 month treasury bills (comparing to 3-month treasury bills). The purpose of figure 2.2 is to show that the difference in average risk premia across countries is consistent across maturities. We find that the risk premia is generally low in countries with better financial development and economics conditions. Government assets in Singapore,Australia and Japan are relatively less risky compared to other countries in the study. Government assets in the Philippines and all Latin American countries are considered to be more risky than the rest. We can also perform country comparison of the risk premia by considering the countries' income and economic development. Figure 3.1 presents risk premia (for holding 6 month treasury bills) comparisons by country group. We find that the risk premia of government assets in the non-OECD countries are relatively higher than the OECD country group. Figure 3.2 presents risk premia (for holding 6 month treasury bills) comparisons by country's income. The higher income countries have relatively safer government assets.

From a rough comparison of risk premia in 43 countries in this study. It is useful to extend an analysis by doing the cross section and panel data analysis. We examine whether the country's macroeconomic variables a¤ect the risk premia in section 5 and 6.

4.2 Explanatory variables:

This section de…nes our control and explanatory variables used in the risk premia regression and discusses the expected sign of relationships with the risk premia. The macroeconomic variables we examine are economic growth ($GGDP$), the in‡ation rate ($INFL$), the real e¤ective exchange rate ($REER$), and the volatility of real e¤ective exchange rate, ($VREER$). The government …scal variables pertain to government debt as a percentage of GDP ($DEBTGDP$) and the …scal de…cit as a percent of GDP ($DEFGDP$) . The institutional variables consist of political constraints ($POLCON5$) and a political risk index ($ICRG$) . These variables will be de…ned subsequently. The sources and de…nition of data are detailed in the data appendix in table 1.2.

A preliminary examination of these relationships is presented by using the bar charts of the explanatory variables and bivariate regression plots of the risk premia and explanatory variables. The bar charts of average value of each explanatory variables are presented in …gures 4.1-4.9. The bivariate regression plots of the mean value of country's risk premia and explanatory variables are presented in …gures 5.1-5.9.

The initial income level ($GDP94$) is our control variable for di¤erences in initial development levels. The initial level of income is derived from the natural log of real gross domestic product per capita in year 1994 of each country. Initial income also be a proxy for the …nancial development. We might expect that there is less risk premia in holding government assets in countries with higher initial income and better …nancial development.

To control for heterogeneity among groups of economies, the regression analysis also include 3 groups of dummies, namely, EMU, $NEMU\_RICH$ and $POOR$. The dummy variable EMU stands for member countries of the European Monetary Union (EMU). We can refer to these countries as the Eurozone[17]. The second dummy variable, $NEMU\_RICH$ stands for other high income countries outside the Eurozone such as Denmark, Sweden, United Kingdom[18], USA, Canada, Japan, etc. Lastly, the dummy variable $POOR$ stands for the low to middle income countries such as Czech Republic, Slovak Republic, Hungary, Poland[19], Malaysia and Thailand, etc. The partitioning of these three groups is presented in the variable list in table 2.1. The de…nition of high/low income countries is obtained from the World Bank (2006). Using dummy variables also allow us to compare these 3 countries groups in the regression analysis. We discuss the reason for adding these three dummy variables in paragraphs below.

In our context, the inclusion of a Euro-zone dummy variable could be particularly relevant. The in‡ation and exchange rate risk associated with their government assets are closely aligned, given their common currency. We begin our analysis in 1994 which is the second stage of the implementation of the European Economic and Monetary Union (EMU)[20]. At this stage, economic

[17] The Eurozone (also called Euro Area, Eurosystem or Euroland) is the subset of European Union member states which have adopted the euro, creating a currency union. The European Central Bank is responsible for the monetary policy within the eurozone.

[18] Denmark, Sweden and the UK are countries in the European Union that do not use the Euro.

[19] Czech republic, Slovak republic, Hungary and Poland joined the EMU on 1 May 2004. However, we do not include them in the group of Eurozone due to the ealrly stage of membership and their income level.

[20] The …rst stage on the EMU (started on 1 July 1990) was to provide complete freedom for capital transactions, to improve economic convergence and to raise co-operation between central banks. There was also a free use of the European Currency Unit (a forerunner of the Euro currency). [European Central Bank, 2006]

The second stage (1 January 1994) is to strangthen co-ordination and economic convergence,

convergence criteria among member countries had been in process, although the o¢cial launch of the euro was not until 1 January 1999. The EMU had a major impact on the European …nancial markets and the management of the economic policies. It was argued that the currency risk would be reduced following EMU. Government assets will instead be subjected just to the default risk.

> "Government assets among EMU member countries would mainly di¤er with respect to their credit worthiness, liquidity and tax treatment since intra-EMU exchange risk should be zero and in‡ation risk would be the same for every country in the Euro zone" [Lemmen and Goodhart, 1999].

Thus the principal source of relative risk in government debt markets in EMU is credit risk. The variation in interest rates and exchange rates, which we regard as the market risk is no longer involved at least in intra-EMU [IBCA, 1996]. We thus may expect no signi…cant di¤erence between the exchange rate and in‡ation risk among EMU member countries in our regression[21].

Basically, the initial income and these dummies are similarly functioning as control variables. They are employed to control for the …nancial development in general. The countries' initial incomes take the economic covergence into account when we measure the economic growth. The dummy variables help enhance the predictability of the model by taking into account the income di¤erence and the in‡ation and exchange rate agreements[22]. An interesting research

to establish European Monetary Institute and to foster the process leading to the independence of the national central bank.

The last stage (1 Jan 1999) is to o¢cially introduce Euro, to conduct the single monetary policy by the Europena System of Central Banks and entry into e¤ect of the intra-EU exchange rate mechanism ($ERM\ II$) and into force of the Stability and Growth pact.

[21] We note that, however, the exchange rate risk still exists externally. The EMU member that trades externally has more risk than a member that does not i.e. it depends on extent of external trade.

[22] Including income dummies tends to enhance the predictability of the model. Figure 3.4A

question is to examine whether EMU member countries have lower risk premia as a result of their exchange rate arrangement. This issue will be unfolded in cross section and panel data analysis section.

Next, we discuss the characteristics of the explanatory variables. Countries with superior macroeconomic conditions, less exchange rate volatility, better fiscal conditions and more reliable political conditions, are expected to have lower risk premia. The superior macroeconomic conditions are characterised by low inflation rate and high output growth. The government will have a good fiscal condition if it has low debt and budget deficit in proportion with the gross domestic product. The political conditions are relatively more reliable if there is less political risk in the country and more stable government policy.

The percentage increase in gross domestic product (GDP) during one year defines economic growth, $GGDP$. Economic growth is defined as

$$GGDP_{it} = \frac{1}{4}\log(GDP_{it}/GDP_{it-4}).$$

The GDP data are available on a quarterly basis. $GGDP_{it}$ is the rate of change in the gross domestic product of country i at quarter t comparing to the same quarter last year, $t-4$. In the risk premia regression, we use the natural log of the average GDP growth of each particular country over 1994 to 2006 as an explanatory variable. We expect that a good economic performance comes along with stable financial market conditions. Alternatively slow economic growth might make the government asset in that country be more risky.

The GDP growth data suggests that there tends to be convergence across the economies in our sample. Figure 4.2 is bar chart of economic growth on average over 1994-2006. It suggests that lower income or developing countries (labelled by $POOR$) experience significantly higher growth rates than the higher

and 3.4B show that countries with high incomes tend to have lower risk premia. We partially control for income by using dummy variables, $NEMU\_RICH$ and $POOR$.

income group (labelled by EMU and $NEMU\_RICH$). Comparing this …gure with the bar chart of each country's initial level of income measured by the gross domestic product in 1994 (…gure 4.1), it suggests that the less advanced economies with lower value of initial income (and initial capital) have higher growth rate of income (and capital).

In the bivariate regression in …gure 5.1, there is a strongly negative relationship between initial level of income ($GDP94$) and the risk premia as suggested earlier. On the other hand, the bivariate regression in …gure 5.2 show a strongly positive relationship between the risk premia and economic growth. This relationship is somewhat contradict to our prior that the better economic growth leads to less risk premia required. Referring back to the chart of average risk premia over 1994-2006 (…gures 2.1 and 2.2), the estimated risk premia for the developing countries are quite high. However, during this period the more backward economies have higher economic growth rate than developed countries as suggested by the convergence. This shows the importance of including the initial level of income variable to control for other factors determining the risk premia apart from the economic growth.

In‡ation is also a potential determinant of risk premia. Investors protect themselves by requiring nominal interest rates that compensate them for expected in‡ation as well as for the risk that the in‡ation deviates from their expectations. The higher prices rise, the lower will be the purchasing power of the principal and nominal interest payments correspondingly must be higher. Not only do investors want to be compensated for the in‡ation they expect, they also want to be compensated for the risk that in‡ation could increase during the term of their loan. In‡ation ($INFL$) is de…ned as the percentage change of consumer price index over the corresponding period of previous year. In the cross section regression, we use the natural log of the mean in‡ation for each country over 1994-2006. We expect a positive relationship between the in‡ation rate and the risk premia.

The data suggest that the attempt to stabilise in‡ation among member countries in EMU seems to be successful. This can be seen in the charts of average country's in‡ation over 1994-2006 in …gure 4.3. Within the Eurozone (excluding Greece[23]), the country's average in‡ation over the period varies between the minimum value of 1.88 percent[24] in France to maximum value of 4.89 percent in Italy (excluding Greece, the mean in‡ation of this group is 2.83 percent).

As mentioned earlier, the in‡ation levels of the Eurozone members tend not to be di¤erent from each others possibly due to the single currency convergence criteria. The higher income countries (both inside and outside Eurozone) have lower in‡ation rate than the lower income group. Comparing in‡ation level between countries in EMU and $NEMU\_RICH$, the di¤erence between these 2 groups is not obvious[25]. However, there is slightly higher variation in in‡ation rates in the latter group. The developing countries group ($POOR$) has highest levels of in‡ation and the variation of in‡ation rates is quite substantial.

The scatter plots illustrating the relationship between risk premia and the in‡ation are presented in …gure 5.3. From the …gure, the EMU members are clustered around one another. The majority of countries in the $POOR$ group are more dispersed in terms of both the risk premia and in‡ation. Overall, the …tted line shows a clear upward trend, which re‡ects a strongly positive relationship between the risk premia and the level of in‡ation. The t statistics from the single regression in both …gures are signi…cant at the 1% level.

[23] The average in‡ation over 1994-2006 of Greece is 8.21 percents which is substaintially higher than the rest of countries in the Eurozone . This is partly because Greece if the last country that join this group. Greece was quali…ed as an EMU memeber state in 2000 and was admitted on 1 January 2001.

[24] In the cross section regression, we use the natural log of this value instead.

[25] Additionally, we …nd that the mean in‡ation in the UK, Denmark and Sweden are not very much di¤erent from the Eurozone (see …gure 4.5). This is reasonable. These three countries are reluctant the to join the Eurozone on political ground, it is not because these three countries have problem qualifying for membership.

The real effective exchange rate ($REER$) provides a measure of a country's competitive position over time by taking the effect of price movements into account[26]. Movements in real effective exchange rates provide an indication of the evolution of a country's aggregate external price competitiveness since it measures the currency's appreciation/depreciation against a weighted basket of foreign currencies and adjusts for relative prices between countries. The goods and services produced in particular country may not find buyers in both foreign and domestic markets if there is a fall in competitiveness. An improvement/fall in international price competitiveness affects the country's international trade position, national production, employment and income. We might expect that a rise in the $REER$ (a fall in international competitiveness) results in an economic contraction as suggested in the Mundell-Fleming model. This in turn might be expected to be associated with a rise in the risk premia for holding government bonds in that country.

We also link real effective exchange rate volatility ($VREER$) to the risk premia of government treasury bills. We measure real exchange rate volatility as the natural log of the standard deviation of the real effective exchange rate over 1994-2006. Using monthly data (t) of $REER$ in country i, we define the annual standard deviation of the real effective exchange rate as

$$VREER = \sigma_i^{REER} = \left[\frac{1}{T} \sum_{t=1} (REER_{it} - \overline{REER_i})^2 \right].$$

[26] To explain the concept of real effective exchange rate, we first refer to the real exchange rate. The real exchange rate is the nominal exchange rate adjusted for relative prices between the countries under consideration. It is expressed as:

$$E_{\text{real}} = \frac{EP}{P^*}$$

where E_{real} is the index of the real effective exchange rate, E is the nominal exchange rate (foreign currency per unit of domestic currency) in index form, P is the index of the domestic price level, and P^* is the index of the foreign price level. Instead of using a single foreign currency, the real effective exchange rate is concerned with what is happening to it against a basket of foreign currencies with whom the country trades.[Pilbeam, 1998, pp.13-16]

In this analysis, more volatile real e¤ective exchange rates implies more uncertainty in the country's competitiveness position. Thus, we would expect a positive relationship between real e¤ective exchange rate volatility and the risk premium.

Di¤erences in the country's competitive position, as measured by the real e¤ective exchange rate ($REER$), between the three countries groups is less clear-cut in the data. The charts of the country's average real e¤ective exchange rate over 1994-2006 are presented in …gure 4.4. On the other hand, the exchange rate volatility ($VREER$) over the period is generally higher in the $POOR$ group than the higher income group (EMU and $NEMU\_RICH$). Additionally, the majority of countries in the EMU group have relatively lower exchange rate volatility than the rest. The charts of the real e¤ective exchange rate volatility are presented in …gure 4.5.

The plots of the relationship between the risk premia and the real e¤ective exchange rate are presented in …gure 5.4. The impact of the country's competitive position on the risk premia on holding 6-month treasury bills is unclear. Figure 5.5 presents data for the relationship between the risk premia and the volatility of the real e¤ective exchange rate. There is a strongly negative relationship between the risk premia and the volatility of the real e¤ective exchange rate which is consistent with our prior. The t statistics from the single regression is signi…cant at the 1% level.

Government debt as a percentage of gross domestic product can be considered as a determinant of government default risk. The higher the existing debt stock to GDP ratios, the greater the debt service obligations and the lower the government's capacity to borrow and roll over debt declines. This ultimately may result in an increase in the risk of default. We thus might expect a positive relationship between the risk premia and the government debt. The regression uses the natural log of the mean government debt as a percentage of GDP over 1994-2006.

An increase in the fiscal deficit might impact the risk premium for two reasons. Firstly, fiscal expansion may worsen future public debt and increase the probability of a debt crisis. Secondly, it affects public trust and investors' expectations. The ability to control fiscal deficits reveals information about government preferences, the importance of lobbies (which expect tax cuts or expenditure increases) and the degree of reform implementation (i.e. future public deficits.). Hence, we might expect the risk premia is increasing with the government budget deficit. In the regression, we use the mean of the deficit as a percentage of GDP for country i over 1994-2006, $\overline{DEFGDP_i}$.

The data for government budget deficit and debt as a percentage of GDP over 1994-2006 are presented in figures 4.6 and 4.7. There is not much different across the groups. In figure 4.6, the negative value represents the government budget deficit. On average of 1994-2006, majority of sample countries have government budget deficit. The exceptions are Ireland, New Zealand, Brazil, Hong Kong, Singapore, Thailand, and Slovak Republic, which have government budget surplus. Due to the high variation among samples, we normalize this variable by taking the natural log of $(1 + 0.1 \times \overline{DEFGDP_i})$ in the regression.

A scatter plot of the risk premia and the government budget deficit data is presented in figure 5.6. There is no significant relationship between these two variables but the sign of the predicted coefficient is correct. We suspect, however, that the budget deficit does not strongly drive risk due to the existence of the outliers e.g. Norway, Sri Lanka, India, Philippines and Singapore. We will leave this issue until the next section.

Figure 5.7 contains data on the risk premia and government debt. The predicted coefficient of government debts is not statistically significant. Surprisingly, the plots show negative relationship between government debts and the risk premia. It can be argued that government debts are not always bad. Debts re‡ect the demand for government assets by investors. The greater demand for them (given that there is no constraint on the supply side) may also mean that they are safer bet than private assets or foreign assets. For example, Belgium and Philippines both have high government debt but the risk premia for holding securities in the former is less than the latter country. On the other hand, there are low government debts in Australia and Colombia. Unsurprisingly, the risk premia in Australia is lower.

The political variables used in this paper are the political risk index created by the PRS group and the political constraints index ($POLCON5$) by Henisz (2002). The political risk index ($ICRG$) measures the political stability of countries on a comparable basis. The index is based on 100 points. The higher number of points indicates lower potential political risk e.g. 80-100 points represent very low risk and 0-49.5 points represent very high risk. In the political risk assessment, the number of points depends on the …xed weight of the political risk components. The political risk components and their weights in the parentheses are Government stability (12), Socioeconomic Conditions (12), Investment Pro…le (12), Internal Con‡ict (12), External Con‡ict (12), Corruption (6), Military in Policies (12), Religion in Policies (6), Law and Order (6), Ethnic Tensions (6), Democratic Accountability (6) and Bureaucracy Quality (4). The data for $ICRG$ are available annually. In the regression, we take natural logs of the mean of the political risk index over 1994-2006. We might expect a negative relationship between $ICRG$ and $RP3\_6$. In other words, lower risk premia for holding government assets should be positively related to the ICRG rating.

$POLCON5$ measures the e¤ective political restrictions on executive behavior. It accounts for the veto powers of the executive whether or not there are, two legislative chambers, sub national entities and an independent judiciary. The index ranges from zero to one, where the higher value indicates stronger political constraints on the government. We take the natural log of the average values of $POLCON$5 over 1994-2006. The stronger political constraint re‡ects a more stable government policy, which may in turn result in reduced risk premia.

Higher income countries tend to have lower political risk ratings (higher score) and stronger political constraints than the lower income group, as shown in ...gure 4.8 and 4.9. From the scatter plots in ...gures 5.8 and 5.9, the risk premia exhibit negative correlations with both political variables as expected. The scatter plot of the risk premia and the political risk rating is presented in ...gure 5.8. The political risk index negatively determines the risk premia as we expected. The predicted coe¢ cient is highly signi...cant (at the 1% level). The scatter plot of the risk premia and the political constraint is illustrated in ...gure 5.9. The determinant of the political constraint index on the risk premia is less strong but the sign of the predicted coe¢ cient is correct. The predicted coe¢ cient is signi...cant at the 12% level.

The next section is to present the result from the cross section regression analysis.

5 The cross section regression

This section examines the determinants of risk premia on holding 6-month treasury bills in 43 countries using cross section regression analysis. We test whether macroeconomic variables, government ...scal variables and political variables determine the risk premia. The dependent variable in the regression is the average risk premia for holding 6-month treasury bills comparing to 3 month treasury bills (RP3_6) for di¤erent countries over the period 1994-2006 (as depicted in ...gure 2.1). In general, investors who hold these assets are mainly ...nancial institutions. These financial institutions are assumed to minimize investment risks by spreading assets among different investments both nationally and internationally. The difference between these 2 assets is that holding shorter term treasury bills is less subjected to liquidity risk. In other words, the ability to sell or convert a security into cash is obviously greater for the shorter term treasury bills.

A small sample version of heteroskedasticity consistent covariance matrix estimator, HC3 proposed by MacKinnon and White (1985)[27] is applied to correct for heteroskedasticity in the cross-sectional data analysis[28]. The following subsection are the results of the risk premia cross-section regression on the macroeconomic and political variables.

We first examine the correlations between risk premia and the explanatory variables across countries. The results are given in table 4.2. To set the notation, ρ is the correlation coefficient. We notice that the risk premia is highly correlated with the political risk index ($\rho = -0.63$), the political constraint index ($\rho = -0.58$) and inflation ($\rho = 0.57$) . Other variables that are fairly correlated with the risk premia are real exchange rate volatility ($\rho = 0.50$) , economic growth[29] ($\rho = 0.43$) and the budget deficit as a percentage of GDP ($\rho = -0.17$). With the exception of economic growth, the signs of all the correlation coefficients are consistent with our priors corresponding to the previous section. Knowing that these variables are associated with the risk premia, we might pre-

[27] Long and Ervin (2000) produced an extensive study of small sample behaviour and arrive at the conslusion that HC3 provides the best performance in small samples (less than 250 observations) as it gives less weight to influential observaitons.

[28] When the variance of the errors varies across observaitons, OLS becomes inefficient and the estimates of the standard errors are inconsistent. This result in incorrect inferences. For a careful data analysis, we thus correct for heteroskedasticity in the cross sectional data analysis by using MacKinnon and White (1985)'s HC3.

[29] Both Inflation and economic growth are consirably correlate to the risk premia. However, the correlation between these two explanatory variables is quite high. In order to avoid endogeneity problem, we should include both variabls in our equation. We can find the determinant of one explanatory variable on risk premia while controlling the impact of another explanatory variable.

dict that these variables would be statistically signi…cant predictor variables in the regression model.

The starting point for the risk premia cross-section regression[30] is to regress the risk premia on the macroeconomic variables, initial level of income and the country's economic and income group dummies. The results are presented in column (1) of table 5. The results show that in‡ation ($INFL$) and the economic growth ($GGDP$) are signi…cant at the 5% level[31]. The budget De…cit as a percentage of GDP ($DEFGDP$) has predictive power at the 10% level. Initial level of income is signi…cant at the 15 percent level. Central government debt as a percentage of GDP ($DEBTGDP$) and the real e¤ective exchange rate volatility ($VREER$) do not statistically determine the risk premia. Approximately 74% of the variability of the risk premia is accounted for by the explanatory variables in the model.

Column (2) adds the political variables, $POLCON5$ and $ICRG$ to the model. The economic factors are robust to the inclusion of additional explanatory variables. However, the economic factors highly dominate in the risk premia regression, thus the political variables have limited explanatory power[32]. The sign of the predicted coe¢cients are as expected although are not signi…cant. We can conclude from the regression in column (2) that the short run macroeconomic circumstances do most of the work in explaining the risk premia e.g. the higher in‡ation, the lower growth and government de…cit lead to lower risk premia. In contrast, the level of long run development as illustrated by the institutional variables, i.e. the political risk index and the political constraint

[30] The regression is based on the heteroscedasticity consistent covariance matrix (HCMM) version HC3 by Mackinnon and White 1985. This helps corerect heteroscedasticity in the small sample size model (n · 250).

[31] The magnitude will be presented in the preferred model. It will be discussed in the latter paragraphs.

[32] Adding political variables $POLCON5$ and $ICRG$ seperately into the model in column (1) of table 5 also does not improve the explanatory power of each political variable in the regression.

index, and the public debt do not determine the risk premia. A good example is Belgium. The average government debt as a percentage of gross domestic product over 1994-2006 is high in this country (as illustrated in ...gure 4.7). However, the risk premia for holding government asset is quite low (see ...gure 5.7). For the case of this country, high debt may be a sign that a country is a safe bet.

Column (3) excludes the insigni...cant explanatory variables. The results from the previous section are unchanged. The e¤ect of the de...cit as a percentage of GDP, $DEFGDP$ become stronger and is signi...cant at 5% level. The variables economic growth ($GGDP$) and in‡ation ($INFL$) are once again signi...cant at the 5% level.[33]. The standardized coe¢cient (beta value) of this model is also presented in table 5. It indicates the size of the change in the risk premia, RP36 (in term of its standard deviation) with respect to a one standard deviation in the explanatory variable. For example, based on the estimates in column (5), a one standard deviation increase in $INFL$ (from Germany to Portugal's level) raises the risk premium by 1.29 of a standard deviation (from Germany to Indonesia's level[34]).

Finally, it is possible that this outlying observations might skew our test for heteroscedasticity in column (3). We thus identify outliers or in‡uential observations[35]. The outliers measure suggests removing observations in Argentina[36], Brazil, Norway, Sri Lanka, Indonesia, Philippines and Singapore. We omit these 7 countries from regression in column (3) and present the result in column (4).

[33] Note that in column (3), omitting $DEBTGDP$ and REER volatility, $VREER$ yields 9 more observations which are Argentina, Brazil, Greece, Mexico, Sri Lanka, India, Indonesia, Korea and Thailand.

[34] The rank of countries by the average risk premia for holding 6 month treasury bill (comparing to those with 3 month maturity) over 1994 to 2006 can be found in picture 3.1.

[35] We assess outliers by DFITS measure. The measure combines information on the residual and leverage.

[36] Omitting observations from these 7 countries are reasonable. Firstly, there are limited observations in deriving risk premia for Argentina (from 1998:07-2002:01), Sri Lanka (from 1994:12-2001:01) and Indonesia (1994:12-2001:01). Lastly, the excess holding yield series in these 7 countries show the statistically insigni...cant ARCH-M. This is partly due to the economic crisis which generate large shocks to the excess holding yield series, for example, the large economic shock in Argentina in 2002.

Comparing the previous column with the latter, dropping observations reduces the variation and standard errors of all estimated coe¢cients. Additionally, column (4) suggests the model does not su¤er from heteroskedasticity (based on Breusch-Pagan and White tests[37]) and omitted variable bias (based on Ramsey's RESET statistics)[38]. Column (4) is thus the preferred model. In this regression, the power of $INFL$ and $DEFGDP$ becomes stronger and are both signi…cant at the 1% level. $GGDP$ is once again signi…cant at 5% level. A one-standard-deviation increase in $INFL$ would raise the risk premia by 71.92 percentage points[39] (or a 1.23 standard deviation increase in the predicted risk premia). Additionally, a one standard deviation increase in an economic growth would yield a 0.91 standard deviation decrease (or 53% decrease) in the predicted risk premia. Lastly, a one standard deviation increase in the de…cit as a percentage of GDP would yield a 0.55 standard deviation increase (or 32.3% increase) in the predicted risk premia.

The scatter plots of the risk premia regression of the preferred model [column (4) of table 5] are presented in …gure 5.10. These …gures show scatter plots of natural log of in‡ation, natural log of government budget de…cit (% GDP) and economic growth, conditional on the natural log of initial level of income, and other control variables. All the three explanatory variables are in correct sign and are statistically signi…cant. Empirically, risk averse investors appear to require less risk premia for holding government securities in countries with a sound and stable …nancial market condition, i.e., the lower level of in‡ations and the government de…cits and higher economic growth. Referreing back to section 4.2, the bivariate regression plots of risk premia and economic growth

[37] The test on heteroskedasticity given by the Breusch-Pagan test and the White's test. Both test the null hypothesis that the variance of the residuals is homogenous. From table 5, column (4), there is no evidence against the null hypothesis.

[38] The omitted variable bias test (ovtest) command performs a regression speci…cation error test (RESET) for omitted variables under the null hypothesis that model has no omitted variables. From table 5, column (4), the null hypothesis is not rejected.

[39] The percentage point is computed from STATA and is not shown in the table.

(figure 5.2) suggested a strongly positive relationship between the two variables. It is interesting to note here that after controlling for the initial level of income, there is a negative relationship between the risk premia and economic growth as suggests in section 4.1 above. The regression plots are presented in the upper right panel of figure 5.10.

We can also compare the scatter plots from a single cross section regression of risk premia on the $DEFGDP$ (in figure 5.6) with its conditional plots (in second picture of figure 5.10). We observe that after cutting outliers (Argentina, Brazil, Norway, Sri Lanka, Indonesia, Philippines and Singapore), the $DEFGDP$ is statistically significant in the risk premia regression.

We can also undertake the risk premia analysis by country group from column (4). Lower income countries[40] are estimated to have risk premia about 19 percent[41] more than in the high income countries outside the Eurozone, holding other variables constant. In the high income countries outside the Eurozone, the risk premia on holding government assets is predicted to be 10 percent more than those in Eurozone.

The results of the standard cross section regression tell us the relationship between the risk premia and the macroeconomic and political variable on average of time during 1994-2006. In the next section, we consider how changes in the macroeconomic and political variables over time affect the change in the risk premia over the same time period. This can be done by the panel estimation of the risk premia.

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[40] In the preferred model (column 4 of table 5), we include dummy variables EMU and $POOR$ in the model. The coefficient (and t-statistics) of dummy variables are $-0.10(0.20)$ and $0.19(0.38)$, respectively.

[41] The dependent variable (the risk premia) is measured in natural logs, thus we can interpret the coefficients of the dummy variables in percentage.

6 Panel Data Analysis

6.1 Methodology

In this section, we employ panel data analysis to study the behavior and determinants of government asset risk premia in 43 countries over the period 1994-2006. In the panel regression, we examine annual data. The risk premia and explanatory variables data are annualised by taking average value of the monthly observations.

In the panel regression analysis, there are 3 critical methodological considerations. Firstly, the panel regression analysis allow us to take into account the arguments that the risk premia is time varying (as stated in sections 1 to 4). Additionally, it accounts for omitted variables and unobserved heterogeneity by incorporating the …xed country e¤ect into the model. Econometricly, the Hausman test indicates that the …xed e¤ects model are more suitable for the data i.e. there is a systematic di¤erence in the coe¢ cients between the random e¤ects and the …xed e¤ects models (p=0.00).

The second methodological consideration concerns how the risk premia is modelled. Choosing the dynamic panel model by taking the lagged dependent variable as an additional regressor is appealing in econometric sense. The Augmented Dickey Fuller test reveals that the risk premia $RP3\_6_{it}$ series are persistent and follow a …rst order autoregressive process. Intuitively, the behaviour of the current risk premia partly depends on the measured value in the recent past[42]. Thus, including the lag dependent variable accounts for partial adjustment of risk premia behavior over time[43].

[42] Intuitively, people form their expectation about the risk premia in the future for holding government bonds based on its past. For example, if the risk premia has been higher than expected in the past, people would revise expectations for the future. This can be referred to the theory of adaptive expectations.

[43] According to Warwo (2002), another motivation for including lags would be to account for exogenous shocks that are believed to have continual e¤ects over time. The coe¢ cients on lagged dependent variables whether these factors have a greater impact over time or whether

To examine the determinant of the risk premia, the following model is estimated:

$$y_{it} = \gamma y_{it-1} + x_{it}^{'}\beta + \eta_i + \delta_t + \epsilon_{it}, \quad (8)$$

given $|\gamma| < 1; i = 1, ..., N$ and $t = 1, ..., T$. Following Bond (2002), we assume that the disturbances ϵ_{it} are serially uncorrelated and are independent across individuals;

$$\begin{aligned} \sigma_\epsilon^2 &> 0, \\ E(\epsilon_{i,t}, \epsilon_{j,s}) &= 0; i \neq j \text{ or } t \neq s, \\ E(x_{i,t}, \epsilon_{j,s}) &= 0; \forall i, j, t, s. \end{aligned}$$

The term y_{it} is the dependent variable $RP3\_6_{it}$, the risk premia for holding 6 month treasury bills (compared with 3 month treasury bills). We normalise[44] it by taking natural log to $(1 + 0.1RP3\_6)_{it}$. The vector of strictly exogenous explanatory variables is x_{it} ,which consists of natural log of inflation $[\ln(1 + 0.1INFL)_{it}]$, natural log of real effective exchange rate $[\ln REER_{it}]$ and its annualised standard deviation, the economic growth $[GGDP_{it}]$, natural log of debt and deficit as a percentage of GDP $[\ln DEBTGDP_{it}$ and $\ln(1 + (DEFGDP/30))_{it}]$, natural log of the political risk index $[\ln ICRG_{it}]$ and the natural log of the po-

their impact decays and the rate at which it decays. Including lags of dependent variables as regressors is a parsimonious way of accounting for the persistent effects of explanatory variables in the past and can also help eliminate serial correlaitons in the disturbance term (Beck and Katz, 1996).

[44] Since there is high variation in the samples, the risk premia data and other explanatory variables are normalised to correct the data for the relatively favourable and unfavourable economic conditions and other influences, which affect the risk premia difference among countries. The normalisation is implemented by taking natural log to the variables. However, some observations are characterised by the negative value such as risk premia (minimum value is -1.94), inflation rate (minimum value is -3.96) and deficit as a percentage of GDP (minimum value is -20.79), thus the remedy is to take natural log to $(1+0.1RP36)$, $(1+0.1INFL)$ and $(1+(DEFGDP/30))$.

litical constraint index [ln $POLCON_{it}$]. The time effect is δ_t .The unobserved individual and time invariant country's fixed effect is η_i. ϵ_{it} is an unobserved white noise disturbance. The subscripts i and t represent country and annually observed time period from 1994-2006, respectively.

The last methodological consideration concerns the choice of estimators to accommodate the joint presence of dynamics and unobserved heterogeneity in individual countries. We employ Bruno's (2005) bias-corrected least squares dummy variable (LSDVC) approach to model the risk premia. The rationale for using this estimator over the rests is presented in the following paragraphs.

Although the autoregressive panel data model helps account for dynamic partial adjustment of the dependent variable, it also introduces bias into the model (Nickell, 1981 and Bond, 2002). According to the standard results for omitted variable bias, the OLS estimator of γ is inconsistent and biased upwards since the lagged dependent variable is positively correlated with the error term due to the presence of the fixed effects. The Within group estimator (LSDV) is instead biased downwards in case of small T panel even when N is large (Bond, 2002). This is because the within group transformation induces a correlation between the transformed lagged dependent variable and the transformed error term in the case of small time period data (Nickell, 1981). In this study the time dimension of the panel is small (T = 11) thus estimating the least square dummy variable model with a lagged dependent variable results in biased estimates. In estimating the dynamic panel data model, Judson and Owen (1999) found that the bias of the LSDV can be large even when T = 20.

The candidate consistent estimator will lie between the OLS and LSDV estimates. In previous literature, the first difference-IV estimators (Anderson and Hsiao, 1981 and 1982), the General Method of Moments (GMM) estimators (Arellano 1989; Arellano and Bond, 1991; Arellano and Bover, 1995) and system GMM (Blundell and Bond, 1998) are usually applied to solve the first order dynamic panel data models. However, these methods are only efficient asymptotically and thus are not suitable for small sample data. Bruno (2005) pointed out that the weakness of these estimators is that their properties hold for large N, so they can be severely biased and imprecise in panel data with a small number of cross-sectional units, such as most macro panels.

A method for implementing the corrected least square dummy variable (LSDVC) gained popularity in recent literature and was introduced by Kiviet (1995 and 1999) for balanced panels. Bruno (2005) extended the LSDVC estimation to unbalanced panels with a strictly exogenous selection rule. The LSDVC offers a method to correct the bias in LSDV estimator for samples where N is small or only moderately large. The Montecarlo evidence in Judson and Owen (1999)[45] showed that the LSDVC estimator is preferred to the GMM estimators when N is small or only moderately large. This argument is supported by Kiviet (1995) and Bun and Kiviet (2001).

There are three consistent estimators available to initialise the bias correction in the LSDVC estimation, which are as follows. The first one is the Anderson and Hsiao estimator (AH), with the dependent variable lagged twice used as an instrument for the first difference model with no intercept. The second estimator is a standard one step Arellano and Bond's estimator (AB) with no intercept. Lastly, the standard Blundell and Bond estimator (BB) with no intercept. Considering the nature of the risk premia data in this study, the AH estimator is chosen to initialise the correction procedure. The data are characterised by small cross section observations, the BB estimator tend to perform badly since

[45] Judson and Owen (1999) use an RMSE criterion to evaluate different techniques for estimating dynamic panel models in macroeconomic balanced panel datasets. The study found that for panels of all sizes, a corrected LSDV (LSDVC) is the most preferred estimator since it generally has the lowest RMSE compared with OLS, LSDV, GMM (both one-step and two-step estimators by Arellano and Bond, 1991), Instrumental variables (by Anderson and Hsiao; 1981) estimators.

BB impose more instrument and more moment conditions. The AB estimator performs better than AH if the estimated coefficient of the lagged dependent variable, γ (equation (8)) in the LSDV estimation is persistent. However, from table 7.1 columns (3) and (4), γ is only approximately 0.26 in this study. Thus the AH estimator is the best choice[46]. Additionally, the statistical significance of the LSDVC coefficients has been tested using bootstrapped standard errors (with 200 iterations).

It is useful to point out that in the corrected least square dummy variable (LSDVC), Kiviet's bias correction assumes strict exogeneity in the explanatory variables, x_{it}. If the the explanatory variables are not strictly exogenous, the bias correction term is invalid[47]. In the risk premia measures, there is one concern about the exogeneity of the right hand side variables i.e. economic growth, $GGDP_t$[48]. We can do a robustness check for the correct LSDV estimators by implementing Instrumental Variables estimation of the fixed effects panel data models (IV-FE), allowing possibility of endogenous regressors. The rest of the variables are treated as strictly exogenous.

We perform instrumental variables regression (or two stage least squares) to estimate the structural model for the risk premia, $RP36_t$ (equation (8)). In the structural model, $RP36$ is the endogenous dependent variable, $GGDP_t$ is an endogenous regressor, and the rest are exogenous variables. The first stage regression is modelled as

$$GGDP_t = \alpha + \beta_1 DUBI_t + \beta_2 DUBI_t^2 + \beta_3 Y_t + v_{i,t} \qquad (9)$$

[46] However, we note that based on the finding by Kiviet and Bun (2001), differences in the initial estimators have only a marginal impact on the LSDVC performance.

[47] Huang (2005) correct the weakness of this methodology by using the lag of explanatory variables instead in the regression. However, this case cannot be applied to the risk premia measures. Intuitively, the risk premia is sensitive and reacts quickly to the shock in macroeconomic circumstances.

[48] If the $GGDP$ varible is proved to be endogenous, it is more proper to apply instumental variable regression. The limitation of the Kiviet's correction in the LSDVC measures is that it does not allow instruments.

where $DUBI_t$ is the natural log of crude oil price[49] (Arab Gulf Dubai) in US dollars per barrel, $DUBI_t^2$ is the square of natural log of crude oil price and Y_t is the real Gross Domestic Product per capita relative to the United States[50]. We postulate that economic growth variable ($GGDP_t$) is a function of $DUBI_t$, $DUBI_t^2$, and Y_t. The variable Y_t re‡ects the degree of economic convergence. The change in oil price has short run impact[51] on the economy. A signi…cant increase in oil price can slow down the economic growth in oil importer countries through its e¤ects on spending, or aggregate demand. It also simultaneously create in‡ationary pressures through increased prices of oil products used by consumers, such as gasoline and heating oil and prices of alternatives such as natural gas. Thus $GGDP_t$ is expected to have signi…cant negative relationships with the oil price. The nonlinear relationships are examined as well. $GGDP_t$ is also expected to have inverse relationship with the economic convergence variable, Y_t. The country's real output relative to the United States implies the rate at which the economy catch up the United States. Countries with lower GDP per capita relative to the United States are expected to grow signi…cantly faster than rich countries and they tend to catch up or converge to those with higher real per capita output in a faster speed.

The reason for introducing IV-FE as a robustness check estimator instead of being the best estimator is that the IV-FE estimator also has a weakness. Its properties hold for large number of cross sectional units (N), so it can be bi-

[49] The oil price data are obtained from Datastream, 2006.

[50] The current per capita GDP expressed relative to the United states (US=100) is obtained from the Penn World Table, 2006.

[51] Under the assumption that the oil prices do not increase sharply and become higher than their already high levels, their long run e¤ect can be manageable. The impact of higher oil prices in the long run is that they possibly reduce the production capacity. However, dealing with the higher oil price in the long run can take place in many ways such as developing alternative energy sources and conserving the oil. Moreover, productivity gains from diverse sources, including technological improvements and a more highly educated workforce, are likely to exceed by a signi…cant margin the productivity losses created by high oil prices (Bernanke, 2004).

ased and imprecise in panel data with small number of N, such as most macro panels including this work. In conclusion, the Kiviet corrections address the problem of small sample bias, but it is invalid if there is endogeneity problem. In contrast, the IV can correct the endogeneity, but it is problematic in the small cross sectional samples. The rationale for choosing best estimators here is to compare the results of the IV-FE and the …xed e¤ect regressions (LSDV). If the estimated coe¢ cients and standard errors are not systematically di¤erent, we can emphasise the Kiviet approach based on the bias correction of the LSDV estimator. Then the initial guess that the economic growth variable is endogenous is proved to be invalid as it does not change the results in the …xed e¤ect estimations.

In the next section, we present the results of the risk premia regression using OLS, LSDV, IV-FE and LSDVC estimators. In the OLS, IV-FE and LSDV estimators, the standard errors computed are asymptotically robust to heteroskedasticity and serial correlation. The results will be presented in aggregate and subgroup estimates. The subgroup is determined by the country's income level. To pick up unobserved time e¤ects, year dummies (δ_t) are included in all regressions in this study.

6.2 The Regression results

6.2.1 Whole sample results

The panel regression results for the whole sample are presented in table 7.1, including estimation by OLS, LSDV, IV-FE and LSDVC. Estimated p-values are given in parentheses below point estimates of parameters. For each estimation procedure, the …rst column is the baseline speci…cation. In these, we control for the impact of macroeconomic variables in the risk premia regression. In the second column, we add political variables to the baseline model.

The results from the pooled regression (OLS) [in columns (1) and (2)] and the LSDV or the dynamic fixed effects estimator [columns (3) and (4)] are presented for comparisons with the result from the best estimates, LSDVC [(columns (7) and (8)]. Before discussing the result from the LSDVC estimates, we check the robustness of this measures by IV-FE.

The risk premia regression by IV-FE can be presented by columns (5) and (6). We test the validity of instruments in equation (9) by the Sargan-Hansen test for overidentifying restriction. The results does not reject the null hypothesis that the instruments ($DUBI_t$, $DUBI_t^2$, and Y_t) in equation (9) are valid instruments. (p-value =0.973 and 0.960 in models in columns (6) and (7), respectively). Thus the instruments are indeed exogenous and correctly excluded from the estimated equation. We also perform the Anderson (1984) canonical correlations test. It is a likelihood ratio test of whether the equation is identified, i.e. that the excluded instruments are relevant, meaning correlated with the endogenous regressors. We reject the null hypothesis that the equation is underidentified (p-value =0.00 in both models in columns (6) and (7)). Thus, it indicates that the model is identified.

We then compare the coefficients of parameter in LSDV and IV-FE regressions. The results suggest the effect of the economic growth is weaker after being instrumented. However, the resulting coefficients of the lag dependent variables and the explanatory variables, and the standard error in both measures are unchanged. We employ the Hausman test allow us to check whether there is a sufficient difference between the coefficients of the instrumental variables regression (IV-FE) and those of the standard fixed effect (LSDV). The Hausman test clearly indicates that the difference in coefficients between the IV-FE and the FE is not systematic (the null hypothesis that different in coefficients is not systematic is accepted with $\chi^2(7)$ = 0.45 and prob. $> \chi^2$= 0.9996). This suggests that we can emphasise on the results of the LSDVC estimates. We can now proceed the analysis of the estimated results from the preferred estimators, LSDVC.

The estimated results from the LSDVC are as follows. First, the estimated coefficients of the lagged dependent variable estimated by LSDVC lie between the OLS and LSDV estimates as proposed in the methodology section.

Secondly, greater real effective exchange rate volatility ($VREER$) and reduced economic growth ($GGDP$) are strongly suggestive of increased the risk premia for holding government's short term assets ($RP36$). In both the baseline (column 7) and the second model (column 8) specifications, the real exchange rate volatility ($VREER$) is highly a significant determinant of the risk premia and is significant at 1% level. The results are robust across the OLS and LSDV estimates in columns (1)-(4). In both the baseline specification and the second model of the LSDVC estimates, the coefficients of the volatility of real effective exchange rate ($VREER$) in the risk premia ($RP36$) regression is 0.01. The interpretation is that as $VREER$ increases by 1 unit, $RP36$ rises by 0.0372 percent anually.

Economic growth ($GGDP$) significantly determines the risk premia ($RP36$) at 7 percent and 5 percent levels in the first and second models, respectively. The results are consistent with the LSDV estimates. The coefficients of economic growth ($GGDP$) in the risk premia ($RP36$) regressions are -0.461 and -0.481 in the baseline specifications and in the second model of LSDVC estimates, respectively. In the baseline specification, as the economic growth increase by 1 percent annually[52], the risk premia decline by 1.4642 percent annually. In the

[52] We calculate the economic growth variable by initially using the quarterly data. The economic growth at quarter t is $GGDP_t$. The unit of growth is percent quarterly. It is defined as $(\ln GDP_t - \ln GDP_{t-4})/4$. This is to avoid the seasonal effects. Thus, this method is to calculate the economic growth by comparing GDP at particular quarter this year with GDP at the same quarter next year. To convert to annual data, we average GDP growth of each quarter within a year.

second model, the risk premia decline by 1.5442 percent annually with respect to 1 percent increase in the economic growth.

The finding that economic growth has an important explanatory role for the dynamics of the yield curve corresponds to the work of Ang and Piazzesi (2003) who proposed that the variance decompositions show that macro factors explain up to 85% variation in bond yields[53] and Hordahl, Tristani and Vestin (2004).

It is interesting note that the coefficient of the economic growth factor is not statistically significant in the OLS regressions (columns (1) and (2) in table 7.1). However, the coefficient is statistically significant in estimates which apply fixed country effects. Referring back to figure 4.2 and 5.2, countries with high average risk premia are growing faster perhaps due to convergence. In contrast, countries with low risk premia have lower economic growth rate. The economic growth rates thus correlate with the fixed country effects. For example, the USA assets have low risk because of financial development and economic stability. However, the economic growth rate of USA is not as high as in Mexico which is less financially developed. The OLS regressions fail to distinguish the association of the low risk and low growth countries, it thus bias coefficients of the economic growth in the risk premia regression back down to zero. This explains why the coefficients of $GGDP$ are not statistically significant in the OLS regression. In contrast, fixed effect estimation distinguishes institutional features of high and low income countries. Fixed effect estimation allows the influence of economic growth on the risk premia, holding country effects constant.

A key finding is a strong statistical relationship between exchange rate volatility ($VREER$) and risk premia ($RP36$). Intuitively, the asset invest-

[53] In the reverse relationship, some other works use the yield curve to predict the macroeconomic conditions such as Ang, Piazzesi and Wei (2004), the result is that the term spread have limited power in forecasting GDP but the short term interest rate perform better in predicting GDP. Accordingly, we check the causal relationships between the risk premia and the economic growth and found that the risk premia does not determine the risk premia. Thus, we can be safe from the endogeneity problem.

ment decision is made with uncertainty over the economic environment such as uncertainty over exchange rates, and uncertainty over future tax and regulatory policy. Thus, investors are sensitive to uncertainty about macroeconomic variables. The uncertainty of macroeconomic variables can be captured by the volatility of the series over time. If there is uncertainty in the foreign exchange rate of that particular country, it will affect the demand and supply of assets in that particular country which in turn affect the asset price. As a result, the risk premia in holding assets tend to go up to capture the risk that the international investors face.

We found that government debt ($DEBTGDP$) and the fiscal deficit ($DEFGDP$) do not determine the risk premia in the panel regression[54]. This corresponds to Lamfalussy (1989) who argued that the fiscal stance of governments is often insufficiently reflected in risk premia.

In the OLS regression, the coefficients on $DEBTGDP$ are significant at 6% and 7% level (columns (1) and (2) of table 7.1). However, the fixed country effects eliminate the importance of $DEBTGDP$. From these results, we can infer that $DEBTGDP$ may be important but that it correlates with the fixed effects. It is likely to be a problem of the debt data since the series observed are quite short and they do not vary much over time.

Finally, the political variables ($POLCON$ and $ICRG$) have limited explanatory power for the risk premia in the panel regressions. In a preliminary test using simple pair-wise correlation, I find that both variables are individually significant at 1 percent level. However, the effect of these two variables is weak in the panel regression. This is partially because of the time dummies (δ_t) in the regression. Adding time dummies is a conventional way to pick up unobserved

[54] Even though, the risk premia appears to be significantly positively related to the government debt as a percentage of GDP ($DEBTGDP$) at 10 percent level in OLS estimations. However, the estimates does not wipe out all the country's time invariant fixed effects that can influence the determinant of the risk premia. Thus the estimate result is subjected to bias.

time effect. However, it is important to note that with the time dummies, we cannot identify variables whose change across time is common to each country. It is possible that the $ICRG$ index is collinear with the time dummies. As a result, the political risk index does not significantly determine the risk premia when the time dummies are included. [Removing the time effects from the LSDV and LSDVC estimations in table 7.1, we found that the $ICRG$ index become significant at 5 and 12 percent level, respectively[55].]

We can conclude that risk-averse investors tend to require less risk premia for holding government assets in countries with good economic performance e.g. high economic growth and stable external price competitive position e.g. low volatility of real effective exchange rate. Although with caveats, the political variable and government fiscal conditions have limited ability to explain the risk premia.

6.2.2 Subsamples

In this subsection, we split the data according to income groups (high income and lower income groups) to restrict the income heterogeneity across countries. The definition of high/lower income countries is according to the World Bank country classification (2006)[56]. The details of this classification are presented in table 1.1. This definition is consistent with the cross section regression in the previous part. We start with the panel estimations of the countries in the high income group.

High income group The panel regression results for the high income countries are presented in table 7.2. The data set consist of 21 countries. We find

[55] Removing the time dummis from LSDV and LSDVC models, the coefficients (and probabiliity) of $ICRG$ are -0.068 (p = 0.04) and -0.062 (p = 0.12), respectively.

[56] For operational and analytical purposes, the World Bank's main criterion for classifying economies is gross national income (GNI) per capita. Based on its GNI per capita, every economy is classified as low income, middle income (subdivided into lower middle and upper middle), or high income.

that the country's real effective exchange rate ($REER$) highly positively determines the risk premia ($RP36$) across all estimates and model specifications. The estimated coefficient of this variable is significant at 1 percent level in LSDV and LSDVC measures. Comparing to the full sample regression in previous part, the impact of the real effective exchange rate volatility ($VREER$) become less strong here and is significant at about 10 percent level in LSDVC estimate [columns (5)-(6)].

The strong positive relationship between real effective exchange rate and the risk premia in the sub-sample is intuitively reasonable[57]. As mentioned earlier, $REER$ measures the currency appreciation / depreciation against weighted basket of foreign currencies and adjusts for relative prices between countries. A real depreciation lowers the country risk premia in financial robust country by shifting demand toward domestic goods as in the Mundell and Fleming model. This in turn raises output and the return earned by entrepreneurs. This also corresponds to Cespedes, Chang and Velasco (2004) which suggest that in the financial vulnerable countries, a real depreciation raises the country risk premium, in contrast, country with financial robustness, the opposite happens. In the LSDVC estimates, the coefficients of $REER$ in the risk premia regressions are 0.059 and 0.058 in the first and second models, respectively (see columns (5) and (6) of table 7.2). The interpretation is as follows, a basis point increase in $REER$ index associates with 0.224 percent annually increase in the risk premia in the first model (and 0.220 percent annually increase in the risk premia in the second model).

The effect of $VREER$ is weaker in this sub-sample. The coefficients of $VREER$ in the risk premia regression is 0.005 in both the first and second

[57] The real effective exchange rate ($REER$) does not appear to significantly determine the risk premia in the full sample regression. This is possibly due to the income heterogeneity across samples as we primarily find that initial income is an important determinant of the risk premia in the cross section regression.

models using LSDVC estimates (see columns (5) and (6)). Thus, we can infer that as the $VREER$ increases by 1 unit, the risk premia increase by 0.018 unit (the size of coe¢cients on $VREER$ is half of those in the whole sample regression).

Other macroeconomic variables also determine the risk premia such as economic growth ($GGDP$), in‡ation ($INFL$) and government budget de…cit as a percentage of GDP ($DEFGDP$).

Economic growth ($GGDP$) negatively determines the risk premia and is signi…cant at 10 percent level in the LSDV and LSDVC models (columns (3)-(6) of table 7.2). In the LSDVC estimates, the coe¢cients of $GGDP$ in the risk premia regression are -0.337 and -0.319 in the …rst and second models, respectively (columns (5) and (6) of table 7.2). As economic growth increase by 1 percent per annum, the risk premia decline by 1.002 percent annually in the …rst model and 0.940 percent annually in the second model, respectively.

In the OLS regression using full sample size, the coe¢cient of $GGDP$ is found to be statistically insigni…cant (as shown in table 7.1 columns (1) and (2)). However, using the sample of high income country group, the coe¢cient of $GGDP$ become signi…cant at 5% level in OLS regressions (see columns (1) and (2) in table 7.2). This is because using the sub-sample helps restricting the income heterogeneity across countries. Since high income countries tend to have high economic growth and vice-a-versa, the growth data is also less heterogenous here[58]. The dividing samples by income group helps partially control for the country …xed e¤ect and thus it allows the data to explain more variation in the risk premia.

In‡ation ($INFL$) and government budget de…cit as a percentage of GDP ($DEFGDP$) positively determine the risk premia and are signi…cant at 10 per-

[58] This support our argument earlier that the OLS regressions fail to distinguish the association of the low risk and low growth countries in the full samples.

cent level in the LSDVC estimates. The coe¢ cients of $INFL$ in the risk premia regression are 0.029 and 0.027 in the …rst and second models, respectively (see columns (5) and (6) of table 7.2). As the in‡ation increase by 1 percent per annum, the risk premia increase by 0.017 percent annually in the …rst model and 0.016 percent annually in the second model. The coe¢ cients of DEF in the risk premia regression are 0.021 in both the …rst and second models. As de…cit increase by 1 percentage of GDP, the risk premia increase by 0.004 percent annually.

Low income group The panel regression results for Medium to low income groups are presented in table 7.3. The sample size in this group is very small[59]. We thus consider dropping the dynamic analysis and the time dummies in the regression of the lower income group (as presented in table 7.3). This section therefore only roughly explains the relationship between risk premia and explanatory variables in these countries. The results from the OLS regression and the LSDV estimates are presented in table 7.3.

The …xed e¤ect estimations in column (4) of table 7.3 show that the volatility of real e¤ective exchange rate ($VREER$) and in‡ation ($INFL$) are the main determinants of the risk premia. The coe¢ cients of $VREER$ and $INFL$ are signi…cant at 1 percent and 5 percent level respectively. Although the real e¤ective exchange rate ($REER$) does not signi…cantly determine the risk premia, it is interesting to discuss the sign of the coe¢ cient of this variable (see column (4) of table 7.3). There is a negative relationship between the risk premia and $REER$ which is in contrast to the results from the high income country group. One possible explanation here is that the medium to low income countries are countries with vulnerable …nancial systems. According to Cespedes et. al. (2004) a real

[59] Initially, there are 13 countries in medium to low income group. However, 5 countries such as Turkey, South Africa, Uruguay, Hungary, Poland.are outliers. We drop observations of these 5 countries. After cutting outliers, there are 8 countries left for examinations which are Brazil, Colombia, Czech Republic, India, Malaysia, Mexico, Philippines and Thailand.

depreciation has positive relationship with the country risk premium in financial vulnerable countries. In conventional textbook, expansionary monetary policy and depreciation of the currency are optimal in response to an adverse foreign shock. In practice, if an economy has a large debt denominated in foreign currency then a weaker local currency can also exacerbate debt service difficulties and wreck the balance sheets of domestic banks and firms. This channel may cause devaluations to be contractionary, not expansionary. As documented by Ricardo Hausmann et al. (2001) and Guillermo Calvo and Carmen Reinhart (2002), balance sheet effects have emerged as a prime reason why many central banks are reluctant to allow their currencies to devalue in response to external shocks.

Although the coefficient of $GGDP$ is significant at the 10% level in the fixed effects estimation in column (4), its predictive power is not strong after omitting other insignificant variables. The model in column (5) is the result of omitting all insignificant variables, $VREER$ and $INFL$ are still significantly determine the risk premia and are significant at 1 percent and 10 percent level respectively. In the regression of columns (4) and (5), there are only 4 countries observed here which are Colombia, Malaysia, Philippines and Czech Republic. This is because the data for $REER$ are not available in Brazil, Mexico, India, and Thailand.

In column (6), if we omit $REER$ from the regression, we can observe data for 8 countries which are Brazil, Colombia, Czech Republic, India, Malaysia, Mexico, Philippines and Thailand. The coefficient of $INFL$ is significant at 5 percent level.

7 Conclusion

This study generates monthly risk premia data using zero coupon government treasury bills for 43 countries over the period of 1994-2006. The measure of risk premia is based on the ARCH-in-Mean (ARCH-M) model introduced by Engle, Lilien and Robins (1987). We show that the risk premia are time varying and also vary considerably between countries. This study also examines the macroeconomic and political determinants of the risk premia by using cross section regressions and dynamic panel regression analysis.

The cross section regression shows that on average through 1994-2006, the risk premia for holding government assets required by risk averse investors is positively influenced by the level of inflation and the deficit as a percentage of GDP and is negatively determined by the country's economic growth. Additionally, lower income countries are estimated to have risk premia about 19 percent more than in the high income countries outside the Eurozone, holding other variables constant. In the high income countries outside the Eurozone, the risk premia on holding government assets is predicted to be 10 percent more than those in Eurozone.

Using panel regression analysis, we found that economic growth and the volatility of the real effective exchange rate are the main determinants of risk premia in the full sample regression. Risk averse investors require lower risk premia for holding government assets in countries with good economic performance e.g. high economic growth and stable external price competitive position e.g. low volatility of real effective exchange rate. If we split the sample by income group, the real effective exchange rate which reflects country's external price competitiveness plays important role in high income countries. In the high income countries, the devaluation of currency brings in the favorable result to the economy. This is consistent with the Mundell-Fleming model. There is a better price competitiveness which in turn reduces the country risk premia. The opposite relationship is found in the regression of lower income countries. The possible explanation is that in a financial vulnerable countries, weaker local currency can exacerbate the external debt service di¢culties which result in economic contraction. This in turn raises the country risk premia. However, the impact of the level of real e¤ective exchange rate is less strong in the low income group. For lower income countries, the volatility of the real e¤ective exchange rate which re‡ects uncertainty in the exchange rate market plays important role in determining the risk premia. The higher real exchange rate volatility, the greater risk premia require for holding government assets in that country.

The institutional variables and the government …scal conditions have limited power in explaining the risk premia in this study. This is possibly due to the measurement errors.

Lastly, it is useful to discuss the policy recommendations as follows. The membership of the European Monetary Union is proved to reduce the risk premia in this study. The economic growth is good as it associates with lower risk premia. On the average of time (using cross section regression), the in‡ation and the budgetary positions tend to have strong e¤ect on the economy which is on contrary to the IMF conventional wisdom.

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Table 1: Data Definition and sources

1.1. Interest Rate Data and definitions of country income group

Country Code	Country	Country	Country	Country	Income group
111	USA	USD Government Agency (FMC84) Zero Coupon Yield	US Dollar	1994:12-2006:01	High income
112	UK	GBP United Kingdom (IYC22) Zero Coupon Yield	British Pound	1994:12-2006:01	High income
122	AUSTRIA	EUR Austria Sovereign (IYC63) Zero Coupon Yield	Austrian Schilling	1994:12-2006:01	High income
124	BELGIUM	EUR Belgium Sovereign (IYC6) Zero coupon Yield	Belgian Franc	1994:12-2006:01	High income
128	DENMARK	DKK Denmark Sovereign (IYC11) Zero coupon Yield	Danish Krone	1994:12-2006:01	High income
132	FRANCE	EUR France Sovereign (IYC14) Zero Coupon Yield	French Franc	1994:12-2006:01	High income
134	GERMANY	EUR Germany Sovereign (IYC16) Zero Coupon Yield	German Mark	1994:12-2006:01	High income
136	ITALY	EU Italy Sovereign (IYC40) Zero Coupon Yield	Italian Lira	1994:12-2006:01	High income
138	NETHERLANDS	EUR Netherlands Sovereign (IYC20) Zero coupon yield	Dutch Guilder	1994:12-2006:01	High income
142	NORWAY	NOK Norway Sovereign (IYC78) Zero coupon yield	Norwegian Krone	1994:12-2006:01	High income
144	SWEDEN	SEK Sweden Sovereign (FMC259) Zero coupon Yield	Swedish Krona	1994:12-2006:01	High income
146	SWITZERLAND	CHF Switzerland Sovereign (IYC82) Zero coupon Yield	Swiss Franc	1994:12-2006:01	High income
156	CANADA	CAD Canada Sovereign (UYC7) Zero Coupon Yield	Canadian Dollar	1994:12-2006:01	High income
158	JAPAN	JPY Sovereign (IYC18) Zero Coupon Yield	Japanese Yen	1990:01-2006:01	High income
172	FINLAND	EUR Finland Sovereign (IYC81) Zero Coupon Yield	Finnish Markka	1994:12-2006:01	High income
174	GREECE	EUR Greece Sovereign (FMC904) Zero coupon Yield	EURO	2000:08-2006:01	High income
178	IRELAND	EUR Ireland Sovereign (IYC62) Zero coupon Yield	Irish Punt	1994:12-2006:01	High income
182	PORTUGAL	EUR Portugal Sovereign (IYC84) Zero coupon Yield	Portuguese Escudo	1994:12-2006:01	High income
184	SPAIN	EUR Spain Sovereign (IYC61) Zero coupon Yield	Spanish peseta	1994:12-2006:01	High income
186	TURKEY	US dollar Turkey Sovereign (IYC I249) Zero coupon yield	US Dollar	2002:12-2006:01	Upper middle income
193	AUSTRALIA	AUD Australia Sovereign (IYC1) Zero Coupon Yield	Australian dollar	1994:12-2006:01	High income
196	NEW ZEALAND	NZD New Zealand (IYC49) Zero Coupon Yield	New Zealand Dollar	1994:12-2006:01	High income
199	SOUTH AFRICA	ZAR South Africa Sovereign (FMC262) Zero Coupon Yield	South African Rand	1994:12-2006:01	Upper middle income
213	ARGENTINA	Argentina Sovereign (FMC801) Zero Coupon Yield	Argentine Peso	1998:07-2006:01	Upper middle income
223	BRAZIL	USD Brazil Sovereign (FMC802) Zero coupon yield	US Dollar	1998:06-2006:02	Lower middle income
233	COLOMBIA	USD Colombia Sovereign (FMC803) Zero Coupon Yield	Colombian Peso	1998:06-2006:01	Lower middle income
273	MEXICO	USD Mexico Sovereign (FMC804) Zero coupon yield	Mexican Peso	1998:06-2006:02	Upper middle income
298	Uruguay	BFV USD Uruguay Sovereign	US Dollar	2000:07-2006:01	Upper middle income
436	ISRAEL	Israel Makam Bond	Israel Shekel	1996:11-2006:01	High income
524	SRI LANKA	LKR Sri Lanka Sovereign (FMC133) Zero Coupon Yield	Sri Lankan Rupee	1994:12-2001:01	Lower middle income
532	HONG KONG	Hong Kong Sovereign (IYC95) Zero Coupon Yield	Hong Kong Dollar	1994:12-2006:01	High income
534	INDIA	India Sovereign (FMC123) Zero Coupon Yield	Indian Rupee	1998:11-2006:01	Low income
536	INDONESIA	IDR Indonesia Sovereign (FMC132) Zero Coupon Yield 3 Month	Indonesian Rupiah	1994:12-2001:01	Lower middle income
542	KOREA	KRW Korea Treasury (FMC232) Zero Coupon Yield	South Korean Won	1999:09-2006:01	High income
548	MALAYSIA	MYR Malaysia Sovereign (FMC128) Zero Coupon Yield 3 Month	Malaysian Ringgit	1999:09-2006:01	Upper middle income

566	PHILIPPINES	Philippines treasury Bill Generic yield	Philippines Peso	1995:10-2006:01	Lower middle income
576	SINGAPORE	Singapore Sovereign (IYC107) Zero Coupon Yield	Singapore Dollar	1994:12-2006:01	High income
578	THAILAND	THB Thailand Sovereign (FMC122) Zero Coupon Yield 3 Month	Thai Baht	1994:12-2006:01	Lower middle income
924	CHINA	CNY China Sovereign (FMC20) Zero Coupon Yield	China Renminbi	2003:09-2006:01	Lower middle income
935	CZECH REPUBLIC	CZK Chech Republic (FMC480) Zero Coupon Yield	Czech Koruna	1997:07-2006:01	Upper middle income
936	SLOVAK REPUBLIC	SKK Slovakia Swap rate Zero coupon yield	Slovakia Koruna	2003:02-2006:01	Upper middle income
944	HUNGARY	HUF Hungary Sovereign (FMC114) Zero Coupon Yield	Hungarian Forint	1998:06-2006:01	Upper middle income
964	POLAND	PLN Poland Sovereign (FMC119) Zero coupon Yield	Polish Zloty	1998:05-2006:01	Upper middle income

Note:

- Descriptions apply for 3-month, 6-month and 12-month treasury bills. For example, the description for 3-month yield is "USD Government Agency (FMC84) Zero Coupon Yield for 3-month treasury bills".
- FMC stands for Fair market value curve. The fair market value indices are derived from data points on Bloomberg's option free market curves. The yield at each maturity point represents the composite yield of securities around that maturity.
- IYC stands for International Yield curve.
- Makam is a short-term (up to one year) zero-coupon bond. The Makam market is the most sensitive barometer of expected changes in interest rates in the monetary auction, and is generally the first to respond to interest rate changes.
-Income group: Economies are divided according to 2005 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income, $875 or less; lower middle income, $876 - $3,465; upper middle income, $3,466 - $10,725; and high income, $10,726 or more. [World bank country classification, 2006]

1.2: The Variables

Variable	Description	Source
RP36	Risk premia for holding 6 month treasury bills (comparing to 3 month treasury bills)	Calculation
	The cross section regression uses natural log of country's mean risk premia, 1994-2006. The panel regression uses natural log of (1+(RP36/10))	
RP312	Risk premia for holding 12 month treasury bills (comparing to 3 month treasury bills)	Calculation
	The cross section regression uses natural log of country's mean risk premia, 1994-2006. The panel regression uses natural log of (1+(RP312/100))	
INFL	CPI % CHANGE over corresponding period of previous year (Percent per annum)	IFS, 2006
	The cross section regression uses natural log of mean inflation, 1994-2006. The panel regression uses natural log of (1+(INFL/10))	
REER	Real Effective Exchange Rate (CPI Based) (REER Based on REL.CP)	IFS, 2006
	The cross section regression uses natural log of mean REER, 1994-2006. The panel regression uses natural log of this variable.	
VREER	The Volatility of Real Effective Exchange Rate (CPI Based)	Calculation
	In the cross section regression, VREER is calculated by taking natural log of standard deviation of **REER** over 1994-2006.	
	In the panel regression, the annually observed VREER is calculated by taking natural log of standard deviation of **REER** over 12 months.	
GGDP	Growth rate of GDP over corresponding period of previous year [g_t= (log (GDP_t)-log(GDP_{t-4}))/4]. The unit is in percent quarterly.	Calculation
	Data source: Gross Domestic Product (National Currency), IFS, 2006	
	The cross section regression uses natural log of mean GDP growth, 1994-2006. The panel regression uses annually observed GDP growth.	
DEFIGDP	The government deficit as a percentage of GDP	Calculation
	The cross section regression uses natural log of (1+(DEFIGDP)/10). The panel regression uses natural log of (1+(DEFIGDP/30))	
	Data source: DEFICIT (-) OR SURPLUS, IFS and Gross Domestic Product (National Currency), IFS	
DEBTGDP	Total central government debt % of GDP (AMT: Stocks: Outstanding amounts)	Calculation
	The cross section regression uses natural log of mean debt as a percentage of GDP, 1994-2006	
	The panel regression uses natural log of this variable	
	Data Source: For OECD countries: International Comparisons - Central Government Debt, statistical yearbook, 1980-2003, OECD	
	: For non-OECD countries: World Development Indicators	
POLCON5	Extent of political constraints in policy-making process. Higher value implies stronger constraints and more stability in the policy.	Heinsz, 2005.
	The cross-section regressions use the natural log of mean POLCON5, 1994-2006.	
ICRG	The political risk rating. The lower the risk point assigned, the higher the political risk.	The PRS group, 2006
	The cross section regression uses natural log of mean ICRG, 1994-2006	
EMU	Dummy for member countries joining the European Economic and Monetary Union (EMU)	EU, 2006
	Country list: Austria, Belgium, France, Germany, Italy, Netherlands, Finland, Greece, Ireland, Portugal and Spain	
NEMU_RICH	Dummy for high income countries which do not belong to the EMU	EU, 2006
	Country list: Canada, Denmark, Norway, Switzerland, Sweden, UK, Japan, USA, Australia, New Zealand, Israel, Hong Kong, Korea, and Singapore	
POOR	Dummy for low income to middle income countries.	World Bank, 2006
	Country list: Turkey, South Africa, Argentina, Brazil, Colombia, Mexico, Uruguay, Sri Lanka, India, Indonesia, Malaysia, Philippines, Thailand, China, Czech republic, Slovak republic, Hungary and Poland	
	Note that Czech republic, Slovak republic, Hungary and Poland are EMU member on 1 May 2004. They are included in this group due to their income level and stage of EU membership.	

Table 2: The risk premia and excess holding yield (1991-2006)

Table 2.1: Excess Holding yield 3 VS 6 months

Country	Code	Mean	Std. Dev.	Min	Max	Obs
USA	111	0.35	0.40	-0.33	1.90	130
UK	112	0.20	0.38	-0.56	1.38	131
AUSTRIA	122	0.15	0.28	-0.46	0.95	131
BELGIUM	124	0.16	0.37	-1.42	1.57	131
DENMARK	128	0.22	0.37	-0.70	1.35	131
FRANCE	132	0.14	0.41	-1.49	1.74	131
GERMANY	134	0.09	0.27	-0.46	0.91	131
ITALY	136	0.23	0.48	-1.81	1.74	131
NETHERLANDS	138	0.16	0.29	-0.46	1.09	131
NORWAY	142	0.03	0.67	-3.15	1.66	131
SWEDEN	144	0.28	0.39	-0.83	1.50	131
SWITZERLAND	146	0.21	0.40	-0.88	1.20	131
CANADA	156	0.34	0.56	-0.95	2.68	131
JAPAN	158	0.11	0.39	-1.73	1.57	190
FINLAND	172	0.16	0.43	-0.73	2.02	131
GREECE	174	0.11	0.22	-0.47	0.83	63
IRELAND	178	0.10	0.43	-1.45	1.44	131
PORTUGAL	182	0.20	0.50	-1.11	1.97	131
SPAIN	184	0.17	0.32	-0.58	1.11	131
TURKEY	186	0.11	1.63	-5.03	5.33	35
AUSTRALIA	193	0.12	0.46	-0.75	2.17	131
NEW ZEALAND	196	0.14	0.74	-1.44	3.49	131
SOUTH AFRICA	199	0.79	1.58	-7.49	5.88	131
ARGENTINA	213	-3.95	18.09	-71.72	52.48	42
BRAZIL	223	1.00	4.27	-9.80	22.75	89
COLOMBIA	233	0.57	1.73	-4.49	5.69	89
MEXICO	273	0.56	1.23	-2.42	7.91	89
Uruguay	298	-0.99	9.73	-38.55	20.22	64
ISRAEL	436	0.03	1.26	-3.67	2.62	108
SRI LANKA	524	0.14	0.37	-0.53	1.13	71
HONG KONG	532	0.34	1.06	-3.51	4.93	131
INDIA	534	0.36	0.56	-1.54	1.81	84
INDONESIA	536	0.17	0.36	-0.47	1.18	71
KOREA	542	0.59	0.44	-0.39	1.56	74
MALAYSIA	548	0.18	0.37	-1.04	1.56	74
PHILIPPINES	566	1.91	2.10	-7.36	9.33	121
SINGAPORE	576	0.11	0.77	-1.87	2.64	131
THAILAND	578	0.19	0.44	-1.20	1.27	131
CHINA	924	0.02	0.03	-0.04	0.07	26
CZECH REPUBLIC	935	0.46	0.73	-0.51	4.18	90
SLOVAK REPUBLIC	936	0.28	0.64	-0.56	1.42	23
HUNGARY	944	0.02	1.40	-3.36	3.62	89
POLAND	964	0.17	1.48	-4.28	6.86	90

Table 2.2: Excess Holding yield 3 VS 12 months

Country	Code	Mean	Std. Dev.	Min	Max	Obs
USA	111	1.69	2.03	-1.88	7.26	124
UK	112	0.83	1.44	-1.88	4.54	125
AUSTRIA	122	1.10	1.35	-1.61	4.59	125
BELGIUM	124	1.07	1.70	-2.73	6.58	125
DENMARK	128	1.90	1.70	-1.44	7.34	125
FRANCE	132	1.04	1.41	-1.43	6.10	125
GERMANY	134	0.76	1.45	-2.17	5.18	125
ITALY	136	1.63	1.89	-3.73	7.11	125
NETHERLANDS	138	1.07	1.45	-1.61	5.77	125
NORWAY	142	0.47	2.84	-9.02	6.37	125
SWEDEN	144	2.10	2.00	-1.57	7.40	125
SWITZERLAND	146	1.31	1.65	-2.89	5.90	125
CANADA	156	1.98	2.08	-1.04	7.16	125
JAPAN	158	0.89	1.61	-3.63	6.36	184
FINLAND	172	1.19	1.98	-2.13	7.71	125
GREECE	174	0.98	1.10	-1.56	3.84	57
IRELAND	178	0.81	1.86	-3.46	5.95	125
PORTUGAL	182	1.22	2.17	-4.16	8.04	125
SPAIN	184	1.33	1.68	-1.55	6.02	125
TURKEY	186	1.67	4.95	-5.59	20.51	29
AUSTRALIA	193	0.90	1.92	-2.28	7.28	125
NEW ZEALAND	196	0.31	2.82	-5.76	9.65	125
SOUTH AFRICA	199	2.06	5.44	-17.63	17.56	125
ARGENTINA	213	-19.79	48.96	-189.72	22.96	36
BRAZIL	223	5.07	14.68	-35.00	80.73	83
COLOMBIA	233	3.51	5.42	-4.39	26.22	83
MEXICO	273	3.22	3.81	-2.07	22.94	83
Uruguay	298	-10.97	35.15	-112.44	47.69	58
ISRAEL	436	1.21	4.37	-11.92	9.46	102
SRI LANKA	524	0.82	1.69	-2.09	5.59	65
HONG KONG	532	1.98	3.60	-7.11	16.71	125
INDIA	534	1.96	1.99	-2.51	7.35	78
INDONESIA	536	0.99	1.77	-1.79	6.27	65
KOREA	542	3.04	2.10	-1.26	7.89	68
MALAYSIA	548	1.03	1.05	-1.88	3.77	68
PHILIPPINES	566	7.42	7.40	-14.38	28.98	115
SINGAPORE	576	0.74	1.89	-3.75	7.96	125
THAILAND	578	1.39	1.74	-3.79	6.75	125
CHINA	924	0.14	0.12	-0.06	0.32	20
CZECH REPUBLIC	935	2.74	3.31	-0.74	15.80	84
SLOVAK REPUBLIC	936	2.19	2.07	-2.02	4.12	17
HUNGARY	944	0.40	5.38	-16.06	8.81	83
POLAND	964	0.63	7.13	-17.17	18.11	84

Table 2.3: Risk Premia: 3 VS 6 months

Country	Code	Mean	Std. Dev.	Min	Max	Obs*
USA	111	0.24	0.21	-0.04	0.87	133
UK	112	0.18	0.20	-0.07	0.78	133
AUSTRIA	122	0.13	0.06	0.03	0.27	133
BELGIUM	124	0.17	0.10	0.05	0.40	133
DENMARK	128	0.20	0.15	0.00	0.59	133
FRANCE	132	0.14	0.23	-0.09	0.84	133
GERMANY	134	0.06	0.10	-0.09	0.34	133
ITALY	136	0.19	0.10	0.06	0.41	133
NETHERLANDS	138	0.14	0.05	0.07	0.30	133
NORWAY	142	0.02	0.02	0.01	0.08	133
SWEDEN	144	0.25	0.08	0.15	0.50	133
SWITZERLAND	146	0.27	0.13	0.09	0.56	133
CANADA	156	0.25	0.13	0.09	0.65	133
JAPAN	158	0.09	0.08	0.01	0.32	192
FINLAND	172	0.13	0.05	0.05	0.31	133
GREECE	174	0.10	0.04	0.06	0.22	65
IRELAND	178	0.12	0.06	0.05	0.33	133
PORTUGAL	182	0.16	0.10	0.04	0.42	133
SPAIN	184	0.14	0.10	0.00	0.36	133
TURKEY	186	-	-	-	-	38
AUSTRALIA	193	0.10	0.25	-0.24	0.93	133
NEW ZEALAND	196	0.11	0.16	-0.05	0.65	133
SOUTH AFRICA	199	0.70	0.23	0.50	1.62	133
ARGENTINA	213	0.80	1.01	0.03	3.33	45
BRAZIL	223	0.88	0.85	0.08	3.07	91
COLOMBIA	233	0.61	0.52	-0.03	1.90	91
MEXICO	273	0.53	0.52	0.00	2.13	91
Uruguay	298	0.59	1.94	-4.32	2.57	66
ISRAEL	436	0.15	0.16	-0.23	0.39	110
SRI LANKA	524	0.16	0.03	0.07	0.20	74
HONG KONG	532	0.42	0.11	0.32	0.75	133
INDIA	534	0.36	0.29	0.06	1.31	86
INDONESIA	536	0.17	0.00	0.16	0.17	74
KOREA	542	0.54	0.21	0.22	1.05	76
MALAYSIA	548	0.23	0.14	0.08	0.57	76
PHILIPPINES	566	1.98	0.58	1.49	3.60	123
SINGAPORE	576	0.09	0.16	-0.10	0.52	133
THAILAND	578	0.21	0.12	0.08	0.66	133
CHINA	924	-	-	-	-	28
CZECH REPUBLIC	935	0.41	0.38	0.03	1.63	92
SLOVAK REPUBLIC	936	-	-	-	-	24
HUNGARY	944	0.16	0.56	-1.14	0.85	91
POLAND	964	0.26	0.41	-0.88	0.68	92

* Obs stands for number of months observed.

Table 2.4: Risk Premia 3 VS 12 months

Country	Code	Mean	Std. Dev.	Min	Max	Obs
USA	111	0.81	1.77	-2.06	5.96	133
UK	112					
AUSTRIA	122	0.93	0.27	0.53	1.57	133
BELGIUM	124	0.87	0.33	0.40	1.87	133
DENMARK	128	1.87	0.90	0.84	4.56	133
FRANCE	132	0.72	0.54	-0.11	2.46	133
GERMANY	134	0.84	0.58	0.13	2.58	133
ITALY	136	1.22	0.52	0.43	2.45	133
NETHERLANDS	138	0.89	0.32	0.41	1.74	133
NORWAY	142	0.76	0.01	0.72	0.77	133
SWEDEN	144	1.74	0.56	1.12	3.39	133
SWITZERLAND	146	1.16	0.32	0.73	1.94	133
CANADA	156	1.25	0.79	0.29	3.14	133
JAPAN	158	0.71	0.65	0.04	2.36	192
FINLAND	172	0.90	0.40	0.39	2.18	133
GREECE	174					
IRELAND	178	0.73	0.17	0.50	1.20	133
PORTUGAL	182	1.07	0.55	0.46	2.35	133
SPAIN	184	1.02	0.42	0.45	2.05	133
TURKEY	186					
AUSTRALIA	193	0.50	1.23	-1.19	4.45	133
NEW ZEALAND	196	0.08	0.87	-1.10	2.82	133
SOUTH AFRICA	199	2.57	0.07	2.49	2.79	133
ARGENTINA	213	3.42	3.03	0.69	9.86	45
BRAZIL	223	5.05	5.16	0.75	20.15	91
COLOMBIA	233	2.66	2.33	-0.36	9.85	91
MEXICO	273	2.48	2.30	-0.33	9.68	91
Uruguay	298	-1.34	22.07	-51.18	22.46	66
ISRAEL	436	2.38	1.12	-0.40	3.84	110
SRI LANKA	524	0.90	0.37	-0.03	1.42	74
HONG KONG	532	2.45	0.53	1.84	3.70	133
INDIA	534	1.36	1.68	-1.61	5.85	86
INDONESIA	536	1.16	0.25	0.58	1.53	74
KOREA	542	2.43	1.74	-0.08	6.89	76
MALAYSIA	548	1.25	0.87	0.36	3.47	76
PHILIPPINES	566	7.46	1.54	5.77	12.25	123
SINGAPORE	576	0.46	1.10	-1.22	3.96	133
THAILAND	578	1.71	2.09	-0.16	10.51	133
CHINA	924					
CZECH REPUBLIC	935					
SLOVAK REPUBLIC	936					
HUNGARY	944					
POLAND	964	1.60	3.90	-8.43	5.48	92

Table 3: result from ARCH-M regression

Table 3.1: Risk Premium 3 VS 6 months

Number	Country	Date	ARCH-M		ARCH	
			b	d	a **0**	a **1**
1	**USA**	1994:12-2006:01	-0.32	1.61	0.02	0.95
			(-2.02)**	(3.49)***	(0.80)	(3.79)***
2	**UK**	1994:12-2006:01	-1.00	3.35	0.06	0.55
			(-1.78)*	(1.99)**	(1.92)*	(1.86)*
3	**AUSTRIA**	1994:12-2006:01	-0.07	0.75	0.01	0.84
			(-1.07)	(2.45)*	(2.13)*	(4.10)***
4	**BELGIUM**	1994:12-2006:01	0.01	0.42	0.00	1.52
			(0.28)	(3.02)***	(0.32)	(9.27)***
5	**DENMARK**	1994:12-2006:01	-0.24	1.39	0.03	0.79
			(-2.32)**	(3.63)***	(2.57)***	(3.78)***
6	**FRANCE**	1994:12-2006:01	-0.20	1.06	0.01	1.07
			(-5.27)***	(5.91)***	(1.24)	(6.69)***
7	**GERMANY**	1994:12-2006:01	-0.26	1.29	0.01	0.87
			(-2.92)***	(3.11)***	(1.38)	(3.89)***
8	**ITALY**	1994:12-2006:01	0.00	0.40	0.01	1.27
			(0.03)	(1.90)*	(1.32)	(7.45)***
9	**NETHERLANDS**	1994:12-2006:01	-0.01	0.57	0.01	0.89
			(-0.17)	(1.67)*	(1.03)	(3.59)***
10	**NORWAY**	1994:12-2006:01	0.00	0.03	0.00	1.34
			(0.03)	(0.26)	(0.15)	(9.45)***
11	**SWEDEN**	1994:12-2006:01	-0.32	1.58	0.08	0.36
			(-0.66)	(1.12)	(4.53)***	(1.70)*
12	**SWITZERLAND**	1994:12-2006:01	0.03	0.60	0.01	1.21
			(1.17)	(6.02)***	(1.38)	(7.13)***
13	**CANADA**	1994:12-2006:01	-0.01	0.50	0.02	1.08
			(-0.09)	(1.83)*	(0.90)	(7.12)***
14	**JAPAN**	1990:01-2006:01	0.00	0.28	0.00	1.13
			(1.30)	(3.69)***	(1.22)	(11.29)***
15	**FINLAND**	1994:12-2006:01	0.02	0.28	0.01	1.03
			(0.49)	(1.46)	(1.27)	(5.52)***
16	**GREECE**	2000:08-2006:01	-0.03	0.60	0.01	0.77
			(-0.28)	(1.25)	(1.46)	(2.67)***
17	**IRELAND**	1994:12-2006:01	0.02	0.25	0.01	1.08
			(0.53)	(1.51)	(1.13)	(5.68)***
18	**PORTUGAL**	1994:12-2006:01	-0.01	0.39	0.01	1.04
			(-0.19)	(1.86)*	(2.09)**	(6.13)***
19	**SPAIN**	1994:12-2006:01	-0.11	0.88	0.01	0.97
			(-1.80)*	(2.91)***	(0.80)	(4.31)***
20	**TURKEY**	2002:12-2006:01	-0.30	0.20	-0.11	1.05
			(-1.47)	(0.96)	(-0.57)	(5.05)***
21	**AUSTRALIA**	1994:12-2006:01	-0.67	1.94	0.04	0.82
			(-3.90)***	(4.42)***	(1.47)	(4.11)***
22	**NEW ZEALAND**	1994:12-2006:01	-0.14	0.42	0.03	0.96
			(-1.99)**	(2.29)**	(1.46)	(5.16)***
23	**SOUTH AFRICA**	1994:12-2006:01	0.38	0.23	0.15	1.10
			(1.30)	(0.81)	(0.99)	(4.95)***
24	**ARGENTINA**	1998:07-2002:01	-0.05	0.05	0.05	2.45
			(-0.09)	(0.26)	(0.03)	(4.88)***
25	**BRAZIL**	1998:06-2006:02	-0.03	0.26	0.05	1.36

			(-0.23)	(2.72)***	(0.60)	(7.62)***
26	**COLOMBIA**	1998:06-2006:01	-0.29	0.59	0.01	1.15
			(-1.28)	(2.69)***	(0.07)	(5.21)***
27	**MEXICO**	1998:06-2006:02	-0.15	0.69	0.01	1.12
			(-2.11)**	(3.94)***	(0.41)	(6.31)***
28	**Uruguay**	2000:07-2006:01	4.16	-0.39	14.79	0.96
			(1.49)	(-0.90)	(1.79)*	(4.47)***
29	**ISRAEL**	1996:11-2006:01	0.68	-0.43	0.42	0.72
			(1.13)	(-0.85)	(2.14)**	(3.74)***
30	**SRI LANKA**	1994:12-2001:01	0.32	-0.44	0.06	0.61
			(1.12)	(-0.55)	(1.15)	(1.31)
31	**HONG KONG**	1994:12-2006:01	0.28	0.16	0.04	1.14
			(2.23)**	(0.74)	(1.12)	(7.66)***
32	**INDIA**	1998:11-2006:01	-0.47	1.64	0.10	0.68
			(-2.78)***	(4.03)***	(3.24)***	(3.42)***
33	**INDONESIA**	1994:12-2001:01	0.18	-0.04	0.07	0.49
			(0.39)	(-0.03)	(1.14)	(0.81)
34	**KOREA**	1999:09-2006:01	-0.66	3.01	0.05	0.67
			(-0.86)	(1.53)	(0.87)	(1.55)
35	**MALAYSIA**	1999:09-2006:01	0.04	0.43	0.00	1.94
			(1.25)	(2.12)**	(-0.14)	(5.07)***
36	**PHILIPPINES**	1995:10-2006:01	-0.01	1.02	2.03	0.50
			(-0.01)	(2.50)**	(7.60)***	(3.27)***
37	**SINGAPORE**	1994:12-2006:01	-0.26	0.50	0.06	0.92
			(-2.07)**	(2.27)**	(1.43)	(4.34)***
38	**THAILAND**	1994:12-2006:01	-0.12	0.81	0.04	0.88
			(-1.12)	(2.64)***	(2.79)***	(3.84)***
39	**CHINA**	2003:09-2006:01	2.31	-82.78	0.00	0.04
			(5.68)***	(.)	(2.71)***	(1.29)
40	**CZECH REPUBLIC**	1997:07-2006:01	-0.12	0.98	0.01	1.19
			(-1.15)	(3.19)***	(0.74)	(7.05)***
41	**SLOVAK REPUBLIC**	2003:02-2006:01	Flat Log-likehood			
42	**HUNGARY**	1998:06-2006:01	3.80	-2.93	0.80	0.49
			(1.54)	(-1.39)	(1.85)*	(1.44)
43	**POLAND**	1998:05-2006:01	0.86	-0.49	0.03	1.07
			(4.29)***	(-2.02)**	(0.32)	(6.97)***

Notes: Figures in parenthesis () are t-ratios.

The parameters are correspond to equation (29) in Section 4.1: Risk premia in an ARCHM model.

*** indicates that a coefficient is significant at the 1% level;

** significant at the 5% level, and * significant at the 10% level.

Table 3.2: Risk Premium 3 VS 12 months

Number	**Country**	**Date**	**ARCH-M**		**ARCH**	
			b	d	a **0**	a **0**
1	**USA**	1994:12-2006:01	-14.07	10.60	0.93	0.54
			(-1.76)*	(1.89)*	(1.51)	(1.76)*
2	**UK**	1994:12-2006:01	flat			
3	**AUSTRIA**	1994:12-2006:01	0.35	0.47	0.11	0.97
			(2.58)***	(3.24)***	(1.17)	(4.28)***
4	**BELGIUM**	1994:12-2006:01	0.28	0.39	0.04	1.11
			(2.37)**	(3.14)***	(0.48)	(5.74)***

5	**DENMARK**	1994:12-2006:01	0.39 (2.69)***	1.01 (7.19)***	0.12 (1.54)	1.01 (4.93)***
6	**FRANCE**	1994:12-2006:01	-0.47 (-2.26)**	1.04 (4.83)***	0.07 (0.65)	0.99 (4.33)***
7	**GERMANY**	1994:12-2006:01	-0.10 (-0.98)	0.69 (6.59)***	0.04 (0.38)	1.06 (4.81)***
8	**ITALY**	1994:12-2006:01	0.21 (1.61)	0.62 (4.84)***	0.06 (0.58)	1.07 (5.81)***
9	**NETHERLANDS**	1994:12-2006:01	0.27 (2.39)**	0.48 (4.2)***	0.06 (0.88)	1.05 (5.81)***
10	**NORWAY**	1994:12-2006:01	0.77 (2.01)**	-0.01 (-0.04)	0.91 (3.03)***	0.92 (5.19)***
11	**SWEDEN**	1994:12-2006:01	0.41 (0.75)	0.86 (2.06)**	0.46 (1.29)	0.80 (3.32)***
12	**SWITZERLAND**	1994:12-2006:01	0.54 (2.80)***	0.41 (2.27)**	0.18 (1.86)*	1.03 (5.10)***
13	**CANADA**	1994:12-2006:01	-0.40 (-0.82)	0.97 (2.36)**	0.24 (0.97)	0.92 (3.51)***
14	**JAPAN**	1990:01-2006:01	0.02 (1.04)	0.68 (7.23)***	0.00 (1.36)	0.99 (8.41)***
15	**FINLAND**	1994:12-2006:01	0.19 (1.14)	0.44 (3.02)***	0.11 (0.80)	1.00 (4.40)***
16	**GREECE**	2000:08-2006:01				
17	**IRELAND**	1994:12-2006:01	0.41 (1.74)*	0.20 (1.04)	0.15 (1.27)	0.98 (4.79)***
18	**PORTUGAL**	1994:12-2006:01	0.30 (1.76)*	0.43 (2.90)***	0.10 (1.68)*	1.03 (6.06)***
19	**SPAIN**	1994:12-2006:01	0.22 (1.30)	0.57 (3.15)***	0.12 (0.97)	0.98 (4.13)***
20	**TURKEY**	2002:12-2006:01	-150.39 (-0.05)	34.07 (0.05)	19.32 (2.15)**	0.03 (0.05)
21	**AUSTRALIA**	1994:12-2006:01	-4.20 (-2.89)***	3.16 (3.24)***	0.65 (1.57)	0.77 (3.50)***
22	**NEW ZEALAND**	1994:12-2006:01	-1.59 (-4.91)***	0.73 (4.20)***	0.27 (1.08)	1.01 (5.44)***
23	**SOUTH AFRICA**	1994:12-2006:01	2.43 (2.53)**	0.03 (0.11)	2.35 (0.88)	0.97 (3.98)***
24	**ARGENTINA**	1998:07-2006:01	0.47 (0.13)	0.05 (0.15)	-2.16 (-0.08)	2.55 (2.83)***
25	**BRAZIL**	1998:06-2006:02	-1.84 (-1.09)	0.65 (2.71)***	13.57 (3.51)***	0.99 (5.37)***
26	**COLOMBIA**	1998:06-2006:01	-2.13 (-1.79)*	1.08 (3.16)***	1.44 (0.91)	1.08 (5.43)***
27	**MEXICO**	1998:06-2006:02	-1.12 (-3.68)***	1.10 (6.52)***	-0.18 (-0.49)	1.39 (7.88)***
28	**Uruguay**	2000:07-2006:01	60.57 (2.10)**	-2.35 (-1.97)**	145.22 (0.59)	0.78 (1.99)**
29	**ISRAEL**	1996:11-2006:01	4.77 (4.79)***	-0.58 (-1.92)*	2.23 (1.70)*	1.02 (4.27)***
30	**SRI LANKA**	1994:12-2001:01	1.83 (3.97)***	-0.57 (-1.87)*	0.30 (0.80)	0.95 (2.93)***
31	**HONG KONG**	1994:12-2006:01	1.65 (5.58)***	0.23 (1.48)	0.43 (0.87)	1.26 (5.64)***
32	**INDIA**	1998:11-2006:01	-27.63	21.71	1.40	0.22

			(-0.75)	(0.78)	(2.73)***	(0.77)
33	**INDONESIA**	1994:12-2001:01	1.87	-0.42	0.46	0.91
			(2.98)***	(-1.11)	(1.01)	(2.85)***
34	**KOREA**	1999:09-2006:01	-17.13	15.74	0.95	0.39
			(-0.85)	(0.98)	(1.42)	(0.97)
35	**MALAYSIA**	1999:09-2006:01	0.22	0.93	0.01	1.55
			(2.12)**	(4.15)***	(0.55)	(5.16)***
36	**PHILIPPINES**	1995:10-2006:01	4.31	0.46	7.39	0.91
			(3.41)***	(2.02)**	(2.55)**	(4.74)***
37	**SINGAPORE**	1994:12-2006:01	-3.19	2.46	0.46	0.82
			(-3.32)***	(3.44)***	(1.72)*	(3.87)***
38	**THAILAND**	1994:12-2006:01	-1.90	2.66	0.18	1.23
			(-3.61)***	(6.63)***	(1.10)	(7.24)***
39	**CHINA**	2003:09-2006:01				
40	**CZECH REPUBLIC**	1997:07-2006:01				
41	**SLOVAK REPUBLIC**	2003:02-2006:01				
42	**HUNGARY**	1998:06-2006:01				
43	**POLAND**	1998:05-2006:01	7.55	-1.20	1.90	0.90
			(7.46)***	(-4.65)***	(1.03)	(3.90)***

Table 4: The descriptive statistics 1994-2006 in the cross section regression

4.1. Summary Statistics for risk premia and their determinants

Variable	Obs	Mean	Std.Dev.	Min	Max
RP3_6	40	-1.5328	0.8325	-3.7883	0.6808
RP3_12	36	0.1377	0.1167	-0.1435	0.5571
GGDP	43	-3.8833	0.8013	-6.0142	-1.5871
INFL	43	1.5289	0.8927	-0.5443	4.1087
DEFGDP	42	-0.2599	0.4146	-1.6359	0.6707
DEBTGDP	41	3.7382	0.6488	2.0096	4.7878
GDP94	42	8.9157	0.7357	7.2464	9.8349
POLCON	42	-0.3917	0.2945	-1.7863	-0.1134
ICRG	43	4.3107	0.1489	3.9604	4.4848
VREER	32	2.0933	0.5419	1.1106	2.9326

4.2. Correlations between risk premium and macroeconomic and political variables

	RP3_6	GGDP	INFL	DEFGDP	DEBTGDP	POLCON5	ICRG	GDP94	VINFL	VREER
RP3_6	1									
GGDP	0.4313	1								
INFL	0.5700	0.9069	1							
DEFGDP	-0.1669	-0.0511	-0.3336	1						
DEBTGDP	-0.1518	-0.2136	-0.2458	-0.1253	1					
POLCON5	-0.5805	-0.5743	-0.6047	0.1159	0.2220	1				
ICRG	-0.6275	-0.6109	-0.6733	0.2486	0.0602	0.7843	1			
GDP94	-0.7674	-0.7118	-0.7334	0.2221	0.2222	0.6631	0.7217	1		
VINFL	0.5250	0.7496	0.8829	-0.2913	-0.2544	-0.5470	-0.6101	-0.6645	1	
VREER	0.5015	0.5284	0.5689	-0.1844	-0.2585	-0.4178	-0.4773	-0.6448	0.7270	1

Table 5: The cross section regression: determinants of the risk premia for holding 6-month treasury bills (RP3_6)

	(1)		(2)		(3)		(4)	
Inflation	1.41	(0.60)**	1.35	(0.61)**	1.18	(0.47)**	0.85	(0.31)***
Deficit (%GDP)	1.62	(0.87)*	1.67	(0.94)*	1.12	(0.54)**	1.15	(0.40)***
Economic Growth	-1.73	(0.75)**	-1.73	(0.78)**	-1.33	(0.61)**	-0.76	(0.38)**
Debt (%GDP)	0.17	(0.22)	0.13	(0.25)				
REER volatility	0.22	(0.39)	0.24	(0.44)				
ICRG			-1.19	(2.08)				
POLCON5			0.06	(1.11)				
Control Variable								
Intial Income (GDP94)	-1.09	(0.73)	-0.93	(0.74)	-0.82	(0.61)	-0.61	(0.30)*
Group dummies								
EMU	0.28	(0.42)	0.36	(0.52)	0.04	(0.24)	-0.1	(0.20)
POOR	-0.1	(1.00)	0.00	(1.02)	0.16	(0.76)	0.19	(0.38)
R^2	0.74		0.75		0.55		0.64	
Number of Countries	29		29		38		31	
P-value for httest	0.23		0.28		0.07		0.37	
P-value for white test	0.07		0.03		0.00		0.31	
P-value for Ovtest	0.01		0.02		0.03		0.44	
Beta value	**Col (3)**	**Col(4)**						
Inflation	1.29	1.23						
Deficit (%GDP)	0.53	0.55						
Economic Growth	-1.15	-0.91						
Intial Income (GDP94)	-0.76	-0.65						
EMU	0.02	-0.08						
POOR	0.10	0.16						

Notes: The dependent variable is the risk premia for holding 6-month treasury bills (comparing to 3-month treasury bills) over 1994-2006, in natural logarithm. ***, ** and * denote significance at 1%, 5% and 10%, respectively. Numbers shown in parentheses are MacKinnon and White (1985) heteroskedasticity-consistent (hc3) standard errors. All regressions have a constant. The group dummies are for 1) Countries joining European Monetary Union (*EMU*); 2) Countries, which are not members of EMU but have high income (*NEU_RICH*); 3) Countries, which are neither members of EMU nor have high income (*POOR*). In the regression, the omitted category is *NEU_RICH*. The hettest performs the Breusch-Pagan test for heteroskedasticity in the independent variables. The whitetst performs a variant of the White test for heteroskedasticity that uses the predicted values from the original regression and their squared values. The ovtest performs the regression specification error test (RESET) for omitted variables. The corresponding numbers shown are p-values.

Table 6 Descriptive Statistics 1994-2006 in the panel regression

6.1 Summary Statistics for risk premium and its determinants

Variable	Obs	Mean	Std. Dev.	Min	Max
RP36	391	0.028	0.041	-0.215	0.226
GGDP	454	0.024	0.107	-1.439	1.486
DEBTGDP	324	3.805	0.630	1.687	4.932
REER	360	4.626	0.109	4.093	4.915
VREER	360	0.625	0.606	-0.991	2.410
INFL	451	0.355	0.389	-0.504	2.429
DEFGDP	350	-0.054	0.147	-1.181	0.446
POLCON	409	-0.337	0.227	-1.903	-0.113
ICRG	418	4.353	0.138	3.883	4.565

6.2. Correlations between risk premium and macroeconomics and political variables

	RP36	GGDP	DEBTGDP	REER	VREER	INFL	DEFGDP	POLCON	ICRG
RP36	1								
GGDP	0.236	1							
DEBTGDP	-0.028	-0.008	1						
REER	-0.037	-0.119	-0.099	1					
VREER	0.427	0.250	-0.280	0.100	1				
INFL	0.343	0.705	-0.112	-0.072	0.374	1			
DEFGDP	-0.121	-0.049	-0.064	-0.032	-0.139	-0.213	1		
POLCON	-0.416	-0.256	-0.006	0.169	-0.163	-0.242	0.143	1	
ICRG	-0.498	-0.407	-0.068	0.112	-0.415	-0.538	0.318	0.471	1

Table 7: Risk premium (rp 3_6) panel regressions

Table7.1. The determinant of the risk premia (whole sample), 1994-2006)

Dependent variable: RP36_(i,t)	OLS		FE		FE-IV		LSDVC	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RP36_(i,t-1)	0.824	0.830	0.257	0.255	0.236	0.236	0.416	0.421
	[0.00]***	[0.00]***	[0.05]**	[0.05]**	[0.05]**	[0.04]**	[0.00]***	[0.00]***
GGDP_(i,t)	-0.254	-0.262	-0.502	-0.520	-0.978	-0.906	-0.461	-0.481
	[0.26]	[0.28]	[0.05]**	[0.05]**	[0.23]	[0.23]	[0.07]*	[0.05]**
DEBTGDP_(i,t)	0.004	0.005	0.000	0.000	0.001	0.001	0.004	0.004
	[0.06]*	[0.07]*	[0.97]	[0.96]	[0.82]	[0.82]	[0.70]	[0.69]
REER_(i,t)	-0.005	-0.007	0.015	0.020	0.012	0.018	0.012	0.019
	[0.84]	[0.78]	[0.47]	[0.27]	[0.68]	[0.50]	[0.58]	[0.43]
VREER_(i,t)	0.008	0.009	0.010	0.010	0.009	0.009	0.010	0.010
	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.01]***	[0.01]***
INFL_(i,t)	0.021	0.024	0.010	0.013	0.017	0.019	0.014	0.019
	[0.16]	[0.08]*	[0.60]	[0.55]	[0.47]	[0.48]	[0.37]	[0.23]
DEFGDP_(i,t)	0.016	0.014	0.020	0.020	0.024	0.022	0.022	0.022
	[0.19]	[0.28]	[0.11]	[0.10]*	[0.16]	[0.18]	[0.23]	[0.24]
POLCON_(i,t)		-0.004		-0.003		0.001		-0.005
		[0.74]		[0.79]		[0.96]		[0.73]
ICRG_(i,t)		0.015		-0.034		-0.048		-0.031
		[0.37]		[0.34]		[0.27]		[0.43]
Anderson cannon p-value					0.000	0.000		
Hansen J statistics p-value					0.973	0.960		
Groups	27	27	27	27	27	27	27	27
Observations	186	186	186	186	186	186	186	186

Notes: 27 countries. P-value is reported in brackets below point estimates.
Year dummies are included in all models.
* stands for significant at 10%; ** stands for significant at 5%; *** stands for significant at 1%.
The LSDV estimator is the fixed effect estimator. In the OLS and LSDV estimators, the standard errors computed are asymptotically robust to heteroskedasticity and serial correlation.
The LSDVC estimator is the corrected LSDV estimator developed by Kiviet (1995) for finite sample bias and contructed for dynamic unbalanced panels by Bruno (2005).

Table7.2: The determinant of the risk premia (rich countries), 1994-2006.

Dependent variable: RP36_(i,t)	OLS		LSDV(FE)		LSDVC	
	(1)	(2)	(3)	(4)	(5)	(6)
RP36_(i,t-1)	0.493	0.481	0.229	0.237	0.426	0.436
	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***	[0.00]***
GGDP_(i,t)	-0.350	-0.340	-0.354	-0.340	-0.337	-0.319
	[0.03]**	[0.03]**	[0.06]*	[0.06]*	[0.07]*	[0.08]*
DEBTGDP_(i,t)	0.003	0.004	0.008	0.008	0.008	0.009
	[0.18]	[0.05]**	[0.40]	[0.33]	[0.27]	[0.23]
REER_(i,t)	0.020	0.021	0.065	0.064	0.059	0.058
	[0.07]*	[0.07]*	[0.00]***	[0.00]***	[0.01]***	[0.01]***
VREER_(i,t)	0.003	0.004	0.005	0.006	0.005	0.005
	[0.13]	[0.10]*	[0.17]	[0.13]	[0.11]	[0.09]*
INFL_(i,t)	0.020	0.024	0.027	0.025	0.029	0.027
	[0.17]	[0.11]	[0.17]	[0.17]	[0.06]*	[0.09]*
DEFGDP_(i,t)	0.006	0.005	0.022	0.022	0.021	0.021
	[0.30]	[0.36]	[0.05]**	[0.05]**	[0.10]*	[0.10]*
POLCON_(i,t)		0.008		0.000		-0.001
		[0.32]		[0.94]		[0.95]
ICRG_(i,t)		0.019		0.031		0.038
		[0.07]*		[0.34]		[0.34]
Groups	21	21	21	21	21	21
Observations	151	151	151	151	151	151

Notes: 21 countries. P-value is reported in brackets below point estimates.
Year dummies are included in all models.
* stands for significant at 10%; ** stands for significant at 5%; *** stands for significant at 1%.
The LSDV estimator is the fixed effect estimator. In the OLS and LSDV estimators, the standard errors computed are asymptotically robust to heteroskedasticity and serial correlation.
The LSDVC estimator is the corrected LSDV estimator developed by Kiviet (1995) for finite sample bias and contructed for dynamic unbalanced panels by Bruno (2005).

Table7.3. The determinant of the risk premia (poor countries), 1994-2006.

Dependent variable: RP36_(i,t)	OLS			LSDV(FE)		
	(1)	(2)	(3)	(4)	(5)	(6)
GGDP_(i,t)	2.855			-1.808		
	(0.48)			(0.08)*		
REER_(i,t)	-0.160			-0.034		
	(0.13)			(0.63)		
VREER_(i,t)	0.043	0.050		0.036	0.030	
	(0.03)**	(0.06)*		(0.01)***	(0.01)***	
INFL_(i,t)	0.016	0.081	0.107	0.111	0.078	0.079
	(0.86)	(0.26)	(0.00)***	(0.03)**	(0.08)*	(0.03)**
DEFGDP_(i,t)	0.315			-0.073		
	(0.05)**			0.264		
Groups	4	4	8	4	4	8
Observations	34	34	70	34	34	70

Notes: P-value is reported in brackets below point estimates.
Year dummies are not included in all models.
* stands for significant at 10%; ** stands for significant at 5%; *** stands for significant at 1%.
The LSDV estimator is the fixed effect estimator. In the OLS and LSDV estimators, the standard errors computed are asymptotically robust to heteroskedasticity and serial correlation.

Figure 1: Excess holding yield of 6 month Treasury Bills and estimated risk premia for 43 countries

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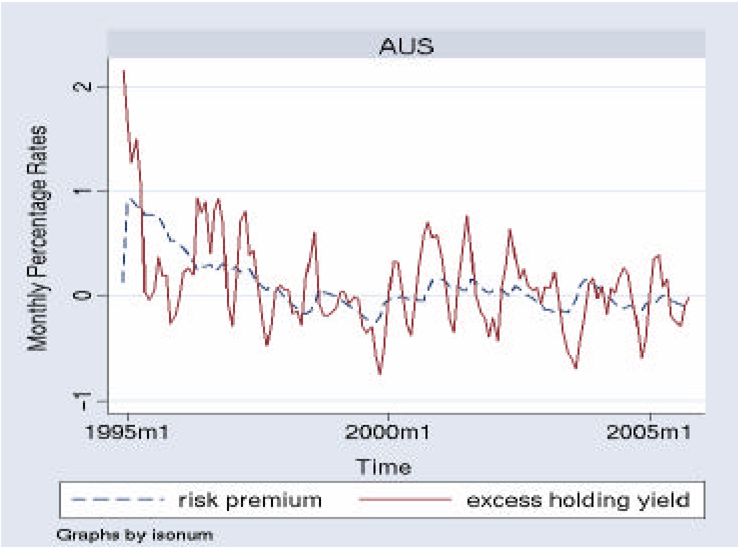
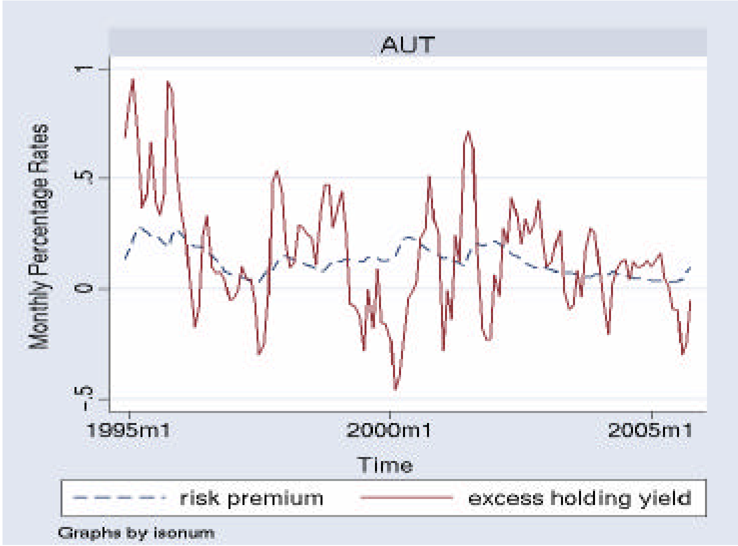
1.1: Argentina

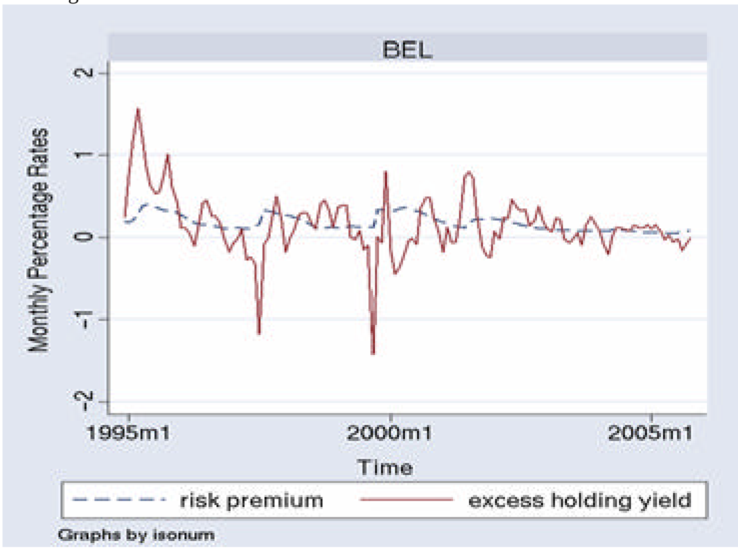
1.2: Australia



1.3: Austria

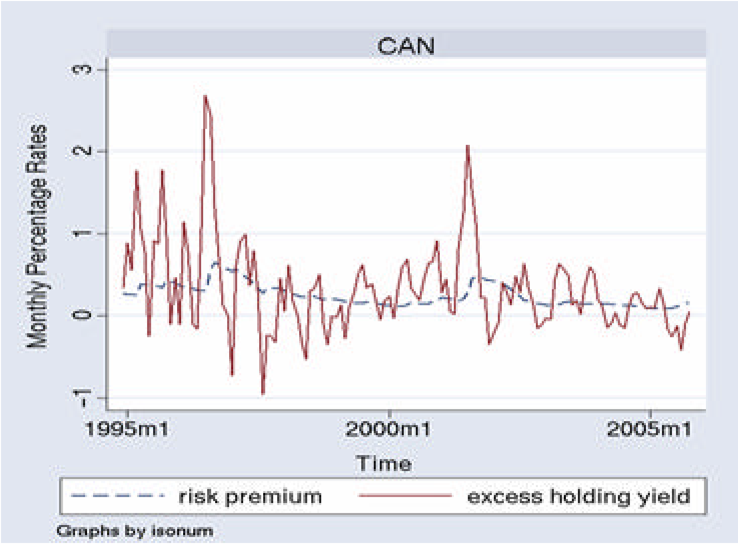


1.4: Belgium

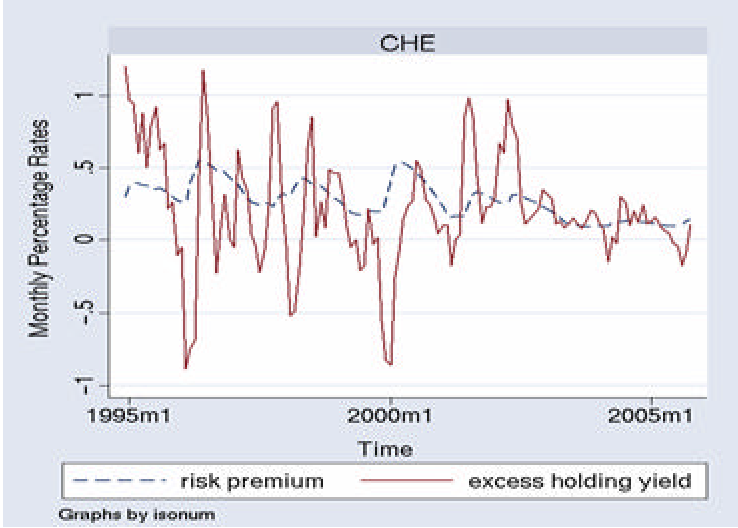


1.5: Brazil

1.6: Canada

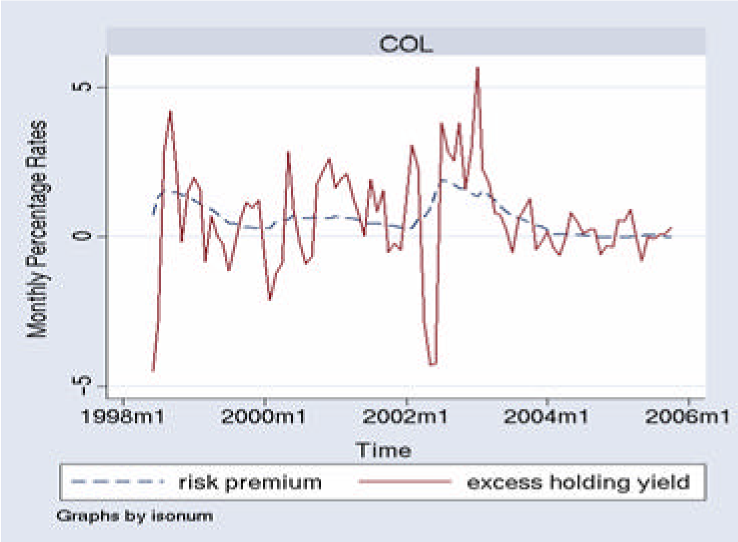


1.7: Switzerland

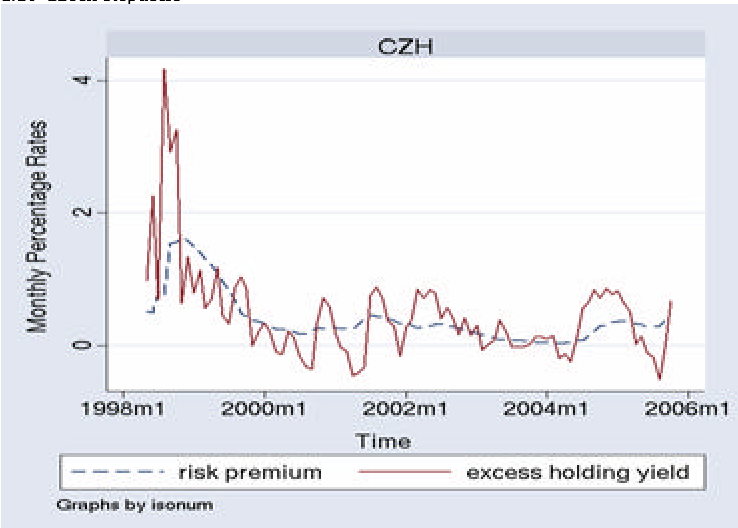


1.8: China

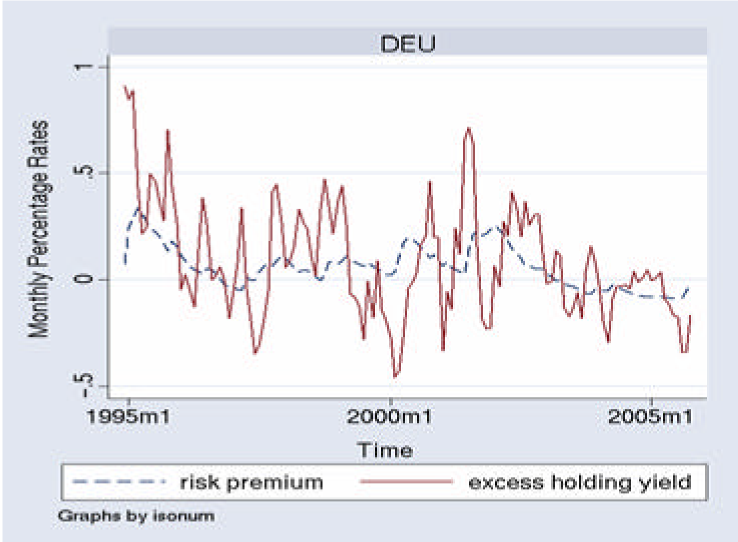
1.9: Colombia



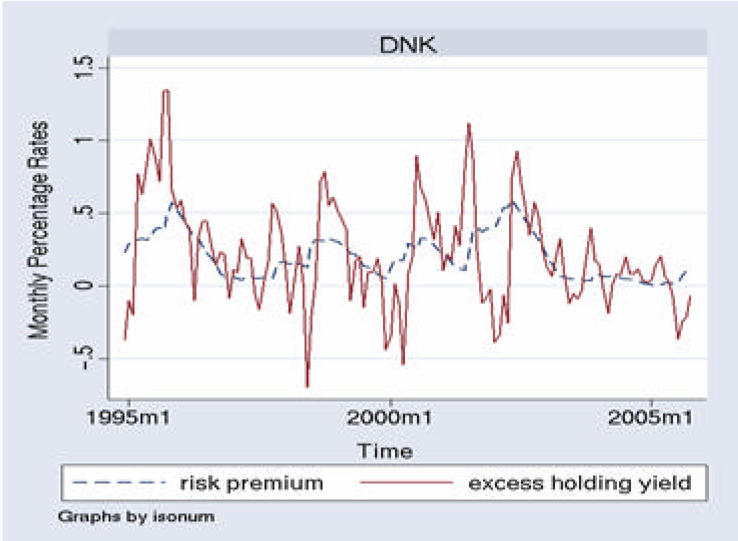
1.10 Czech Republic



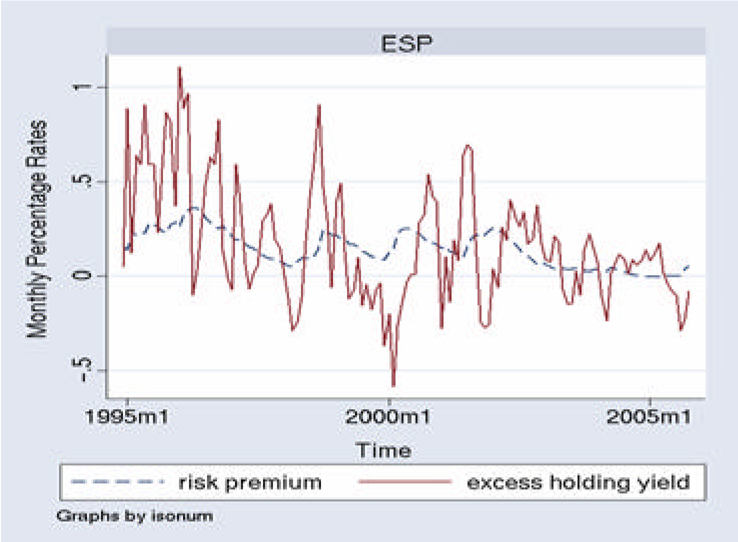
1.11 Germany



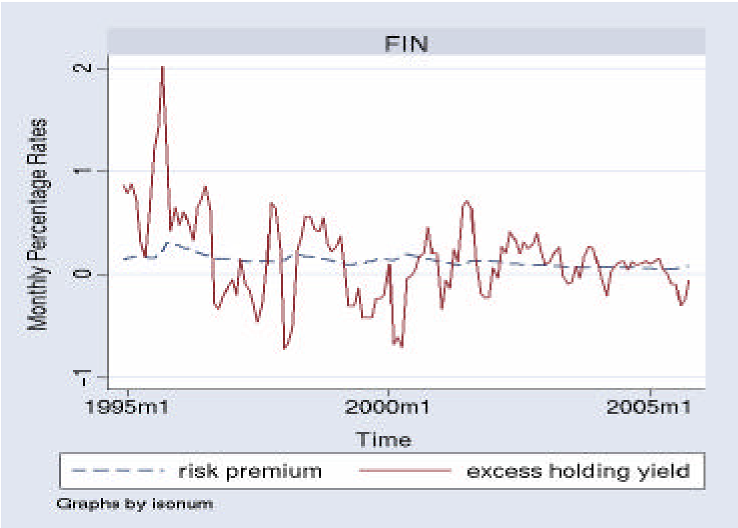
1.12 Denmark



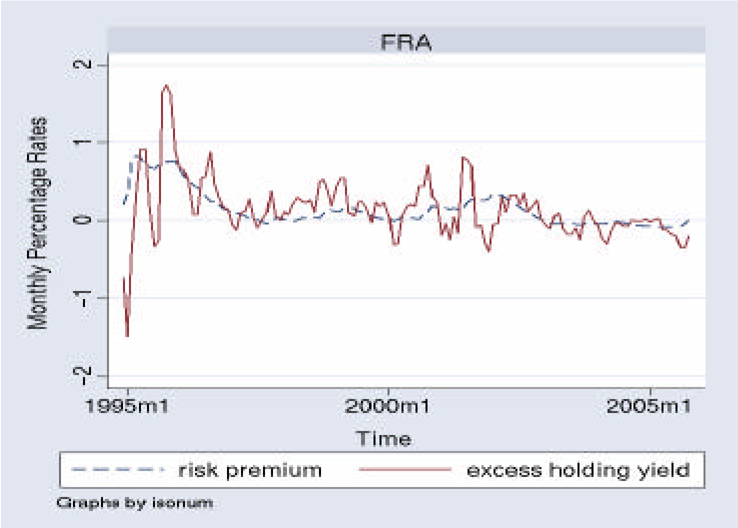
1.13 Spain



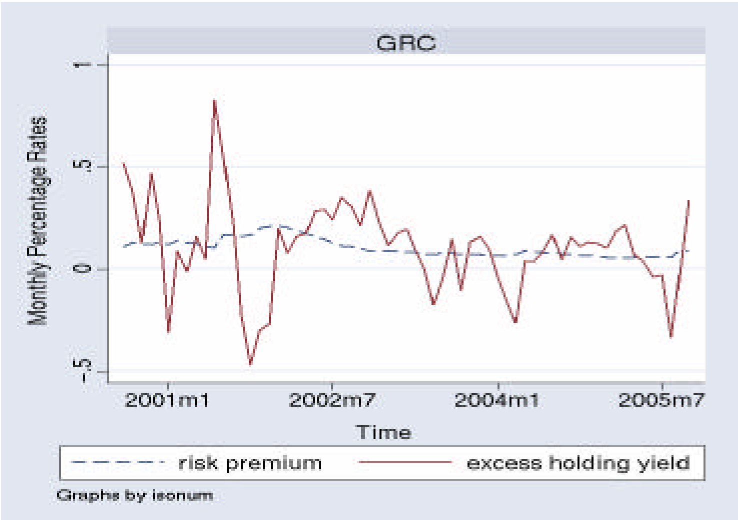
1.14 Finland



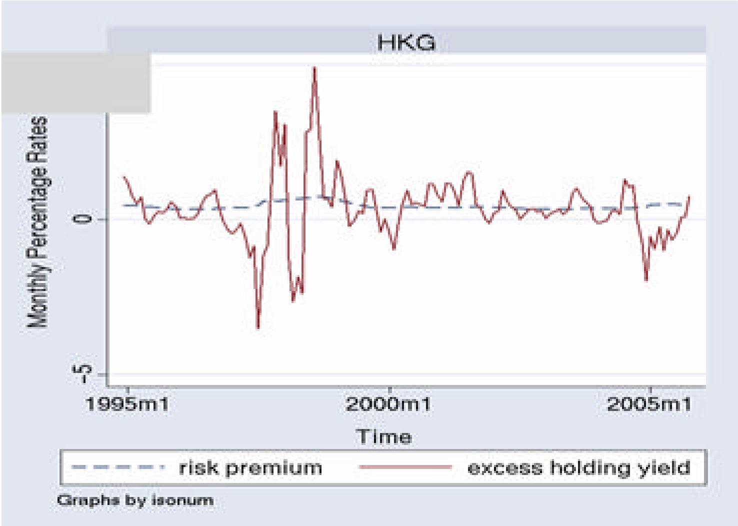
1.15: France



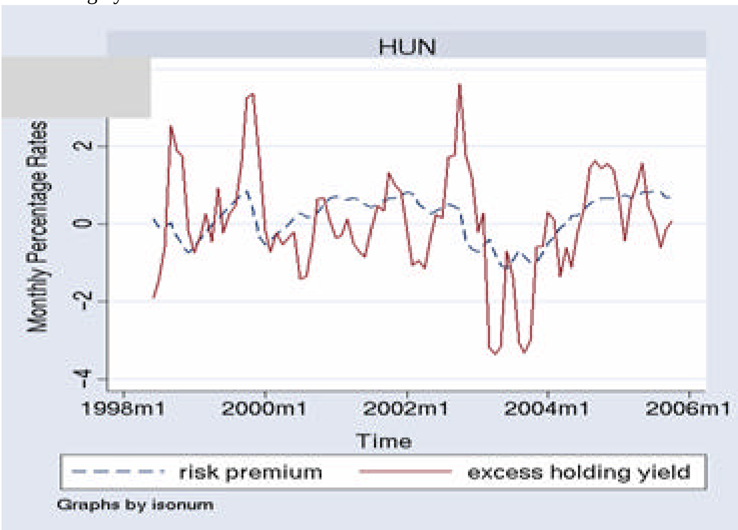
1.16: Greece



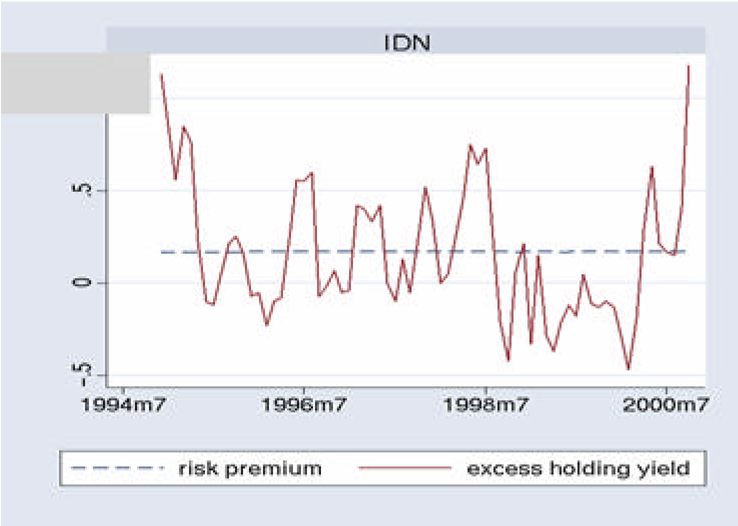
1.17 Hong Kong



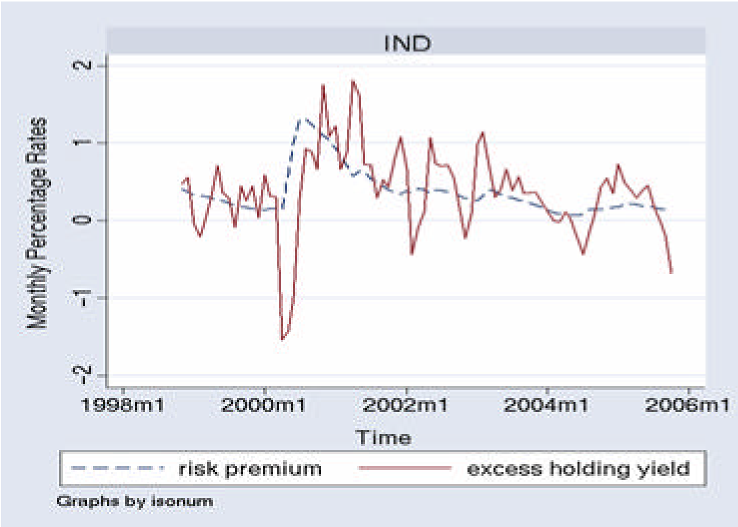
1.18: Hungary



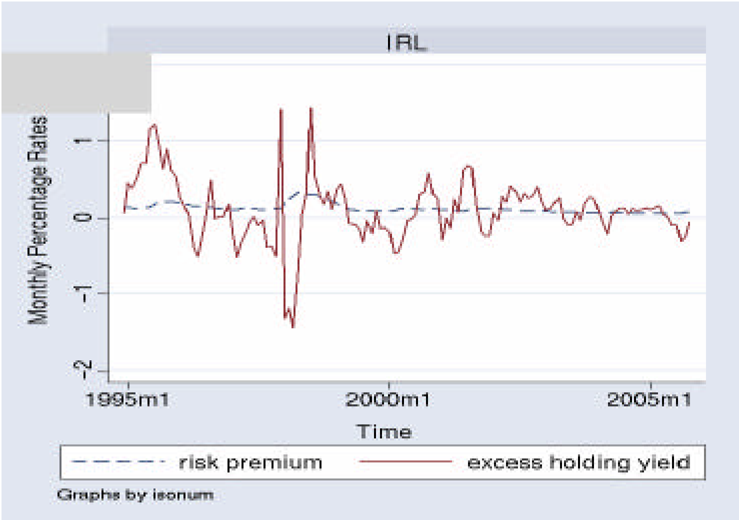
1.19: Indonesia



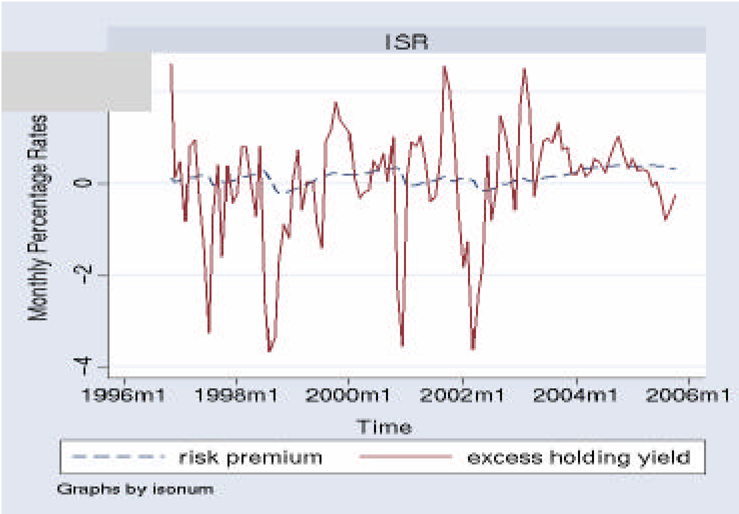
1.20: India



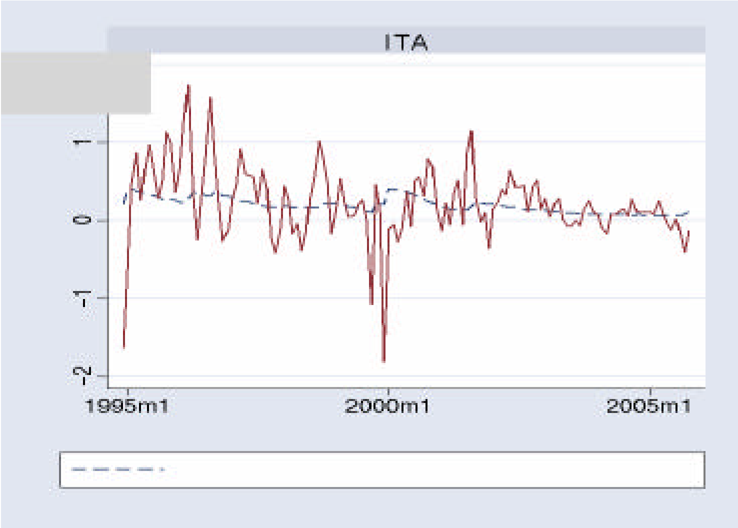
1.21: Ireland



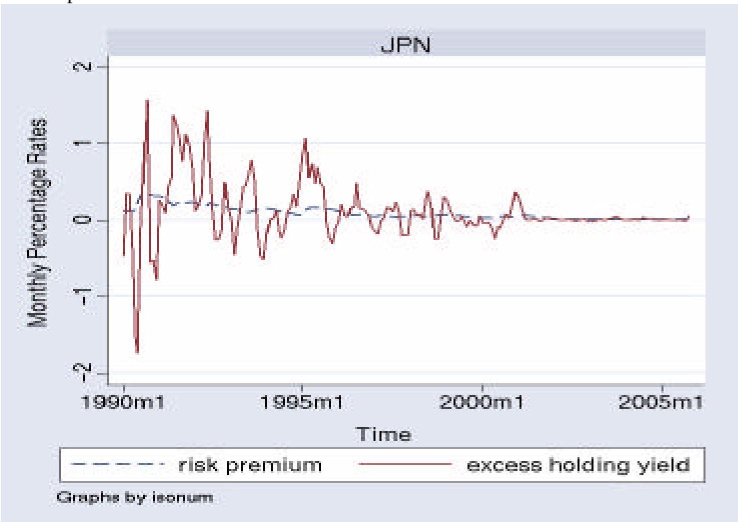
1.22: Israel



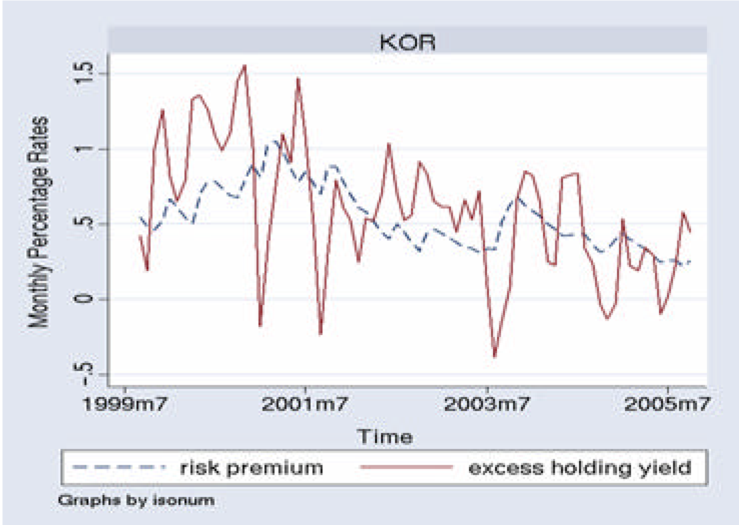
1.23: Italy



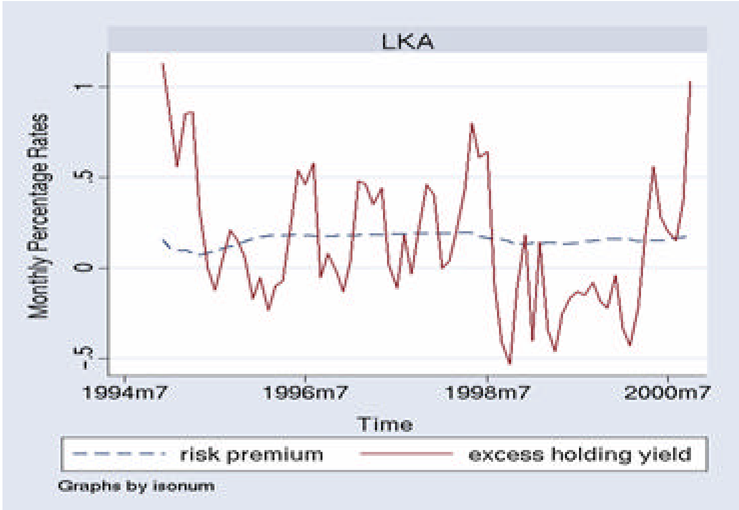
1.24: Japan



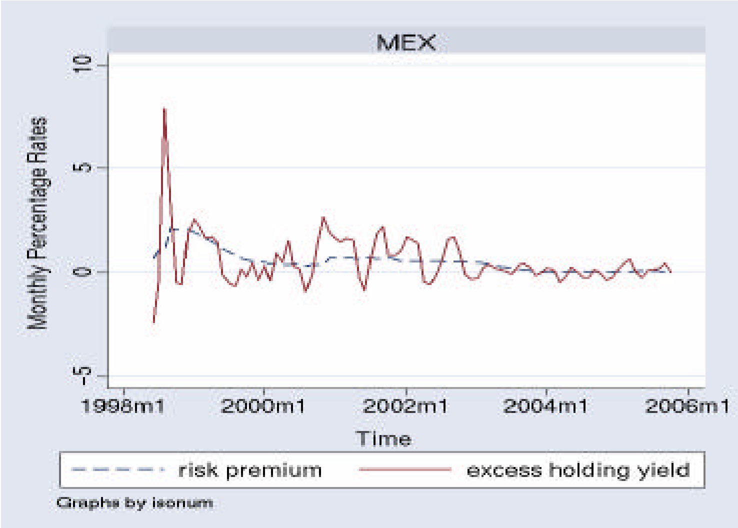
1.25: Korea



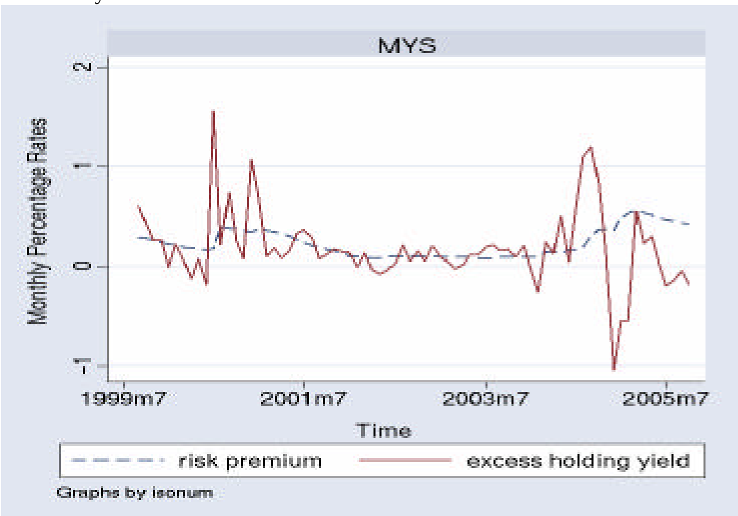
1.26: Sri Lanka



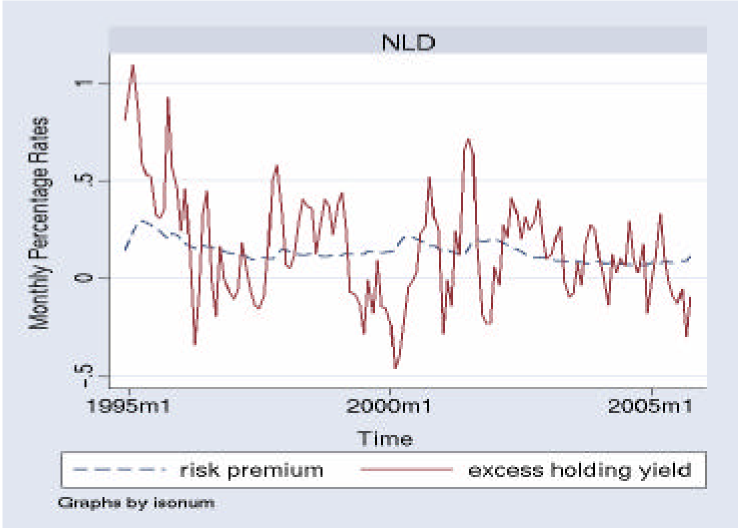
1.27: Mexico



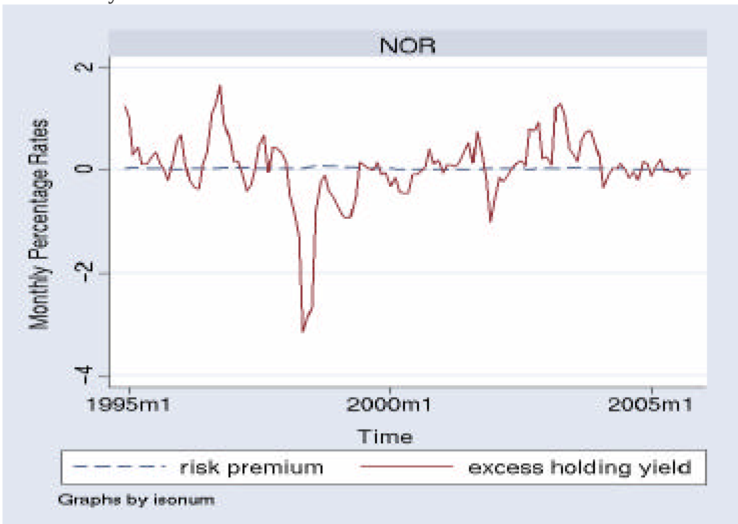
1.28: Malaysia



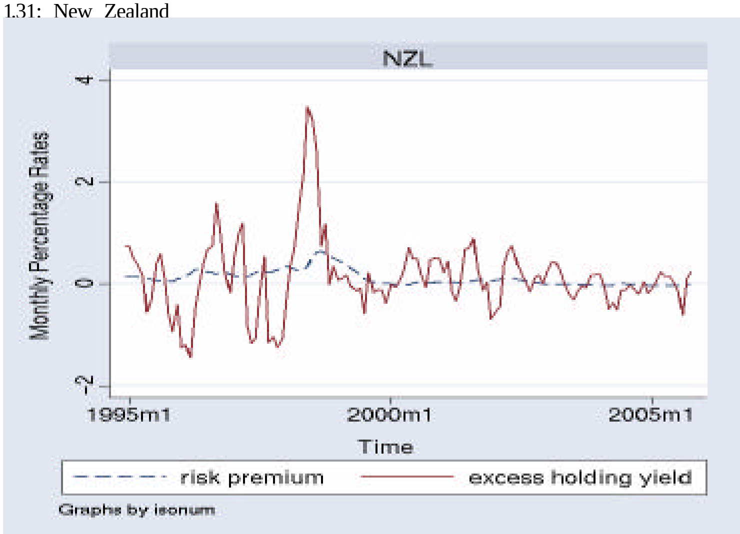
1.29: Netherlands



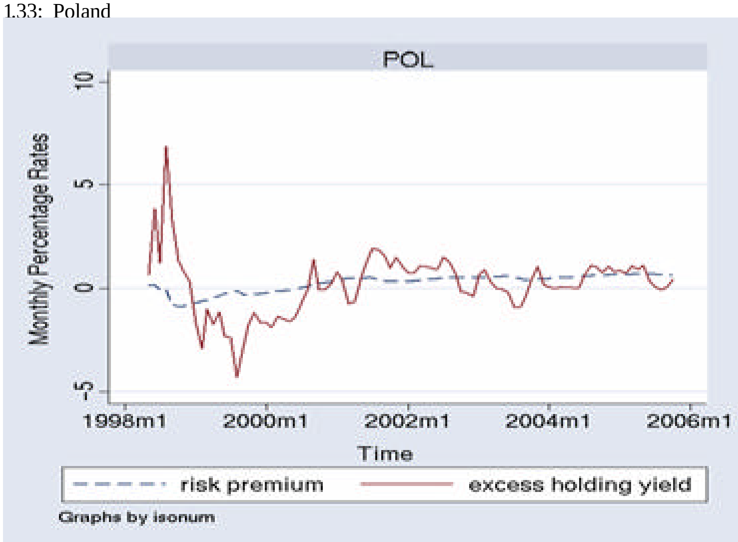
1.30: Norway



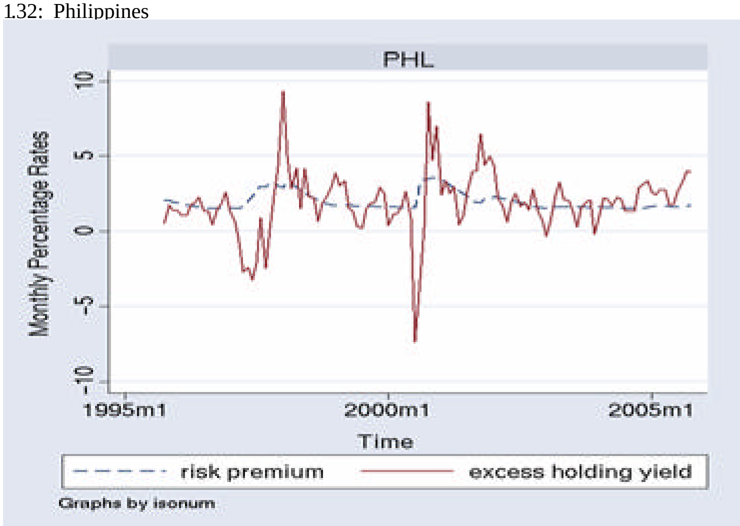
1.31: New Zealand



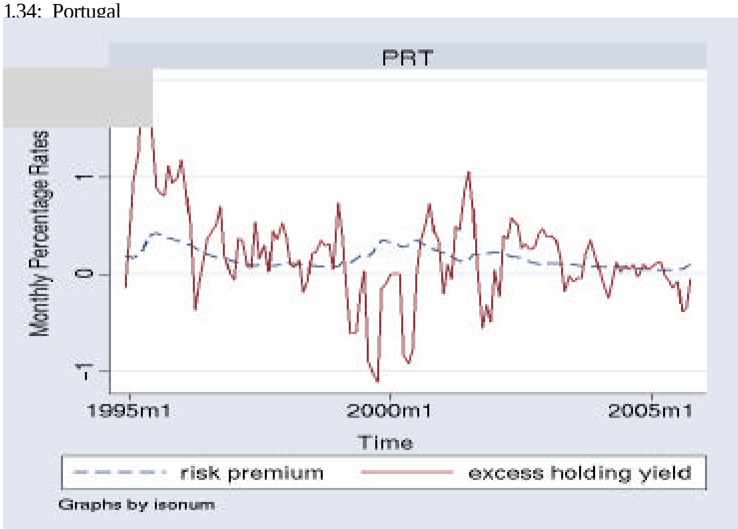
1.33: Poland



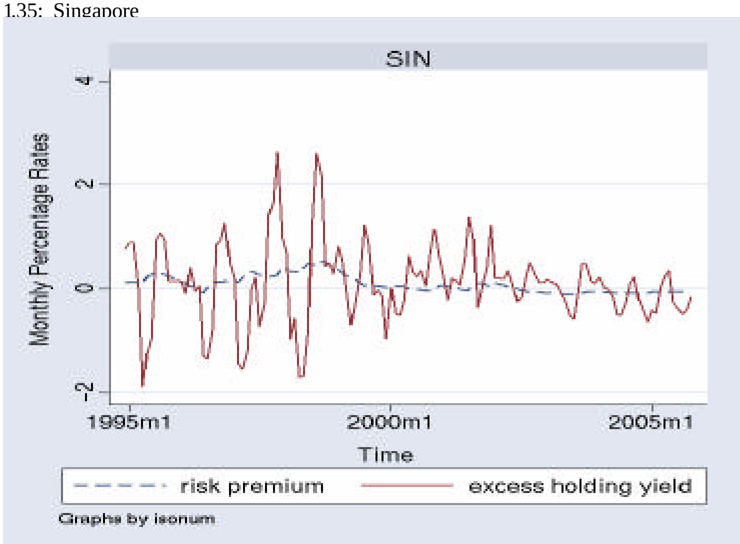
1.32: Philippines



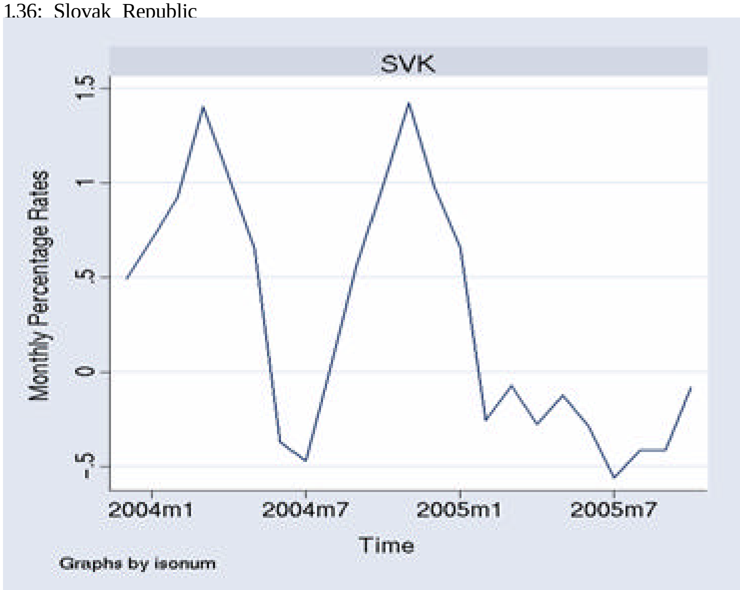
1.34: Portugal



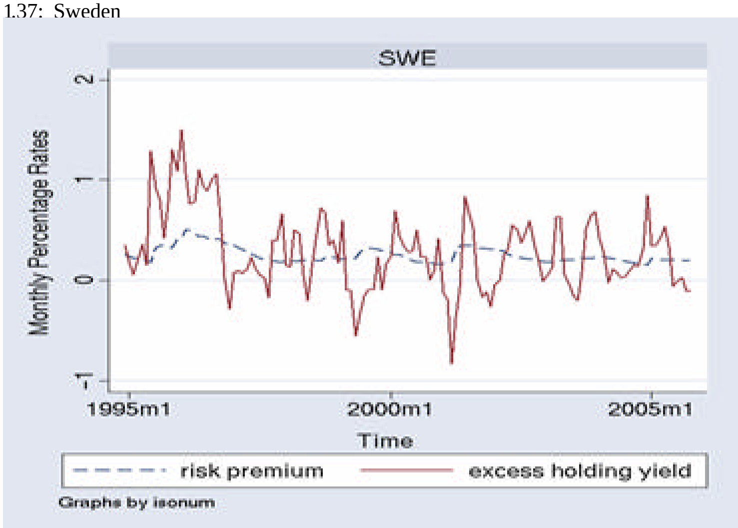
1.35: Singapore



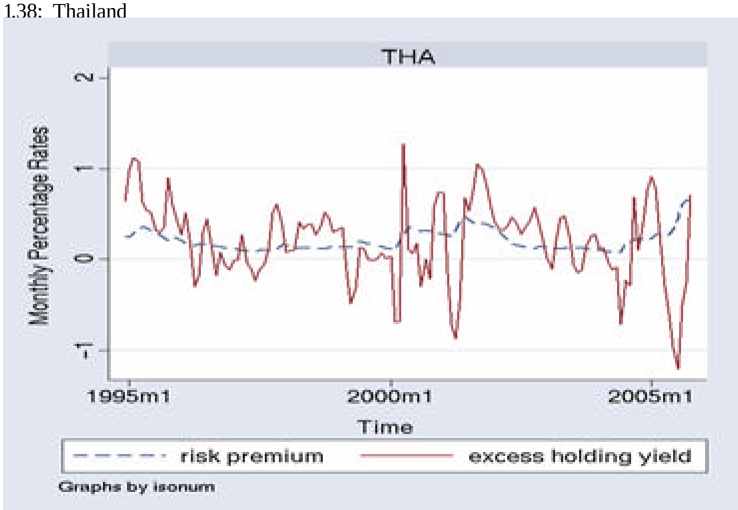
1.36: Slovak Republic



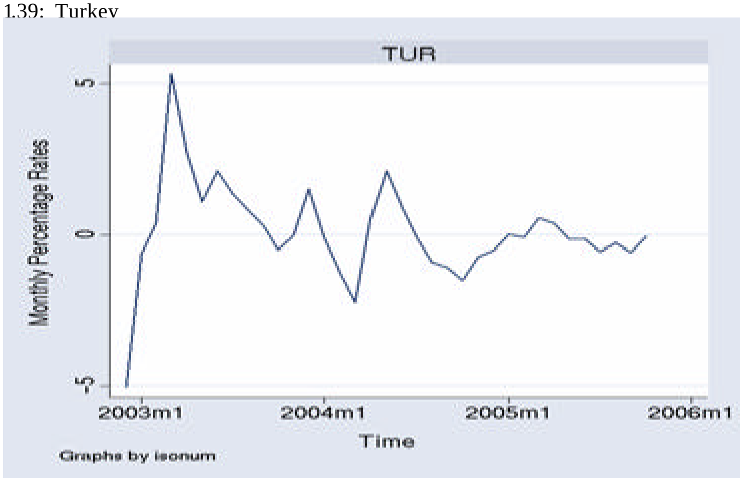
1.37: Sweden



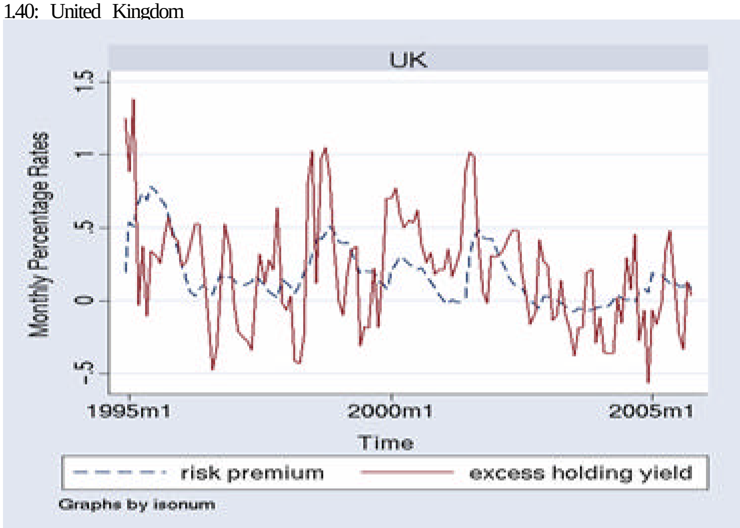
1.38: Thailand



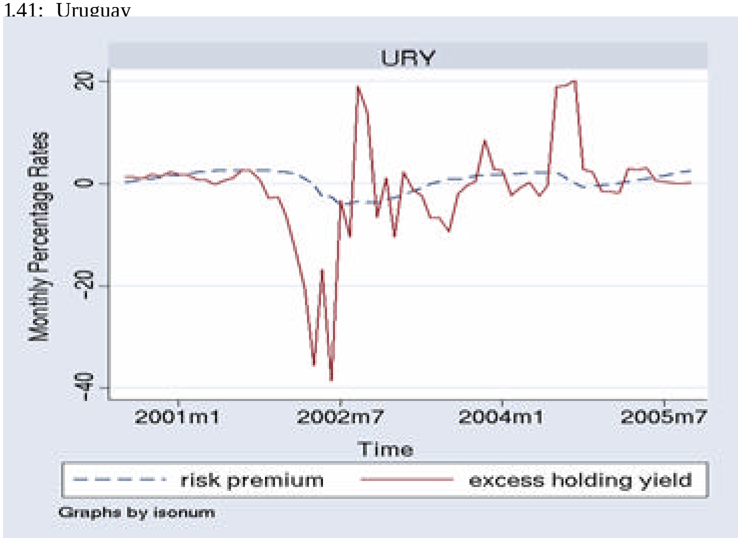
1.39: Turkey



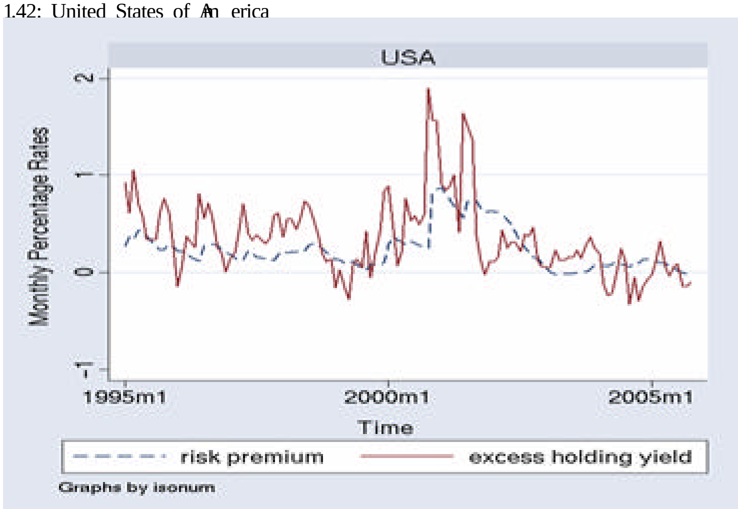
1.40: United Kingdom



1.41: Uruguay



1.42: United States of America



1.43: South Africa

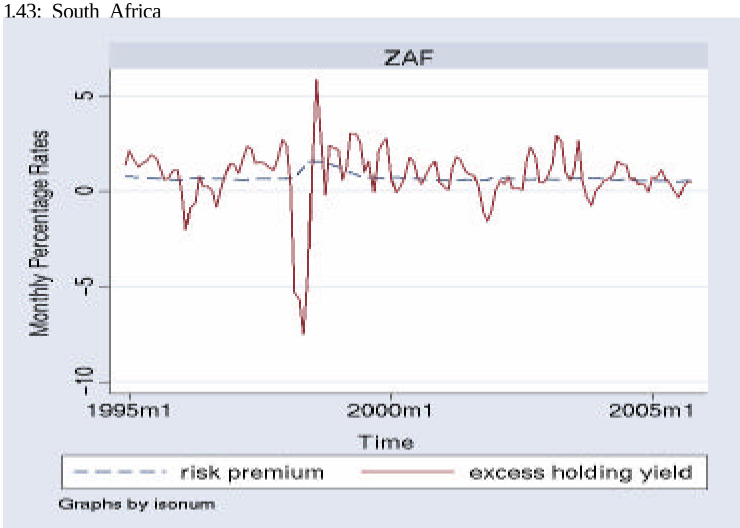


Figure 2 Risk Premium of sample countries over the period of 1994-2006

Figure 21: Average risk premium for 3 months versus 6 months treasury bills.

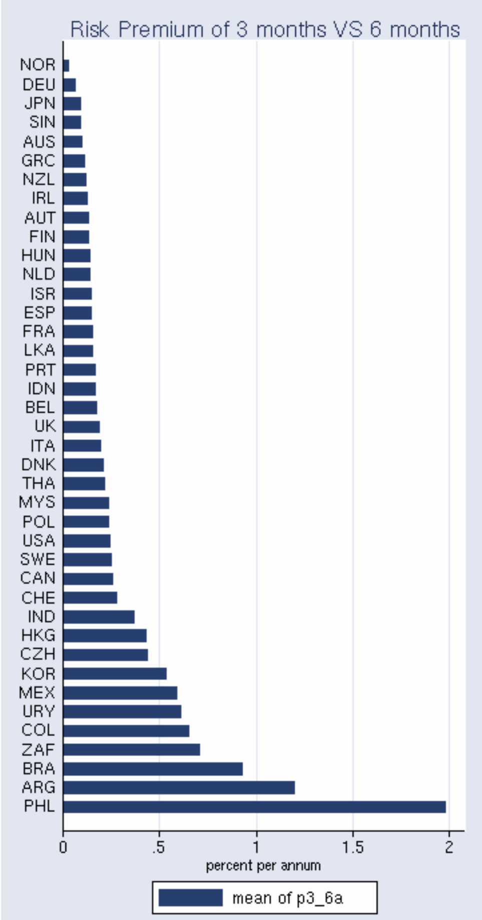


Figure 22: Average risk premium for 3 months versus 12 months treasury bills.

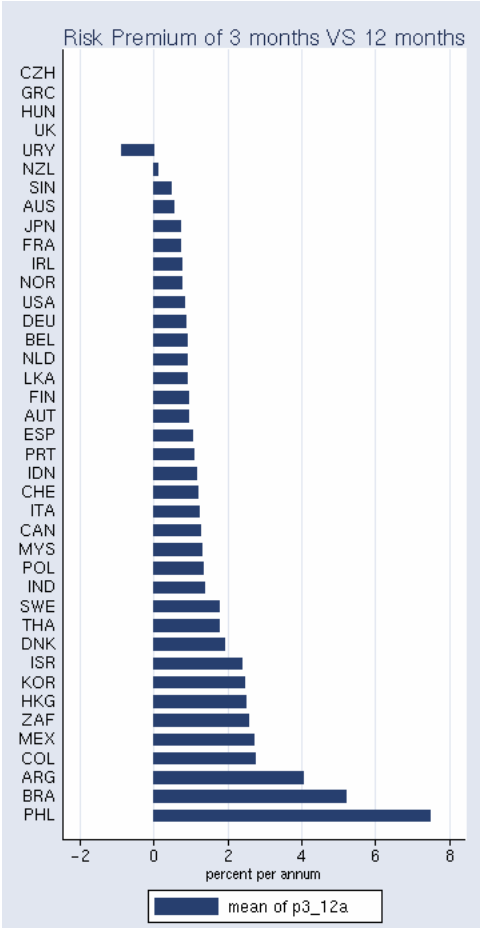
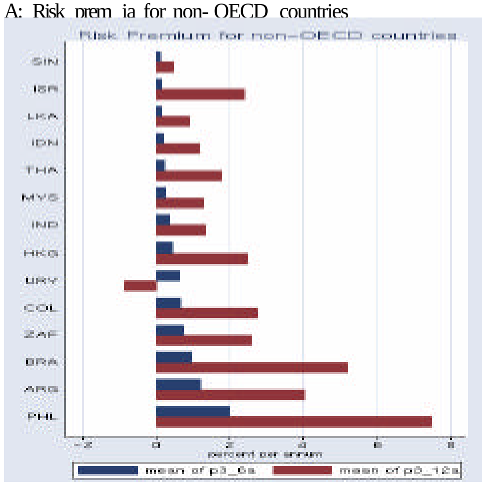


Figure 3.1: Risk premia comparisons by country groups

A: Risk premia for non-OECD countries



B: Risk premia for OECD countries

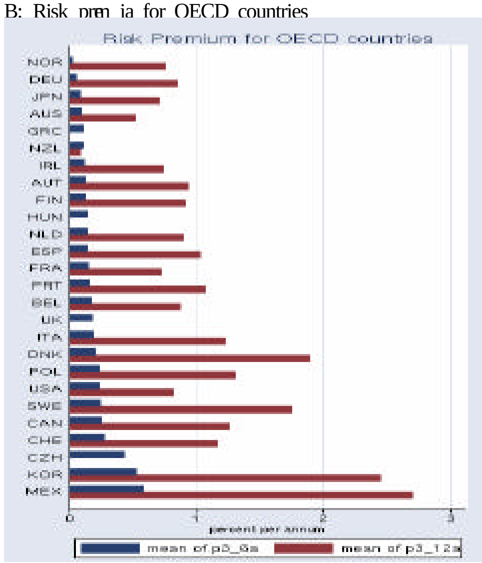
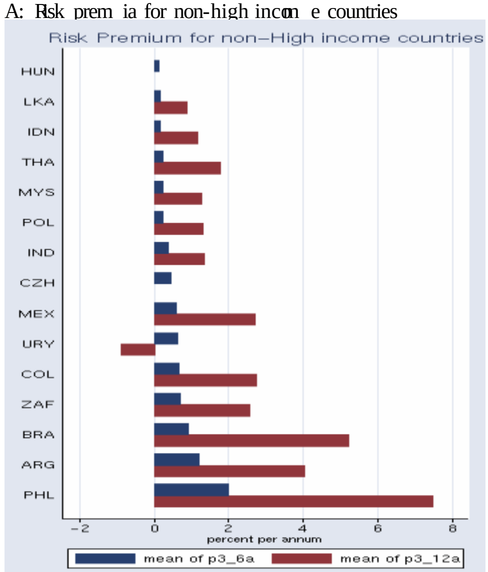


Figure 3.2: Risk premium comparisons by income

A: Risk premia for non-high income countries



B: Risk premia for high income countries

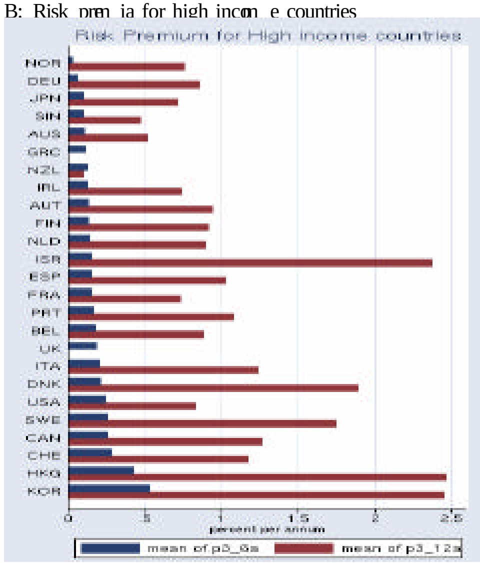


Figure 4: Variable plots, average 1994-2006

Figure 4.1: Initial level of income

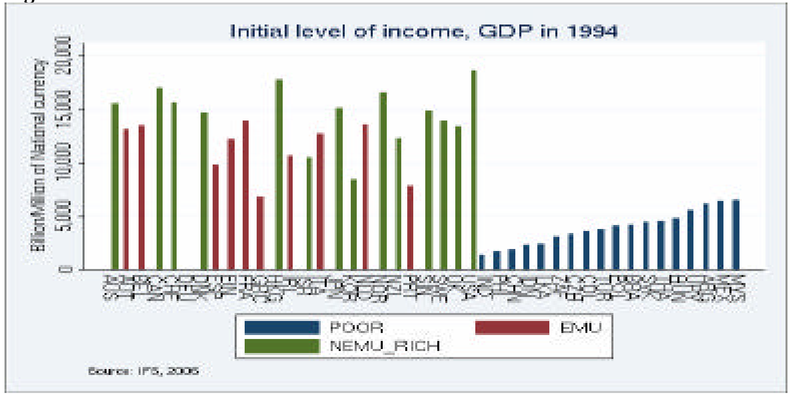


Figure 4.2: Average economic growth over 1994-2006.

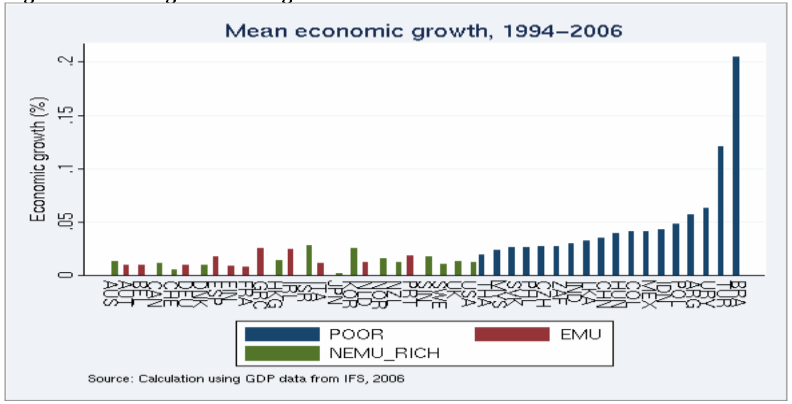


Figure 4.3: Average inflation over 1994-2006.

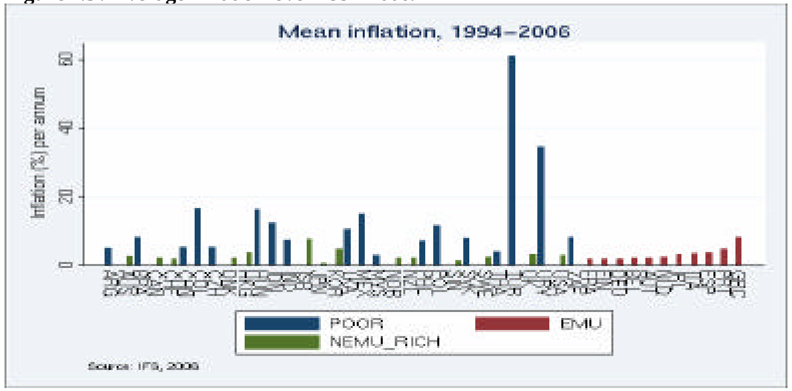


Figure 4.4: Average real effective exchange rate over 1994-2006.

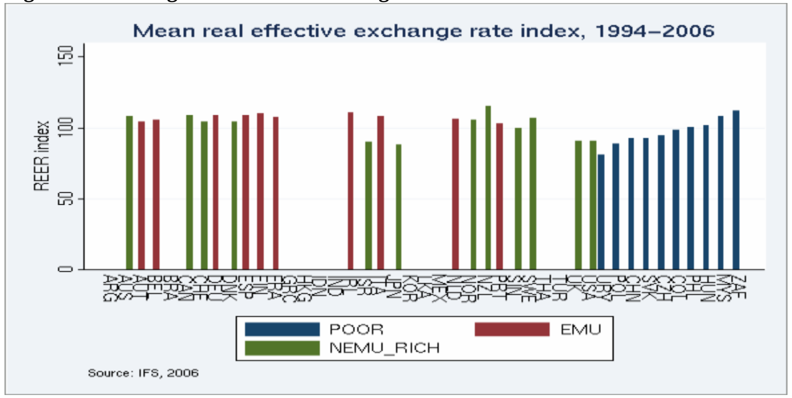


Figure 4.5: Average standard deviation of real effective exchange rate over 1994-2006.

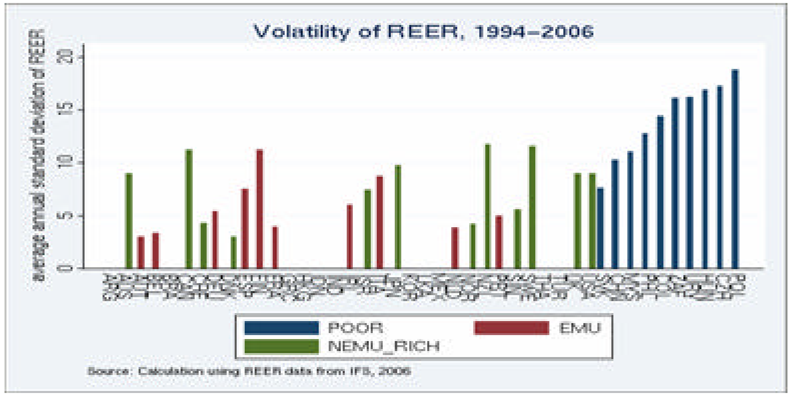


Figure 4.6: Government budget deficit (% GDP), 1994-2006.

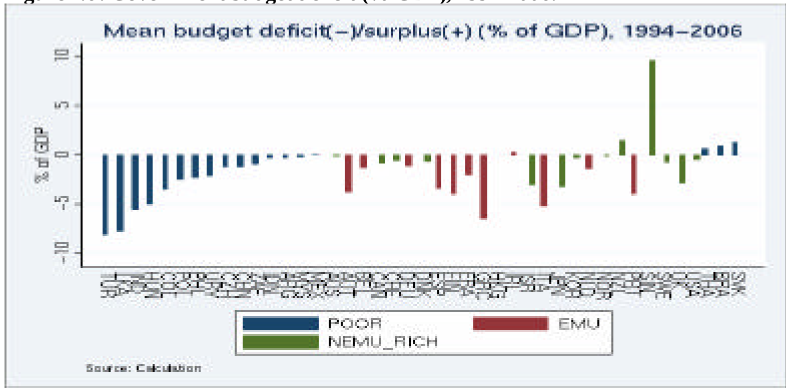


Figure 4.7 : Government debt (% GDP), 1994-2006

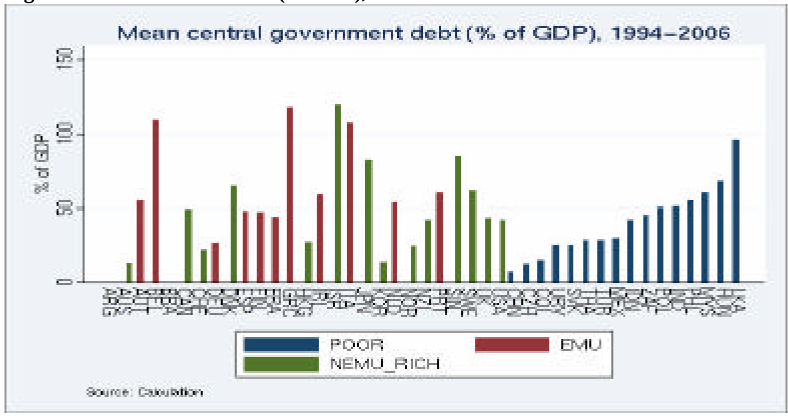


Figure 4.8 : Average political risk rating from International country risk guide (ICRG), 1994-2006.

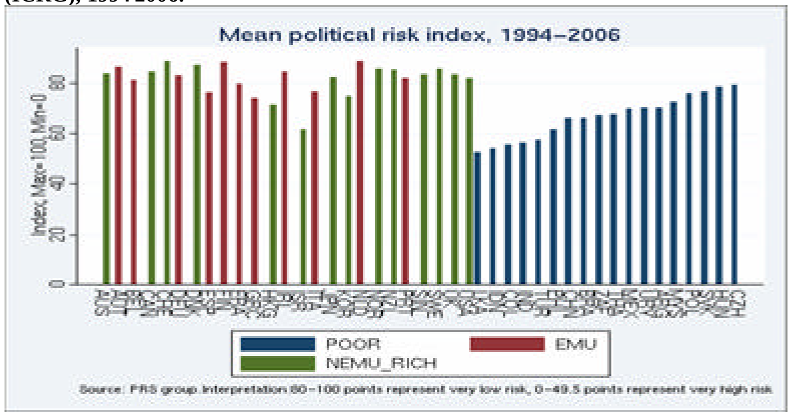


Figure 4.9 : Political constraint index (POLCON5), 1994-2006.

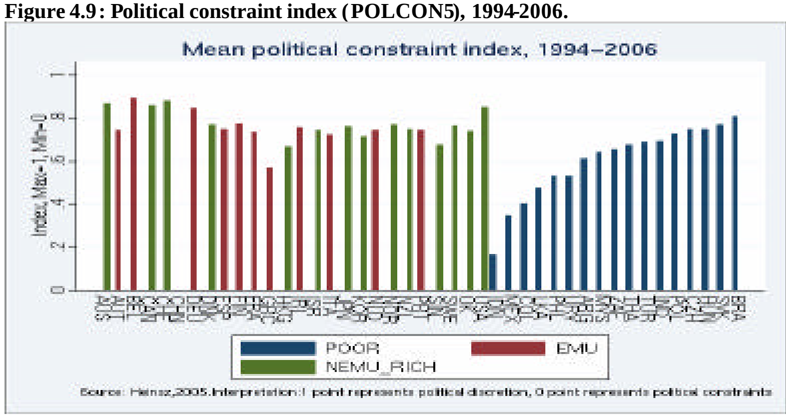


Figure 5: Bivariate regression plots of mean value of country's risk premia and explanatory variables (1994-2006).

Figure 5.1: Bivariate regression plots of the average risk premia and initial level of country's income

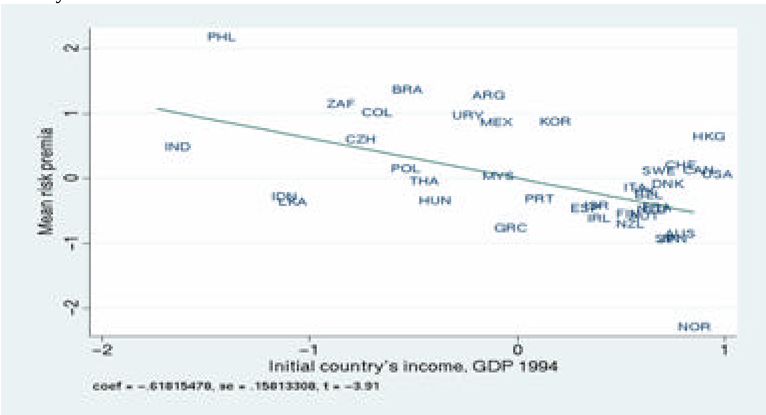


Figure 5.2: Bivariate regression plots of the average risk premia and economic growth.

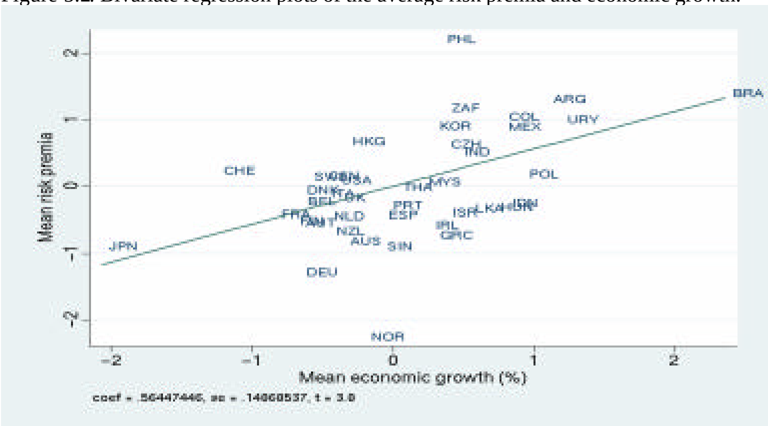


Figure 5.3: Bivariate regression plots of the average risk premia and inflation.

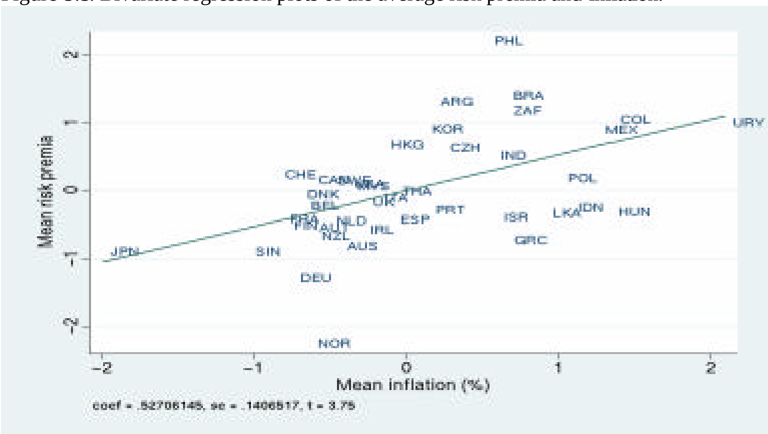


Figure 5.4: Bivariate regression plots of the average risk premia and real effective exchange rate

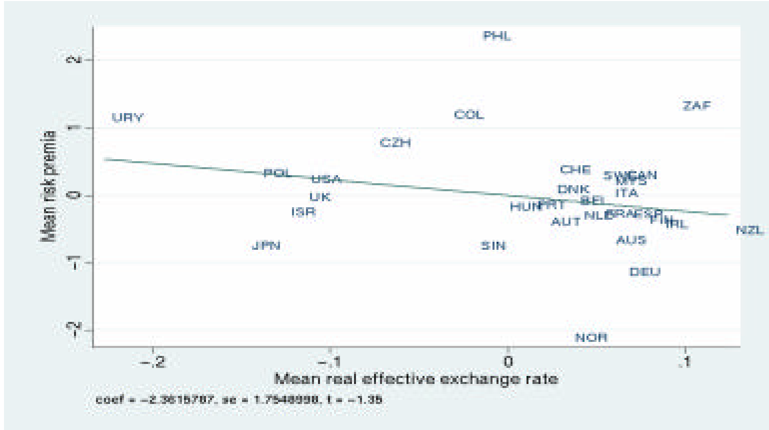


Figure 5.5: Bivariate regression plots of the average risk premia and volatility of the real effective exchange rate.

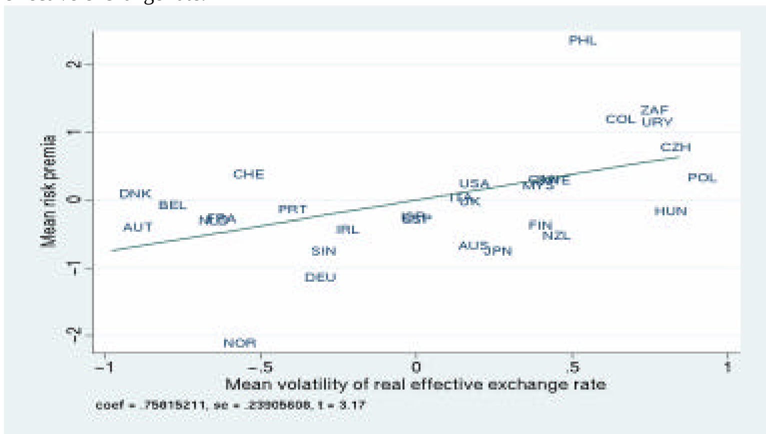


Figure 5.6: Bivariate regression plots of the average risk premia and government budget deficit (% of GDP)

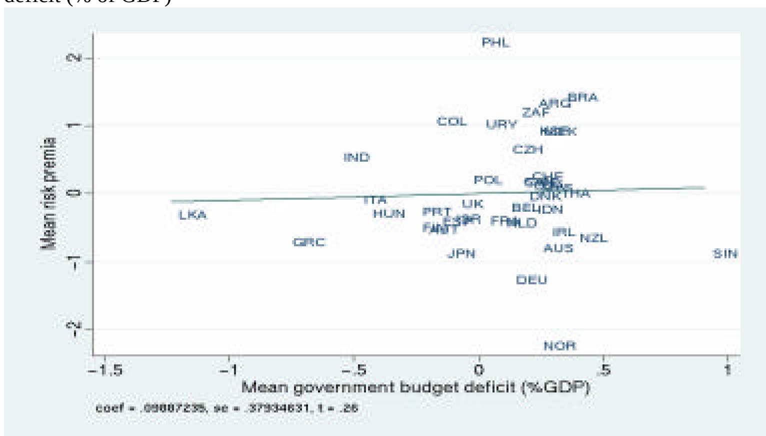


Figure 5.7: Bivariate regression plots of the average risk premia and government debt (% of GDP).

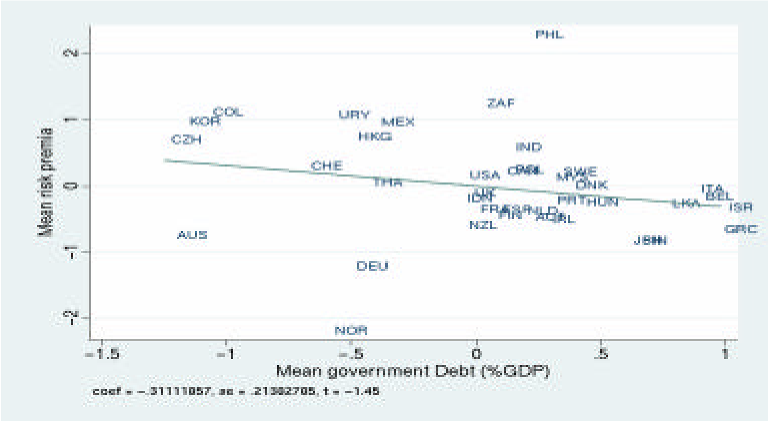


Figure 5.8: Bivariate regression plots of the average risk premia and the political risk index.

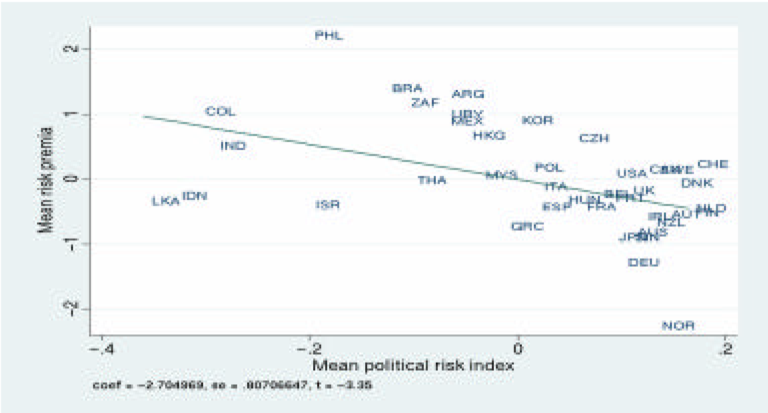


Figure 5.9: Bivariate regression plots of the average risk premia and the political constraint index.