An exploration of the emerging debt market
Describing the market and developing a prediction model

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Internship report

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Preface

The Master's programme in Business Mathematics and Informatics is concluded by an internship at a business, industry or research facility other than the departments of Mathematics and Computer Science of the VU University. In this internship, the knowledge attained during the Master's programme is applied in practice to complete a project within six months.

This report presents the finding of my internship at the Quantitative Strategies (QS) department of Robeco. The objective was to provide a description of the debt market for emerging countries to find the most appropriate market to invest in. Subsequently, a prediction model was developed and implemented to predict future market returns.

The application of quantitative models and tools in combination with the exploration of a new financial market is why I chose to perform my internship at Robeco QS. I have learned the value of the knowledge attained during the Master's programme. In addition, I have also gained knowledge about new areas in business, mathematics and informatics. For this I would like to gratefully thank my supervisor at Robeco, drs. Johan Duyvesteyn, and my supervisors at the VU University, prof. dr. Aad van der Vaart and dr. Rene Bekker. I would also like to thank all the members of the QS department as well as the Rates team for their feedback and support during the six months of my internship.

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Summary

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The financial market of emerging debt comprises of debt instruments issued by emerging countries, such as Poland, Turkey and Brazil. The past return of the emerging debt market has been impressive compared to other asset classes (for example equities). This high return however coincides with an equally high risk, largely because of several financial crises.

To profit from the high return and avoid the high risk, Robeco developed a quantitative prediction model for the emerging debt market. However, the results of this model were not satisfactory and therefore it was terminated in 2001. Since then the market has changed and new data is available for research. The objective of this research is twofold. Because of the changes of the market, an exploration and analysis of its structure is needed to choose the research set up for the second objective. This second objective is developing a prediction model.

The exploration and analysis of the emerging debt market revealed several new insights. First, the market for debt denominated in US dollars, external debt, is not appropriate to base a model on. I believe that interest for this market from both the investors as well as the emerging countries will decrease in the future. This interest will shift to the market for debt denominated in local currencies, local debt, because it offers a higher return to investors and benefits countries. A prediction model will therefore be more useful in the future when based on the local debt market.

Second, I found the local currency market to form the most important driver of the returns of the local debt market. Specifically, I found the exposure of the local debt market to currency risk to dominate its exposure to sovereign, default and interest rate risk. Third, the local currency markets of the emerging countries have little in common and viewing this market from a global perspective will not add value. The second and third insights point out the prediction model must focus on the local currency market of each country.

The prediction model is developed using two methods, Z-scores and regression, applied to a limited set of variables. The Z-scores method indicates variables such as momentum, carry, oil and reserves have predictive power. The final Z-score model however does not achieve a positive performance in the period characterized by financial crises. Furthermore, the regression method is not able to find a predictive relationship at all between the variables and the local currency returns. A final regression model can therefore not be developed. This conclusion also applies after taking the financial crises into account through a robust regression approach.

Finally, I believe further research regarding an early warning system for crises will add value to a prediction model for local currencies. In addition, an exploration of more sophisticated trend strategies such as momentum may be rewarding.

Contents

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1.   Introduction

Emerging debt is a fixed income asset class that has grown considerably in the last decade. Before the 1990's the market was inaccessible to individual investors. In addition, Illiquidity made this asset class an unattractive investment opportunity. The 90's are however a turning point because several measures were taken to improve the economic condition of the emerging countries. Financial institutions recognized the opportunities this offered and developed more products pertaining to emerging debt.

This resulted in a rapid growth for this asset class, evidenced by the high annual total return of 14% it exhibited from 1991 to 2006[1]. The economic instability of these countries nevertheless remains, which characterizes its high risk. For instance, the high returns coincide with an equally high annual volatility of 48%. However in comparison to other asset classes the return of emerging debt has been impressive, as presented in *Figure 1*.
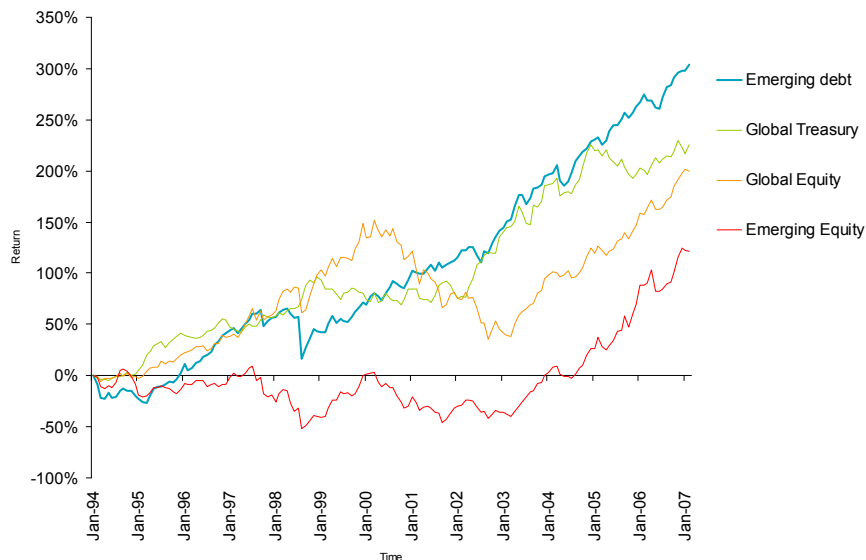

Figure 1: Cumulative total (USD) return emerging debt versus other asset classes

Considering the high risk and return, the Robeco Quantitative Strategies department developed a prediction model for the emerging debt market in 1999. As an asset manager, Robeco is responsible for managing the investment portfolios of institutional clients. The Quantitative Strategies (QS) department focuses on developing quantitative models and tools for asset management and risk management based on detailed financial markets research. This department therefore aids in the managing of the investment portfolios. Robeco has viewed the emerging markets as an investment opportunity since its foundation. The primary focus has always been on equities but the prediction model for emerging debt was an attempt to expand this focus.

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[1] Based on the JP Morgan EMBI (1991-1993) and JP Morgan EMBI global indices (1994-2006)

Nevertheless, the model developed by Robeco QS did not perform to satisfaction and in 2001 the research project was finished. However, renewed interest for the emerging debt market has reestablished the demand for a prediction model. The old model and insights may nevertheless no longer apply because the current market has experienced changes. A new model and new insights therefore form the objectives of this emerging debt research project.

The overall objective of this project is thus twofold. First, a description of the emerging debt markets is given to gain new insights. This description explores and analyzes the structure of the emerging debt markets. The insights gained by fulfilling this objective are used to choose a research set-up for developing the prediction model. The new insights must also identify the most appropriate market on which to base the prediction model. This appropriateness is measured by a combination of investment potential and data availability.

The second objective is developing the new prediction model. As this is a relatively new market, a simple approach is chosen for this development and only two methods are implemented. These two methods, Z-scores and regression, are implemented using a limited set of variables. The focus is on the methods and not on the variables to identify in which direction further research should be conducted. In addition, an investment strategy is implemented using the developed prediction models to test their economic significance.

The structure of this report is in line with the objectives. Chapter 2 provides a qualitative description of the market. This description is further discussed in Chapter 3, where a quantitative analysis is performed. Based on the results of these chapters, Chapter 4 describes the research set-up for developing the prediction model. The results of this development are reported in Chapter 5. Finally, Chapter 6 concludes this report.

6.   Conclusion

The objective of the emerging debt research project comprises two goals. The first is to give a description of the different areas of the emerging debt market. These descriptions provide new insights on the market which are used in the development of the prediction model. The second goal is the actual development of the prediction model.

Section 6.1 presents the conclusion of the results achieved by fulfilling the first goal. For the second goal this conclusion is presented in Section 6.2. Finally, Section 6.3 discusses possible directions for further research.

6.1   The emerging debt market

The emerging debt market can be divided into three areas, external debt, local debt and local currency. The external debt market comprises long-term US dollar denominated bonds. The local debt market comprises long-term local currency denominated bonds. Finally, the local currency market comprises foreign exchange forwards and thus represents money markets.

The description of the external debt market reveals it possesses a bias towards Latin American countries and Brady bonds. Further analysis shows the market structure is dominated by one component, although recent years have seen the emergence of a second component. In addition, this market is primarily exposed to interest rate risk and sovereign/default risk. Based on the declining portion of Brady bonds and the fact future interest in this market may decline, I choose not to base the prediction model on this market.

Instead, I expect the local debt market to become a more important instrument to invest in emerging debt in the future. Analysis of this market and comparison to the local currency market reveals local debt is primarily driven by the exposure to currency risk. It differs in this aspect from external debt. Because of the short data history of local debt however, I choose the local currency market as the appropriate market on which to base the prediction model. Exploration and analysis of this market shows its structure is governed by more than two components. In addition, little overlap is found between the countries of the local currency market. A prediction model is therefore developed for each country from a selected group.

For Robeco these insights indicate investments in local emerging debt have more added value. However this added value can also be achieved through investments in the local currency markets. Furthermore, these markets should be viewed individually and not from a global perspective.

6.2 A prediction model

To develop a prediction, two methods are applied with a limited set of variables. These variables are selected from academic literature and in cooperation with portfolio managers. The focus is however on the two methods, Z-scores and linear regression, and their ability to model the local currency markets.

The regression approach does not possess this ability as it does not find any predictive relationships between the variables and the local currency returns. The freedom for the data to determine this relationship thus has little added value. This also applies to the case of robust regression, where extreme values in the data are taken into account. Based on these results, I conclude that it is not possible to develop a prediction model using a regression approach in combination with the selected variables.

On the other hand, the Z-score approach provides more useful insights. In this setting, certain variables do have predictive power. These variables include momentum of the currency market, carry, oil, US yield curve (spread), dollar and reserves. The performance generated by the investment strategy for these variables however indicates their predictive ability is not always satisfactory. Particularly in the period characterized by crises these variables are not able to exhibit significant performance.

The final Z-score model, a combination of the above variables, suffers from the same problems. It is therefore not applied to the out-of-sample set. It can however be applied to the local debt market but not to the external debt market. Although this leaves Robeco with no prediction model the results do provide certain insights. For example, the importance of crises is large and variables such as the reserves are useful in avoiding the negative influence of these events.

Finally, the complex dynamics of the emerging market can not entirely be captured by the simple Z-score approach. However, the more complex regression approach also does not possess this ability. The next section provides suggestions for methods that may be useful.

Before discussing these suggestions I must first add a critical note to the above analyses and calculations. These are based on a short time period (maximum 13 years) and therefore their reliability can be questioned. However, more data is not available and I believe the statistical tests are sufficient to base conclusions on despite the short time period.

6.3 Follow-up research

There are two specific directions for further research I discuss in this section. The first covers the methodology for a prediction model. As the impact of crises is of such importance it may be useful to develop an early warning system to avoid the negative influence of these financial events. The academic literature (Kaminsky et al. 1997, Berg and Patillo 1999, Edison 2000, Kumar et al. 2003) provides useful insights for this area of interest.

Furthermore, this warning system can be combined in a so called regime switching model (Hamilton 1989). These models specifically take into account changes in the market

behaviour and allow certain variables to be "switched off". For example, suppose a variable is not able the predict returns during crises periods. A regime switching model in combination with the warning system would then neutralize this variable for the duration of the crises. The negative influence of the crises is thus avoided.

The second direction for further research lies in the variables. The objective of this research project was not to test all variables and therefore certain variables with predictive power may have been ignored. I can however not indicate which variables this may apply to. Based on the Z-score results I do suggest further research should be performed regarding trend-related variables such as momentum because this variable proved to be useful.

More sophisticated trend models could be developed using variables or strategies such as the Relative Strength Index (RSI), Average Directional Index (ADX), Parabolic Stop and Reverse (PSAR), Moving Averages (MA) or the Moving Average Convergence/Divergence (MACD). These concepts are further explained in Wilder (1978). Robeco has experience with these concepts but not applied to the emerging debt market. It may therefore prove useful to test their applicability to this market.