# CALENDAR EFFECTS IN DAILY BOND RETURNS: CASE OF SELECTED EMERGING ECONOMIES

by

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Abstract

# CALENDAR EFFECTS IN DAILY BOND RETURNS: CASE OF SELECTED EMERGING ECONOMIES

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This thesis investigates the existence of calendar effects on the bond market of selected emerging countries and conducts comparative analysis of these effects on the stock and bond markets. The empirical analysis for the bond markets show clear signs of Tuesday effect for most countries. This fact was confirmed by regression on dummies and bootstrap analysis. At the same time, stock market shows no evidence for any day-of-the-week-effect as a result of application of mentioned methods. Day-of-the-month effect, on the other hand, was found significant for both stock and bond markets: returns for the end of the month are higher than for the rest of the month. As it was expected the size of this effect was bigger for the stock market as equity is associated with higher risk.

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*Chapter 1*

# INTRODUCTION

The seasonal patterns in the behavior of prices of various securities have been researched during more than 75 years and have become a well documented phenomenon. These calendar effects" are not only a subject for a study by scientists but can also be used by agents on the financial markets.

Calendar effects can be described as an unusually high or low average return depending on the date, they include day-of-the-week, day-of-the-month and month-of-the-year effects. The fact that these effects exist for such a long period of time is itself an anomaly as according to efficient market hypothesis all these effects should disappear once they are studied by researchers and explained to the traders. However, recent papers show that these anomalies still exits (Polwitoon and Tawatnuntachai (2008), but some works (Nippani and Arize (2007)) show that on the developed markets some of these effects are disappearing or losing power.

In contrast to the numerous studies on equity market, much less effort has been dedicated to examination of calendar anomalies on the fixed-income side. Just by comparing volumes of the financial markets one can clearly see that

bonds are vital for every financial system[1]. Another argument in favor of importance of the study of bonds price behavior is that it gives the opportunity to compare calendar patterns of stocks and bonds and therefore helps in finding the causes of this phenomenon. If the behavior is the same for these instruments it will mean that security-specific factors (effect of coupon payment, dividend effects, maturity of the issue etc) are not that important as overall market factors (tax-loss selling, settlement/clearing procedures, calendar patterns in the arrival of buy and sell orders etc).

Over the last years studies of performance of financial markets in emerging economies had intensified significantly. This can be explained by the fact that these financial markets are less researched but provide a higher average rate of return compared to the developed ones (for example the sovereign bond of the same maturity date can yield 2-5% in US and 6-10% in CIS countries).

The main goal of this thesis will be the investigation of existence of the calendar effect on the bond and stock markets of selected emerging countries (Brazil, Bulgaria, Mexico, Philippines, Russia, Turkey and Ukraine) and comparison of the price behavior on these markets. Day-of-the-month and day-of-the-week effects had not yet been studied for any of mentioned countries, while month-of-the-year effect has been researched only for Brazil, Mexico and

[1] In fact volume of outstanding bonds can be even higher than stock market capitalization. For example in Ukraine total government eurobonds outstanding constitute 6% of GDP, while total capitalization of stock market – 5.5%.

Russia. This is why this research is going to concentrate on calendar effects for the developing countries.

Chapter 2 presents the review of related literature both for stock and bond markets. It mostly includes papers concentrating on developed markets, but also has several analyzing emerging markets. Chapter 3 provides descriptive analysis of data on stock and bond returns. Chapter 4 presents empirical methodology used in the research. The results of the regression analysis are given in Chapter 5. Finally, Chapter 6 contains conclusions and discussion of the results.

*Chapter 2*

# LITERATURE REVIEW

Since calendar effects tend to be different on different markets it is reasonable to split the literature review into two parts: articles studying developed markets and those concentrated on the emerging economies.

*Developed countries.*

The first work concerning calendar effects was a short article by Fields (1931). He was the first to recognize the existence of specific patterns in the stock returns. Although this work was of the theoretical type and contained no econometric research, it gave rise to a number of relevant studies. By now, articles that research calendar effects on the market for fixed-income instruments remain outnumbered by works concerning similar issues in stock returns. In the eighties and nineties there was a burst of studies aimed at comparing the calendar effects on these markets (Johnston, Kracaw and McConnell (1991), Jordan and Jordan (1991), Connolly (1989) etc). It has to be emphasized that there are few works among the literature researching financial markets of the emerging countries. Moreover, most of existing works in this sphere deal with US bond market, leaving broad space for analysis of developing countries.

A comprehensive study of day-of-the-week effect in financial futures on US Treasury securities is documented in research by Johnston, Kracaw and

McConnell (1991). Their work analyses various securities – GNMA (bonds of Government National Mortgage Association), T-bonds, T-notes and T-bills futures. Two calendar effects were found for GNMA, T-bonds and T-note contracts, while T-bill (the paper with the smallest duration) exhibits no seasonal patterns. Similarly to well-known Monday effect in stock returns, GNMA and T-bonds contracts follow negative Monday effect before 1982. At the same time, the evidence for positive Tuesday effect after 1984 for GNMA, T-note and T-bond contracts was found. These effects were concentrated in February and May respectively. So this brings us the evidence of certain "delivery cycle" which affects not only the maturing issues but also other similar papers trading.

At the same time, in their study of US corporate bond returns Jordan and Jordan (1991) tested for seasonal patterns in Dow Jones Composite Bond Average (DJCBA) index for period from 1963 to 1986. The paper considers five calendar effects: day-of-the-week, turn-of-the-year, January, turn-of-the-month, and week-of-the-month. Overall results from the study show that there is some degree of seasonality in bond prices, but the pattern is not the same as for the equity market. The study found significant turn-of-the-year and week-of-the-month effects, while January effect was also observed, but not as strong. The interesting fact is that with the exception of week-of-the-month effect DJCBA exhibits mirror patterns to S&P500. The fact that intraweek effect is much more evident in the stock market than in the bond market suggests that this effect result from features specific to equity market. At the same time, the significance

of turn-of-the-year effect for bonds results in conclusion that year-end portfolio adjustments influence both markets. This study also emphasizes the weakening of all these effects indicating that US capital market becomes more efficient.

The more recent paper concerning three separate US corporate bond indices in the period from 1982 to 2002 was done by Nippani and Arize (2007). In analysis they used models developed by French (1980) and Connolly (1989). According to their research no Monday effect was found with the use of French's model, while Connolly approach resulted in significant negative Monday effect. This result is different from findings of Jordan and Jordan (1991), who reported no day-of-the-week effects prior to 1986. The possible explanation for this includes changes in nature of equity market and its impact on bond market therefore proving evidence for cross-market hedging. Researchers also report turn-of-the-year effect consistent with Jordan and Jordan (1991). The most evident reason for this effect is tax-loss selling. The study didn't found any significant differences in behavior of industry indices with the exception of utilities index, which exhibits smaller turn-of-the-year effect.

*Emerging markets.*

As it was already mentioned there are few works on stock or bond returns on emerging markets. One of the recent studies was done by Klesov (2008), it researches calendar effects for stock markets of selected developing CIS and CEE countries. According to this work intraweek effect (Friday effect) was found

for most countries with the usage of bootstrap approach[2], while Monday effect was found only for a couple of countries using GARCH approach. In the meantime, the evidence for day-of-the-week and month-of-the-year was partly significant due to the relatively small size if the dataset. This work can be used for comparison of various calendar effects existing on stock and bond markets of specific country.

One more study, done by Polwitoon and Tawatnuntachai (2007), examines the behavior of U.S.-based emerging market bond funds over a period from 1996 to 2005, the top six holding countries are Argentina, Brazil, Mexico, Philippines, Russia and Venezuela (almost all bonds are denominated in dollars). This paper analyzed only month-of-the-year effect for the bond funds and found positive effect for November and December. This is most likely caused by common reason of end-of-the-year activity bursts on the capital markets.

The literature reviewed above illustrates different price behavior (both in intraweek and day-of-the-month effects) for developed and emerging countries. The difference in patterns is also observed between stock and bond calendar effects: while stocks mostly exhibit Monday and Friday effects, bonds tend to have Tuesday effect. Another aspect elucidated in the studies is that while on the developed markets calendar effects tend to fade out on the emerging markets they still exist.

[2] Bootstrap approach was suggested by Sullivan, Timmermann and White (2001).

This research contributes to the existing literature by exploring the bond return behavior in Ukraine and others emerging markets and by comparing this behavior with the stock return patterns observed in these countries.

*Chapter 3*

# DATA DESCRIPTION

The bond data for this study will include daily observations for bond and stock indices from selected emerging economies. Additionally Emerging Markets Bond Index (EMBI+) and Morgan Stanley Capital International index for emerging countries (MSCI EM) are analyzed as a benchmark for the other ones. The indices are preferred to individual bond's prices as they provide broader and more generalized image of the particular market. The data on indices is acquired via Bloomberg and official site of MSCI.[3]

[3] http://www.mscibarra.com/index.jsp

**Table 1. General information about data**[4]

| Country | Index | Length of sample | # of observations |
|---|---|---|---|
| Emerging markets | EMBI+ | 31.12.2002 – 23.01.2009 | 1520 |
| Emerging markets | MSCI EM equity index | 22.03.2004 – 23.01.2009 | 1265 |
| Brazil | EMBI+ Brazil | 31.12.2002 – 23.01.2009 | 1520 |
| Brazil | MSCI Brazil equity index | 22.03.2004 – 23.01.2009 | 1265 |
| Bulgaria | EMBI+ Bulgaria | 31.12.2002 – 23.01.2009 | 1520 |
| Bulgaria | MSCI Bulgaria equity index | 31.05.2005 – 23.01.2009 | 953 |
| Mexico | EMBI+ Mexico | 31.12.2002 – 23.01.2009 | 1520 |
| Mexico | MSCI Mexico equity index | 22.03.2004 – 23.01.2009 | 1265 |
| Philippines | EMBI+ Philippines | 31.12.2002 – 23.01.2009 | 1520 |
| Philippines | MSCI Philippines equity index | 22.03.2004 – 23.01.2009 | 1265 |
| Russia | EMBI+ Russia | 31.12.2002 – 23.01.2009 | 1520 |
| Russia | MSCI Russia equity index | 22.03.2004 – 23.01.2009 | 1265 |
| Turkey | EMBI+ Turkey | 31.12.2002 – 23.01.2009 | 1520 |
| Turkey | MSCI Turkey equity index | 22.03.2004 – 23.01.2009 | 1265 |
| Ukraine | EMBI+ Ukraine | 31.12.2002 – 23.01.2009 | 1520 |
| Ukraine[5] | PFTS | 22.03.2004 – 23.01.2009 | 1184 |

As the subject of this research is the behavior of returns rather than indices the data is transformed and return on the index is computed using following formula:

[4] The details about indices EMBI and MSCI are provided in Appendices A and B.

[5] MSCI equity index for Ukraine includes less then 500 observations so it was substituted by local one – PFTS.

$$R_i = \frac{BI_i - BI_{i-1}}{BI_{i-1}}$$

where $R_i$ is a daily return on the bond index for day $i$, and $BI_i$ is the value of the index as of the end of the day $i$.

The following table presents the descriptive statistics of the available data for all bond indices.

**Table 2. Descriptive statistics of bond index returns.**

| Country | Mean | Median | Standard deviation | Min | Max | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| Emerging markets | .0003641 | .0004891 | .005571 | -.0710295 | .0598858 | -1.670233 | 48.13602 |
| Brazil | .0007075 | .0006862 | .0074058 | -.089136 | .0518075 | -1.305685 | 23.2991 |
| Bulgaria | .0001714 | .000195 | .0034593 | -.031736 | .031639 | -.9792333 | 23.90476 |
| Mexico | .00027 | .0004022 | .0049068 | -.0482706 | .0469006 | .1870535 | 29.09041 |
| Philippines | .0004017 | .0004406 | .0069649 | -.0906559 | .0964184 | -.2515253 | 75.40104 |
| Russia | .000281 | .0003439 | .006699 | -.1079971 | .0715251 | -2.159211 | 72.88355 |
| Turkey | .000414 | .0004766 | .0075607 | -.0903231 | .0746187 | -1.679881 | 42.34707 |
| Ukraine | -.000111 | .0002407 | .0079634 | -.0880967 | .0865777 | -1.169821 | 54.63796 |

Table 2 gives the ground for drawing the following conclusions:

- Relationship between return and risk is preserved: the countries with the return higher than overall for emerging markets (Turkey, Brazil, Philippines) have the highest risk associated with them. (Negative

returns for Ukraine can be explained by recent negative sentiment from investors, which placed Ukrainian bonds among the worst performers on the market.)

- High kurtosis for all indices (reaching 75 for Philippines) indicates that the distribution of the returns is spiked. The skewness, on the contrary, takes different values (positive for Mexico and negative for the rest).

Next table presents the descriptive statistics of the available data for all stock indices.

**Table 3. Descriptive statistics of stock index returns.**

| Country | Mean | Median | Standard deviation | Min | Max | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| Emerging markets | .0001851 | .002 | .0149813 | -.095 | .106 | -.4095643 | 12.59226 |
| Brazil | .0009739 | .002 | .0265608 | -.116 | .181 | -.0539449 | 11.23408 |
| Bulgaria | -.0012833 | 0 | .0205618 | -.167 | .121 | -1.388381 | 15.18573 |
| Mexico | .0004612 | .001 | .0190276 | -.103 | .164 | .275369 | 12.59549 |
| Philippines | .0004937 | .001 | .0173444 | -.135 | .098 | -.4314408 | 8.995929 |
| Russia | -.0000633 | .001 | .0273712 | -.226 | .271 | .260318 | 23.02949 |
| Turkey | .0002682 | .001 | .0270265 | -.137 | .175 | -.0969595 | 7.019205 |
| Ukraine | .0008636 | .0011757 | .0199569 | -.1510506 | .1447421 | -.1340929 | 14.44661 |

Table 3 gives the ground for drawing the following conclusions:

- Once again relationship between return and risk is preserved: countries with highest mean returns (Ukraine, Philippines and Brazil) have the highest standard deviation associated with them.
- In stock returns data kurtosis values are not that high, which means that this distribution is much less spiked compared to bond returns.
- Comparing standard deviations for bonds and stocks one can conclude that stocks have much bigger standard deviation attached to them, meaning that the profit here is associated with bigger risk. This is not surprising as our bond index includes only sovereign and quasi-sovereign papers, which are virtually risk free.

*Chapter 4*

# METHODOLOGY

In this work two types of effects are studied. First let's concentrate on day-of-the-week effect.

*Day-of-the-week effect.*

As simple linear regression models are typical and widely used by most researchers of calendar effects on the financial markets. The following model of this sort is suggested:

$$R_t = \delta_1 + \delta_2 D_{2t} + \delta_3 D_{3t} + \delta_4 D_{4t} + \delta_5 D_{5t} + \varepsilon_t$$

Here $D_{2t}$, $D_{3t}$, $D_{4t}$ and $D_{5t}$ are dummies for days of the week – Tuesday, Wednesday, Thursday and Friday. The intercept $\delta_1$ measures the mean return for Monday, and the coefficients $\boldsymbol{\delta_2}$ through $\boldsymbol{\delta_5}$ measure the difference between Monday returns and the expected return for each of the other days of the week. The purpose of this model is to investigate the existence of not only Monday and Friday effects but also possible effects of other days.[6]

However the use of this approach is linked with several specific problems that may arise during the estimation:

[6] Some researchers (Basher and Sadorsky (2006)) suggest that for countries that are situated in Western Hemisphere Monday effect is substituted by Tuesday effect. This can be explained by the correlation with American market and the time difference.

- The returns are likely to be autocorrelated.
- Residuals can be non-normal.
- Heteroskedastisity may arise.

Several tests are proposed to identify these problems, while solution for them includes alternative model (bootstrap approach) and different estimation technique (Newey-West correction).

Another method used in this thesis is nested bootstrap[7]. Bootstrapping is the practice of estimating properties of an estimator (such as its variance or mean) by measuring those properties when sampling from an approximating distribution. One standard choice for an approximating distribution is the empirical distribution of the observed data. In the case where a set of observations can be assumed to be from an independent and identically distributed population, this can be implemented by constructing a number of resample of the observed dataset (and of equal size to the observed dataset), each of which is obtained by random sampling with replacement from the original dataset. It may also be used for constructing hypothesis tests.

The first article employing bootstrap approach for the study of calendar effects was done by Sullivan, Timmermann and White (2001). Their reasoning was that calendar effects are no more that just products of data mining and can be ruled out using the bootstrap technique.

[7] The MATLAB program used for this method is provided Appendix D.

In this thesis nested bootstrap technique is used to calculate confidence intervals for mean returns on Monday, Tuesday, Wednesday, Thursday and Friday. This allowed testing the same hypothesis as in linear regression case.

*Day-of-the-month effect.*

The day-of-the-month effect is studied with the help of usual linear regression approach. The model for this effect looks like this:

$$R_t = \beta_0 + \beta_1 First_t + \beta_2 Last_t + \xi_t$$

Here $First_t$ is dummy variable responsible for first 5 trading days of the month and $Last_t$ is a dummy for 5 trading days at the month end. This will allow testing for existence of abnormal returns both in the beginning and at the end of the month.

*Chapter 5*

# RESULTS

This thesis investigates two types of calendar effects: day-of-the-week effect, day-of-the-month effect. First let's consider day-of-the-week effect.

The following table summarizes the result of the regression suggested for this effect ($R_t = \delta_1 + \delta_2 D_{2t} + \delta_3 D_{3t} + \delta_4 D_{4t} + \delta_5 D_{5t} + \varepsilon_t$). Since the residuals of all the regressions exhibit autocorrelation and heteroskedasticity (see Appendix C), Newey and West (1987) correction is used.

**Table 4. Simple linear regression of bond returns.**

| Country | Intercept | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Emerging markets | .01523 | .07859** | .01719 | -.03542 | .0426 |
| Brazil | .0648 | .05413 | -.02134 | -.0626 | .0585 |
| Bulgaria | .03071 | -.00425 | .01493 | -.0479*** | -.03021 |
| Mexico | 4.21e-05 | .06241*** | .04319 | -.02601 | .05144 |
| Philippines | .01913 | .09168*** | .04138 | -.03472 | .00337 |
| Russia | .01036 | .08198*** | -.01177 | -.00456 | .02122 |
| Turkey | -.01997 | .16386** | .07682 | -.00636 | .06475 |
| Ukraine | -.07627 | .09588*** | .04528 | .12192** | .05697 |

Results are given in percents.

**, *** Indicate t-value significant at 5% and 10% respectively

As Table 4 indicates Tuesday and Thursday effects are present for analyzed countries. However, Tuesday effect appears present in most countries and on the emerging markets as a whole. This fact together with the absence of Monday effect for all countries coincides with the results of Basher and Sadorsky (2006) for the stock markets. An explanation for this may be that vast majority of deals with Eurobonds are made in Europe (London, Frankfurt, Luxemburg etc). This fact combined with time difference with American market may produce Tuesday effect instead of Monday one.

The size of the positive Tuesday effect is quite small (0.06-0.16 %). However the following factors justify its economic significance:

- This effect represents the difference in returns for one day.
- All bonds included into indices are sovereign or quazi-sovereign, which means that they are virtually risk-free.
- The majority of transactions on the bond market amounts for millions of dollars.

Next table gives the results for stock returns. Again because of autocorrelation and heteroskedasticity Newey-West correction was used.

**Table 5. Simple linear regression of stock returns.**

| Country | Intercept | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Emerging markets | .0123 | -.03681 | .03157 | -.01388 | .05015 |
| Brazil | -.02143 | .19969 | .14159 | .04633 | .20601 |
| Bulgaria | -.09053 | -.22 | .06906 | -.11785 | .07901 |
| Mexico | .05794 | .06183 | -.0777 | .03337 | -.07651 |
| Philippines | -.05079 | .02787 | .1583 | .25158 | .06265 |
| Russia | .08413 | -.24263 | -.20152 | -.07227 | .06449 |
| Turkey | -.2373 | .3705 | .17327 | .35074 | .42505*** |
| Ukraine | .05189 | -.09001 | .01025 | .12327 | .12325 |

Results are given in percents.

**, *** Indicate t-value significant at 5% and 10% respectively

As it can be seen from the Table 5 virtually no day-of-the-week effect is observed in all countries. These results are well in line with those obtained by Klesov (2007). The absence of day-of-the-week effect may be explained by the following two facts:

- The deals including stocks of emerging counties happen all around the world (as depositary receipts (ADR and GDR) are also included in this index).
- Stock market because appear more efficient then bond one and that's why may not provide evidence for day-of-the-week effect.

Appendix C shows that Newey-West correction technique allowed dealing with problems of autocorrelation and heteroskedastisity.

Next tables provides the results of the bootstrap approach for bond and stock market returns.

**Table 6. 95% confidence intervals for mean bond returns constructed by nested bootstrap method**

| Country | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Emerging markets | (-0.03,0.06) | (0.02,0.21)* | (-0.04,0.09) | (-0.08,0.04) | (-0.01,0.11) |
| Brazil | (-0.03,0.17) | (0.06,0.18)* | (-0.07,0.12) | (-0.10,0.08) | (0.05,0.20)* |
| Bulgaria | (-0.02,0.09) | (0.01,0.07)* | (-0.01,0.09) | (-0.06,0.03) | (-0.07,0.05) |
| Mexico | (-0.07,0.07) | (0.01,0.13)* | (-0.03,0.10) | (-0.10,0.03) | (-0.02,0.11) |
| Philippines | (-0.06,0.11) | (0.02,0.27)* | (-0.05,0.13) | (-0.12,0.09) | (-0.08,0.09) |
| Russia | (-0.04,0.06) | (0.03,0.21)* | (-0.13,0.11) | (-0.07,0.09) | (-0.09,0.09) |
| Turkey | (-0.16,0.07) | (0.07,0.27)* | (-0.02,0.13) | (-0.13,0.07) | (-0.07,0.12) |
| Ukraine | (-0.16,-0.01)* | (-0.08,0.11) | (-0.17,0.09) | (-0.02,0.12) | (-0.14,0.09) |

Results are given in percents.

* - Indicate significance at 95% confidence level

**Table 7. 95% confidence intervals for mean stock returns constructed by nested bootstrap method**

| Country | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Emerging markets | (-0.22,0.29) | (-0.18,0.15) | (-0.22,0.23) | (-0.16,0.14) | (-0.15,0.28) |
| Brazil | (-0.43,0.52) | (-0.19,0.55) | (-0.34,0.50) | (-0.25,0.31) | (-0.18,0.52) |
| Bulgaria | (-0.44,0.14) | (-0.73,-0.03)* | (-0.28,0.24) | (-0.59,0.17) | (-0.45,0.27) |
| Mexico | (-0.22,0.38) | (-0.16,0.43) | (-0.29,0.21) | (-0.22,0.40) | (-0.17,0.14) |
| Philippines | (-0.26,0.15) | (-0.30,0.23) | (-0.23,0.38) | (-0.08,0.48) | (-0.18,0.16) |
| Russia | (-0.32,0.47) | (-0.53,0.26) | (-0.67,0.22) | (-0.37,0.48) | (-0.32,0.78) |
| Turkey | (-0.72,0.31) | (-0.16,0.52) | (-0.40,0.26) | (-0.24,0.51) | (-0.27,0.59) |
| Ukraine | (-0.32,0.31) | (-0.34,0.28) | (-0.34,0.28) | (-0.10,0.49) | (-0.12,0.49) |

Results are given in percents.

* - Indicate significance at 95% confidence level

The results presented in Table 6 give grounds confirm the existence of positive Tuesday effect on the bond markets for almost all countries. The only outlier there is Ukraine, which instead has negative Monday effect. Possible explanation for this may be the fact that Ukraine bonds were largely affected by the current financial crisis and have negative sentiment from the investors attached.

The magnitude of the Tuesday effect is virtually the same as in the linear regression approach. But comparative analysis of bootstrap and linear regression

approach (see Appendix E) shows that the former gives more significant evidence in favor of Tuesday effect.

As for the stock returns, Table 7 shows that virtually no day-of-the-week effect was found for all countries. The only exception constitutes negative Tuesday effect for Bulgaria. So bootstrap approach confirm the results obtained earlier – there is no evidence for day-of-the-week effect for stock markets of emerging countries.

Next table contains the results of testing the day-of-the-month effect.

**Table 8. Day-of-the-month effect on bond returns.**

| Country | First days of the month | Last days of the month |
|---|---|---|
| Emerging markets | .06858*** | .07911** |
| Brazil | .09741*** | .10629** |
| Bulgaria | .03987 | -.04254*** |
| Mexico | .01552 | .07136** |
| Panama | .07813** | .04086 |
| Philippines | .10867** | .11684** |
| Russia | .04558 | .03986 |
| Turkey | .13937* | .09817*** |
| Ukraine | .05443 | .08268 |

Results are given in percents.

*, **, *** Indicate t-value significant at 1%, 5% and 10% respectively

The results can be summarized as following:

- The first days of the month dummy is significant for 4 out of 8 countries, while the last days of the month one is significant for 5 out of 8 countries.
- For all emerging markets both effects appear to be significant, however the last days effect is stronger and more significant (which explains why there is more evidence in favor of it).

The magnitude of the both effects is again somewhat small (between 0.06 and 0.14 percents) but due to the facts mentioned earlier for the day-of-the-week effect they are economically significant.

**Table 9. Day-of-the-month effect on stock returns.**

| Country | First days of the month | Last days of the month |
|---|---|---|
| Emerging markets | .19443*** | .35978* |
| Brazil | .16992 | .61243* |
| Bulgaria | -.15079 | .533* |
| Mexico | .2699*** | .2441*** |
| Philippines | .39561* | .29486** |
| Russia | .17867 | .46405*** |
| Turkey | .38363** | .51908** |
| Ukraine | .10704 | .13766 |

Results are given in percents.

*, **, *** Indicate t-value significant at 1%, 5% and 10% respectively

Table 9 shows that on the stocks market both first-days-of-the-month and last-days-of-the month is present, however the latter is much more evident across countries.

The magnitude of the both effects is bigger than for bond returns (between 0.4 and 0.5 percents). This difference can be explained by bigger standard deviation of stock returns, meaning that profit here is associated with bigger risk.

These results prove that day-of-the-month effect is very similar on stock and bond markets. This means that the causes of this effect are likely to be market specific, not security specific.

*Chapter 6*

# CONCLUSIONS

The main goal of this thesis was to study the existence of calendar effects in the bond market of the selected emerging economies and to compare return patterns on stock and bond markets. The following effects were considered:

- Day-of-the-week effect
- Day-of-the-month effect

To detect the existence of these calendar effects the following techniques were applied:

- Linear regression on dummies and bootstrap approach for the day-of-the-week effect for stock and bond returns.
- Linear regression on dummies for day-of-the-month effect.

The evidence was found for existence of day-of-the-week effect on the bond markets of almost all studied countries. Usual regression models signals that there is positive Tuesday effect. More robust evidence confirming this effect was found with the use of bootstrap approach. The economic significance of the effect can be justified by large volumes of transactions and low risk attached to sovereign bonds.

On the other hand no proof for existence of day-of-the-week effect on the stock markets was observed. Both regression on dummies and bootstrap approach gave almost no evidence in favor of any day-of-the-week effect for all countries.

The day-of-the-month effect was found to be significant for both stock and bond markets; more precisely the last-days-of-the-month effect was observed. The size of the effect is bigger for stocks, which is natural as these instruments have higher risk attached to them.

These results indicate that stock market of emerging counties show more signs of efficiency compared to bond market, as it contains no signs of day-of-the-week effect. But at the same time both markets appear to have day-of-the-month effect present (namely last-days-of-the-month effect). Such difference may be caused by the fact that stock markets have longer history of operations and transactions in stocks of emerging countries companies are made all over the world and are not concentrated in Europe as it is for bonds.

These findings are consistent with recent results concerning the day-of-the-week effect for developing countries. The results of comparison of equity and fixed-income markets in terms of calendar effects are novel and have no analogues for emerging countries.

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# APPENDIX

## Appendix A: Description of EMBI indices.[8]

### Defining the universe of eligible countries

Initially, two criteria determine whether a country is defined as an emerging market and, therefore, can be considered for inclusion in the EMBI Global. Effective December 31, 1999, a country must be classified as having a low or middle per capita income by the World Bank for at least two consecutive years, based on data lagged one year. Requiring two years of classification reduces the potential for traditionally high-income countries to briefly enter and then exit the index. Our current source for these classifications is the World Bank publication *Global Development Finance*. Published annually, this report reflects per capita income brackets as of the previous year's close. Second, regardless of their World-Bank-defined income level, countries that either have restructured their external or local debt during the past 10 years or

currently have restructured external or local debt outstanding will also be considered for inclusion in the index.

### Instrument selection process

[8] Source: Emerging Markets Research: Bond Index. J.P. Morgan Securities Inc. December 2004

Once this universe of emerging markets countries has been defined, the eligible instruments from these countries must be selected. Instruments that satisfy all the following defined criteria will be eligible for inclusion in the EMBI Global:

1. Instrument type

2. Issuer type classification;

3. Currency denomination;

4. Current face amount outstanding;

5. Remaining time until maturity;

**Instrument type**

The EMBI Global/Diversified includes both fixed and floating-rate instruments, as well as capitalizing/amortizing bonds or loans. Bonds or loans with embedded options and warrants are eligible for inclusion if a) the options/warrants are attached to instruments that would otherwise be included in the index and b) the quotation convention (as recommended by the Emerging Markets Traders Association) is for instrument prices to be quoted cum options or warrants. Convertible bonds are not eligible for index inclusion.

**Issuer type classification**

The EMBI Global/Diversified contains only those bonds or loans issued by sovereign and quasi-sovereign entities from index-eligible countries. Instruments issued by municipalities or provinces are not eligible for inclusion. Historically, any quasi-sovereign issue was considered eligible for inclusion. As of May 31,

2002, we strengthened our definition of "quasi-sovereign" as an entity that is 100% guaranteed or 100% owned by the national government, and resides in the index eligible country. Instruments will not be eligible for inclusion in the index if their credit has been improved by a) giving security over commercial receivables or b) giving a guarantee from a guarantor which is not a subsidiary of the eventual obligor or the parent company / beneficiary of the issuer of the instrument. For the purposes of clarification, bonds that are secured in part by US Treasuries (e.g. Brady bonds) are eligible for inclusion. Where financing vehicles are used, bonds or loans may be included in the EMBI Global if either 1) the financing vehicle or bond is guaranteed by an index eligible issuer or 2) the transaction is structured as a pass-through where the creditor of the financing vehicle has full recourse to the underlying loan or bond between the financing vehicle and the final obligor, which itself must be an index eligible issuer. In order to avoid double counting of index instruments, a bond or loan that is issued by a financing vehicle is only eligible for inclusion into the EMBI Global if the underlying loan or bond is not itself included in the index.

**Currency denomination**

Only those instruments denominated in US dollars are considered for inclusion. Instruments denominated in US dollars where the amount of coupon or redemption payment is linked to an exchange rate are not eligible for inclusion.

**Current face amount outstanding**

Only issues with a current face amount outstanding of $500 million or more will be considered for inclusion. If an issue's current face outstanding falls below this requirement (due to either a debt retirement by the sovereign or the amortization of principal), the issue will be removed from the index at the next month-end rebalancing date. The reverse also holds true. Existing issues that, through reopenings, increase in size to satisfy our minimum current face outstanding requirement are then considered for inclusion in the index at the next month-end rebalancing date.

**Time until maturity**

Only those instruments with at least 2½ years until maturity are considered for inclusion. Once added, an instrument may remain in the EMBI Global until 12 months before it matures. On the month-end preceding this anniversary, the instrument is removed from the index.

## Appendix B: Description of MSCI equity indices.

### Country Indices

To construct a country index, every listed security in the market is identified. Securities are free float adjusted, classified in accordance with the Global Industry Classification Standard (GICS®), and screened by size, liquidity and minimum free float.

### Regional and Composite Indices

MSCI Barra maintains a consistent index construction and maintenance methodology for all of its international equity indices enabling the aggregation of the country indices into regional and global indices. Maintaining a consistent policy in both the developed and emerging markets is crucial in the calculation of combined emerging and developed market indices like the All Country series.

Indices are built at a country market level and then aggregated into regional and other composites. In the case of MSCI Provisional Europe Index alone, the index is constructed by treating Europe as a single market. The securities in all DM countries in Europe are aggregated into a single market for index construction purposes and the MSCI Provisional Europe Index is built first. Subsequently, individual DM Europe country indices within the MSCI Provisional Europe Index are derived from the constituents of the MSCI Provisional Europe Index.

MSCI Barra also offers indices calculated on GDP weights, indices hedged to the various currencies, custom indices, as well as sector and industry indices.

**All Country (AC)**

MSCI All Country Indices represent both the developed and the emerging markets for a particular region. For example, the MSCI All Country Far East Index includes both developed markets such as Hong Kong and Singapore and emerging markets such as Indonesia and Thailand. The MSCI All Country World Index includes 48 markets.

**Developed Markets (DM), Emerging Markets (EM) and Frontier Markets (FM) Coverage**

MSCI Barra covers 23 developed, 24 emerging and 27 frontier markets. If there is no designation (such as "EM" or "AC") before a regional or composite index, the index consists of developed markets only.

**Free**

All MSCI International Equity Indices are fully adjusted for free float as defined in the MSCI Methodology Book and all MSCI International Equity Indices, regardless of 'Free' branding, are constructed and managed with a view to being fully investable from the perspective of international institutional investors.

MSCI Barra intends to maintain the branding of all Developed Market Indices including: Singapore Free, EAFE Free, World Free, Pacific Free, Pacific Free ex Japan, and Far East Free.

The continued "Free" branding for certain Developed Market Indices recognizes that these indices have histories different from the similar index that does not

have the suffix "Free". Otherwise, these indices have the same current constituents and current performance. For example, the MSCI EAFE and EAFE Free Indices now have exactly the same constituents and performance. However, due to investment restrictions on foreign investors in the past, in Singapore, Switzerland, Sweden, Norway and Finland, which were recognized in EAFE Free, but not in EAFE, the history of the two indices is different.

Historically, the MSCI Free indices reflected investable opportunities for global investors by taking into account local market restrictions on share ownership by foreigners. These restrictions may have assumed several forms: (1) specific classes of shares excluded from foreign investment; (2) specific securities or classes of shares for an individual company may have had limits for foreign investors; (3) the combination of regulations governing qualifications for investment, repatriation of capital and income, and low foreign ownership limits may have created a difficult investment environment for the foreign investor; and (4) specific industries, or classes of shares within a specific industry, may have been restricted to foreign investors.

**Provisional Indices**

To facilitate client transition to the MSCI Global Investable Market Indices (GIMI) Methodology, MSCI Barra provided Provisional Standard and Provisional Developed Market Small Cap Indices. The Provisional indices reflected the performance of the MSCI Standard and Developed Market Small

Cap Indices had they been maintained according to the rules of the MSCI Global Investable Market Indices Methodology during the transition. The Provisional indices helped clients to compare the characteristics of indices constructed under the enhanced GIMI Methodology with those of the Standard Methodology. They also provided clients with the flexibility to transition to the enhanced GIMI Methodology at any point in advance of the second and final phase of the transition of the MSCI Standard and Developed Small Cap Indices to the MSCI GIMI Methodology, which took place as of close of May 30, 2008.

The Provisional indices were discontinued as of July 1, 2008, with the last day of calculation for the Provisional indices being June 30, 2008. Note that Provisional indices were not available for Emerging Markets or All Country (AC) Small Cap indices, or for Developed, Emerging Market or All Country Large, Mid, SMID and IMI capitalization indices, as these indices did not exist prior to June 2007.

**Pro Forma Data**

When MSCI Barra announces the changes that will be made to the MSCI indices as a result of the Quarterly and Semi-Annual Index Reviews, we also provide pro forma data to core module subscribers. The pro forma data is provided to help investors to understand the anticipated changes in the indices on the rebalancing date. The pro forma data reflects the scheduled changes due to the Quarterly and Semi-Annual Index Reviews as if they were implemented on the date of announcement.

Actual index characteristics as well as weights of securities in an index following rebalancings may vary from pro forma data due to various factors, including price movements, capital changes, and corporate events that take place between the release of the pro forma data and the implementation of the rebalancing.

Pro forma data, including market capitalization, number of securities, as well as composition by industry group and country is made available for many MSCI indices, including all major regional indices. In addition, pro forma weights are provided for the largest additions to the indices, as well as the largest increases and decreases in security weights.

## Appendix C: Linear regression postestimation

### Normality tests for bond returns

| Country | Shapiro-Walk test | Shapiro-Francia test | Skewness-kurtosis test |
|---|---|---|---|
| Emerging markets | 0.00000 | 0.00001 | 0.0000 |
| Brazil | 0.00000 | 0.00001 | 0.0000 |
| Bulgaria | 0.00000 | 0.00001 | 0.0000 |
| Mexico | 0.00000 | 0.00001 | 0.0000 |
| Panama | 0.00000 | 0.00001 | 0.0000 |
| Philippines | 0.00000 | 0.00001 | 0.0000 |
| Russia | 0.00000 | 0.00001 | 0.0000 |
| Turkey | 0.00000 | 0.00001 | 0.0000 |
| Ukraine | 0.00000 | 0.00001 | 0.0000 |

**Normality tests for stock returns**

| Country | Shapiro-Walk test | Shapiro-Francia test | Skewness-kurtosis test |
|---|---|---|---|
| Emerging markets | 0.00000 | 0.00001 | 0.0000 |
| Brazil | 0.00000 | 0.00001 | 0.0000 |
| Bulgaria | 0.00000 | 0.00001 | 0.0000 |
| Mexico | 0.00000 | 0.00001 | 0.0000 |
| Panama | 0.00000 | 0.00001 | 0.0000 |
| Philippines | 0.00000 | 0.00001 | 0.0000 |
| Russia | 0.00000 | 0.00001 | 0.0000 |
| Turkey | 0.00000 | 0.00001 | 0.0000 |
| Ukraine | 0.00000 | 0.00001 | 0.0000 |

$H_0$: normal residuals

**Breusch-Pagan / Cook-Weisberg test for heteroskedasticity for bond returns**

| Country | P value |
|---|---|
| Emerging markets | 0.0038 |
| Brazil | 0.0245 |
| Bulgaria | 0.7567 |
| Mexico | 0.0007 |
| Panama | 0.0897 |
| Philippines | 0.0000 |
| Russia | 0.0839 |
| Turkey | 0.1133 |
| Ukraine | 0.5924 |

**Breusch-Pagan / Cook-Weisberg test for heteroskedasticity for stock returns**

| Country | P value |
|---|---|
| Emerging markets | 0.4570 |
| Brazil | 0.0026 |
| Bulgaria | 0.0013 |
| Mexico | 0.1112 |
| Philippines | 0.1114 |
| Russia | 0.3980 |
| Turkey | 0.0092 |
| Ukraine | 0.0689 |

$H_0$: constant variance

**Arellano-Bond test for autocorrelation for bond returns**

| Country | P value for Newey-West correction | P value for OLS |
|---|---|---|
| Emerging markets | 0.1377 | 0.0000 |
| Brazil | 0.0348 | 0.0000 |
| Bulgaria | 0.8371 | 0.6138 |
| Mexico | 0.0643 | 0.0000 |
| Panama | 0.0189 | 0.0000 |
| Philippines | 0.1595 | 0.0000 |
| Russia | 0.9155 | 0.5333 |
| Turkey | 0.4088 | 0.0009 |
| Ukraine | 0.0515 | 0.0000 |

**Arellano-Bond test for autocorrelation for stock returns**

| Country | P value for Newey-West correction | P value for OLS |
|---|---|---|
| Emerging markets | 0.0293 | 0.0000 |
| Brazil | 0.2449 | 0.1051 |
| Bulgaria | 0.3937 | 0.0887 |
| Mexico | 0.1031 | 0.0017 |
| Philippines | 0.0154 | 0.0001 |
| Russia | 0.1302 | 0.0003 |
| Turkey | 0.0284 | 0.0051 |
| Ukraine | 0.0107 | 0.0000 |

$H_0$: there is no autocorrelation

**Appendix D: MATLAB code for bootstrap confidence intervals.**

```
function[Lo,Up]=confint(x,statfun,alpha,B1,B2,varargin)
%
%      [Lo,Up]=confint(x,statfun,alpha,B1,B2,PAR1,...)
%
%      Confidence interval of the estimator of a parameter
%      based on the bootstrap percentile-t method
%
%     Inputs:
%           x - input vector data
%       statfun  -  the  estimator  of  the  parameter  given  as  a
Matlab function
%      alpha  - level of significance (default alpha=0.05)
%              B1  -  number  of  bootstrap  resamplings  (default
B1=199)
%          B2 - number of bootstrap resamplings for variance
%               estimation (nested bootstrap) (default B2=25)
%    PAR1,... - other parameters than x to be passed to statfun
%
%     Outputs:
%         Lo - The lower bound
%         Up - The upper bound
%
%     Example:
%
%     [Lo,Up] = confint(randn(100,1),'mean');
%  Created by A. M. Zoubir and D. R. Iskander
%  May 1998
%  Edited by Mykhailo Bespalko
%  May 2009
pstring=varargin;
if (exist('B2')~=1), B2=25; end;
if (exist('B1')~=1), B1=199; end;
```

```
if (exist('alpha')~=1), alpha=0.05; end;

x=x(:);
vhat=feval(statfun,x,pstring{:});
[vhatstar,ind]=bootstrp(B1,statfun,x,pstring{:});

if length(pstring)~=0,
  if length(pstring{:})==length(x)
     newpstring=pstring{:};
     bstats=bootstrp(B2,statfun,x(ind),newpstring(ind));
  else
     bstats=bootstrp(B2,statfun,x(ind),pstring{:});
  end;
else
  bstats=bootstrp(B2,statfun,x(ind),pstring{:});
end;
bstat=bootstrp(B2,statfun,x,pstring{:});
sigma1=std(bstat);

q1=floor(B1*alpha*0.5);
q2=B1-q1+1;
sigma=std(bstats)';
tvec=(vhatstar-vhat)./sigma;
[st,ind]=sort(tvec);
lo=st(q1);
up=st(q2);
Lo=vhat-up*sigma1;
Up=vhat-lo*sigma1;
```

**Appendix E: Comparison of bootstrap and linear regression confidence intervals for bond returns deviation from mean on Tuesday.**

| Country | Bootstrap approach | Linear regression with Newey West correction |
|---|---|---|
| Emerging markets | (0.02,0.21)* | (0.0036, 0.153)* |
| Brazil | (0.06,0.18)* | (-0.053, 0.163) |
| Bulgaria | (0.01,0.07)* | (-0.055, 0.047) |
| Mexico | (0.01,0.13)* | (-0.0058, 0.13)** |
| Philippines | (0.02,0.27)* | (-0.0052, 0.188)** |
| Russia | (0.03,0.21)* | (-0.0053, 0.169)** |
| Turkey | (0.07,0.27)* | (0.0326, 0.295)* |
| Ukraine | (-0.08,0.11) | (-0.0079, 0.199)** |

Results are given in percents

*, ** - Indicate significance at 95% and 90% confidence levels respectively.