Value-indifferent weighting schemes for developed, emerging and frontier government bond markets[1]

Vanja Piljak

University of Vaasa

Finland

vanja.piljak@uva.fi

Laurens Swinkels

Erasmus University Rotterdam,

The Netherlands

lswinkels@ese.eur.nl

May 2016

---

[1] Swinkels would like to disclose that he is affiliated with Norges Bank Investment Management.

Value-indifferent weighting schemes for developed, emerging and frontier government bond markets

Abstract

We examine the risk and return characteristics of value-indifferent weighting schemes for developed, emerging, and frontier government bond markets; and compare these to market capitalization weighted indexes. Our sample consists of four different groups: (i) 41 investment grade local-currency government bond markets over the period 1987 to 2015; (ii) 25 USD denominated emerging government bond markets over the period 1994 to 2015; (iii) 25 local-currency emerging government bond markets over the period 2008 to 2015; and (iv) 40 USD denominated frontier government bond markets over the period 2002 to 2015. We document positive excess returns for the investment grade sample only when currency risks are not hedged. However, these excess returns can be explained by standard factors from equity and currency markets. For USD denominated emerging and frontier markets, we find (insignificant) positive excess returns that cannot be explained by these standard factors. For local currency emerging markets, excess returns tend to be negative, no matter whether currency risks are hedged or not.

Keywords: Bond markets, Currencies, Emerging markets, Fixed income, Investing

1. Introduction

Arnott, Hsu, and Moore (2005) have been seminal in the development of valuation-indifferent investment strategies. This type of investment strategies is sometimes referred to as "fundamental indexation", as it offers an alternative to a market capitalization weighted index by using each asset's fundamental value rather than its market price. Individual stocks are weighted by their fundamentals such as their book value, sales, or earnings, instead of using market capitalization weights that might overweight stocks that are overvalued. These valuation-indifferent weighting schemes have historically led to superior performance compared to market capitalization weighted portfolios, mainly because the resulting portfolios are (correlated with) value portfolios; see Perold (2007) and Blitz and Swinkels (2008).

Arnott, Hsu, Li, and Shepherd (2010) apply the same idea of value-indifferent weighting to corporate and sovereign bond markets. They use fundamental values to form bond portfolios and compare these to market-capitalization weighted portfolios. For government bond portfolios, they use the gross domestic product of a country, as well as the population, the (square root of) land area, and energy use. These variables are proxies for the production-capacity of a country, which in turn is positively related to the amount of debt a government is able to pay back to its debtors. For government bonds, Arnott, Hsu, Li, and Shepherd (2010) include only dollar-denominated emerging bond markets in their empirical analysis over the period 1997 to 2009. Shepherd (2012) provides risk and return statistics for fundamentally-weighted sovereign developed and local- and foreign-currency emerging government bond indexes over the period 1997 to 2011, but his study does not aim to provide statistical

analyses of the relative performances versus market-capitalization weighted indexes. De Jong and Wu (2014) extend this work to European corporate and sovereign bond markets. For sovereigns, they limit themselves to GDP- weighting schemes within the Eurozone over the period 2003 to 2013. Our paper aims to extend this line of research to global developed and emerging bond markets, in both local currency (currency hedged and unhedged) as well as dollar-denominated debt. Moreover, our sample starts already in 1987 for developed markets, extending the sample period used in prior research. Our results should therefore paint a more complete picture about value-indifferent weighted schemes for government bonds than the existing literature.

The contribution of this paper is that we are the first to provide a comprehensive risk and return analysis of value-indifferent weighting schemes of sovereign bond markets investable to foreign investors. Moreover, we provide the analysis of frontier markets category, which has not been examined earlier in the context of fundamental indexation for bond markets.

We find that value-indifferent weighting schemes are not providing superior risk-return characteristics compared to market-capitalisation weighting schemes for local currency bond markets when currency risks are hedged. We document 0.60 percent per annum excess return when currency risks are not hedged, suggesting that currency forward returns and not fixed income returns are related to country fundamentals. For our sample of emerging markets bonds, we report an excess return of 1.82 percent per annum, which cannot be due to currency risk as these are all bonds denominated in USD. When we examine the relation of these excess returns to factor returns from equity and bond markets, we find that alphas become negative for our investment grade sample, but not for our emerging markets sample.

This paper is organized as follows. Section 2 contains the descriptive statistics of each of the groups of sovereign bond markets we consider. In Section 3, we analyse the risk and return of each of the fundamental weights in relation to the market-capitalization-weighted portfolio. Section 4 relates the returns of these fundamental government bond strategies with value strategies on other asset classes. Section 5 provides conclusions.

2. Data and descriptive statistics

We distinguish four groups of bond markets that come from two different data sources. First, the sample we label "Investment Grade" contains all fixed-rate local currency government bonds with investment grade rating and a bond market that is easily accessible for foreign investors. The data source is Barclays and contains all constituent countries from the Barclays Global Treasury Index, which was established by Lehman Brothers in 1992 and backfilled until January 1987.[2] Within each country, the bonds are weighted by market capitalization. This means that the weighted average remaining maturity differs from country to country based on their issuance patterns.[3] The advantage of working with constituents from an index that was introduced a long time ago is that there is less possibility of survivorship bias or backfill bias, in the sense that countries were added later that were not investable at the time. With only five years of backfill from our data source, the potential for

---

[2] Source: Barclays Global Treasury Index Factsheet (4 March 2014). Notice that there are two differences from pure market capitalization weighting prior to 1999 according to the Lehman Brothers Global Treasury Index (October 1998) report. First, bonds issued in the European Currency Unit (ECU) were considered a separate country. Second, to account for investability the Japanese bond market received a lower weight. When we calculate historical market capitalization weighted indexes, we disregard the "country ECU" and use full market capitalization weighting of Japan, also before 1999.

[3] See Eichengreen, Hausmann, and Panizza (2005) for a discussion the ability of country to borrow at longer maturities.

survivorship bias in our sample is small. Note that the requirement of being rated investment grade eliminates several emerging markets in the beginning of our sample period, but Barclays allows them to enter the index when their ratings are above BBB-, and drop out of our sample the month after their rating drops below BBB-. While the exclusion criteria based on ratings is hard, for inclusion an investment grade rating is required but not sufficient. Elements such as capital constraints and liquidity also play a role. We think this selection criterion is more objective than an ex-post separation of developed and emerging markets, which might be prone to survivorship bias.[4] Moreover, as many portfolio managers are benchmarked against this index, this seems to be a relevant investment universe to consider. Moreover, Thomas and Bennyhoff (2012) show that fundamentally-weighted fixed income indexes often boil down to underweighting the United States and Japan and overweighting emerging markets. Hence, separating investment grade and emerging markets in our analyses might limit the overweight to emerging markets somewhat.

Second, the sample we label "Emerging Markets USD" contains all investable USD-denominated bonds issued on international markets by emerging markets. This data is from the J.P. Morgan EMBI+ index and starts at the end of 1993. The EMBI+ tracks total returns for US dollar-denominated debt instruments issued by emerging market sovereign and quasi-sovereign entities, including Brady bonds, loans, and Eurobonds. Within each country, the bonds are weighted by market capitalization.

Third, the sample we label "Emerging Markets Local" contains all investable fixed-rate local currency treasury bonds from emerging markets that satisfy certain size and investability

---

[4] For example, while Greek government bonds are part of our sample from June 2001 to July 2010, they would not be if we classify them at the end of our sample. Especially for value-like investment strategies like fundamental indexation as we analyse here, biased sample selection may lead to overestimation of returns and underestimation of risk.

criteria. This data is from Barclays Emerging Markets Local Government Universal Index and starts in July 2008. Within each country, the bonds are weighted by market capitalization.

Fourth, the sample we label "Frontier Markets" contains all investable bonds denominated in USD issued on international markets by frontier markets, the next generation of emerging markets. This data is from J.P. Morgan, and contains the constituents of their NEXGEM index, which was launched in 2011 and backfilled until the end of 2001. The NEXGEM index tracks US dollar-denominated debt issued by sovereign and quasi-sovereign issuers. The country must have a rating of Ba1/BB+ or lower by both Moody's and S&P to be classified as a frontier market. Within each country, the bonds are weighted by market capitalization. This is the same sample as used in Piljak and Swinkels (2016). In the Appendix we display for each sample a table that contains the starting date, annualized average return, annualized standard deviation, minimum and maximum on monthly returns of each country, as well as market characteristics (average yield, average maturity, and market capitalization). We take the perspective of an investor with the USD as home currency. For international bonds in local currency, we use both returns hedged to USD using currency derivatives and unhedged in USD. The latter returns are more volatile because of the volatility of the exchange rate, which is typically about twice the volatility of the bond market.

Similar to Arnott, Hsu, Li and Shepherd (2010), we use fundamental factors that are proxies for the current and potential importance of a country in the world economy. The following four factors are the same as in Arnott, Hsu, Li and Shepherd (2010): total population, land area, gross domestic product, and energy consumption. We add the fifth fundamental factor "Natural resources", which should serve as a more advanced proxy for resources as

"land area", which is used by Arnott, Hsu, Li and Shepherd (2010). The data on the five fundamental factors are from the World Bank, the World Development Indicators.

Note that we do not include characteristics that do not directly relate to the fundamental value of a country, such as its credit rating, interest rates, or political risk score; see, e.g., Ilmanen (1995), Ilmanen and Sayood (2002), Duyvesteyn and Martens (2014), Duyvesteyn, Martens, and Verwijmeren (2015). Thomas and Bennyhoff (2012) indicate that these could be important for expected returns on these international bond markets. However, these measures do not refer to the *economic fundamental importance* of a country. For example, the weight of an economically small country with an AAA-rating would be the same as that of an economically large country with an AAA-rating, irrespective of how economically small and large are exactly measured.

3. Risk and return of value-indifferent weighting schemes

In this Section, we analyse the risk and return characteristics of value-indifferent weighting schemes and compare these to a market-capitalisation weighted index. The investment strategies are monthly rebalanced strategies with the portfolio weight of each country *i* at the end of month *t* to be equal to

$$w_{i,t} = \frac{F_{i,t}}{\sum_{k=1}^{K} F_{k,t}}$$

and the total return for fundamental strategy F in month t is

$$R_t^F = \sum_{k=1}^{K} w_{k,t-1} \times R_{k,t}$$

It is important that the weights should be known at the month-end before the returns are measured, such that they can be used in a real-life portfolio context. We abstract from estimating transactions costs in the analyses. Other portfolio characteristics, such as the maturity or yield are calculated in a similar fashion, replacing the return of asset k in period t with the maturity or yield in that period. We also display the Herfindahl Index, a measure of portfolio concentration, as an indication whether the weighting scheme tilts more or less towards countries with large weights in the market capitalization weighted portfolio.

$$HI_t^F = \sum_{k=1}^{K} w_{k,t}^2$$

The Herfindahl Index equals unity on a fully concentrated portfolio and $\frac{1}{K}$ for a portfolio with equal weights. Thus, a lower number indicates a higher degree of diversity of the portfolio. This diversity or portfolio concentration is a naive measure of diversification of a portfolio. It is naive in the sense that it only uses weights and does not take into account correlations between assets.

The alphas in this section are estimated with respect to a single factor model F, with the market capitalization (*MC*) weighted bond portfolio the single factor:

$$R_t^F - R_{f,t} = \alpha + \beta \cdot \left(R_t^{MC} - R_{f,t}\right) + \varepsilon_t^F$$

The tracking error is the standard deviation of the excess return series of the bond portfolio minus the market capitalization weighted index, and the information ratio (IR) the average excess return divided by the tracking error. This measure is closely related to the Sharpe ratio, where the return on the market capitalization weighted portfolio is replaced with the risk-free rate:

$$IR^F = \frac{1}{T}\sum_{t=1}^{T} (R_t^F - R_t^{MC}) \div \sqrt{Var(R_t^F - R_t^{MC})}$$

Table 5 contains the performance of the market capitalization-weighted portfolio and compares this to portfolios weighted by the five fundamental factors, and the composite the equally-weighted average of the five fundamental weights. Note that the first four fundamental factors are the same as in Arnott, Hsu, Li, and Shepherd (2010). The fifth fundamental factor "Natural Resources" is an improved version of "Area", which they use as "a crude proxy for resources". Each panel contains a different sample of bond markets or differs with respect to currency hedged or unhedged performance evaluation. As far as we know, we are the first to investigate these fundamental factors for such a broad sample of local currency government bonds for such a long period. De Jong and Wu (2014) only consider Eurozone government bonds over the period 2003 to 2013 and Arnott, Hsu, Li, and Shepherd

(2010) only investigate hard-currency government bonds issued by emerging markets over the period 1997 to 2009.

<INSERT TABLE 1 ABOUT HERE>

Table 1 Panel A contains the results for the sample of investment grade government bonds and investigates the currency hedged performance over the period January 1987 until December 2015. The market cap portfolio has a return of 6.17 percent per annum for a volatility of 3.19 percent. The Sharpe ratio of this portfolio has been 0.92 over this period. The market cap portfolio has a weighted average maturity of 7.92 years, a yield of 4.34 percent, and a diversity score of 0.19 (with 1.00 being the least diversified portfolio that invests everything in one country). The average return is substantially higher than the average yield, which can be explained by a falling interest rate over this sample period. For each of the five fundamental factors and the equally-weighted composite, the returns are about the same as for the market cap portfolio. The highest excess return is 0.05 percent (or 5 basis points) per annum for the GDP-weighted portfolio. Since the betas for each fundamental factor are slightly above unity, the risk-adjusted excess returns or alphas are even smaller or more negative. Hence, our conclusion from Panel A is that for an international local-currency government bond investor who hedged his currency risk, fundamental weighting does not seem to add much value compared to market capitalization weighting.

Table 1 Panel B contains the performance statistics of the same fundamental weighting schemes, but then evaluating the unhedged returns in USD. We see that these

results are notably different from currency hedged returns from Panel A. First, the Sharpe

ratios are markedly smaller due to the increased volatility of the unhedged return series, due

to the approximately double volatility of currencies relative to bonds. The excess returns are

now between 0.36 and 0.84 percent per year, and the risk-adjusted excess return of 1.08

percent per annum is statistically significant at the 10 percent level for the composite. The

reason that the alphas are above the excess returns is that the exposures to the market, the

betas, are somewhat below unity. The information rations for the individual factors are

between 0.08 and 0.12, and 0.20 for the composite. From Panel B we conclude that

fundamental or value-indifferent weighting schemes for unhedged bond returns are

statistically significantly higher than for market cap weighting schemes. The combination of

Table 1, Panels A and B implies that fundamental weighting might be particularly relevant for

currency forward returns, and less so for the bond returns themselves.

< INSERT TABLE 2 ABOUT HERE >

Table 2 shows the results for the dollar-denominated emerging markets government

bond index. The volatility of our fundamental weighting schemes is typically larger than the

market cap index. The composite index has a volatility of 16.24 percent, while the market cap

portfolio has a volatility of 13.46 percent. Arnott, Hsu, Li, and Shepherd (2010)'s market cap

index had a volatility of 13.87 percent, but their composite fundamental weighting scheme

only 11.72. Our excess returns with respect to the market cap weighted index are all positive,

but the risk-adjusted excess returns are never statistically significant. While our excess returns

and tracking errors are close to Arnott, Hsu, Li, and Shepherd (2010), the risk-adjusted excess

returns that we find are markedly lower. For example, in their sample "Population" had an excess return of 0.43 percent per annum while we have 1.40 percent per annum. However, they report an alpha of 3.44 percent per annum with a t-statistic of 2.09, while we estimate alpha to be 1.18 and statistically insignificant with a t-statistic of 1.33. Our empirical results only partially support the findings of Arnott, Hsu, Li, and Shepherd (2010) for hard-currency emerging government bonds.[5]

< INSERT TABLE 3 ABOUT HERE >

Table 3 Panel A reports the results for the sample of local currency emerging government bonds and investigates the currency hedged performance over the period July 2008 until December 2015. The market cap portfolio has a return of 3.45 percent per annum for a volatility of 2.72 percent, while the Sharpe ratio of this portfolio has been 1.23 over this period. The market cap portfolio has a weighted average maturity of 7.88 years, a yield of 5.57 percent, and a diversity score of 0.13. The average return is substantially lower than the average yield. This is due the interest differential between many of the emerging markets with the USD, which is effectively the cost of currency hedging. For each of the five fundamental factors and the equally-weighted composite, the returns are slightly lower than for the market cap portfolio. The excess returns per annum are negative for all five fundamental-weighted portfolios.

---

[5] Note that our sample is different from Arnott, Hsu, Li, and Shepherd (2010) and it is impossible to reconcile precisely where the differences come from. They mention the Merrill Lynch USD Emerging Markets Sovereign Plus Index has 36 countries, while our sample has 22 countries. Moreover, our country indexes are market cap weighted within each country, while they weight bonds according to their face value.

Table 3 Panel B shows the performance statistics of the same fundamental weighting schemes, but then evaluating the unhedged returns in USD. Those results differ from currency hedged returns from Panel A in several ways. First, the Sharpe ratios are markedly smaller due to the increased volatility of the unhedged return series (similar to the pattern of investment grade sample). Second, in the currency unhedged sample, for three fundamental factors (population, GDP, and energy consumption) the returns are higher than for the market cap portfolio; while in the currency hedged sample, the returns for all five fundamental factors are lower than for the market cap portfolio.

Since the estimated betas relative to the market cap portfolio are close to one, and the realized return on the market portfolio is relatively small with 3.45 per cent, the excess returns and alphas are qualitatively the same for the currency-hedged analysis. All are negative except the alpha for GDP-weighting of 0.24, which is statistically insignificant with a t-statistic of 0.43. For the unhedged sample, the results are mixed with some positive and negative alphas that are statistically insignificant, leading to an alpha that is virtually zero for the Composite indicator.

< INSERT TABLE 4 ABOUT HERE >

Table 4 shows the results for the dollar-denominated frontier markets government bond index. For each of the five fundamental factors and the equally-weighted composite, the returns are higher than for the market cap portfolio and the volatility lower, leading to higher Sharpe ratios. The betas of these fundamental strategies are close to 0.8, which leads

to alphas that are higher than the raw excess returns. For the Composite indicator, the excess return is 0.49, the alpha 2.40, and corresponding t-statistic 2.29. This suggests that fundamental strategies have higher risk-adjusted returns than market cap weighted portfolios for frontier markets.

4. Factor exposures of value-indifferent government bond weighting

In this section, we investigate to what extend the value-indifferent weighting schemes are related to known factors in equity markets and currency markets. We examine three asset pricing models; 1) the Fama and French (1996) three factor model with the excess return on the equity market, the return on small stocks minus the return on large stocks, and the return on value stocks minus the return on growth stocks. We do this for factors derived from US equity markets and from the sample of international stocks markets. The data is downloaded from the online data library maintained by Kenneth French.[6] The US equity sample is available from the start of our sample, but the international series only from July 1990. For currency factors, we use the Deutsche Bank value, momentum, and carry factors on the G10 currency universe. We obtain the excess return index series from Bloomberg with codes "DBPPPUSF Index", "DBMOMUSF Index", and "DBHTG10U Index", respectively. These series start in July 1989. The existence of these currency factors is analysed in for example Kroencke, Schindler, and Schrimpf (2014) and Barroso and Santa-Clara (2015). The excess return series that we use is the composite fundamental index minus the market capitalization weighted index. The tests we report are based on the regression equation:

$$R_t^F - R_t^{MC} = \alpha + \beta \cdot RMRF_t + \gamma \cdot SMB_t + \delta \cdot HML_t + \varepsilon_t^F$$

< INSERT TABLE 5 ABOUT HERE >

Table 5 contains the regression results of the equation above. We see that the excess returns of 0.60 percent per annum for the Investment Grade sample becomes negative for all three ways of factor-adjustments. It seems that the returns can be explained by exposures to exposures to the equity market and equity value strategies, as well as currency value and currency carry strategies. This is much less the case for the Emerging Markets USD sample. Although several exposures are statistically significantly different from zero, the adjustment to the excess return is much lower and alphas remain positive, although never statistically different from zero. For the local currency emerging bond markets, exposures to the risk factors are close to zero and alphas remain (insignificantly) negative. For the frontier markets sample, factor exposures also tend to be small, rendering alphas and excess returns almost equal to each other. So they remain (insignificantly) positive.

5. Conclusions

Fundamental indexation in fixed-income markets has recently gained significant interest as an investment strategy. While fundamental indexation has been traditionally investigated in stock markets, the most recent literature has applied the valuation-indifferent weighting approach to bond markets as well. In this paper, we contribute to this strand of the literature

16

by providing a comprehensive risk and return analysis of value-indifferent weighting schemes of sovereign bond markets investable to foreign investors. Our sample comprises of four different groups of government bond markets: (i) investment grade local-currency government bond markets; (ii) USD denominated emerging government bond markets; (iii) local-currency emerging government bond markets; and (iv) USD denominated frontier government bond markets. The novelty of our paper relates also to the analysis of frontier markets category, which has not been examined earlier in the context of fundamental indexation for bond markets.

Our main findings indicate that value-indifferent weighting schemes are not providing superior risk-return characteristics compared to market-capitalisation weighting schemes for local currency bond markets when currency risks are hedged. We provide evidence of positive excess returns for the investment grade sample only when currency risks are not hedged. However, these excess returns can be explained by standard factors from equity and currency markets. For emerging and frontier markets, we find insignificantly positive excess returns that cannot be explained by these standard factors. Excess returns for local currency emerging bond markets are negative regardless whether currency risks are hedged.

References

Arnott, R., Hsu, J., Li, F., and Shepherd, S., 2010, "Value-indifferent weighting for bonds", *Journal of Portfolio Management* 36(3), pp. 117-130.

Arnott, R., Hsu, J., and Moore, P., 2005, "Fundamental indexation", *Financial Analysts Journal* 61(2), pp. 83-99.

Barroso, P., and Santa-Clara, P., 2015, "Beyond the carry trade: Optimal currency portfolios", *Journal of Financial and Quantitative Analysis*, forthcoming.

Blitz, D., and Swinkels, L., 2008, "Fundamental indexation: An active value strategy in disguise", *Journal of Asset Management* 9(4), pp. 264-269.

De Jong, M., and Wu, H., 2014, "Fundamental indexation for bond markets", *Journal of Risk Finance* 15(3), 264-274.

Duyvesteyn, J., and Martens, M., 2014, Emerging Government Bond Market Timing, *Journal of Fixed Income* 23(3), pp. 36-49.

Duyvesteyn, J., Martens, M., and Verwijmeren, P., 2015, "Political Risk and Expected Government Bond Returns", *Journal of Empirical Finance,* forthcoming.

Eichengreen, B., Hausmann, R., and Panizza, U., 2005, "The pain of original sin", In Other people's money: Debt denomination and financial instability in emerging-market economies, ed. Barry Eichengreen and Ricardo Hausmann, 13–47. Chicago: University of Chicago Press

Fama, E., and French, K., 1996, "Multifactor explanations of asset pricing anomalies", *Journal of Finance* 51(1), pp. 55-84.

Ilmanen, A., 1995, "Time-varying expected returns in international bond markets", *Journal of Finance* 50(2), pp. 481-506.

Ilmanen, A., and Sayood, R., 2002, "Quantitative Forecasting Models and Active Diversification for International Bonds", *Journal of Fixed Income* 12(3), pp. 40-51.

Kroencke, T., Schindler, F., and Schrimpf, A., 2014, "International diversification benefits with foreign exchange investment styles", *Review of Finance* 18(5), pp. 1847-1883.

Perold, A., 2007, "Fundamentally flawed indexing", *Financial Analysts Journal* 63(6), pp. 31-37.

Piljak, V., and Swinkels, L., 2016, "Frontier and emerging government bond markets", *Emerging Markets Review*, forthcoming.

Shepherd, S., 2012, "A fundamentally weighted broad-based fixed-income index", *Journal of Indexes* 15(1), pp. 20-23.

Thomas, C., and Bennyhoff, D., 2012, "A review of alternative approaches to fixed income indexing", Journal of Indexes 15(1), pp. 10-19.

Table 1: Performance of value-indifferent portfolios for investment grade government bonds

This table contains the return and risk characteristics of value-indifferent weighting schemes in investment grade government bond markets over the period January 1987 to December 2015. Panel A contains the returns hedged to USD using currency derivatives. Panel B contains the returns in USD without currency hedging. The average bond maturity is in years, average bond yield in percentage per annum, and the diversity score is the Herfindahl-index on the portfolio weights. The average return, volatility, and alphas are in percentages and have been annualized.

	Return	Volatility	Sharpe	Maturity	Yield	Divers	Excess return	Alpha	T-stat	Beta	Tracking err	Inform Ratio
Investment Grade - currency hedged - 1987/1-2015/12												
Market cap	6.17	3.19	0.92	7.90	4.35	0.19	-	-	-	-	-	-
Population	6.20	3.30	0.89	7.69	5.14	0.14	0.03	0.01	0.09	1.01	0.80	0.04
Area	6.02	4.06	0.68	7.74	5.88	0.24	-0.15	-0.42	-1.08	1.09	2.07	-0.07
GDP	6.22	3.36	0.88	7.78	4.73	0.18	0.05	-0.06	-0.51	1.04	0.61	0.09
Energy cons	6.16	3.51	0.83	7.84	4.97	0.24	-0.01	-0.20	-1.13	1.06	0.93	-0.01
Nat resource	5.97	3.83	0.71	7.90	5.73	0.21	-0.19	-0.42	-1.32	1.08	1.68	-0.12
Composite	*6.11*	*3.53*	*0.81*	*7.74*	*5.25*	*0.15*	*-0.05*	*-0.22*	*-1.07*	*1.06*	*1.07*	*-0.05*
Investment Grade - currency unhedged - 1987/1-2015/12												
Market cap	6.14	6.81	0.42	7.90	4.35	0.19	-	-	-	-	-	-
Population	6.79	7.03	0.50	7.69	5.14	0.14	0.65	0.75	1.64	0.97	2.43	0.27
Area	6.98	7.55	0.49	7.74	5.88	0.24	0.84	1.74	1.57	0.69	6.27	0.13
GDP	6.64	6.58	0.51	7.78	4.73	0.18	0.50	0.68	2.44	0.94	1.54	0.33
Energy cons	6.50	5.99	0.54	7.84	4.97	0.24	0.36	0.87	2.23	0.82	2.43	0.15
Nat resource	6.80	7.06	0.50	7.90	5.73	0.21	0.66	1.38	1.52	0.75	5.14	0.13
Composite	*6.74*	*6.46*	*0.54*	*7.74*	*5.25*	*0.15*	*0.60*	*1.08*	*1.89*	*0.83*	*3.27*	*0.33*

Table 2: Performance of value-indifferent portfolios for USD-denominated emerging government bonds

This table contains the return and risk characteristics of value-indifferent weighting schemes in USD-denominated emerging government bond markets over the period January 1994 to December 2015. Returns are in USD. The average bond maturity is in years and the diversity score is the Herfindahl-index on the portfolio weights. The average return, volatility, and alphas are in percentages and have been annualized.

	Return	Volatility	Sharpe	Maturity	Yield	Divers	Excess return	Alpha	T-stat	Beta	Tracking err	Inform Ratio
EMBI PLUS 1994/1-2015/12												
Market cap	9.83	13.46	0.54	13.49	6.85	0.14	-	-	-	-	-	-
Population	11.22	14.45	0.60	13.09	6.38	0.11	1.40	1.18	1.33	1.03	4.10	0.34
Area	12.47	19.26	0.52	11.67	7.14	0.26	2.64	0.95	0.45	1.23	10.27	0.26
GDP	10.23	13.24	0.58	12.83	6.68	0.14	0.40	0.64	1.20	0.97	2.52	0.16
Energy cons	12.03	17.66	0.54	11.39	6.55	0.19	2.21	1.33	0.67	1.12	9.32	0.24
Nat resource	12.27	18.07	0.54	12.30	6.95	0.23	2.44	1.22	0.63	1.17	9.16	0.27
Composite	*11.64*	*16.24*	*0.56*	*12.26*	*6.74*	*0.16*	*1.82*	*1.06*	*0.75*	*1.10*	*6.69*	*0.27*

Table 3: Performance of value-indifferent portfolios for local currency emerging government bonds

This table contains the return and risk characteristics of value-indifferent weighting schemes in local currency emerging government bond markets over the period July 2008 to December 2015. Panel A contains the returns hedged to USD using currency derivatives. Panel B contains the returns in USD without currency hedging. The average bond maturity is in years, average bond yield in percentage per annum, and the diversity score is the Herfindahl-index on the portfolio weights. The average return, volatility, and alphas are in percentages and have been annualized.

	Return	Volatility	Sharpe	Maturity	Yield	Divers	Excess return	Alpha	T-stat	Beta	Tracking err	Inform Ratio
Emerging (local currency)- currency hedged - 2008/7-2015/12												
Market cap	3,45	2,72	1,23	7,88	5,57	0,13	-	-	-	-	-	-
Population	3,14	3,22	0,94	8,89	6,64	0,22	-0,31	-0,78	-2,26	1,14	0,96	-0,32
Area	2,01	4,21	0,45	7,18	8,06	0,18	-1,44	-0,51	-0,35	0,74	3,78	-0,38
GDP	3,33	2,84	1,13	7,74	6,33	0,17	-0,12	0,24	0,43	0,90	1,48	-0,08
Energy cons	2,79	2,66	1,01	8,35	5,90	0,24	-0,67	-0,15	-0,29	0,85	1,37	-0,49
Nat resource	2,11	3,46	0,58	7,82	6,99	0,18	-1,34	-0,39	-0,35	0,73	2,94	-0,46
Composite	2,68	2,98	0,86	*8,00*	6,78	*0,16*	-0,78	-0,32	-0,45	0,87	1,85	-0,42
Emerging (local currency)- currency unhedged - 2008/7-2015/12												
Market cap	3,25	8,55	0,37	7,88	5,57	0,13	-	-	-	-	-	-
Population	4,46	7,60	0,57	8,89	6,64	0,22	1,21	1,72	1,96	1,82	2,72	0,45
Area	1,14	12,52	0,08	7,18	8,06	0,18	-2,12	-2,70	-0,98	1,03	7,59	-0,28
GDP	3,65	8,46	0,42	7,74	6,33	0,17	0,39	0,56	0,64	1,41	2,40	0,16
Energy cons	3,47	7,29	0,46	8,35	5,90	0,24	0,21	0,86	0,93	1,28	3,04	0,07
Nat resource	2,21	10,10	0,21	7,82	6,99	0,18	-1,04	-0,98	-0,48	1,01	5,59	-0,19
Composite	2,99	8,87	0,32	*8,00*	6,78	*0,16*	-0,27	-0,11	-0,08	1,31	3,55	-0,08

Table 4: Performance of value-indifferent portfolios for USD-denominated frontier government bonds

This table contains the return and risk characteristics of value-indifferent weighting schemes in USD-denominated frontier government bond markets over the period January 2002 to December 2015. Returns are in USD. The average bond maturity is in years and the diversity score is the Herfindahl-index on the portfolio weights. The average return, volatility, and alphas are in percentages and have been annualized.

	Return	Volatility	Sharpe	Maturity	Yield	Divers	Excess return	Alpha	T-stat	Beta	Tracking err	Inform Ratio
Frontier markets 2002/1-2015/12												
Market cap	10.38	12.62	0.72	10.09	8.34	0.13	-	-	-	-	-	-
Population	10.45	10.83	0.84	7.18	7.68	0.18	0.07	2.26	1.61	0.76	5.95	0.01
Area	11.39	10.88	0.92	8.28	8.12	0.16	1.00	2.87	2.44	0.79	5.03	0.20
GDP	11.19	11.03	0.89	8.45	7.83	0.15	0.80	2.37	2.40	0.83	4.21	0.19
Energy cons	10.88	10.19	0.94	7.33	7.11	0.19	0.50	2.90	2.47	0.74	5.44	0.09
Nat resource	10.47	11.32	0.81	8.92	7.47	0.24	0.09	1.58	1.40	0.84	4.60	0.02
Composite	10.87	10.66	0.90	*8.03*	*7.64*	*0.15*	0.49	2.40	2.29	0.79	4.65	0.11

Table 5: Factor-adjusted excess returns for value-indifferent weighting schemes

This table contains the factor-adjusted excess returns of each of the samples of value-indifferent weighting schemes. The row with RAW contains the annualized average excess returns of the investment strategy and the factors. The factors labelled "US EQ" are from the data library of Kenneth French based on the US equity market, the factors labelled "INT EQ" are from the data library of Kenneth French based on global equity returns, and the factors labelled "CURR" are from Deutsche Bank based on G10 currencies. The acronyms "RMRF" is the equity market minus the short-term risk-free rate, "SMB" is the Small Minus Big factor, also known as the size effect, and "HML" is High Minus Low, also known as the value effect. The acronyms "VAL" is currency value (absolute Purchasing Power Parity), "MOM" is momentum, and "CRY" is nominal interest rate carry. The alphas are annualized. The top line of the regression is the coefficient, while the bottom line (in italics) is the t-statistic for the null hypothesis that the parameter is zero.

Investment Grade Hedged

RAW	-0.05	7.53	1.25	2.09
	ALPHA	RMRF	SMB	HML
US EQ	-0.07	0.00	0.00	0.00
	-0.35	*0.60*	*-0.26*	*0.00*
RAW	-0.02	5.11	0.50	3.61
	ALPHA	RMRF	SMB	HML
INT EQ	-0.06	0.00	0.01	0.01
	-0.28	*0.65*	*1.35*	*0.64*
RAW	0.00	3.24	2.21	3.33
	ALPHA	VAL	MOM	CRY
CURR	0.06	-0.01	-0.01	0.00
	0.30	*-1.61*	*-1.62*	*-0.16*

Investment Grade Unhedged

RAW	0.60	7.53	1.25	2.09
	ALPHA	RMRF	SMB	HML
US EQ	-0.11	0.08	0.03	0.05
	-0.19	*6.84*	*1.90*	*2.88*
RAW	0.43	5.11	0.50	3.61
	ALPHA	RMRF	SMB	HML
INT EQ	-0.16	0.08	0.05	0.05
	-0.27	*6.60*	*1.95*	*2.14*
RAW	0.58	3.24	2.21	3.33
	ALPHA	VAL	MOM	CRY
CURR	-0.15	0.04	-0.03	0.20
	-0.29	*2.25*	*-1.77*	*12.36*

Emerging Markets USD

RAW	1.82	7.31	1.86	1.87
	ALPHA	RMRF	SMB	HML
US EQ	1.29	0.05	0.10	0.00
	0.91	*1.74*	*2.64*	*-0.06*
RAW	1.82	5.70	0.23	3.79
	ALPHA	RMRF	SMB	HML
INT EQ	1.33	0.06	0.13	0.02
	0.93	*2.36*	*2.33*	*0.48*
RAW	1.82	3.67	2.38	4.15
	ALPHA	VAL	MOM	CRY
CURR	1.77	0.02	-0.10	0.05
	1.22	*0.38*	*-2.08*	*1.11*

Table 5 (continued)

Emerging Local Hedged

RAW	-0.78	9.88	2.22	-2.10
	ALPHA	RMRF	SMB	HML
US EQ	-1.28	0.06	-0.05	-0.02
	-2.04	4.72	-1.97	-0.76
RAW	-0.78	6.34	0.71	-1.56
	ALPHA	RMRF	SMB	HML
INT EQ	-1.15	0.05	0.00	-0.03
	-1.86	4.78	0.09	-1.09
RAW	-0.78	4.24	1.93	-0.76
	ALPHA	VAL	MOM	CRY
CURR	-0.47	-0.03	-0.07	0.05
	-0.83	-1.29	-3.75	2.83

Emerging Local Unhedged

RAW	-0.27	9.88	2.22	-2.10
	ALPHA	RMRF	SMB	HML
US EQ	-0.38	0.03	-0.08	-0.02
	-0.29	1.03	-1.69	-0.37
RAW	-0.27	6.34	0.71	-1.56
	ALPHA	RMRF	SMB	HML
INT EQ	-0.38	0.01	0.00	-0.02
	-0.29	0.54	0.06	-0.32
RAW	-0.27	4.24	1.93	-0.76
	ALPHA	VAL	MOM	CRY
CURR	-0.22	0.05	-0.11	0.05
	-0.18	0.87	-2.69	1.19

Frontier Markets USD

RAW	0.49	6.50	2.89	1.38
	ALPHA	RMRF	SMB	HML
US EQ	1.07	-0.07	-0.03	-0.02
	0.87	-2.82	-0.70	-0.39
RAW	0.49	6.70	2.20	2.43
	ALPHA	RMRF	SMB	HML
INT EQ	1.11	-0.08	-0.12	0.07
	0.91	-3.49	-1.87	1.07
RAW	0.49	3.57	2.21	2.45
	ALPHA	VAL	MOM	CRY
CURR	0.41	0.00	0.14	-0.09
	0.34	-0.10	3.40	-2.36

Appendix

Table A1: Descriptive statistics from the investment grade sample, 1987-2015.

This table contains the descriptive statistics from the investment grade sample. Average return and volatility are annualized. Minimum and maximum are monthly. Average yield is in percentage per annum. Average maturity in years. Market cap in USD billions. Numbers are calculated over the periods the country was in the index, which is indicated by the first columns.

	Index inclusion			USD Hedged Returns				USD Unhedged Returns				Market characteristics		
	Enter	Exit	Obs	Average	Volatility	Min	Max	Average	Volatility	Min	Max	Yield	Maturity	Mkt cap
Australia	Apr-88	-	333	5.5	4.7	-3.7	5.7	8.7	11.8	-14.6	10.0	6.6	5.8	74
Austria	Jan-87	-	348	6.3	3.8	-2.9	4.6	7.0	10.9	-9.5	10.7	4.7	7.6	112
Belgium	Jan-87	-	348	6.8	4.1	-4.0	6.2	7.6	10.8	-9.8	11.0	5.0	7.3	210
Canada	Jan-87	-	348	6.5	5.0	-4.7	6.2	7.5	9.0	-12.2	7.8	5.5	9.3	208
Chile	Jan-05	-	132	3.7	3.9	-2.8	6.4	4.7	12.8	-15.4	10.3	5.3	4.3	4
Czech	Jan-05	-	132	5.8	4.5	-4.7	3.7	5.2	13.8	-11.3	12.2	2.7	7.3	39
Denmark	Jan-87	-	348	6.5	4.6	-3.6	4.9	8.0	10.7	-9.9	13.8	5.2	7.0	75
Finland	Jul-91	-	294	6.5	3.9	-3.2	3.7	6.4	11.2	-12.7	10.6	4.5	5.6	52
France	Jan-87	-	348	6.4	4.4	-3.6	4.4	7.5	10.8	-9.3	11.6	5.0	8.4	670
Germany	Jan-87	-	348	6.0	3.6	-2.6	3.8	6.5	10.8	-10.0	11.5	4.4	7.0	708
Greece	Jun-01	Jul-10	109	2.3	8.0	-15.0	8.2	6.9	13.5	-16.8	7.9	4.2	7.7	187
Hong Kong	Sep-04	-	116	3.4	2.7	-2.3	3.2	3.0	2.8	-2.4	3.2	2.0	3.6	4
Hungary	Jan-05	Dec-11	84	3.3	8.0	-7.9	8.4	5.0	23.2	-20.7	16.0	7.6	4.9	33
Ireland	Jan-87	-	348	7.7	7.2	-9.5	15.4	9.2	12.9	-15.8	15.6	5.9	7.9	44
Israel	Jan-12	-	48	5.5	3.4	-2.6	2.9	6.0	6.7	-3.5	4.0	2.2	6.4	53
Italy	Jan-87	-	348	7.0	4.7	-5.1	5.6	8.0	12.1	-13.7	10.3	6.5	6.9	700
Japan	Jan-87	-	348	6.2	3.8	-4.9	5.1	5.4	12.2	-11.3	16.7	2.2	7.2	2,744
Latvia	Feb-14	-	23	8.5	4.5	-2.9	3.5	-2.7	8.6	-4.0	4.4	1.2	6.7	3
Lithuania	Jan-15	-	12	4.2	5.6	-2.8	2.6	-6.5	9.9	-4.4	3.8	0.7	7.0	4
Luxembourg	Jan-10	-	72	5.0	3.8	-2.7	3.2	0.9	9.5	-7.0	6.7	1.5	6.8	7
Malaysia	Jan-06	-	120	2.7	3.0	-3.2	3.9	3.0	8.9	-10.2	7.2	3.6	6.1	72
Mexico	Jan-05	-	132	6.0	6.6	-8.4	7.4	5.9	14.4	-21.4	12.7	6.8	8.4	103
Netherlands	Jan-90	-	312	6.1	3.9	-3.1	4.4	6.4	10.5	-10.0	11.0	4.4	7.7	222
New Zealand	Jan-87	-	348	5.5	3.9	-3.1	4.5	10.5	12.2	-11.9	13.1	7.1	5.1	17
Norway	Apr-91	-	297	5.0	3.8	-3.6	4.2	5.9	11.1	-11.6	9.7	4.8	5.4	23
Poland	Jan-05	-	132	4.2	3.5	-2.8	2.8	4.9	16.3	-15.0	10.6	4.5	5.0	95
Portugal	Aug-91	Nov-11	244	3.9	6.1	-7.4	9.0	6.4	12.4	-12.3	10.9	6.2	5.8	53
Russia	Apr-14	-	21	-1.5	12.6	-11.1	6.0	-26.4	38.6	-27.4	19.4	10.5	5.4	44
Singapore	Jan-02	-	168	3.7	3.4	-2.9	3.9	5.2	7.1	-7.3	5.9	1.9	6.3	43
Slovakia	Jan-05	-	132	5.7	3.9	-4.6	3.4	6.4	12.2	-10.8	12.2	3.0	5.9	20
Slovenia	Jan-05	-	132	5.8	5.9	-8.4	5.6	4.2	12.6	-11.9	10.1	3.7	6.8	12
South Africa	Jan-05	-	132	2.1	7.2	-6.2	8.1	0.0	20.1	-16.4	16.5	8.1	10.0	67
South Korea	Jan-02	-	168	5.7	3.2	-2.0	6.7	7.3	12.7	-12.7	22.5	4.1	4.7	293
Spain	Jan-89	-	324	6.7	5.0	-6.8	6.9	7.6	12.0	-13.1	11.9	6.0	6.7	310
Sweden	Jan-87	-	348	6.0	4.6	-3.9	4.5	7.0	11.4	-11.3	9.8	5.8	6.2	65
Switzerland	Jan-10	-	72	4.2	3.8	-2.2	3.6	4.8	11.3	-9.9	11.6	0.6	10.1	96
Taiwan	Jan-06	Dec-11	72	5.4	3.3	-2.9	3.7	4.2	6.0	-4.2	4.7	1.8	8.7	117
Thailand	Jan-02	*	152	4.6	5.9	-5.5	7.3	7.9	8.4	-5.4	10.2	3.7	8.3	49
Turkey	Apr-14	-	21	-1.3	9.1	-4.3	4.6	-8.9	16.9	-7.4	9.6	9.1	5.1	74
United Kingdom	Jan-87	-	348	6.2	5.9	-4.8	6.5	8.4	10.8	-9.0	12.6	5.7	11.8	632
United States	Jan-87	-	348	6.1	4.5	-4.4	5.3	6.1	4.5	-4.4	5.3	4.7	8.1	2,644

* Thailand left the index from Mar-07 to Jun-2008

Table A2: Descriptive statistics from the emerging markets USD sample, 1994-2015.

This table contains the descriptive statistics from the emerging markets USD sample. Average return and volatility are annualized. Minimum and maximum are monthly. Average yield is in percentage per annum, and data on yields only starts in December 2001. Average maturity in years. Market cap in USD billions. Numbers are calculated over the periods the country was in the index, which is indicated by the first columns.

	Index inclusion			USD Hedged Returns				Market characteristics		
	Enter	Exit	Obs	Average	Volatility	Min	Max	Yield	Maturity	Mkt cap
Argentina	Jan-94	-	264	8.5	28.0	-43.9	33.8	18.3	16.8	14
Brazil	Jan-94	-	264	11.6	18.7	-27.2	26.5	7.0	14.6	36
Bulgaria	Jan-94	Dec-13	240	13.1	18.1	-36.4	25.8	4.2	9.9	2
Colombia	Jun-99	-	199	10.3	10.6	-12.5	12.2	6.3	11.0	10
Croatia	Apr-11	-	57	7.4	9.3	-7.4	5.8	5.2	6.9	7
Ecuador	Jan-94	Nov-14	251	15.1	29.6	-55.8	28.3	11.9	15.7	2
Egypt	Jun-02	Apr-08	71	9.8	4.9	-3.1	5.1	0.0	6.2	1
Hungary	May-11	-	56	8.9	10.2	-5.6	9.8	5.3	10.1	10
Indonesia	Nov-06	-	110	8.3	16.7	-24.2	27.0	5.8	16.4	16
Malaysia	Feb-02	Dec-04	35	9.8	6.7	-4.0	4.2	0.0	7.1	4
Mexico	Jan-94	-	264	8.7	10.4	-14.6	12.9	5.5	16.6	31
Morocco	Jan-94	Nov-06	155	9.9	15.9	-30.3	22.5	5.7	4.9	2
Nigeria	Jan-94	Oct-06	154	14.9	18.2	-25.7	15.5	0.0	19.5	2
Panama	Jan-94	-	264	13.0	18.1	-22.6	28.9	6.1	15.4	5
Peru	Jan-94	-	264	12.7	19.5	-29.9	34.5	6.1	13.9	6
Philippines	Jan-94	*	257	8.9	10.3	-20.4	7.8	6.2	13.3	14
Poland	Jan-94	Apr-07	160	11.1	14.4	-23.8	19.9	0.0	14.5	4
Qatar	Dec-00	Aug-02	21	20.3	7.3	-5.0	3.8	0.0	19.3	3
Romania	Mar-13	-	34	6.1	7.6	-4.9	6.0	4.2	10.1	5
Russia	Jan-94	-	264	14.9	29.2	-72.2	35.6	6.0	10.7	27
South Africa	Jan-95	*	190	7.5	7.6	-14.2	9.4	5.0	7.1	5
South Korea	May-98	Jul-02	51	13.6	16.3	-22.5	18.7	5.5	6.8	4
Turkey	Aug-99	-	197	10.7	13.2	-15.8	12.5	6.8	11.8	24
Ukraine	Aug-01	-	173	11.6	24.1	-33.0	38.5	9.8	4.8	4
Venezuela	Jan-94	-	264	12.1	24.0	-39.1	34.0	12.8	14.4	14

* Philippines was not included from Oct-98 to Apr-99, South Africa was not included from Mar-97 to Mar-02

Table A3: Descriptive statistics from the emerging markets (local currency) sample, 2008-2015.

This table contains the descriptive statistics from the local currency emerging markets sample. Average return and volatility are annualized. Minimum and maximum are monthly. Average yield is in percentage per annum. Average maturity in years. Market cap in USD billions. Numbers are calculated over the periods the country was in the index, which is indicated by the first columns.

	Index inclusion			USD Hedged Returns				USD Unhedged Returns				Market characteristics		
	Enter	Exit	Obs	Average	Volatility	Min	Max	Average	Volatility	Min	Max	Yield	Maturity	Mkt cap
Argentina	Jul-08	Jun-11	36	22,0	47,9	-50,0	38,5	33,0	52,0	-55,8	40,1	29,1	2,5	0,3
Brazil	Jul-08	-	90	2,2	5,4	-4,0	5,8	0,3	18,3	-14,3	13,4	11,1	3,2	171,9
Chile	Jul-08	-	90	3,4	4,0	-2,3	6,4	3,6	13,3	-15,4	10,3	4,9	4,5	4,6
China	Jul-08	-	90	2,9	2,6	-1,9	2,0	5,2	3,0	-2,1	2,7	3,5	9,3	688,5
Colombia	Jul-08	-	90	6,5	5,6	-3,8	6,0	3,7	17,5	-12,4	14,8	6,8	6,3	51,3
Croatia	Jul-08	-	90	4,7	4,3	-5,0	4,8	1,8	13,1	-11,4	8,2	5,0	4,8	3,9
Czech Republic	Jul-08	-	90	6,6	4,9	-4,7	3,7	1,1	14,9	-11,3	12,2	2,3	7,6	44,5
Egypt	Jul-08	-	90	-5,5	6,4	-5,3	5,2	7,2	7,0	-5,6	5,8	12,9	3,8	24,9
Hungary	Jul-08	-	90	6,6	7,7	-7,9	8,4	3,3	23,1	-20,7	16,0	6,2	4,8	33,7
India	Jul-08	-	90	2,5	6,7	-5,5	10,6	3,8	12,3	-9,9	13,9	8,1	10,2	438,0
Indonesia	Jul-08	-	90	7,0	13,0	-14,1	10,8	8,8	21,9	-27,3	22,7	8,5	11,3	57,8
Israel	Jul-08	-	90	5,9	3,9	-2,6	4,7	5,1	9,1	-6,6	9,2	3,0	6,1	45,8
Malaysia	Jul-08	-	90	2,2	2,9	-3,2	3,9	1,1	9,6	-10,2	7,2	3,6	6,2	80,8
Mexico	Jul-08	-	90	5,6	7,1	-8,4	7,4	3,4	16,3	-21,4	12,7	6,2	9,2	125,3
Nigeria	Apr-13	-	33	0,7	13,3	-7,1	13,9	6,9	16,7	-9,3	14,7	13,4	7,3	19,3
Peru	Jul-08	-	90	3,6	10,7	-7,7	11,0	5,3	14,5	-11,3	17,0	6,0	14,5	11,2
Philippines	Jul-08	-	90	8,2	6,9	-6,7	7,7	9,7	10,4	-8,8	8,6	5,1	9,5	38,8
Poland	Jul-08	-	90	4,2	3,6	-2,8	2,9	0,1	17,8	-15,0	10,6	4,2	5,1	103,7
Romania	Apr-13	-	33	5,4	3,2	-1,7	2,4	0,6	9,9	-4,6	6,5	3,4	4,0	19,6
Russia	Jul-08	-	90	-1,6	10,0	-11,1	9,4	-5,7	25,2	-27,4	19,4	8,3	6,8	56,9
South Africa	Jul-08	-	90	3,2	7,8	-6,2	8,1	1,8	21,1	-16,4	16,5	8,0	10,8	72,8
South Korea	Jul-08	-	90	5,0	3,6	-1,3	6,7	5,8	15,7	-12,7	22,5	3,4	5,6	382,6
Taiwan	Apr-13	-	33	3,3	2,5	-1,5	2,5	-0,5	4,4	-2,5	2,3	1,4	10,3	161,8
Thailand	Jul-08	-	90	4,9	5,6	-5,2	7,3	5,9	8,4	-5,4	10,2	3,3	8,8	71,9
Turkey	Jul-08	-	90	4,8	8,0	-5,7	6,2	2,1	18,2	-22,0	13,5	10,1	3,4	62,4

Table A4: Descriptive statistics from the frontier markets sample, 2002-2015.

This table contains the descriptive statistics from the investment grade sample. Average return and volatility are annualized. Minimum and maximum are monthly. Average yield is in percentage per annum. Average maturity in years. Market cap in USD billions. Numbers are calculated over the periods the country was in the index, which is indicated by the first columns.

	Index inclusion			USD Returns				Market characteristics		
	Enter	Exit	Obs	Average	Volatility	Min	Max	Yield	Maturity	Mkt cap
Algeria	Dec-01	Feb-03	14	11,3	6,2	-2,5	3,7	8,1	3,9	0,5
Angola	Oct-12	-	38	1,3	7,5	-6,3	3,6	5,3	3,6	1,1
Argentina	Oct-09	*	53	26,4	22,2	-14,8	14,5	10,3	17,7	7,7
Armenia	Oct-13	-	26	4,9	7,6	-5,3	5,2	6,0	6,6	0,8
Honduras	Apr-13	-	32	9,4	10,7	-9,9	6,8	7,1	7,7	0,9
Belarus	Sep-10	-	63	10,0	16,7	-13,8	17,3	9,3	3,6	1,4
Bolivia	Nov-12	-	37	6,6	8,0	-4,7	7,7	5,0	8,7	0,9
Belize	Mar-07	-	105	8,4	26,5	-26,8	34,9	12,9	14,2	0,4
Costa Rica	Oct-14	-	14	-3,8	5,9	-3,6	2,8	6,7	16,1	5,9
Dominic Republic	Dec-01	-	168	10,7	17,3	-40,0	21,4	8,1	7,9	1,9
Ecuador	Dec-01	*	152	11,7	26,2	-55,8	22,1	12,4	11,4	2,1
Egypt	May-02	-	163	6,9	8,6	-12,3	7,7	5,5	7,4	1,6
El Salvador	Nov-09	-	73	5,8	8,9	-6,5	5,0	6,7	15,9	4,6
Ethiopia	Dec-14	-	12	-2,8	8,8	-4,6	3,9	7,0	9,4	1,0
Gabon	Dec-07	-	96	7,6	17,9	-31,3	14,1	6,4	7,5	1,1
Georgia	Jun-08	-	90	9,8	13,3	-18,3	11,4	7,2	6,3	0,8
Ghana	Oct-07	-	98	8,6	19,3	-33,2	21,7	7,9	7,2	1,1
Guatemala	Jun-12	-	42	6,3	8,4	-6,9	4,5	4,7	10,5	1,3
Indonesia	May-04	Dec-06	31	17,0	6,5	-2,6	5,0	7,0	11,3	3,0
Iraq	Mar-06	-	117	9,3	17,9	-26,9	16,6	8,8	13,2	2,1
Ivory Coast	Dec-01	*	144	18,1	26,1	-26,5	25,8	20,2	10,9	1,1
Jamaica	Oct-07	-	98	11,0	19,0	-25,2	26,5	8,5	19,4	1,2
Jordan	Jan-11	*	46	6,9	3,9	-2,3	3,8	4,0	2,8	0,7
Kenya	Jul-14	-	17	-4,6	7,7	-6,0	3,5	6,4	7,9	2,6
Lebanon	Dec-01	Sep-02	9	1,7	10,2	-5,7	4,1	12,9	4,8	3,1
Mongolia	Apr-12	-	43	4,9	9,5	-4,6	6,5	6,6	5,5	1,8
Morocco	Dec-01	Oct-06	58	6,2	3,1	-2,9	3,4	5,7	2,4	1,1
Mozambique	Nov-13	-	25	1,4	8,3	-4,0	4,6	8,1	3,3	0,8
Nigeria	Feb-11	-	76	5,6	8,7	-8,0	8,0	4,2	7,2	1,3
Pakistan	Dec-01	*	152	11,7	16,8	-25,9	17,1	9,0	5,1	1,2
Paraguay	Feb-13	-	34	3,5	7,8	-4,8	4,8	5,1	15,0	1,1
Senegal	May-11	-	55	7,7	10,5	-11,5	8,1	6,8	8,1	0,7
Serbia	Apr-05	Dec-09	56	9,0	16,9	-15,5	20,6	7,5	9,9	1,0
Sri Lanka	Nov-07	-	97	9,8	16,3	-26,5	21,0	7,3	5,4	3,2
Tanzania	May-13	-	31	3,5	5,6	-2,7	3,8	6,1	3,5	0,6
Tunisia	Feb-15	-	10	-13,5	8,8	-5,4	2,3	6,1	9,5	1,0
Ukraine	Dec-01	Feb-11 *	90	13,2	7,7	-5,1	9,1	6,1	4,8	5,1
Uruguay	May-02	Mar-07	58	22,7	28,9	-33,6	28,5	10,3	18,9	2,5
Vietnam	Nov-05	-	121	7,5	12,2	-23,7	14,6	5,6	6,9	1,4
Zambia	Oct-12	-	38	-4,5	12,5	-11,2	6,2	7,2	8,9	1,4

These countries leave the index for the periods between brackets: Argentina (Aug-11/Mar-13), Ecuador (Sep-06/Nov-07), Ivory Coast (Jun-08/Apr-10), Jordan (Nov-14/Oct-15), Pakistan (Feb-03/Apr-04), Ukraine (Mar-08/Sep-09).