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Determinants Of Sovereign Bond Spreads
A Comparative Analysis During The Global Financial Crisis

Halil Guler*, Anil Talasli**

Abstract

The main focus of this paper is to examine the effect of the recent global financial crisis on emerging countries' borrowing costs by implementing a panel data analysis. We propose an empirical assessment over the period 2006-2010 for seven selected emerging countries including Turkey. It is crucial for countries to investigate the determinants of borrowing costs which actively use international markets actively to access external financing. The determinants of borrowing costs can be classified into two groups: i) investors' risk appetite, ii) country specific macroeconomic fundamentals. The dataset is divided into two sub-groups to identify the relative effect of the global crisis on different emerging economies; the first sub-group covers 2006Q1-2008Q2 period while the second group consists of 2008Q3-2010Q2. The results indicate that the most significant determinants of sovereign bond spreads are the risk appetite and yields on alternative instruments. The paper also presents country specific analyses of the actual and fitted borrowing costs to derive whether a country's bond spread is overpriced or not.

JEL Classification: F34,G12.

Keywords: Sovereign spread, emerging markets, government bond spreads, market sentiment, fundementals.

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1. Introduction

The determinants of the sovereign bond spread, which is basically the difference between the yield on a country's USD-denominated debt securities and the same maturity of U.S. Treasury bonds, have always been subject of academic interest. The decline in spreads to all-time-low levels prior to the global financial crisis and the changes in spreads during the crisis have renewed the attention in this field.

The trend towards globalization since 1990's and the decline in international investment barriers have caused an upsurge in international capital movements. In addition, high average returns of the treasury bonds in emerging markets started to attract foreign investors and consequently caused a portfolio shift towards these assets (Gau and Liao, 2008).

After the burst of the equity bubble in 2000, major central banks have loosened monetary policy by cutting policy interest rates dramatically in order to foster economic growth. Loose monetary policies pursued in this period, both increased asset prices and encouraged banks to give longer term credits via low-cost short-term financing (Yılmaz, 2008). Excess global liquidity conditions during this period caused a significant decline in the borrowing costs of emerging countries from international markets. As a result, the outstanding international government debt securities has reached to USD 450 billion from USD 110 billion between 1993 and 2005 (Borensztein et al., 2006).

Global liquidity conditions have reversed beginning from May 2006 and most of the emerging countries including Turkey have experienced foreign capital outflows. The market turmoil of summer 2007 has become a systemic crisis with the bankruptcy of Lehman Brothers in September 2008 and the distress in global financial markets accelerated foreign capital outflows from emerging countries. The rapid capital outflows from emerging markets including Turkey caused sovereign bond spreads to widen significantly.

The recent crisis had a higher effect on the spreads of countries which were exposed to external financing, had unfavorable debt dynamics and high fiscal imbalances.

We aim to analyze how the sovereign bond spreads of emerging countries have evolved in what direction and to what extent during the global financial crisis. To this end, we develop a panel data consisting of seven emerging countries[1] which covers quarterly data during the period first quarter 2006 and second quarter 2010.

[1] The emerging countries in this study are Brazil, Argentina, Russia, Hungary, South Africa, China and Turkey.

The remainder of this paper is structured as follows. Section II reviews the existing literature on sovereign bond spreads, with a particular emphasis on Emerging Market Bond Index (EMBIG) calculated by JP Morgan. Section III discusses the determinants of sovereign bond spreads. Section IV provides information about the dataset and the estimation methodology while Section V provides details on estimation results and specification results. Firstly, the econometric model is run with the whole dataset and then the data is divided into two sub-groups to identify the effect of the global financial crisis. The econometric analyses for the periods 2006Q1-2008Q2 and 2008Q3-2010Q2 are presented in Section III. Panel data analysis method is implemented and heterogeneity across countries is investigated. Then, the final models are specified by running specification tests on random effects. Section VI presents the main conclusions and remarks. The last section also provides analyses of the actual and fitted sovereign bond spreads for each selected country.

2. Literature Review on Sovereign Bond Spreads

The empirical analysis of government bond spreads goes back to Edwards (1984) who first connected sovereign spreads to the market perception of countries' risk of default. He claims that sovereign spreads can be explained by a set of domestic as well as international macroeconomic, fiscal and financial variables which form investors' assessment of a country's creditworthiness.

Eichengreen and Mody (1998) analyze the determinants of spreads on emerging market debt and find that market sentiment not obviously related to fundamentals drives the spread by large amounts over short-time horizons.

Ferrucci (2003) examines the determinants of emerging market sovereign bond spreads by implementing a ragged-edge panel of JP Morgan EMBI and EMBI Global secondary market spreads and a set of macro prudential indicators. He uses the model to get benchmark market spreads and assess whether the sovereign risk is overpriced or underpriced. He finds that a debtor country's fundamentals and external liquidity conditions are important determinants of bond spreads.

Alexopoulou et al. (2009) provide an empirical assessment of the role of fundamentals in driving long-term sovereign bond spreads. They implemented a dynamic panel error correction model and analyze the effect of fundamentals on bond spreads of the new EU countries. They find that countries' external debt levels, fiscal and current account balances,

Exchange and inflation rates, degree of trade openness and short-term interest rate spreads play an important role in the new EU countries' long-term sovereign bond spreads.

Dumicic and Ridzak (2010), analyze the effect of the recent crisis on sovereign bond spreads for Central and Eastern European countries. They test to what extent the change in sovereign spreads is related to changes in market perception and what is the role of country specific fundamentals. The results suggest that the dynamics of spreads can be explained by risk appetite, macroeconomic fundamentals and EU accession process.

Rowland and Torres (2004) identify the determinants of spread over US Treasuries of 16 selected emerging market sovereign bonds and creditworthiness of the issuers by using a panel-data framework. They find that economic growth rate, debt-to-GDP ratio, reserves-to-GDP ratio, and debt-to-exports ratio are significant explanatory variables for both the spread and the creditworthiness.

There also exist studies in the literature investigating the determinants of spreads for individual countries other than implementing panel data for a set of countries. For example, Budina and Manchev (2000) analyze empirically the importance of domestic fundamentals for pricing the Bulgarian Brady bonds in the secondary market. They find positive impact of gross foreign reserves and exports and negative impact of real exchange rate and Mexican nominal exchange rate depreciation on prices of Brady bonds in the long-run. The authors claim that the Asian crisis has a negative effect and the change in political regime and the introduction of currency board in Bulgaria has a positive impact on Bond prices in the short-run.

Rojas and Jaque (2003) study the determinants of the Chilean sovereign spread using OLS estimation. They find debt-to-reserves ratio, exports, economic activity and US interest rates as significant variables on sovereign spreads.

JP Morgan Emerging Market Bond Spreads

The yield spread of a US dollar denominated bond is basically defined as the difference in yield between the bond and a benchmark US Treasury bond of a similar maturity. This study uses J.P. Morgan EMBIG (Emerging Markets Bond Index Global) index as dependent variable in examining the factors that determine emerging market spreads.

JP Morgan started to publish EMBI index at the end of 1991. Bonds had to meet strict liquidity criteria to be included in EMBI index and consequently there were only five countries in the original EMBI. On the other hand, the EMBI Global, introduced in January

1998, uses a more relaxed liquidity criterion and thus includes a broad set of emerging market debt instruments. The EMBI Global is a benchmark index which is the most comprehensive and available data to analyze sovereign bond spreads.

While the countries to be included in the EMBI must be rated BBB+ or lower by Standard & Poor's, countries under the EMBI Global only need to satisfy one of the following criteria: (i) classified as having low or middle per capita income by the World Bank; (ii) has restructured external or local debt in past 10 years; or (iii) currently has restructured external or local debt outstanding.

The EMBI Global – like the EMBI – considers for inclusion emerging markets issues denominated in U.S. dollars, with a minimum current face outstanding of US$500 million and at least 2½ years to maturity. The EMBI Global only requires that easily accessible and verifiable daily prices, either from an interdealer broker or JP Morgan source, be available for the given instrument.

3. Determinants of Sovereign Bond Spreads

There exist numerous economic, social, and political factors that determine countries' sovereign spreads and creditworthiness. However, majority of these determinants cannot be represented in numerical values (Cantor and Packer, 1996). Some of the variables are described below as potential determinants; macroeconomic, liquidity and external shock variables:

a) Real GDP growth rate: High economic growth rates are generally associated with strong fiscal position hence countries with higher growth rates have lower sovereign spreads.

b) Inflation rate: Inflation rate is usually used as a proxy of government's fiscal discipline. Higher inflation rates are in general associated with political instability and therefore higher sovereign spreads.

c) Debt-to-GDP ratio: Although the maturity structure and yield of a country's debt also affect the country's creditworthiness, the higher debt is generally associated with the higher default risk. In other words, a higher debt-to-GDP ratio leads to a higher spread on sovereign bonds.

d) Current account balance as a percentage of GDP: Current account deficit is a condition where a country's gross savings is below its consumption. Consequently,

a large current account deficit means that the country relies on funds from abroad. Persistent current account deficits generate concerns about the sustainability of external debt and adversely affect sovereign spreads.

The liquidity variables related to the country's ability to pay its short-term debt. The foreign currency debt has to be paid by country's international reserves, hence export performance and foreign reserves become crucial variables in determining the sovereign spreads.

a) International reserves as a percentage of GDP: Low levels of international reserves are associated with high default risk and consequently lead to elevated sovereign spreads.
b) Exports as a percentage of GDP: Export revenues have direct effect on international reserves and hence the country's ability to pay its foreign debt. High export-to-GDP ratio normally leads to a lower default risk and sovereign spreads.

The variables related to external shocks related to those which capture the external shocks to the economy. There exist a number studies in the literature about the impact of international interest rates to sovereign spreads of emerging economies[2] and the yield on U.S. 10 year Treasury bond with the Volatility Index (VIX) are used as variables to capture external shocks.

a) 10-year U.S. Treasury bond rate: The yield of 10-year U.S. Treasury bond is a good proxy for global liquidity conditions and there exists a correlation between the yield and the capital flows to/from emerging countries. During turbulent times, investors increase their 10 year U.S. Treasury bond holdings by reducing risky assets in their portfolios. Flight-to-quality concept leads to capital outflows from emerging markets and cause an upward pressure in sovereign spreads.
b) Volatility index (VIX)[3]: Since investors' risk appetite affect the borrowing costs of emerging economies, we include the volatility index in our model capture this effect. VIX is generally used as a proxy for global risk appetite and an increase

[2] See, for example, Arora and Cerisola (2000) and Hartelius et al. (2008) find a positive correlation, Eichengreen and Mody (1998), McGuire and Schrijvers (2003), and Uribe and Yue (2006) find a negative relationship, while Kamin and von Kleist (1999), Sløk and Kennedy (2003), and Baldacci et al. (2008) find the relationship insignificant.

[3] The VIX is a measure of the market's expectation of stock market volatility over the next 30 day period. It is calculated with the prices for a range of options on the S&P 500 index. For additional information, see http://www.cboe.com/micro/VIX/vixintro.aspx

in the index means a reduction in risk appetite which leads sovereign spreads to widen.

These two variables representing external shocks are important for our model since the dataset covers the recent global financial crisis period when the explanatory power of external liquidity conditions on sovereign spreads is thought to be robust and significant.

4. Methodological Issues and Data

We discuss the effects of the recent financial crisis on the borrowing costs of emerging countries by using a quarterly data in a panel data framework. The data consists of sovereign spreads for seven emerging countries covering the period from first quarter of 2006 to second quarter of 2010. We collect the data used in this study from International Financial Statistics (IFS) and Bloomberg.

Table 4.1. Data and Data Sources

Data Series	Source	Expected Sign
Dependent Variable		
EMBI Global Country Spread	JP Morgan	
Explanatory Variables		
Real GDP Growth (%)	IMF, IFS	-
Budget Balance/GDP (%)	IMF, IFS	-
International Reserves/GDP (%)	IMF, IFS	-
CPI Inflation (%)	IMF, IFS	+
Exports/GDP (%)	IMF, IFS	-
Current Account Balance/GDP (%)	IMF, IFS	-
VIX Index	Bloomberg	+
10-year US T-Bond rate (%)	Bloomberg	-

We first use a model covering the whole dataset and then present the model results for two sub-sets of the data. The first sub-group covers 2006Q1-2008Q2 period while the second group consists of 2008Q3-2010Q2. We conduct empirical analysis by using a panel data framework, then estimate the model for the two sub-sets and control for country heterogeneity. Statistical tests are conducted in order to test for random effects and we finally decide for the appropriate model to be used for the estimations.

4.1. The Model

We estimate two panel regression models; i) fixed-effects, and ii) random effects model. We use the following equations for the regression models as follows:

$$y_{it} = x_{it}\beta + u_{it} \quad \text{where} \quad u_{it} = \alpha_i + \varepsilon_{it} \quad \text{, for fixed-effects model}$$

$$y_{it} = \alpha + x_{it}\beta + u_{it} \quad \text{where} \quad u_{it} = \alpha_i + \varepsilon_{it} \quad \text{, for random-effects model}$$

We estimate the models with the log of countries' bond spreads (y_{it}) as the dependent variable and a matrix of explanatory variables (x_{it}), where subscript i denote the countries and t is the time subscript.

4.2. Variables and Some Stylized Facts

This section presents some descriptive analysis and discusses the evolution of sovereign spreads and explanatory variables by specifically focusing on Turkey. With the bankruptcy of Lehman Brothers in September 2008, the financial crisis became more systemic and the sovereign bond spreads of all selected emerging countries displayed sharp increases with foreign capital outflows (Figure 4.1).

Figure 4.1. Evolution of J.P. Morgan EMBIG Spreads

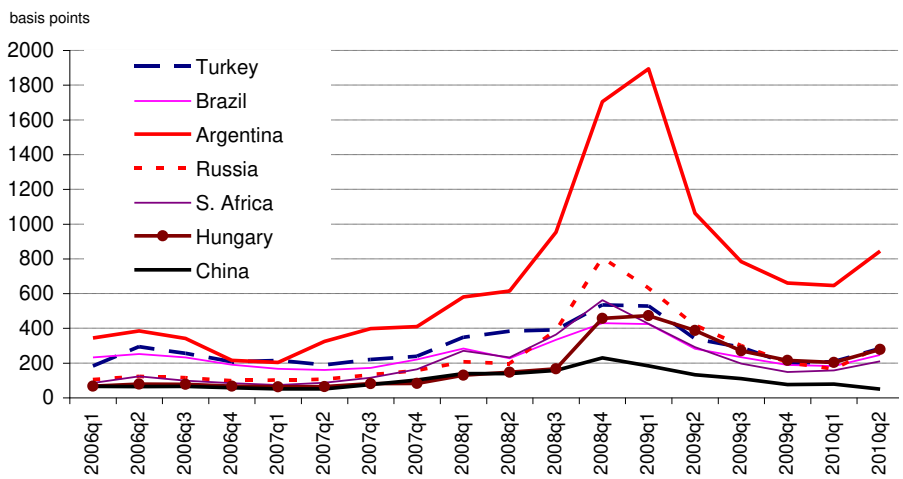
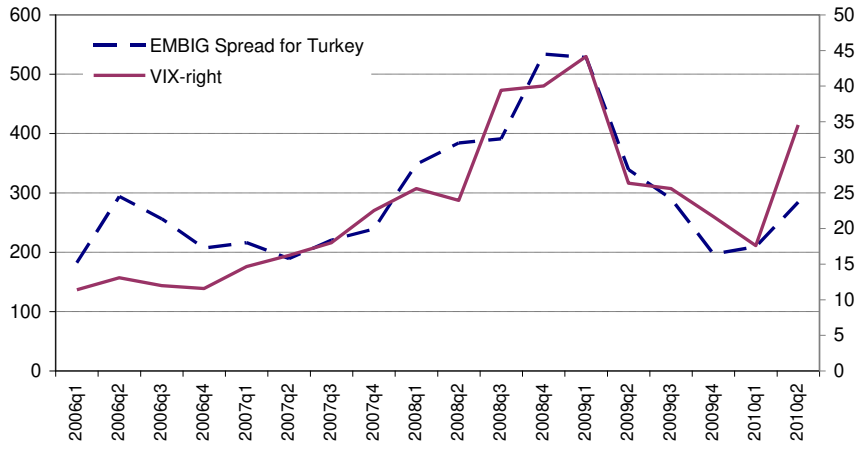


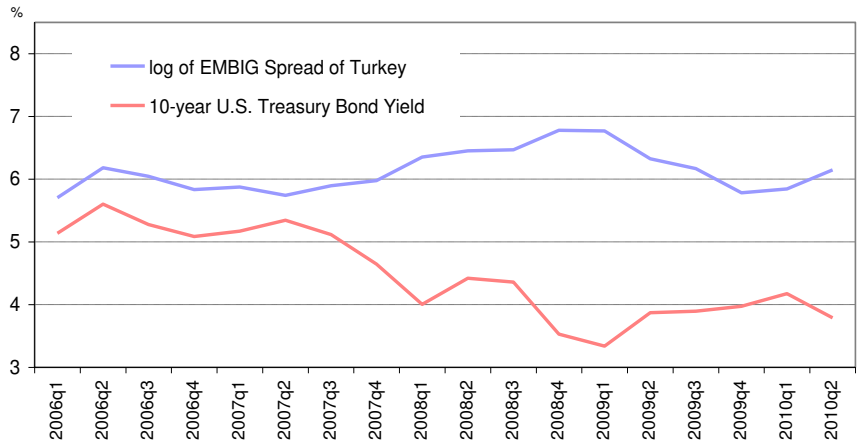
Figure 4.2. presents the relationship of the VIX which captures the investors' risk sentiment and Turkish sovereign bond spread index. The positive relationship between these two variables is quite obvious as seen from the graph. The investors' risk appetite showed a significant deterioration especially at the end of year 2007 and Turkish sovereign spreads widened during this period.

Figure 4.2. Evolution of Turkey's J.P. Morgan EMBIG Spread and VIX



As mentioned in Section 3, the yield of 10-year U.S. Treasury bond is a proxy for global liquidity conditions and during turbulent times investors increase their 10-year U.S. Treasury bond holdings. This flight-to-quality concept can be clearly seen in Figure 4.3 where the decline in U.S. Treasury bonds leads to a widening of Turkish sovereign spreads.

Figure 4.3. Evolution of log of Turkey's EMBIG Spread and the yield of 10-year U.S. Treasury Bond



The relationships between some potential macroeconomic variables and the sovereign bond spread of Turkey are presented below. Turkey's GDP has contracted as a result of the global financial crisis especially between 2008Q4-2009Q4, and Turkish sovereign spreads were widened as expected during this period (Figure 4.4). The international reserves-to-GDP ratio seems to have a one period lagged effect on the sovereign spread and the upsurge in the ratio in 2009 is as a result of the drastic contraction in growth rates. As mentioned before, high inflation rates are generally associated with political and fiscal instability, hence economic theory predicts a positive relation between inflation rates and sovereign spreads. However, the positive relationship between these two variables is not obvious for Turkey for the pre-crisis period (Figure 4.6). Before the global financial crisis, the inflation in Turkey declined due to favorable food and oil prices while the risk appetite has deteriorated which led foreign capital outflows. A negative relation between current account balance to GDP ratio and sovereign spread holds for Turkey in line with our expectations (Figure 4.7).

Figure 4.4. Evolution of log of Turkey's EMBIG Spread and real GDP growth rate

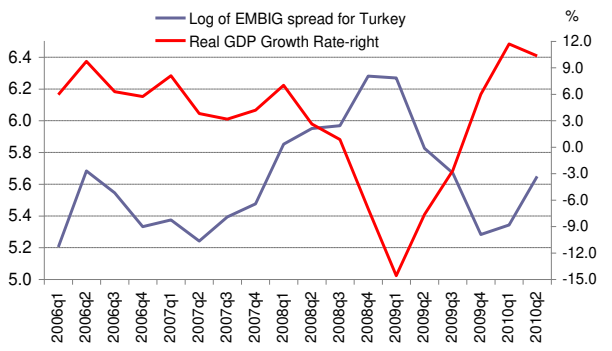


Figure 4.5. Evolution of log of Turkey's EMBIG Spread and International Reserves

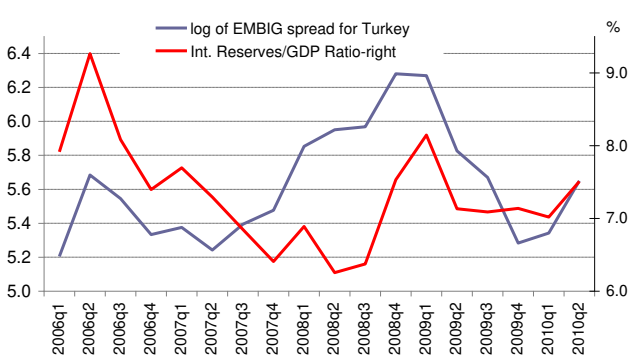


Figure 4.6. Evolution of log of Turkey's EMBIG Spread and Inflation

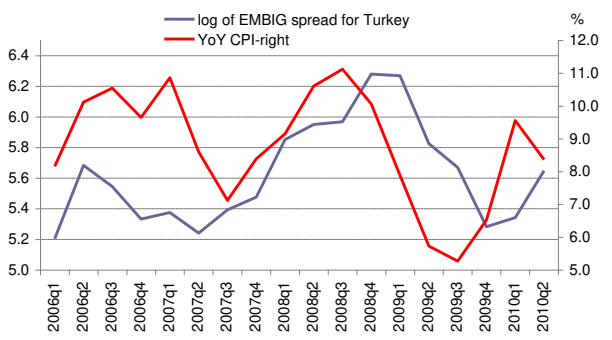
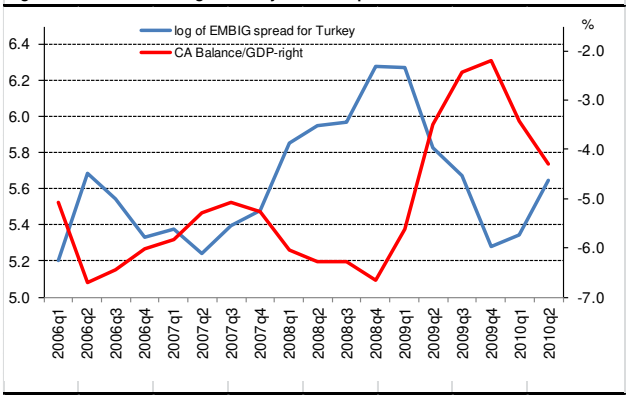


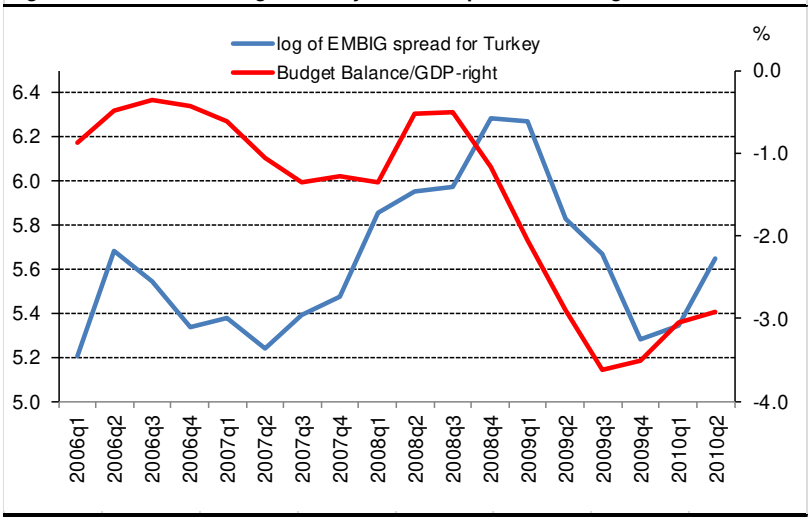
Figure 4.7. Evolution of log of Turkey's EMBIG Spread and Current Account Deficit



The evolution of the budget deficit and sovereign spread for Turkey presents a significant positive relationship for 2008Q4-2009Q4 period, contrary to our expectations (Figure 4.8). This tendency can be explained by Turkey's fiscal discipline since 2001 and

declining public debt stock. EU-defined public debt stock-to-GDP ratio declined from 73.7 percent in 2002 to 45.5 percent in 2009. Most of the countries including Turkey implemented expansionary fiscal policies to cope with the adverse effects of the global crisis; however Turkey's strong and sustainable public debt figures enabled international investors to demand Turkish sovereign bonds and caused spreads to contract.

Figure 4.8. Evolution of log of Turkey's EMBIG Spread and Budget Deficit



5. Empirical Results and Specification Tests

Following Baltagi (1995), we use a panel data framework for the empirical analysis in this study. Since we assume that countries in our spread analysis are heterogeneous, the panel data methodology is optimal since it controls for individual heterogeneity. Some statistical tests have been employed to decide for the correct estimation technique. Breusch-Pagan test is used to choose between a constant or variable intercept while holding the slope coefficients constant. We used Wald test in order to judge the joint significance of country and time specific effects. Finally, the decision between fixed and random effects is done with the Hausmann specification test, where the null hypothesis states that the effects are random (Wooldridge, 2002).

Model estimates for the fixed effect panel are provided in Appendix 1, while the random effect panel estimates are presented in Appendix 2. Model specification tests are provided in Appendix 3.

5.1. Full Data Estimates

According to the model specification tests, fixed-effect model is chosen as the final model for the full dataset. The signs of the coefficient estimates of the fixed-effect model are parallel to our expectations except for the current account-to-GDP ratio. The positive sign of the coefficient can be explained by the contraction in the GDP during the global financial crisis. The contraction in the GDP together with the declining import demand caused current account balance-to-GDP ratio to rise, and consequently resulted a positive relation with the sovereign spreads. The sovereign spreads widened with an increase in global risk aversion and contract with rise in the yield of U.S. 10 year bonds and economic growth.

5.2. Empirical Results of the First Sub-Group (2006Q1-2008Q2)

The model specification tests for the pre-crisis period suggest that a random-effect model should be chosen as the final model. According to the model, the signs of the coefficient estimates are parallel to our expectations except for the current account-to-GDP ratio. Different from the full data estimates, both the coefficient estimates on reserves-to-GDP and exports-to-GDP are turned to be significant and both estimates have the expected signs. High levels of international reserves and high export revenues are associated with lower default risk and consequently lead to lower sovereign spreads.

5.3. Empirical Results of the Second Sub-Group (2008Q3-2010Q2)

The model specification tests for the post-crisis period suggest that a fixed-effect model should be chosen as the final model. The signs of the coefficient estimates are parallel to our expectations except for the budget balance-to-GDP ratio. The post-crisis period is associated with a rise in global risk appetite and decreasing sovereign spreads which is captured by the significant and positive sign of the VIX. Fiscal balances of all selected countries in our study deteriorated during the global crisis and the budget deficit-to-GDP ratios remained elevated in the post-crisis period.

6. Conclusion

This paper analyzes the effect of the recent global financial crisis on emerging countries' borrowing costs by implementing a panel data analysis over the period 2006-2010 for selected emerging countries such as Brazil, South Africa, Russia, Argentina, Hungary, China and Turkey.

The dataset is divided into two sub-groups as pre-crisis and post-crisis in order to identify the relative effect of the global crisis on different emerging economies; the first sub-group covers 2006Q1-2008Q2 period while the second group consists of 2008Q3-2010Q2.

Panel data analysis for the final models reveal that the most significant determinants of sovereign bond spreads are the external shock variables like the risk appetite and yield on U.S. Treasury 10-year bond. The effect of investors' risk appetite on bond spreads is higher in the pre-crisis period than the post-crisis period. However, the yield on U.S. 10 year bonds is turned out to have a higher impact on sovereign bond spreads in the post-crisis period.

The effect of macroeconomic variables on bond spreads is weak relative to external shock variables. For the pre-crisis period, high levels of international reserves and high export revenues lead to lower sovereign spreads as the economic theory predicts.

According to our findings, the borrowing costs of emerging countries is mostly effected by the investors' risk appetite and the yield on alternative instruments like U.S. Treasury bond. Global investors tend to focus more on external shock factors during the pre-crisis period like the VIX and yield on U.S. 10 year bonds, on the other hand they appear to assign more weight to macroeconomic factors like economic growth during the post-crisis period.

Finally, actual and fitted sovereign bond spreads for each selected country are provided in Appendix 5. According to our full dataset analyses, Turkey and Argentina seem to borrow at higher costs than the model predicts. On the other hand, the borrowing costs of Brazil, Russia, South Africa and Hungary from international markets are in line with the model estimates. In addition, China's actual sovereign spread is underpriced according to the model. During the pre-crisis period, countries except China and South Africa are found to borrow at costs in line with model predictions, while these two countries' actual borrowing costs are lower than the estimated figures. Lastly, Argentina's sovereign spread is overpriced while China's spread is lower than expected during the post-crisis period.

References

Alexopoulou, I., Bunda, I. and Ferrando, A. (2009), Determinants of government bond spreads in new EU countries, *ECB Working Paper,* No. 1101.

Arora, V. B. and Cerisola, M. B. (2001) How Does U.S. Monetary Policy Influence Economic Conditions in Emerging Markets? IMF Staff Papers 48, 474–498.

Baldacci, E., Gupta, S. and A. Mati (2008) "Is it (Still) Mostly Fiscal? Determinants of Sovereign Spreads in Emerging Markets", IMF Working Paper No. 08/259, November.

Baltagi, B. H. (1995), *Econometric Analysis of Panel Data*, John Wiley and Sons, Chichester.

Budina, N., and Tzvetan M. (2000), "Determinants of Bulgarian Brady Bond Prices: An Empirical Assessment", World Bank Working Paper, No. WPS 2277, Washington D.C.

Borensztein, E., Barry E., and Ugo P., (2006), "Debt Instruments and Policies in the New Millennium: New Markets and New Opportunities", *Inter-American Development Bank,* Research Department, Working Paper No.558.

Cantor, R. M. and Packer, F. (1996), "Determinants and Impact of Sovereign Credit Ratings, Economic Policy Review, Vol. 2, No. 2, October

Damodaran, A. (2010) "Equity Risk Premiums (ERP): Determinants, Estimation and Implications"

Dumičić M. and Ridzak T. (2010), "*Determinants of Sovereign Risk Premiums for European Emerging Markets (From Saints and Sinners?)"* THE YOUNG ECONOMISTS' SEMINAR to 16th Dubrovnik Economic Conference, Croatian National Bank.

Eichengreen, B. and Mody, A. (1998), "What explains changing spreads on emerging market debt: fundamentals or market sentiment?", NBER Working Paper, No. 6408.

Erb, C. B., Harvey, C. R. and Viskanta, T. E. (1999), "New Perspectives on Emerging Market Bonds," Journal of Portfolio Management 25, 83-92.

Ferrucci G. (2003), "Empirical determinants of emerging market economies' sovereign bond spreads", *Bank of England Working Paper,* No. 205.

Gau Y. F., and Liao W. (2008), "Determinants of Emerging Markets Bond Returns" *Working Paper*, *National Chi Nan University.*

Hartelius, K.,Kashiwase K. and Kodres, L. (2008), "Emerging Market Spread Compression: Is it Real or is it Liquidity?", IMF Working Paper No. 08/10, January.

Judge, George G., William E. Griffiths, R. Carter Hill, Helmut Lütkepohl, and Tsong-Chao Lee (1985), *The Theory and Practice of Econometrics*, 2nd ed., John Wiley andSons, New York.

JP Morgan (1999), "Introducing the JP Morgan Emerging Markets Bond Index Global (EMBI Global)", Methodology Brief, JP Morgan, New York.

Kamin, S. B. and von Kleist, K. (1999) The Evolution and Determinants of Emerging Market Credit Spreads in the 1990's, Board of Governors of the Federal Reserve System International Finance Discussion Paper 653.

McGuire, P., and M. Schrijvers, 2003, "Common Factors in Emerging Market Spreads," *BIS Quarterly Review*, Basel: Bank of International Settlements.

Rojas, A., and Jaque, F. (2003). "Determinants of the Chilean sovereign spread: Is it purely fundamentals?". Banco Central de Chile, Chile.

Rowland, P. and Torres, J.L. (2004), "Determinants of Spread, Credit Ratings and creditworthiness for Emerging Market Sovereign debt rating: A Panel Data Study", A Follow-Up Study Using Pooled Data Analysis", *Central Bank of Columbia.*

Slok, T. and M. Kennedy, 2004, "Factors Driving Risk Premia," OECD Working Paper No. 385, Paris: Organization for Economic Co-operation and Development.

Uribe, M. and Yue, V. Z. (2006) Country Spreads and Emerging Countries: Who Drives Whom? Journal of International Economics 69, 6–36.

Wooldridge, J. (2002), "Econometric Analysis of Cross Section and Panel Data", *MIT Press.*

Appendix 1: Model Estimates for Fixed Effect Panel

Full data-set (2006Q1-2010Q2)

Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.5918	0.1314	4.50	0.000
US 10 year bond	-0.2506	0.0842	-2.98	0.004
GDP growth	-0.0137	0.0030	-4.57	0.000
CPI	-0.0047	0.0076	-0.61	0.542
Reserve/GDP	-0.0077	0.0102	-0.75	0.455
Exports/GDP	0.0111	0.0177	0.63	0.531
Current Account/GDP	0.0322	0.0142	2.27	0.025
Budget Balance/GDP	0.0105	0.0165	0.64	0.526
Constant	4.5341	0.7749	5.85	0.000
F Test :	F(6, 111)	7.59	Prob. >	F = 0.0000

Sub-Group 1 (2006Q1-2008Q2)

Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.5656	0.1989	2.84	0.006
US 10 year bond	-0.2065	0.1052	-1.96	0.055
GDP growth	-0.0086	0.0056	-1.55	0.128
CPI	0.0166	0.0186	0.90	0.374
Reserve/GDP	-0.0312	0.0213	-1.46	0.149
Exports/GDP	0.0047	0.0251	0.19	0.852
Current Account/GDP	-0.0177	0.0267	-0.66	0.510
Budget Balance/GDP	0.0010	0.0240	0.04	0.965
Constant	4.7216	1.0046	4.70	0.000
F Test :	F(6, 55)	5.72	Prob. >	F = 0.0001

Sub-Group 2 (2008Q3-2010Q2)

Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.4685	0.1717	2.73	0.009
US 10 year bond	-0.3609	0.1503	-2.40	0.021
GDP growth	-0.0119	0.0046	-2.59	0.013
CPI	0.0008	0.0092	0.09	0.932
Reserve/GDP	-0.0180	0.0159	-1.13	0.265
Exports/GDP	-0.0159	0.0304	-0.52	0.605
Current Account/GDP	0.0402	0.0222	1.82	0.077
Budget Balance/GDP	0.0756	0.0285	2.65	0.011
Constant	6.1949	1.0674	5.80	0.000
F Test :	F(6, 41)	4.93	Prob. >	F = 0.0007

Appendix 2: Model Estimates for Random Effect Panel

Full data-set (2006Q1-2010Q2)

Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.5937	0.1365	4.35	0.000
US 10 year bond	-0.3367	0.0888	-3.79	0.000
GDP growth	-0.0119	0.0032	-3.68	0.000
CPI	-0.0187	0.0060	-3.12	0.002
Reserve/GDP	-0.0460	0.0031	-14.75	0.000
Exports/GDP	0.0035	0.0019	1.80	0.074
Current Account/GDP	0.0605	0.0098	6.19	0.000
Budget Balance/GDP	0.0429	0.0141	3.04	0.003
Constant	5.8566	0.7415	7.90	0.000

Sub-Group 1 (2006Q1-2008Q2)

Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.7302	0.1941	3.76	0.000
US 10 year bond	-0.2270	0.1210	-1.88	0.061
GDP growth	-0.0005	0.0052	-0.09	0.930
CPI	-0.0107	0.0137	-0.78	0.433
Reserve/GDP	-0.0456	0.0038	-12.05	0.000
Exports/GDP	-0.0050	0.0023	-2.18	0.030
Current Account/GDP	0.0474	0.0111	4.27	0.000
Budget Balance/GDP	0.0165	0.0198	0.84	0.403
Constant	4.9876	1.0264	4.86	0.000

Sub-Group 2 (2008Q3-2010Q2)

Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.2135	0.1762	1.21	0.232
US 10 year bond	-0.3680	0.1709	-2.15	0.036
GDP growth	-0.0110	0.0046	-2.40	0.020
CPI	-0.0147	0.0067	-2.19	0.033
Reserve/GDP	-0.0503	0.0041	-12.15	0.000
Exports/GDP	0.0129	0.0028	4.59	0.000
Current Account/GDP	0.0838	0.0174	4.83	0.000
Budget Balance/GDP	0.0985	0.0243	4.06	0.000
Constant	7.2234	1.0229	7.06	0.000

Appendix 3: Model Specification Tests

Full data-set (2006Q1-2010Q2)

Breusch ve Pagan test for random effects		
t-value : 4.18	Prob. > chi^2 =	0.0409
Hausman specification test		
t-value : 30.92	Prob. > chi^2 =	0.0001

Sub-Group 1 (2006Q1-2008Q2)

Breusch ve Pagan test for random effects		
test-statistics : 4.63	Prob. > chi^2 =	0.0315
Hausman specification test		
test statistics : 4.49	Prob. > chi^2 =	0.8102

Sub-Group 2 (2008Q3-2010Q2)

Breusch ve Pagan test for random effects		
test statistics : 1.92	Prob. > chi^2 =	0.1659
Hausman specification test		
test statistics : 19.87	Prob. > chi^2 =	0.0108

Appendix 4: Model Estimates for the Final Model

Full data-set (2006Q1-2010Q2, Fixed Effects Model)

Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.6478	0.1135	5.71	0.000
US 10 year bond	-0.1983	0.0714	-2.78	0.006
GDP growth	-0.0146	0.0028	-5.26	0.000
Current Account/GDP	0.0329	0.0128	2.58	0.011
Constant	4.2241	0.6056	6.98	0.000

Sub-Group 1 (2006Q1-2008Q2, Random Effects Model)

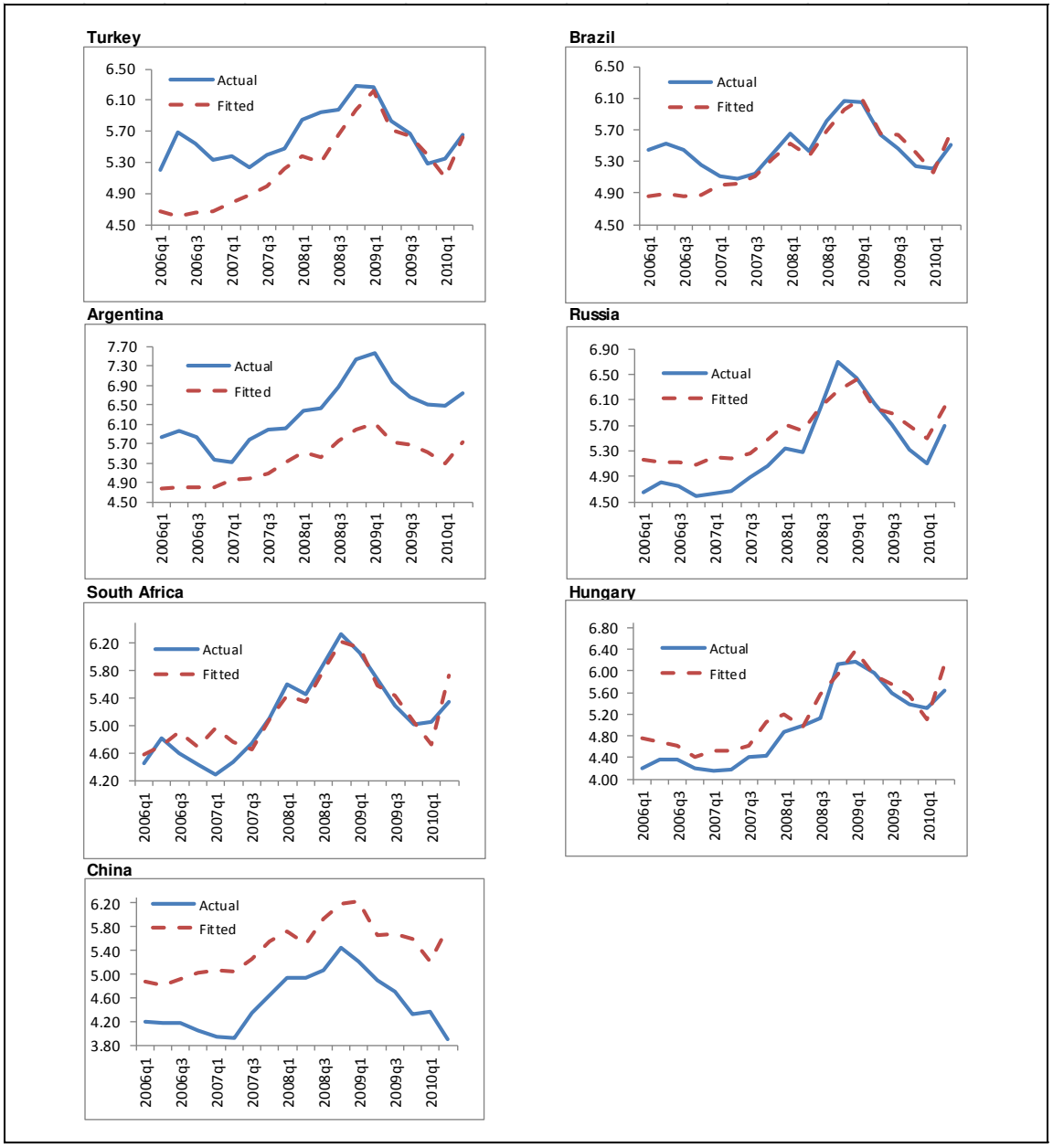
Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.6324	0.1644	3.85	0.000
US 10 year bond	-0.2364	0.1026	-2.30	0.021
Reserve/GDP	-0.0355	0.0057	-6.25	0.000
Exports/GDP	-0.0102	0.0036	-2.87	0.004
Current Account/GDP	0.0255	0.0127	2.01	0.044
Constant	5.1504	0.8686	5.93	0.000

Sub-Group 2 (2008Q3-2010Q2, Fixed Effects Model)

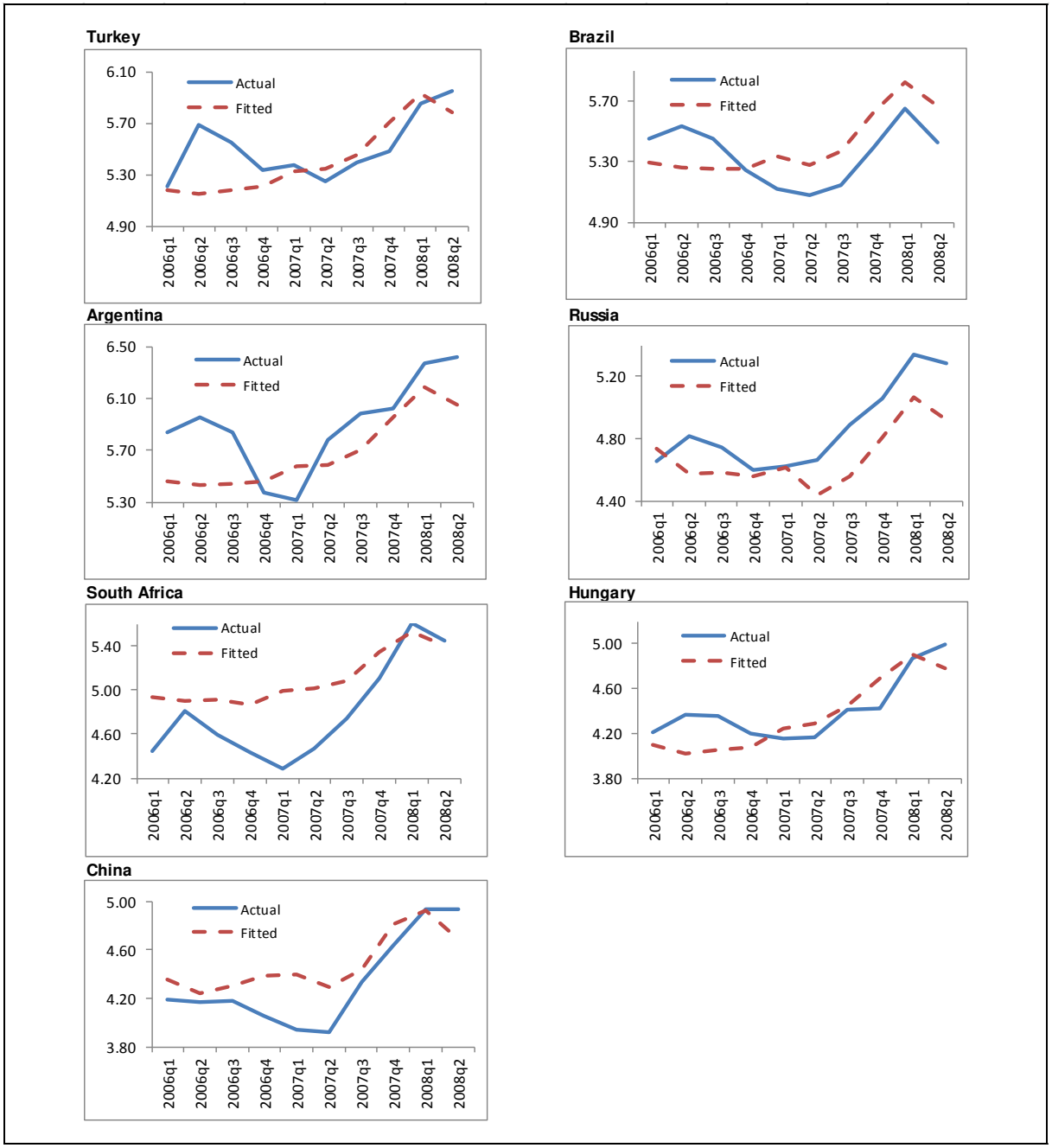
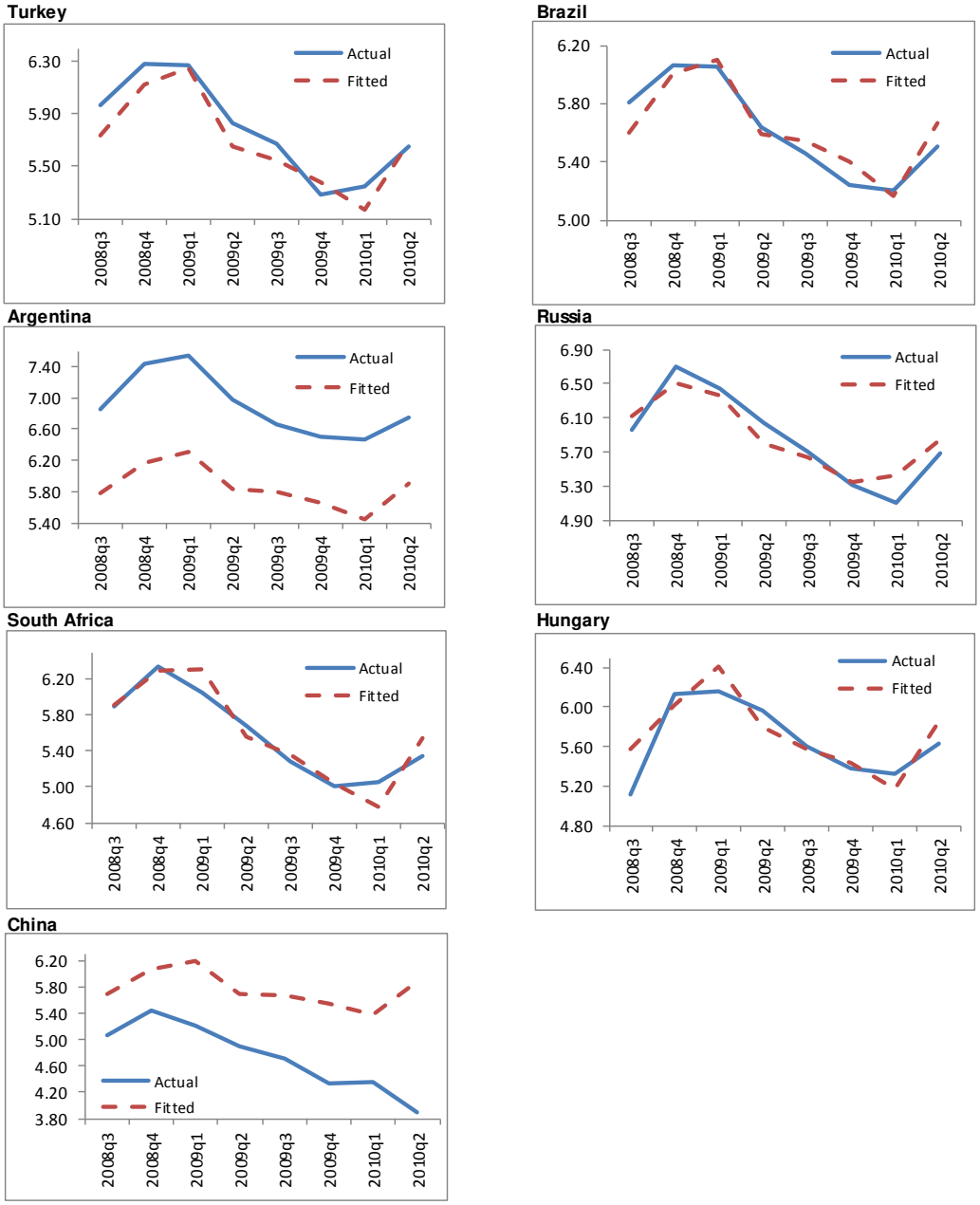
Dependent: log(Spread)	Coefficient	Standard Error	t-value	Prob.
log(Vix)	0.4840	0.1434	3.38	0.002
US 10 year bond	-0.4352	0.1340	-3.25	0.002
GDP growth	-0.0074	0.0036	-2.07	0.044
Budget Balance/GDP	0.0679	0.0225	3.01	0.004
Constant	5.6781	0.8245	6.89	0.000

Appendix 5: Actual and Fitted Values for the Sovereign Bond Spreads

Full data-set (2006Q1-2010Q2, Fixed Effects Model)



Sub-Group 1 (2006Q1-2008Q2, Random Effects Model)



Sub-Group 2 (2008Q3-2010Q2, Fixed Effects Model)