Three essays on international finance

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THREE ESSAYS ON INTERNATIONAL FINANCE

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Par ***Georgios Gatopoulos***

pour l'obtention du grade de
Docteur ès sciences économiques et sociales
mention : ***économie politique***

Membres du jury de thèse :

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M. Pierre-André Dumont, professeur, Université de Genève
Mme Rajna Gibson Brandon, professeure, Université de Genève, Présidente du jury
M. Dušan Isakov, professeur, Université de Fribourg
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Genève, le ***27 janvier 2010***

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Professeur Dušan ISAKOV, Université de Fribourg

Professeur Henri LOUBERGÉ, Université de Genève, directeur de thèse

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Préface en français

Ce manuscrit constitue ma thèse de doctorat. Elle a été rédigée sous la direction du professeur Henri Loubergé au sein du département de l'Économie Politique de la Faculté des Sciences Économiques et Sociales de l'Université de Genève. Pendant la rédaction de ce travail, le professeur Pierre-André Dumont de la section HEC de la Faculté des Sciences Économiques et Sociales de l'Université de Genève m'a offert des opportunités d'emploi en tant qu'assistant d'enseignement. Dans ce cadre, j'ai également eu l'occasion de collaborer avec les professeurs André Bender, Tony Berrada, René Sieber et Alessandro Beber.

Certaines parties de ce travail ont fait l'objet de communications dans des congrès internationaux. Plus spécifiquement, différentes parties de cette thèse ont été présentées au «4th Swiss Annual Doctoral workshop» (Gerzensee 2005), au «5th Conference on Research on Economic Theory and Econometrics» (Rethymnon 2006), au «4th IFC meeting» (Hammamet 2007), au «FMA European conference» (Barcelone 2007), au «5th INFINITI conference» (Dublin 2007), au «7th Swiss Annual Doctoral workshop» (Gerzensee 2008), au «7th Conference on Research on Economic Theory and Econometrics» (Naxos 2008), au «6th INFINITI conference» (Dublin 2008), au «Paris December 2008 Finance International Meeting AFFI-EUROFIDAI» et au «12th Conference of the Swiss Society for Financial Market Research» (Genève 2009).

La thèse est rédigée en anglais et comporte trois essais sur la finance

internationale. Ce manuscrit est structuré comme suit. Le chapitre 1 présente une brève introduction des aspects des marchés financiers internationaux qui ont motivé le choix de la thématique des trois essais. Le chapitre 2 présente le premier article intitulé «Firms' use of foreign currency derivatives under the threat of currency crises: the case of Latin America». Cet article est coécrit avec Henri Loubergé. Le chapitre 3 présente le deuxième article intitulé «ADR spreads and their informational content: the role of relative US investor sentiment». Le chapitre 4 comporte le troisième article intitulé «Explaining firms' exchange rate exposure: the role of country factors». Finalement, le chapitre 5, conclue la thèse et propose des avenues de recherche ultérieure. L'auteur est seul responsable des toutes erreurs éventuelles.

Preface

This manuscript presents my doctoral thesis in the department of Economics of the University of Geneva. My thesis is supervised by professor Henri Loubergé. During the completion of this work, professor Pierre-André Dumont from the department of HEC Geneva - Graduate School of Management has provided me with useful teaching assistantship opportunities. In addition, as a teaching assistant, I have also had the chance to collaborate with professors André Bender, Tony Berrada, René Sieber and Alessandro Beber.

Parts of this work have been presented to international conferences, such as the 4th Swiss Annual Doctoral workshop (Gerzensee 2005), the 5th Conference on Research on Economic Theory and Econometrics (Rethymnon 2006), the 4th IFC meeting (Hammamet 2007), the FMA European conference (Barcelona 2007), the 5th INFINITI conference (Dublin 2007), the 7th Swiss Annual Doctoral workshop (Gerzensee 2008), the 7th Conference on Research on Economic Theory and Econometrics (Naxos 2008), the 6th INFINITI conference (Dublin 2008), the Paris December 2008 Finance International Meeting AFFI-EUROFIDAI and the 12th Conference of the Swiss Society for Financial Market Research (Geneva 2009).

This thesis is based on three essays in international finance and is structured as follows. Chapter 1 presents a brief introduction of some stylized facts of international financial markets that motivate the choice of the topic of the three essays. Chapter 2 presents the first article entitled "Firms' use

of foreign currency derivatives under the threat of currency crises: the case of Latin America". This article is coauthored with Henri Loubergé. Chapter 3 presents the second article entitled "ADR spreads and their informational content: the role of relative US investor sentiment". Chapter 4 presents the third article entitled "Explaining firms' exchange rate exposure: the role of country factors". Finally, chapter 5 concludes the thesis and proposes some further research. The author is the only responsible for any errors.

Acknowledgements

Writing a doctoral thesis is often believed to be a lonely path and a strictly personal achievement. During this beautiful experience of the past few years, I figured out that it is everything else than that. It feels like poet Cavafy's description of the trip to Ithaka:

"As you set out for Ithaka
hope your road is a long one,
full of adventure, full of discovery..."

I feel indeed that this road has been a road full of discovery, which has been made tractable for me thanks to a number of people. For this reason, I owe them my humble but deepest gratitude.

I would not have been able to accomplish my thesis adventure, if it had not been for my supervisor, professor Henri Loubergé. He has shown remarkable confidence in me, even in difficult moments and I owe him a large share of this work. It is needless to say that his comments, our discussions and debates provided me with precious help in all stages of my research progress. "Un très grand merci!"

In their turn, I would like to thank all the members of the jury for accepting to participate in my thesis committee and for their constructive comments. My gratitude of course lies beyond their participation as jury members. Professor Pierre-André Dumont has been a second academic mentor for me, since he inspired me with the art of teaching and showed me the exam-

ple of an excellent pedagogue. I thank him for his generosity, simplicity, our numerous discussions and experienced guidance. Professor Tony Berrada has also shown me considerable trust and has provided me with generous feedback and precious academic and friendly advice during the last two years of my thesis. Professor Dušan Isakov has been generous in providing me with useful comments and making suggestions in different stages of my research. I thank him for his interest and for participating as an external member of the jury. I would also like to thank professor Rajna Gibson Brandon for her kind availability to preside this jury and for all her time and comments. Professor Mathias Thoenig made useful remarks on a previous stage of my work presented as a "mémoire préliminaire".

There are some additional academics that have indirectly contributed to this thesis. Professors Alessandro Beber, André Bender and René Sieber have provided me with extremely useful insights, while offering me opportunities to collaborate with them. Professors Pascal Dumontier and Bernard Raffournier have introduced me to the interesting grounds of financial accounting. I would also like to thank all professors who helped me with their references during my student life, such as professors Eleni Louri, Konstantinos Gatsios, Georgios Mergos, Gregory Connor and Hyun Song Shin. In terms of my educational path, it would be an important omission not to mention the crucial contribution of several professors and colleagues from Pierce College in Aghia Paraskevi, from the Athens University of Economics and Business, as well as from the London School of Economics and Political Science. I would also like to thank the FAME doctoral program (Swiss Finance Institute) for its scholarship during my doctoral courses. Funding from both the HEC and the Economics department of the University of Geneva was greatly appreciated, since it allowed me to participate in a significant number of conferences. Administrative assistance has been very helpful, thanks to people like Karine Rama, Karen Longden and Sandrine Perruchoud.

I would like to thank all my university colleagues and friends for making my everyday life cosy and pleasant. Special thanks to my two first "office-mates" Boris Nikolov and Philipp Fasnacht. I am particularly indebted to them for their genuine friendship as well as to their families, for making my integration in the Swiss environment faster. Special thanks go as well to my longest-lasted "office-mate" Laurent Barras for his friendly and professional help. My other colleagues with whom I had the pleasure to share my office, were Pierre Bajgrowicz, Milana Finyutina and Kagba Koussé.

There have been some people I met in Switzerland, whom I already feel as good friends of mine. They have helped me a lot during difficult moments of my stay. Among them, special thanks to Anne Caroline Pissis, Camilo Serrano, Christophe Jeannette, Damianos Serefidis, Daria Cibrario, Dejan Munjin, Dimitris Protopsaltou, Frederic Fancello, Giannis Petropoulos, Nicolas Pissis, Ramona Westermann, Renaud Martel, Stefanos Konandreas, Thibaut Bardon and Vasilis Karpos. A special reference needs to be made for my very good friend Christian Reich, thanks to whom I was informed about the FAME doctoral program and thus came to Switzerland. Another very important special reference needs to be made about the Christoforou family and how they have helped me with their warmth and by "bringing my home country in Geneva" through Emilios restaurant! I thus sincerely thank Emilios, Alexandros, Salomé, Anthony and Melina for providing me with a second home.

I want to mention that my long-lasting friends back in Greece have also helped me a lot to reach where I am now. Special thanks to Dimitris Fotopoulos and his family, Alexandros Aldous, Fivos Georgakakis, Giannis Mergos, Nicholas Vrousalis, Spyros Floratos, Thodoris Papageorgiou and their families.

There are members of my family who have played an extremely supportive role. I thank my grandparents Kosta and Sofia Getimi for their unconditional

generosity and principles, as well as grandparents Giorgo and Lili Gatopoulou for their foresight and deepest care. I would like to thank the families of my uncles Dionisi and Fivo and my aunt Evgenia, for their discrete support. Special thanks to my uncle Panagiotis, who inspired me to a large extent in order to pursue a doctoral thesis and for whom I profoundly wish that justice will prevail. I thank all my cousins as well, each one of them separately and Elina in particular for sharing my last months in Geneva together.

Most importantly, I would not have had the chance to be who I am, study abroad and write down those few words of huge importance for me, if it had not been for my parents and sister. Their humane principles, numerous sacrifices, invaluable guidance, continuous support, understanding and affection during the last 30 years have been the most precious endowment one could receive for his life. Nadia's sensitivity, sincerety and altruism, Gianni's solid reasoning, guidance and humour, are features that have been inspiring me all time long. Sofia's affection, remarkable patience, maturity and unconditional support have helped me more than she can imagine. Last but definitely not least, I would like to express my profound gratitude to Charlotte Beauchamp. I thank her for illuminating my life, for her invaluable help, her shining heart and generous understanding. They all have been there for me, where and when I needed. I thus owe a large part of this work to them.

Executive summary

This thesis is constituted of three essays in international finance. The characteristics that distinguish emerging from developed markets are of crucial importance and constitute the common link of the three essays of this thesis.

The first essay examines non-financial firms' decisions in relation to the extent of use of financial instruments. Inspired by the impressive growth of derivatives markets and the increasing exchange rate exposure of firms, the first essay focuses on the use of foreign exchange related financial tools by firms based in emerging countries. This study emphasizes on the importance of country specific factors when it comes to the motivation, as well as the impact of the use of these tools. Emerging market firms use foreign debt for hedging and speculation in the long-term. Firms use foreign exchange derivatives more in order to adjust the long-term speculative and hedging positions and less in order to speculate in the short-term.

The second essay concerns international investors and the interest to explain international portfolio pricing puzzles. Inspired by the increasing number of firms being traded in multiple markets, the second essay focuses on documenting and explaining the puzzling persistent differences in stock returns of the same firm across different markets. As solutions to the puzzle, it emphasizes on the importance of investor sentiment, among other market segmentation sources, such as market microstructure and emerging markets' special characteristics.

The third essay concerns policy makers' interest to assess how country factors affect their corporate sectors' exchange rate exposure. Focusing on a worldwide panel of firms, it documents significant variations of firms' exchange rate exposure between developed and emerging markets. It shows that country specific factors account for about 30% of the variability of firms' exposure after controlling for firm and industry level determinants. Country factors, such high aggregate use of foreign currency derivatives, as well as deep domestic bond markets significantly decrease firms' sensitivity with respect to exchange rate changes in both developed and emerging markets.

Chapter 1

Introduction

1.1 International financial trends

During the last few decades, the world has been witnessing an increasing financial globalization movement. Periodic financial turmoils, such as the "confidence crisis" of 2008, have, nonetheless, repeatedly emphasized the importance of risk management, international regulation and coordination. A central issue in such a global environment is exchange rate exposure. In relation to the globalization of capital flows and the importance of exchange rate exposure, three stylized facts have inspired the choice of this thesis' research questions. The three stylized facts presented in the first part of this introduction are the following. First, the impressively rapid expansion of derivatives markets during the last couple of decades. Second, the explosion of the number of firms that become tradable in foreign markets. Third, the increasing importance of the role of emerging markets on the global scene.

Emerging markets refer to countries that have been facing a transitional phase between the developing and developed status. The characteristics that distinguish emerging from developed markets are of crucial importance and constitute a common link of the three essays of this thesis. All three essays need to take into account and confront practices in the developed markets versus practices in emerging markets. By shedding light on the different ways that these two types of markets approach the observed trends, this thesis contributes on the current debate and provides explanations on the three following global issues.

The first such issue is non-financial firms' decisions in relation to the extent of use of foreign exchange related financial instruments. Inspired by the impressive growth of derivatives markets and the increasing international presence of firms based in emerging markets, the first essay focuses on the optimal use of foreign currency debt and derivatives by such firms. This study emphasizes on the importance of country specific factors, related to

emerging market features, in explaining both firms' motivation as well as the impact of the use of these tools.

The second issue concerns international investors and the interest to explain international portfolio pricing puzzles. Inspired by the increasing number of firms being traded in multiple markets, the second essay focuses on explaining the puzzling persistent differences in stock returns of the same firm across different markets. It emphasizes on the importance of investor sentiment, among other market segmentation sources, such as market microstructure and emerging markets' special characteristics.

The third issue concerns country policy makers' interest to measure and control for their corporate sectors' exchange rate exposure. Inspired by the recent worldwide growth of derivatives markets and its controversial impact on firm exposure, the third essay focuses on measuring and explaining exchange rate exposure of firms from both developed and emerging markets. It emphasizes on the role of country factors, such as the degree of financial development in explaining the observed cross-sectional variations of corporate exposures around the world. This is of particular interest for policy makers' task to assess the impact of rapidly growing currency derivatives markets.

This thesis manuscript is organized as follows. In the first part of the introduction, we describe the three stylized facts that motivate our choice of the essay topics. This involves describing the worldwide evolution of derivatives markets, international firm listings and emerging markets features. In the second part of the introduction, we clearly state our research questions and position each essay's contribution. The second chapter presents the essay examining emerging market firms' use of foreign exchange financial instruments. The second chapter is coauthored with Henri Loubergé. The third chapter presents the essay explaining the American Depositary Receipt spreads puzzle. The fourth chapter consists of the essay documenting and explaining firms' exchange rate exposure through country factors. Finally,

the fifth chapter concludes the thesis and proposes steps for further research.

1.1.1 Derivatives markets

All types of financial contracts, whose value depends on the price of an underlying good, are called derivatives. Such financial instruments owe their name to the fact that their price is derived from the price of an underlying good. The underlying good can be any financial security, an index, a loan, a commodity, the weather tomorrow, or other elements that are of certain worth to at least some economic agents. There are four basic types of derivative contracts, namely the forwards, futures, options and swaps.

Derivatives are not a modern invention. Historically, earlier versions of their present form have been documented during the antiquity, the Middle Ages and the Renaissance. Aristotle (350 B.C.), for example, describes a first version of an option contract through the story of philosopher Thales from Miletus. According to the story, about 2'400 years ago, Thales paid a premium and made agreements with olive-press owners in order to obtain the right of exclusive use of their installations for a given period after a specific year's harvest. That particular year's harvest was rich and therefore Thales made an important profit out of the operation. This example from ancient years illustrates the two main motivations for the use of derivatives. Thales himself speculated on the good harvest to come, being confident about his forecasting capacities. As far as olive-press owners are concerned, they decided to hedge their risk of low revenues due to a potential bad harvest and preferred to "lock" their revenues in advance for the sake of security. These two types of motivation for the use of derivatives, speculation and hedging, have remained identical until today.

The development of the first organized exchanges for derivative contracts is largely due to the seasonal nature of agricultural production. Among the first exchanges were the old Dojima market in Japan in the 17th century, the

Chicago Board of Trade in the 19th century and the Chicago Mercantile Exchange in the beginning of the 20th century. The last two markets are among the most active organized derivatives markets even today. During the last four decades, the derivatives markets have been experiencing an impressive expansion in both terms of volume, but also in worth. Two facts have contributed towards this direction. The first is the development of the options asset pricing literature. The second is the collapse of the fixed exchange rates system, which increased the use of foreign exchange derivatives.

Despite the important diversity and increasing complexity of modern derivatives instruments, they can be distinguished in two major categories, depending on whether their underlying asset is tradable or non-traded. There are three major branches of the tradable derivatives. The first branch are the so-called equity linked derivatives, whose underlying asset can be an equity, a portfolio of equities, or an equity index. The second branch are the interest rate (IR) derivatives, whose underlying asset can be a government or corporate bond, or any other interest rate. The third branch are the foreign exchange (FX) or foreign currency derivatives. The underlying asset in this case is a given exchange rate. This type of instrument is of central interest to our thesis, since it is used in order to manage exchange rate exposure.

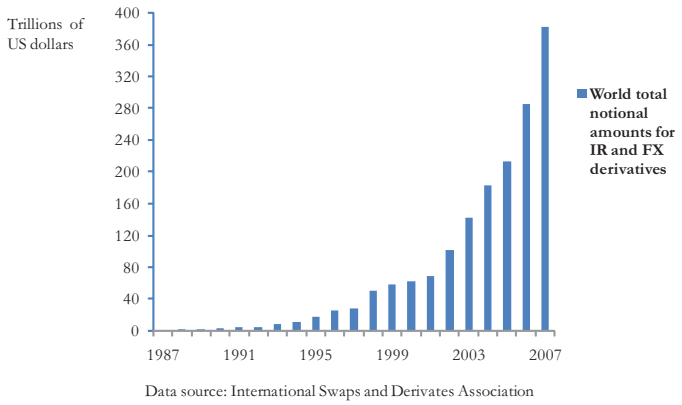
There are different ways to measure the size of derivatives markets. The most common practice, that is followed in this study, is to use notional amount of outstanding contracts. An alternative method is to use gross fair market value and often in the case of credit IR derivatives, it is advised to compare both methods with net credit exposure.

The Bank of International Settlements provides data on the aggregate use of derivatives by country[1]. Such data is released on a quarterly frequency for the G10 countries and on a three-annual frequency for 54 developed and

[1]These publications are known as the BIS Quarterly Review and the BIS Triennial Central Bank Survey, respectively.

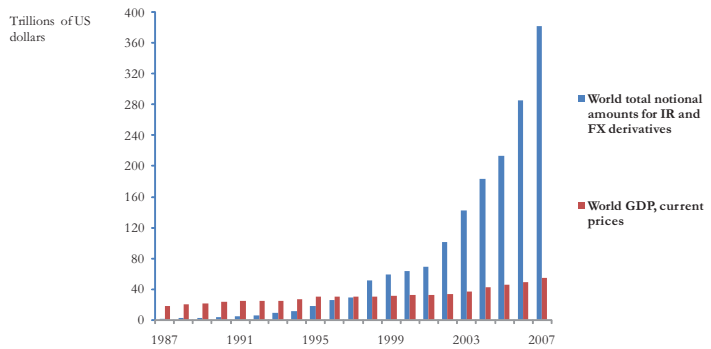
emerging countries. Figure (1.1) shows evidence of the "explosion" of the two most popular categories (IR and FX) of derivatives during the last two decades. In order to get an idea of what this market represents in terms of size, it is noteworthy that, according to figure (1.2), worldwide total annual derivatives notionals consistently exceed world annual gross domestic product for the last ten years.

Figure 1.1: Worldwide annual end of year outstanding notional amounts for interest rate and currency derivatives



Data source: International Swaps and Derivates Association

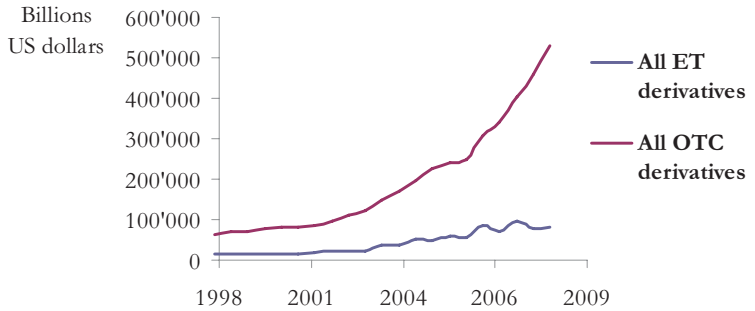
Figure 1.2: Comparing worldwide annual end of year outstanding notional amounts for interest rate and currency derivatives to worldwide gross domestic product in current prices



Data sources: International Swaps and Derivates Association & IMF

Another important distinction in the derivatives markets is whether an instrument is traded in an organized exchange (ET) or whether it is negotiable Over-The-Counter (OTC). The ET derivatives contracts are standardized contracts, like futures and many option contracts, for which the existence of the clearing house reduces counterparty risk. On the other hand, OTC derivatives are privately negotiated with banks or other derivatives dealers. Even though, ET derivatives are supposed to be more liquid, the worldwide total OTC derivatives notional amounts are much higher, as seen in figure (1.3), due to their flexibility and "tailor-made" nature. For this reason, we hereafter present some more detailed statistics on OTC derivatives.

Figure 1.3: Worldwide annual end of quarter outstanding notional amounts for all types of exchange traded (ET) and over- the- counter (OTC) derivatives

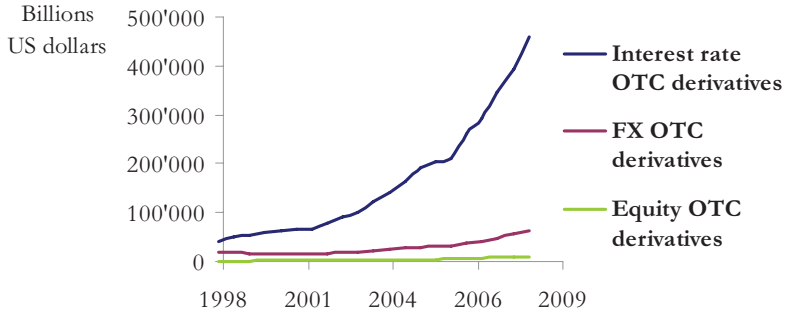


Data source: Bank of International Settlements

In terms of popularity among the different underlying assets categories, figure (1.4) decomposes all OTC derivatives and shows the dominance of interest rate derivatives, followed by foreign exchange derivatives. The popularity of IR derivatives is owed to the high notionals of interest rate swap contracts that account for about three quarters of the total IR volume. Such contracts have been extensively used, among others for interest rate risk

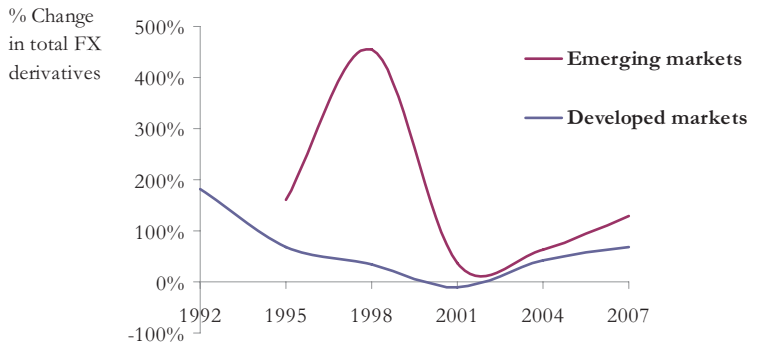
management. The study of FX derivatives, though, in more detail, is of particular interest for the purposes of this work, which examines questions related to exchange rate exposure. Figure (1.5) shows that there has been an impressive percentage increase in the total FX notionals during the last fifteen years and that the increase is persistently higher in emerging markets. The increase becomes smaller during the years of the "Internet bubble", but remains positive for the whole time span for emerging markets. According to the 2007 BIS Triennial Survey, the currency composition of global FX turnover has increasingly become more diversified. Even though major currencies continue to play the biggest role, the share of emerging market currencies in global volume has almost reached 20% in April 2007, compared to a modest 3% in 1998. This increase of the importance of emerging market currencies motivates the second and fourth chapter of this thesis, where we study the FX choices of emerging market firms and the role of derivatives market on emerging market firms exposure, respectively.

Figure 1.4: Worldwide annual end of quarter outstanding notional amounts for different types of over- the- counter (OTC) derivatives



Data source: Bank of International Settlements

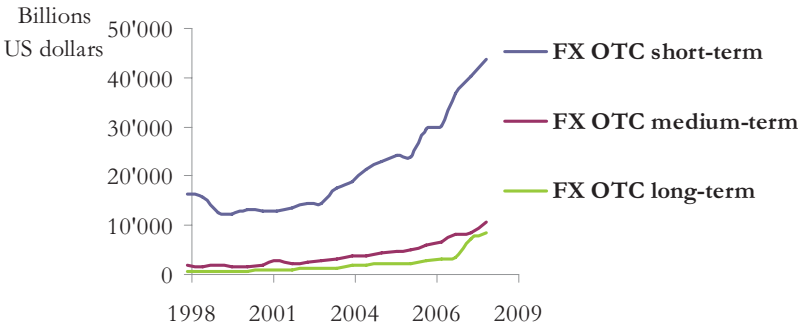
Figure 1.5: Worldwide triannual percentage change of outstanding notional amounts for FX derivatives



Data source: Bank of International Settlements

There is an extensive academic and public policy debate about the use and the potential "misuse" of derivatives. Aspects of this debate are presented in the first essay. In the case of FX derivatives, at least one stylized fact is clear. Market participants mostly use FX derivatives on a short-term horizon and less for longer horizons. This can be seen in figure (1.6) showing evidence that 70-85% of total FX OTC contracts every year have a maturity up to one year. This fact is of crucial importance for our first essay, where we examine a firm's optimal FX use choice, while decomposing the decision between the short-term and the long-term horizon.

Figure 1.6: Worldwide end of quarter outstanding notional amounts for FX derivatives across different maturities. Short-term maturity is defined up to 1 year, medium-term between 1 and 5 years, long-term more than 5 years.



Data source: Bank of International Settlements

1.1.2 International cross-listing

A firm is cross-listed when its shares are tradable in more than one organized exchanges. The reasons why a firm decides to cross-list in a foreign market are multiple[2]. A basic motivation for cross-listing is the access to important foreign capital markets that often lowers the firm's cost of capital. The diversification of the firm's shareholder base can be advantageous. Apart from diversifying the existing shareholder base, firms may also use foreign markets in order to raise capital on a larger scale than what the local market would allow. Another reason for cross-listing can be the firm's objective to increases its visibility and name recognition internationally.

The most common method used by a firm in order to cross-list is the issuance of a Depositary Receipt (DR). A Depositary Receipt traded in country "X", corresponds to an "X" currency denominated negotiable certificate,

[2]Among others, Doidge et al. (2004) present various reasons of why cross-listing may enhance firm value.

which is issued in country "X" by a depositary bank. This Receipt represents ownership in the underlying (UND) ordinary shares of a firm originally not from country "X". In such a way, firms can access the capital markets of country "X", where usually in reality "X" stands for leading developed countries, such as the U.S., the U.K., or other western European markets. Legally, the issuance procedure is as follows. Underlying shares are purchased in the firm's home market by a regular broker and need to be deposited to a local custodian bank in the home market. Once that is confirmed, the depositary bank of country "X" has the right to issue the corresponding DRs.

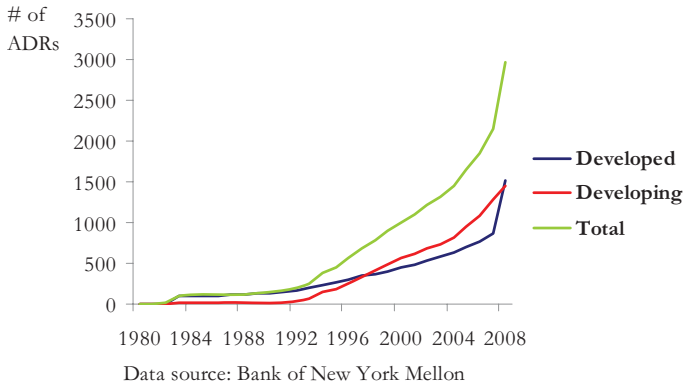
Among several Depositary Receipt programs, the American Depositary Receipts (ADRs) were the first to appear in 1927, as a response to a British law that prohibited UK shares physically to leave the UK, since listing overseas required a British-based transfer agent. Since then, ADRs have become increasingly popular, especially during the last two decades. Nowadays, there also exist other DR programs, such as the Global Depositary Receipts (GDRs), the European Depositary Receipts (EDRs), the Singapore Depositary Receipts and others. We hereafter focus and present some descriptive statistics on the ADR market, which is the more developed among all DR markets.

There are several types of ADR programs, involving different disclosure requirements towards the exchange authorities. A first distinction is between capital raising and non-capital raising programs. Among the non-capital raising ADRs, there are the Unsponsored and the Sponsored Level I and II programs. Among the capital raising ADRs, there are the Sponsored Level III and the Rule 144a programs. Level II and III programs are mostly traded in organized US exchanges, whereas the rest are mostly traded OTC.

The number of ADR programs in place has been monotonically increasing since 1980, as shown in figure (1.7). Note that the important increase in 2008 in developed market ADR programs is partly due to a change in US

legislation that facilitates Level I ADR initiations. Nevertheless, the significant increasing trend in the total number of ADR programs is unquestionable during the last three decades.

Figure 1.7: End of year number of active ADR programs



It is useful to shed some light on the reasons why ADR programs have gained in popularity during the recent years, among both developed and developing market firms. Despite increasing globalization of capital flows, direct investment in local trading markets still faces some obstacles, such as complicated trade settlements, tax and currency conversions, or even language barriers. According to the Bank of New York Mellon, the world's largest depositary bank for ADRs, a US agent willing to invest in a foreign company's equity, may save "up to 10-40 basis points annually, compared to the costs associated with trading and holding ordinary shares outside the United States". This could probably explain the increasing popularity of ADRs as reflected from their increasing trading volume. It needs to be noted, though, that in terms of liquidity and market depth, ADRs usually lack behind their respective underlying stock markets.

Figures (1.8) and (1.9) show that in the early 80s, ADR issues involved mostly firms from developed markets. Nevertheless, since late 90s we observe

that firms from developing countries represent at least about half of the total number of active programs. The evolution of the percentage share of ADRs from emerging market firms from 7% in 1988 to 49% in 2008 is revealing. ADR issues from emerging markets have been gaining weight in the total number of established ADR programs. This can also be explained by the fact that increasing financial integration among developed markets has made foreign direct investment less costly in those countries and thus the advantages of ADRs are relatively more important for firms based in emerging markets.

Figure 1.8: End of year number of active ADR programs decomposition

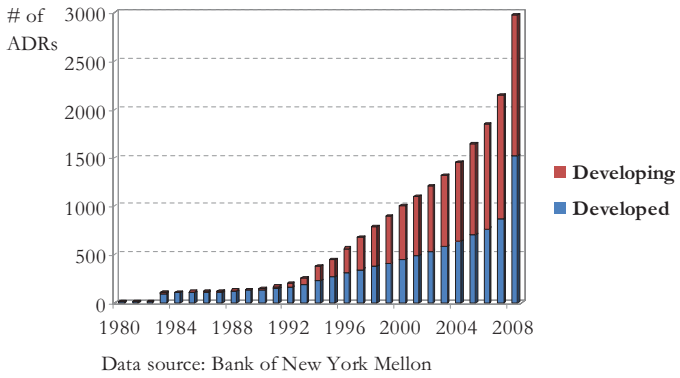
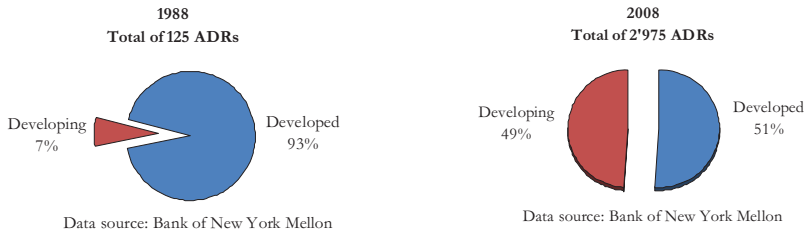
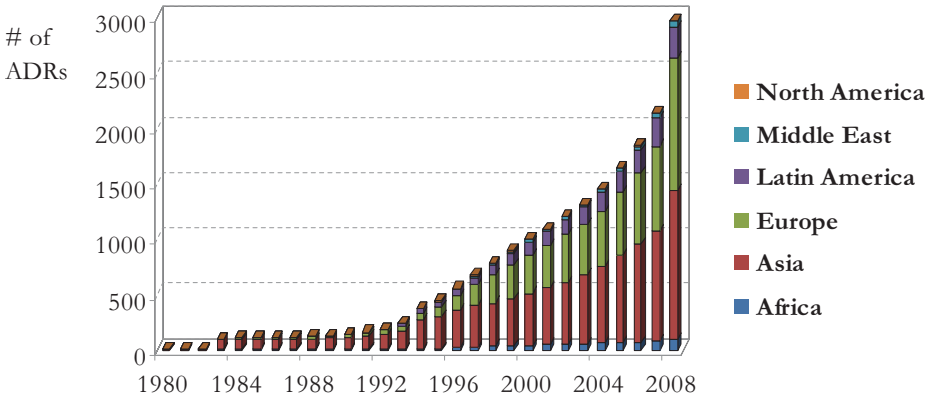


Figure 1.9: Comparing percentage share of ADRs from emerging markets versus percentage share of ADRs from developed markets in 1988 and 2008



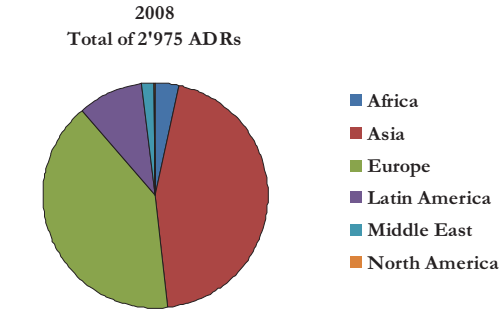
From an investors point of view, ADRs are interesting primarily because they offer an accessible solution for broad geographic portfolio diversification. Firms from more than 70 countries were represented with ADR programs at the end of 2008. Figures (1.10) and (1.11) show that Asia and Europe are the mostly represented regions, followed by Latin America and Africa. Such a market, with recent rapid growth and so diverse representatives offers grounds for useful natural experiments. This is especially true because pricing ADRs and their underlying shares, involves pricing the same firm in two different markets. Therefore, any persistent spreads should reflect some form of market segmentation. This latter, could either be due to market microstructure differences and barriers to arbitrage, or due to investor heterogeneity. The second essay of the thesis, presented in chapter 3, addresses precisely the issue of extraction of useful information content from the analysis of differences in prices between ADRs and their underlying shares.

Figure 1.10: End of year active ADR programs decomposition by region



Data source: Bank of New York Mellon

Figure 1.11: Active ADR programs region decomposition at the end of 2008



Data Source: Bank of New York Mellon

1.1.3 Emerging versus developed markets

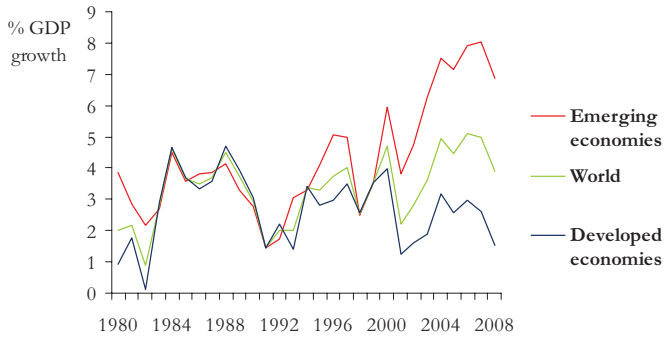
In the context of the modern globalized financial environment, there are still important aspects of economic and financial structure that differ from one country to another. The World Bank proposes both geographical as well as income based country classifications. The latter are based on four categories following the country's gross national income: high income, upper middle income, lower middle income and low income. The distinction between developed and emerging or developing countries is not based on a universally accepted clear definition, but rather on some key characteristics that members of each one of the two categories share. Implicitly, though, most non classified as developed countries, according to any international organization's ad hoc definition, fall into the category of emerging or developing economies.[3]

The term "emerging" owes its name to the appealing effect of a non-developed country emerging onto the global scene. Without being independent of global economic conditions, in general, emerging economies are char-

[3]In this dissertation, we follow the MSCI Barra classification of emerging markets as of 2008.

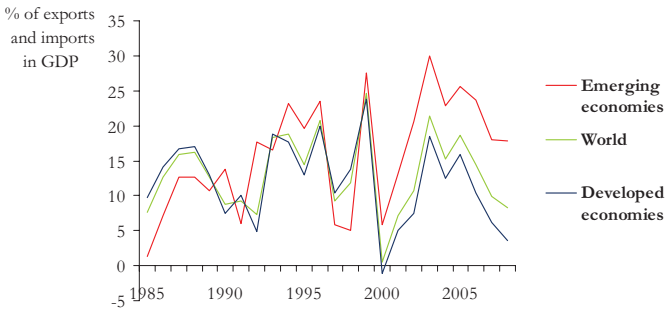
acterized by high economic growth rates. Figure (1.12) shows that, indeed, since mid 90s, average emerging economies growth rates have been higher than developed economies rates. Other features of emerging markets include relatively high local and foreign investment, high saving rates and high net private inflows. It is important to mention here their increasingly important role in international trade, sine they account for a high percentage of world trade volume. Figure (1.13) reveals that the sum of exports and imports as a percentage of GDP has been persistently higher among emerging than among developed countries during the last decade. Hence, one motivation for the third essay of this thesis, presented in chapter 4, is to study the impact of emerging economies' increasing openness on their corporate sectors' exchange rate exposure.

Figure 1.12: Average worldwide GDP growth rates



Data source: IMF World Economic Outlook

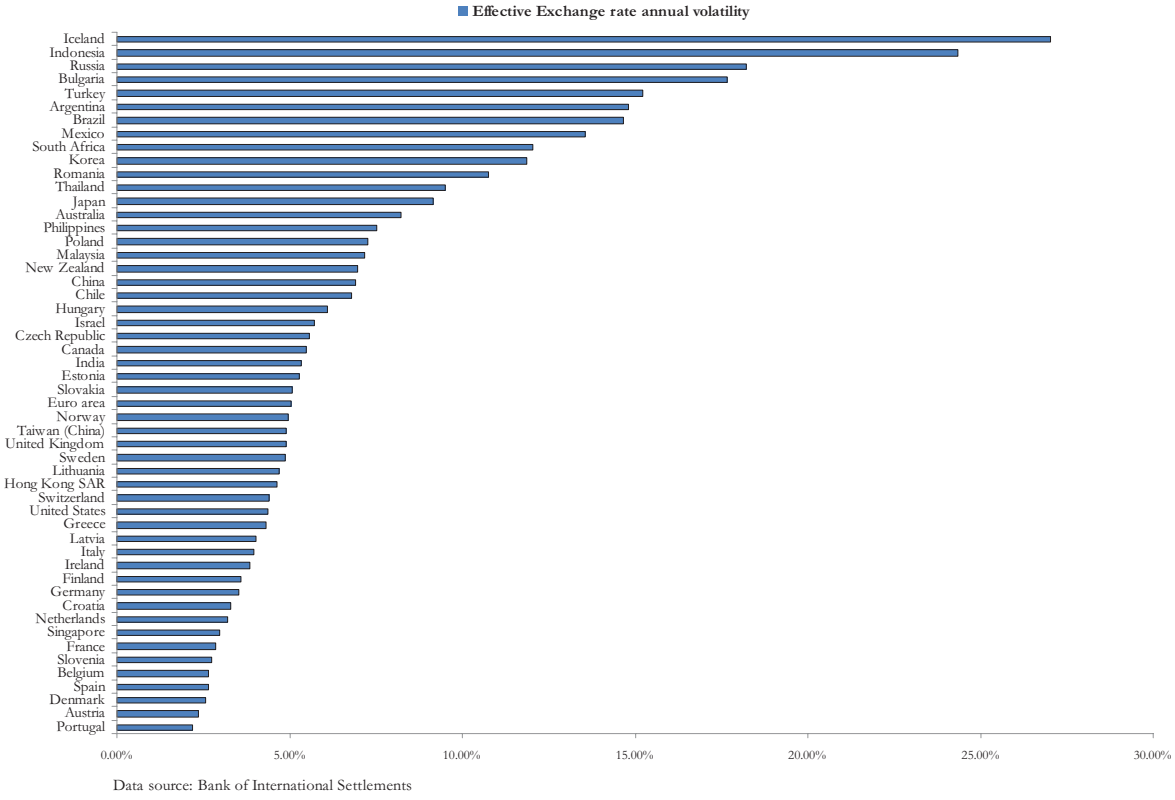
Figure 1.13: Average worldwide percentage of coutries' degree of "openness"



Data source: IMF World Economic Outlook

Another feature of emerging markets that is of particular interest for this thesis is that they exhibit relatively high exchange rate volatility. This reflects the fact that emerging markets are more vulnerable and unstable. Figure (1.14) plots the annual effective exchange rate volatility provided by the Bank of International Settlements for 52 countries. Effective exchange rates are computed for each country with respect to a basket of currencies weighted by each country's trading partnerships, and thus provide an adequate proxy for the economy's competitiveness. One may notice that most countries with relatively high volatility are emerging economies, whereas most countries with low volatility are developed economies.

Figure 1.14: Average annual effective exchange rate volatility by country for the period 1994-2008



This stylized fact highlights the importance of measuring, explaining and managing exchange rate exposure, particularly in emerging markets. Towards this direction, the first essay of the thesis, presented in chapter 2 studies the optimal management of emerging market firms' exposure through financial tools. From a more macro perspective, the third essay presented in chapter 4, addresses the issue of measuring and explaining firms' currency exposure through country factors. The distinction between emerging and developed markets adds explanatory power on both research objectives.

1.2 Thesis contribution

The objective of this thesis is to leave the reader with a clear view on research questions, such as the following: How do firms in emerging markets use foreign exchange derivatives and foreign currency debt in relation to managing exchange rate risk? Are puzzling observed ADR spreads mostly due to market microstructure reasons or due to heterogeneous investor perceptions, such as sentiment effects? How do country factors, such as the degree of financial development affect the firms' sensitivity to exchange rate movements and do these factors differ between emerging and developed economies?

May such questions appear unrelated at first sight, they are all inspired by and based on the same stylized facts described in the previous section. This thesis makes use of valuable information incorporated in the recent rapid development of derivatives markets, international cross-listings and emerging markets, in order to provide the reader with convincing answers on all three debates.

If one would have to resume the thesis in one paragraph, the answers to the research questions above are the following. Emerging market firms use foreign debt for both hedging and speculation purposes in the long-term. On the contrary, they use foreign exchange derivatives more in order to adjust the long-term speculative and hedging positions and less in order to speculate in the short-term. ADR spreads are as importantly affected by market microstructure differences as by relative investor sentiment. When it comes to relative investor sentiment though, U.S. sentiment is a more significant driving force of the spread, compared to the firm's home country investor sentiment. In relation to the last research question, there is evidence that country factors account for about 30% of firms' exchange rate exposure and higher domestic financial market sophistication allows firms to decrease their exposure.

In this second part of the introductory chapter, we provide a snapshot of each essay's contribution and positioning with respect to existing literature. Then, each essay is presented in detail in chapters 2, 3 and 4.

1.2.1 Use of FX derivatives and debt

Inspired by the impressive expansion of currency derivatives markets, many researchers have examined the reasons why non-financial firms use foreign exchange related instruments. Periodic financial crises have often orientated the debate towards the distinction between use and "misuse" of such instruments. We choose to study how firms optimally use FX derivatives and debt in an emerging markets framework. Such a framework is motivated by two factors. Firstly, the fact that these firms often need important proportions of foreign currency debt to finance their operations and secondly, the fact that emerging currencies exhibit highly positive currency risk premia.

There is extensive literature about firms using financial instruments for hedging, meaning in order to reduce the variability of their cash-flows. According to financial theory, hedging can increase firm value under the presence of the following types of capital market imperfections: bankruptcy costs and convex tax schedules as in Smith and Stulz (1985), underinvestment or overinvestment as in Bessembinder (1991), Froot et al. (1993), Morellec and Smith (2002), agency conflicts as in Brown (2001), managerial compensation as in DeMarzo and Duffie (1995), financial constraints, like liquidity and leverage, as in Mello and Parsons (2000), Fehle and Tsyplakov (2005), Purnanandam (2008).

Most empirical studies about the motivation to use financial instruments focus on developed markets non-financial firms. They reveal that hedging is a primary motivation and that it is associated to different firm specific elements. Nonetheless, speculation often arises as a motive of use as well. For example, the comparative survey by Bodnar and Gebhardt (1998), finds that

a significant percentage of firms admit to enter in derivatives positions as a result of their market view. Bartram et al. (2009) examine a large worldwide cross-section of firms and claim that these tools are used more for risk management purposes rather than for speculation. There are also studies that analyze the interaction between foreign debt and FX derivatives choice at an empirical level, but with no clear-cut result about whether these tools are substitutes or complements. For this reason, our study fills a gap in the literature by addressing this issue specifically in the context of Latin American emerging markets where firm foreign currency debt ratios are significant.

Among few studies of corporate risk management in non-developed very volatile markets, Allayannis et al. (2003) focus on the Asian crisis of 1997. They find that foreign debt is used for both hedging and speculative purposes. However, hedging appears partially effective, since they find significant negative relationship between the use of foreign debt and firms' financial performance and no significant difference in operational profits between users and non-users of derivatives. They claim that this surprising result could be due to derivatives market illiquidity, increased counterparty risk and several credit constraints that these firms faced during the 1997 period. Derivative markets have become much more liquid since the Asian crisis and this inspires our first essay data choice of an emerging markets sample beginning in 2000.

The first essay, thus presented in chapter 2, shows how and why foreign currency derivatives are used by large non-financial corporations which are both based in emerging markets and cross-listed in foreign developed markets. The presence of significant country currency risk premia, as well as these firms' fundamental choice to use foreign debt for their operations, are two parameters that influence the firm use decision. We find that country factors, such as measures of the expected currency devaluation are significant determinants of both FX derivatives and debt use. We also find evidence

that derivatives are mostly used for short-term hedging and adjustments of long-term exposures created by foreign debt. Finally, there is evidence that derivatives markets have been useful as hedging tools in recent crises periods in emerging markets.

1.2.2 ADR spread puzzle

Following the recent development of ADR securities market, it has been observed that returns on ADRs significantly differ from returns on their underlying shares, after adjusting for exchange rate changes. Such "ADR spreads" are larger in absolute value for emerging market firms and more volatile after crisis events. It is natural to claim that ADR spreads reflect market segmentation, otherwise arbitrage mechanisms would make them disappear. The main motivation of the second essay is to provide explanations as to the sources of these spreads and evaluate their informational content.

Two asset pricing puzzles that can be considered as "predecessors" of studies on ADR spreads include the closed-end fund discount, first presented by Pratt (1966), Boudreaux (1973), Malkiel (1977) and the country fund discount puzzle, described by Bonser-Neal et al. (1990), Bodurtha et al. (1995), Klibanoff et al. (1998). In their case, the puzzle refers to the difference between the share price of the fund and the net asset value of the weighted average of the assets in which it is invested.

In relation to the two fund puzzles, researchers have proposed explanations from both market microstructure and sentiment approaches as sources of market segmentation. Most of these explanations have their analogies in the ADR spreads context of our second essay. From the microstructure side, barriers to arbitrage due to illiquidity shocks, as the ones explained by Acharya and Pedersen (2005) are of primary importance. From the sentiment side, price differences can be due to heterogeneous perceptions and segmentation of investor groups between the two types of markets, as in Zweig (1973),

DeLong et al. (1990), Lee et al. (1991), Chopra et al. (1993).

Studies on ADR spreads explanation are quite recent. Aggarwal et al. (2007), Chan et al. (2008) focus on liquidity and other market microstructure factors. Suh (2003), Grossmann et al. (2007), Arquette et al. (2008) show evidence that arbitrage costs, ownership restrictions and consumer sentiment explain to some extent the differences in prices between ADRs and their underlyings (UNDs). When it comes to sentiment, though, the mechanism of its impact on spreads' components is unclear. For this reason, the thesis' second essay fills a gap in explaining ADR spreads, by using direct measures for investor sentiment and by showing that there is a persistent negative relation between US sentiment and ADR spreads. It also provides some theoretical interpretation for this persistent negative relation.

The second essay, thus presented in chapter 3, documents ADR spreads on a worldwide sample of 35 countries, analyzes their determinants and evaluates their informational content. Findings show that sentiment related factors are economically as significant as market microstructure ones. Among all factors, US investor sentiment, relative market illiquidity, the degree of the home country's market development, the presence of short-selling constraints and the firm's home market type (emerging or developed) appear as the most significant. Finally, the essay finds significant informational content in ADR spreads, that could be used in order to create profitable active investment strategies.

1.2.3 Explaining currency exposure

After the collapse of Bretton Woods and the fixed exchange rate regime system, high exchange rate volatilities have increasingly attracted attention in international financial markets. This is also due to the globalization of capital flows and the rapidly growing international operations of non-financial firms. As a result, there is an increasing interest on measuring, as well as

explaining exchange rate exposure, on a firm as well as on an industry level. This essay contributes on the empirical debate about both measurement and interpretations of cross-sectional variations of firms' exchange rate exposure by focusing on two axes. The first axis is the importance of country specific explanatory factors, and the second is the role of the type of the firm's home market, meaning whether it is a developed or an emerging economy.

From a theoretical point of view, exchange rate changes affect stock returns, either by varying the firm's expected cash flows, or through variation of the cost of capital used to discount these cash flows. Among seminal papers in this field, Adler and Dumas (1984), Jorion (1990, 1991) highlight the importance of a firm's foreign sales in its degree of exchange rate exposure. Even though, theoretically, exchange rate exposure is well founded, there is only partial empirical evidence supporting its economic importance. This is referred to as the "exchange rate exposure puzzle". From an empirical point of view, several measurement issues have been raised. Such issues include the sensitivity of the exposure estimations on the length of the chosen time horizon, as in Chow et al. (1997), the choice of the exchange rate factor, or the choice of the market portfolio as in Bodnar and Wong (2003).

Apart from the debate on how to measure exposure, extensive literature has studied the question of how to explain it. Bodnar and Gentry (1993) emphasized the importance of a firm's industry characteristics, Griffin and Stulz (2001) the role of the competition framework, Allayannis and Ihrig (2001) the link with potential markups, whereas Allayannis and Ofek (2001) the importance of financial hedging through foreign currency derivatives. A recent study by Bartram et al. (2010) assesses several firm specific factors that could explain the exchange rate exposure puzzle. By order of importance, these variables are the firm's use of foreign debt, its use of foreign currency derivatives, pass-through to prices and operational hedging.

Inspired by findings on firm level factors affecting currency exposure, this

essay of the thesis contributes on the debate on the exchange rate exposure puzzle, by proposing new explanatory factors on a country level. Proxies for the domestic financial market degree of sophistication seem to affect considerably observed corporate currency exposures. In order to show the impact of such factors, we emphasize on the distinction between emerging and developed markets. We find evidence that developed market firms are on average negatively affected by domestic effective exchange rate appreciations, whereas the opposite is true for emerging market firms. As far as explaining exposure is concerned, we find that the country's aggregate use of foreign currency derivatives, decreases firm exposure, and the impact on emerging markets is particularly high. The depth of a country's local bond market also decreases firm exposure, with higher economic significance in the developed world. These findings, presented in chapter 4, could be of interest for policy makers and financial market regulators.

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Chapter 2

Essay on firms' use of FX instruments

2.1 Title

"Firms' Use of Foreign Currency Derivatives Under the Threat of Currency Crises: the case of Latin America"[1]

2.2 Abstract

We investigate the determinants of firms' use of foreign currency derivatives in emerging markets exposed to currency crises. We develop a model where a firm with international orientation chooses its optimal foreign debt and hedging ratio. In the context of recently highly volatile exchange rates in five Latin American countries, we calibrate the model on ADRs. We find theoretical and empirical evidence that country specific factors (i.e. aggregate exposure of a country to a crisis) explain significantly part of our firms' foreign debt and hedging policy, as opposed to literature on firms in developed markets. We claim that derivative markets have been effective tools for firms in these countries.

KEYWORDS: foreign currency derivatives, exchange rates, corporate hedging

JEL classification: F31, F49, G39

[1]This paper is coauthored with my thesis director, professor Henri Loubergé. It has been presented at the 4th Swiss Annual Doctoral workshop (Gerzensee 2005), the 5th Conference on Research on Economic Theory and Econometrics (Rethymnon 2006), the 4th IFC meeting (Hammamet 2007), the FMA European conference (Barcelona 2007) and the 5th INFINITI conference (Dublin 2007). I would like to thank Laurent Barras, Alessandro Beber, Tony Berrada, Pierre-André Dumont, Erwan Morellec, Boris Nikolov, Norman Schürhoff, René Stulz, Charlotte Beauchamp, Philipp Fasnacht and seminar participants for valuable feedback.

2.3 Introduction

This work examines how and why foreign currency derivatives are used by large non-financial corporations which are both based in emerging markets and cross-listed in foreign developed markets. In general, firms use financial derivatives for hedging and speculative purposes. This should not be different in emerging markets. But firms based in these markets are attractive to investigate for two reasons at least. Firstly, the domestic currencies exhibit highly positive currency risk premia, with an impact on the cost of foreign exchange operations. Secondly, it is well-known that these firms use important proportions of foreign currency debt to finance their operations, with obvious implications on their decision to use currency derivatives for hedging and speculative purposes. These characteristics motivate our research. Given their fundamental choice to use foreign debt for their operations, and taking into account a framework where both firm and country specific variables can have a strong impact on results, how do firms in emerging markets use currency derivatives? Do they ignore these instruments? Do they use them steadily? or selectively? And, in this latter case, what elements influence the decisions? Have these instruments been effective tools to deal with recent episodes of currency crises in emerging markets?

To approach these questions, we first develop a theoretical model where a firm with international orientation chooses its optimal foreign debt and currency derivatives ratios sequentially. We link the first optimal choice to a long-term horizon and the second optimal choice to short-term motivations. This approach is in line with the observed average maturities of products available in the two markets. We consider that, apart from firm specific factors frequently invoked by the theory of hedging as it applies to developed markets, there are country specific factors such as the currency risk premia that will have an impact on firms' decisions when emerging economies are

considered. The impact may be different when long-term financing needs are addressed and when short-term hedging and speculative motivations are taken into account. The model predicts that foreign debt will be used, instead of domestic debt, as well for long-term speculation, as for long-term hedging purposes. Currency derivatives will be used for adjusting the firms' long-term optimal exposure to short-term conditions. They will not be used for short-term speculation or short term hedging per se (independently of the long-term net exposure). It appears also that country-specific variables, such as the currency risk premia observed in the long-term and short-term segments of the financial market, will probably have an impact on the decisions. These predictions are tested using data from five Latin American countries during the turbulent period 2000-2003. This short time span encompasses three major currency crises[2] and allows us to draw conclusions about the usefulness of foreign currency derivative markets for firms operating in such a volatile environment.

There is extensive literature about why do firms use financial instruments for hedging.[3] Among the benefits of using derivative contracts at a firm's level, one may emphasize the following: they permit firms to achieve payoffs they could otherwise attain only at a higher cost; they minimize accounting earnings volatility; and under certain conditions may increase firm value.[4] More precisely, financial theory indicates that risk management increases firm value when there exist capital market imperfections. Examples can be

[2]One may notice in panel A of table (2.1) three depreciations greater than 25% on a semestrial basis, in particular the currency crises in Argentina (end of 2001), Brazil (summer of 2002) and Venezuela (end of 2002).

[3]We define as hedging the acquisition of financial assets that reduce the variability of firms' payoffs.

[4]For an illustrative review of the benefits of using these tools, see Stulz (2003, 2004). Graham and Rogers (2002) relate the use with tax incentives, Allayannis and Weston (2001) and Bartam et al. (2004) with firm performance.

bankruptcy costs and convex tax schedules as in Smith and Stulz (1985), underinvestment as in Bessembinder (1991) and Froot et al. (1993), either underinvestment or overinvestment as in Morellec and Smith (2002), agency conflicts as in Brown (2001), or managerial compensation as in DeMarzo and Duffie (1995). The intuition behind creation of firm value is that financial risk management can increase shareholder value when capital market imperfections provoke deadweight costs borne by shareholders.

Additional theoretical motivations for hedging are presented by Mello and Parsons (2000) who evoke a liquidity impact on the hedging decision and Fehle and Tsyplakov (2005) and Purnanandam (2008) who link optimal hedging to proxies of financial distress, such as leverage. Literature about how hedging can be achieved includes Brown and Toft (2002) and Wong (2003) who derive some optimal hedge ratios after specifying the type of hedging tool used.

Most empirical studies about the motivations to use financial instruments focus on U.S. non-financial firms. They reveal that hedging is a primary motivation and they find out that it is associated to different firm specific elements. For example, Geczy, et al. (1997) show that there is a positive relationship between the use of currency derivatives and firms' growth opportunities. A speculative motivation arises, however, in the comparative survey by Bodnar and Gebhardt (1998), where a significant percentage of firms admit to enter in derivatives positions as a result of their market view. Beber and Fabbri (2006) confirm that U.S. firms adopt an active "market view" attitude. They also link corporate derivatives use to different managerial characteristics. The effectiveness and importance of derivatives usage for hedging purposes is empirically challenged by Guay and Kothari (2003) who argue that positions account for very small percentages of firms' total cash flows.[5] On the contrary, Allayannis et al. (2001) show that in the case of

[5] One may also refer to Allayannis et al. (2001) for the importance of operational hedg-

U.S. multinationals the use of currency derivatives significantly increases firm value. In accordance with this finding, on a sample of S&P 500 non-financial firms, Allayannis and Ofek (2001) show that derivatives use significantly decreases the firms' exchange rate exposure. Guay (1999) focuses on firms' initiation year of using derivatives and suggests that there is a significant decrease in firm risk as well. As far as foreign debt is concerned, its use for hedging motives is confirmed by Kedia and Mozumdar (2003) and Elliott et al. (2003).

Empirical research addressing the use of financial derivatives by non-U.S. firms[6] supports evidence that hedging is the major motivation and that it is partially effective. Bartram et al. (2009) bring evidence of the use of derivatives by 7319 firms in 50 countries and claim that these tools are used in fact for risk management purposes rather than for speculation. There are also a few studies that insist on the interaction between foreign debt and currency derivatives choice at an empirical level,[7] but with no clear-cut conclusion about whether these tools are substitutes or complements and why. For this reason, our study intends to close a gap in the literature by addressing this issue specifically in the context of markets where it arises quite clearly. Foreign currency debt can be used for hedging inherent foreign assets exposure, as well as for speculation. Speculation incentives arise when firms find that the benefits from lower foreign borrowing costs are greater than the losses from potential exchange rate devaluations.

The first attempt to study corporate risk management in very volatile

ing strategies and the claim that the exclusive study of derivatives impact is insufficient.

[6] A non-exhaustive list includes He and Ng (1998) for Japanese multinationals, Nguyen and Faff (2003) for Australian firms, Hagelin and Pramborg (2004) for Swedish firms and Nguyen, Faff and Marshall (2007) for French firms.

[7] See for instance Keloharju and Niskanen (2001) for Finland, Elliott et al. (2003) for U.S. multinationals, Chiang and Lin (2005) for Taiwan, Aabo (2006) and Clark and Judge (2008) for U.K. and Nguyen and Faff (2006) for Australia.

markets was Allayannis et al. (2003). They focus on non financial firms from eight different developed and developing Asian countries around the crisis of 1997. They find that foreign debt is used for both hedging and speculative purposes. Concerning the ex post effectiveness of this policy, they point out a significant negative relationship between the use of foreign debt and firms' financial performance. They also find no significant difference in operational profits between users and non-users of derivatives. They claim that this surprising result could be due to derivative market illiquidity, increased counterparty risk and several credit constraints that these firms faced during the 1997 period.

It seems that derivative markets have become more liquid since the Asian crisis.[8] Our objective is thus to examine more recent volatile periods, by addressing more specifically the interactions between foreign debt and currency derivatives usage in an emerging market context. In short, the focus of our study is on large firms of emerging markets where financial stability is a crucial issue due to significant country currency risk premia. Our unique data set of firms concerns the volatile exchange rate environment in Argentina, Brazil, Chile, Mexico and Venezuela during the period 2000-2003. We show that for these firms, the choices of foreign debt in a long-term horizon and of currency derivatives in a short-term horizon are not independent. We decompose and identify the motives for each choice under the two broad categories of "hedging" and "speculation". We find that rational expectations drive the use of the two financial instruments, since the foreign debt ratio and derivatives ratios decrease and increase, respectively, as the currency exposure increases, in the corresponding time horizon. The notion of exposure is decomposed by taking into account country factors, such as measures of the expected devaluation, as well as firm specific characteristics, such as elements

[8]The evolution of the total annual volume of all derivative products traded has more than doubled in the period 1998-2003 (BIS Quarterly Review December 2004).

of capital structure. We provide evidence that country specific variables are significant determinants of both control ratios. The significance of these factors as motivations for hedging gives us the chance to claim that derivatives markets have been useful as hedging tools in crises periods in the developing countries of our sample. This claim is further reinforced by evidence that derivatives' users outperformed non-users and improved their debt capacity during our sample period.

The essay is organized as follows. In the next section, we present a simple theoretical framework where a cross-listed firm chooses its optimal foreign currency debt ratio as well as its optimal foreign currency derivatives ratio in a long-term and short-term horizon respectively. We interpret the optimal ratios based on the emerging market context and its implications. In section 2.5, we explain the choice of our data and provide some descriptive statistics. We also present the estimations we use in order to obtain our proxies for certain country specific variables and we briefly expose our empirical methodology. Section 2.6 presents the results concerning the determinants for the use of the two types of financial instruments : foreign debt (FD) and foreign currency derivatives (FCD). It appears that foreign debt is used both for hedging purposes and for speculative purposes (to reduce the cost of debt). In contrast, the use of foreign derivatives is mainly motivated by hedging considerations. In both cases, various-firm specific and country-specific variables have an impact on the decision. In section 2.7, we briefly present a preliminary discussion of the impact of the use of these tools on capital structure and operating performance. The essay closes with some concluding remarks.

2.4 Theoretical motivation

2.4.1 The firm's decision making process

We consider a firm based in an emerging market with some exogenous non negative source of foreign revenue $\alpha \geq 0$.[9] In particular, α may be linked to historical and structural characteristics related to the nature and the long-term strategy of the firm. We focus on one main source of exposure, the exchange rate. The firm is relatively large and is in the maturity stage of its life cycle. At this stage, its financing problem is more often addressed via debt rather than equity issuing.[10] The manager's decision making procedure concerns the choice of denomination of debt and the choice of derivative contracts in order to optimally hedge (partially or fully) the currency exposure of the firm. We argue that this procedure involves two steps according to two different time horizons. In the long-term period from 0 to T, the manager observes the percentage of foreign currency generating assets $\alpha \geq 0$ and chooses an optimal percentage of foreign currency denominated debt β^*. In the short-term period from t to $t+1$, the manager observes the ratios of α, β^* and chooses an optimal percentage γ^* of forward and swap contracts.[11] Then, the manager rolls-over her position in the forward market over the

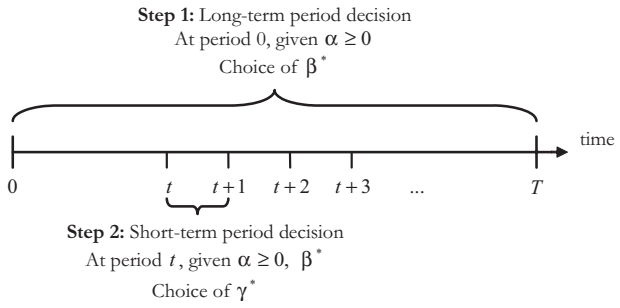
[9] Typically, cross-listed firms (ADR's) of emerging markets are large firms with international orientation and provide a good example for testing our theory. They often possess assets that generate foreign currency income or/and exhibit export sales, foreign debt and positions in foreign exchange derivatives markets.

[10] The choice of debt versus equity issuing at this stage of the life cycle may be backed by traditional agency theory arguments applicable to our representative firm (i.e. firm with low growth opportunities, high book to market ratio, low Tobin's Q, etc.). Jung et al.(1996) provide an overview of the models of the security issue decision.

[11] We focus on the optimal hedging ratio and not so much on the type of product selected. For the purpose of this study, we focus on forward contracts and swaps. One reason for this is that emerging markets often have limited availability of different product types. Panel C of table (2.1) shows that forwards and swaps are the most commonly used.

following short-term periods $t+2$, $t+3$, etc. The decision process is illustrated in figure (2.1). The disaggregation of the decision making process into two steps is backed by a worldwide stylized fact, which is even more intense among emerging market firms. Foreign debt contracts are mostly long-term, whereas most financial instruments available in derivatives markets mature in a time period of up to 9 months. Underdeveloped credit markets for long-term loans in local currency is one of the reasons why the long-term horizon is more suitable for the foreign debt financing choice of emerging market firms.[12]

Figure 2.1: Long-term vs. short-term decision



The firm's utility is assumed to be a constant relative risk aversion function of net worth W_t, as defined by the difference between assets (A_t) and liabilities (B_t). This difference is assumed to be positive at period 0. The firm (via its manager's decision) maximizes its expected utility of net worth both in the long and short-term, with relative risk aversion coefficient R. The manager's compensation is a positive function of firm value, thus providing

[12] The importance of time horizon in such a decision process is mentioned in some studies of developed markets corporations as well. Allayannis and Ofek (2001) explain US firms' preference for foreign currency derivatives in order to match short-term exporting flows. Aabo (2006) emphasizes the important role of foreign debt as hedging tool for danish firms that have long-term established business activities with some inherent currency exposure.

incentives to reduce the variance of the firm's cash flows.[13]

Furthermore, we assume that net worth follows a normal distribution, hence the expected utility problem may be transformed to an equivalent mean variance optimization. In both the long and short-term optimization problem, we use a two period model: at period 0 (t for the short-term), the decision maker (firm's manager) selects her exposure, meaning chooses the optimal ratio of use of financial instruments and at period T ($t+1$ for the short-term), uncertainty about the exchange rate is resolved. For simplicity and since the purpose of the analysis concentrates on foreign currency exposure, we assume that the only random variable is the spot exchange rate S. At T ($t+1$), S_T (S_{t+1}) is the amount of domestic currency units per one unit of foreign currency and $\sigma^2_{s,0}$ is the long-term volatility ($\sigma^2_{s,t}$ the short-term volatility) of the spot exchange rate. We define the long-term exchange rate change $s \equiv \frac{S_T}{S_0}$ ($s_{t+1} \equiv \frac{S_{t+1}}{S_t}$ for the short-term). Domestic and foreign liabilities exhibit net rates of increase equal to r_d and r_f respectively over the long-term period. This net rate of increase is based on long-term interest rates and takes into account possible amortization of the initial debt as well as new intermediate borrowing (assumed to occur at known rates). Domestic and foreign assets exhibit net rates of increase equal to r^A_d and r^A_f respectively over the same period. For assets, the same assumptions hold: the net rate of increase reflects long-term returns on assets and takes amortization of tangible assets into account.

As far as the long-term decision of foreign debt at time 0 is concerned,

[13] There is an extensive literature about the role of managerial compensation contracts as well as agency conflicts in general for the firm's optimal hedging decision [see Brown (2001)]. In our setting the firm is relatively large, therefore the conflict of interests between managers and shareholders is significant. For this reason, managerial compensation is important. The rationality of our assumption may be backed by models such as Stulz (1984), Smith and Stulz (1985), Froot et al. (1993) or asymmetric information arguments as in DeMarzo and Duffie (1992).

for a fixed $\alpha \geq 0$, the firm's choice concerns the optimal foreign debt ratio β^*. We define $\alpha \equiv \frac{FA}{W}$ and $\beta \equiv \frac{FD}{W}$, where FA and FD are the amounts of foreign assets and foreign debt respectively, expressed in domestic currency. The firm's expected net worth at T is given by

$$\begin{aligned} E_0(W_T) &= E_0(s)W_0\alpha(1+r_f^A) + (A_0 - \alpha W_0)(1+r_d^A) - \\ &\quad -E_0(s)W_0\beta(1+r_f) - (B_0 - \beta W_0)(1+r_d) \end{aligned} \tag{2.1}$$

The long-term maximization problem is thus

$$\text{at period } 0: \ \max_{\beta} E_0(U(W_T))$$

from which we obtain[14]

$$\beta^* = \underbrace{\frac{\left[\frac{(1+r_d)}{(1+r_f)} - E_0(s)\right]}{R\sigma_{s,0}^2(1+r_f)}}_{\text{speculative component}} + \underbrace{\frac{\alpha(1+r_f^A)}{(1+r_f)}}_{\text{hedging component}} \tag{2.2}$$

The optimal foreign debt ratio β^* has two components. The first is a speculative component that tends to 0 as risk aversion tends to infinity ($R \to \infty$), meaning that highly risk averse firms are less willing to speculate. Cross-sectional changes in R can be related to different firm specific characteristics, such as size, profitability, growth opportunities, liquidity, and credit constraints. This speculative component, which reflects the profit opportunity from foreign borrowing, is positive as long as the expected cost of foreign borrowing is lower than the cost of domestic borrowing and vice versa. This condition implies violation of the uncovered interest rate parity (UIP) in the long-term horizon. Under such circumstances, non-financial firms may get implicated in forecasting the risk factor and consider a non-zero speculative component in their long-term choice of foreign debt ratio.

$$\begin{aligned} \text{speculative component} &\neq 0 \Leftrightarrow \\ (1+r_d) &\neq (1+r_f)\cdot E_0(s) \Leftrightarrow \frac{(1+r_d)}{(1+r_f)} \underbrace{\neq}_{\text{violation of UIP}} E_0(s) \end{aligned} \tag{2.3}$$

[14] The solution to the optimization problem is presented in the Appendix.

The second component of the optimal ratio β^* is the hedging component. This component is an increasing function of the given currency exposure inherent in α. It is larger than α if the cost of foreign debt is lower than the return on foreign assets ($r_f^A > r_f$). Naturally, the initial exposure measured by α reflects a long position in the foreign currency, whereas the amount of foreign debt measured by β reflects a short position in foreign currency. The currency mismatch in the long-term period is thus measured by the difference between foreign debt and foreign assets ratios ($\mid \beta^* - \alpha \mid$).

As far as the short-term decision at t is concerned, for fixed α, β^*, the firm's choice concerns the optimal ratio of currency derivatives γ^*.[15] We define $\gamma \equiv \frac{FCD}{W}$, where FCD refers to the net long foreign currency position in the forward and swap markets, expressed in domestic currency. Let F_t be the forward price of the foreign currency in terms of domestic units agreed in period t for a maturity at period $t+1$. We also define $f_t \equiv \frac{F_t}{S_t}$. We suppose that there are n short-term periods in one long-term period. Hence, each long-term gross rate of return equal to $(1+r)$ corresponds to a gross rate of return equal to $(1+r)^{(1/n)}$ for each short-term period. Then the expected net worth at $t+1$ is given by

$$\begin{aligned} E_t(W_{t+1}) &= E_t(s_{t+1})W_t\alpha(1+r_f^A)^{(1/n)} + (A_t - \alpha W_t)(1+r_d^A)^{(1/n)} - \\ &\quad -E_t(s_{t+1})W_t\beta^*(1+r_f)^{(1/n)} - (B_t - \beta^* W_t)(1+r_d)^{(1/n)} + \\ &\quad +[E_t(s_{t+1}) - f_t]W_t\gamma \end{aligned} \tag{2.4}$$

The short-term maximization problem is thus

$$\text{at } t: \ \max_{\gamma} E_t(U(W_{t+1}))$$

[15] At a preliminary stage of the decision process, which is omitted here, the firm chooses whether to use foreign currency derivatives or not. This decision is linked to sunk costs of creating and maintaining a risk management department. Our model concerns only firms with such departments already existing.

Using a mean variance optimization framework provides the following optimal γ^* ratio for the most general case $\alpha > 0$[16]

$$\gamma^* = \frac{[E_t(s_{t+1}) - f_t]}{R\sigma^2_{s,t}} + \beta^*(1 + r_f)^{(1/n)} - \alpha(1 + r_f^A)^{(1/n)} \tag{2.5}$$

The optimal γ^* ratio has hence three components. The first component is a short-term speculative position resulting from the discrepancy between the short-term expectation of exchange rate change $E_t(s_{t+1})$ and the forward rate f_t. It reflects the profit opportunity from foreign exchange expectations. Note that this component is positive as long as $[E_t(s_{t+1}) - f_t] > 0$, in other words as long as the foreign exchange market is in normal backwardation. This condition implies violation of the uncovered interest rate parity (UIP) in the short-term horizon. Under such circumstances, non-financial firms may get implicated in forecasting the risk factor in the short-term horizon as well, and thus consider a non-zero speculative component in their short-term choice of currency derivatives ratio.

The second and third term represent the hedging component that increases as long as the long-term currency mismatch $(\beta^* - \alpha)$ increases. The long-term exposure is adjusted conditional on the new information at time t. This resembles an investor's tactical asset allocation mechanism. The currency mismatch in the short-term period is now measured with respect to the difference between the long-term mismatch $(\beta^* - \alpha)$ and the optimal net foreign currency derivatives proportion γ^*.

We observe that the second part of the optimal γ^* ratio corresponds to a transformation of the speculative component of the optimal foreign debt ratio of the long-term optimization problem of equation (2.2). Actually, one may think of the optimal long-term solution as a constraint on the repeated short-term choice. By replacing the long-term optimal β^* ratio, we can thus

[16] The solution to the optimization problem as well as one particular case are presented in the Appendix.

rewrite the optimal γ^* ratio

$$\gamma^* = \underbrace{\frac{[E_t(s_{t+1}) - f_t]}{R\sigma^2_{s,t}}}_{\text{short-term speculative component}} + \underbrace{\frac{\left[\frac{(1+r_d)}{(1+r_f)} - E_0(s)\right]}{R\sigma^2_{s,0}}}_{\text{long-term speculative component}} \cdot C_1 + \alpha \cdot C_2 \qquad (2.6)$$

where $C_1 = C_1(r_f) > 0$ and $C_2 = C_2(r_f, r_f^A) > 0$ (for $r_f^A > r_f$) are presented in Appendix A. One may interpret equation (2.6) as the optimal choice for γ^* at a moment in time where optimal β^* ratio is chosen simultaneously. This is the reason why some long-term variables such as the long-term exogenous exposure α affect now the choice of γ^* in an opposite way than when the long-term optimal choice β^* is taken as exogenous [equation (2.5)].

The three components serve again as adjustments to the long-term existing currency exposure according to the new information set at each short-term period. The first component is the same short-term speculative position as in equation (2.5). The second component may be viewed as a short-term cancellation of the long-term speculative position resulting from the choice of β^*. This is the case since γ^* (contrary to β^*) is defined in terms of net long (short) foreign currency position. It can thus be considered as an adjusting component of the long-term speculative term. The third component is a hedging component related to the original exogenous currency exposure α.[17]

Summarizing the above, in a long-term horizon the firm chooses its optimal foreign debt ratio β^*, partly in order to hedge its fixed foreign currency inflows and partly to take advantage of the low expected cost of foreign borrowing. In repeated short-term period intervals, the firm chooses its optimal foreign currency derivatives ratio γ^* for speculative purposes in the short-run,

[17] Previous literature has shown that apart from currency derivatives and foreign debt, a firm may hedge its currency exposure via foreign cash holdings. The impact of foreign cash holdings is assumed to be incorporated in α.

as well as for adjusting its long-run speculative and hedging position. This total adjustment achieved with the choice of γ^* in the short-term concerns, thus, both speculative and hedging purposes.

2.4.2 Emerging market context implications

Once we have analyzed the firm's optimal decision making procedure, it is useful to examine in more detail how the emerging market environment of our representative firm may influence the optimal choice of use of financial instruments. An extensive literature in international finance examines parity relations between macroeconomic variables such as spot and forward exchange rates, interest rates and inflation rates.[18] Applying the uncovered interest rate parity (UIP) on our long-term horizon, we get

$$\begin{aligned} UIP_{l.t.} \quad : \quad & \frac{E_0(S_T)}{S_0} = \frac{(1+r_d)}{(1+r_f)} \Leftrightarrow E_0(s) = \frac{(1+r_d)}{(1+r_f)} \Leftrightarrow \\ \Leftrightarrow \quad & \ln\left[E_0(s)\right] = \ln(1+r_d) - \ln(1+r_f) \approx r_d - r_f \end{aligned} \tag{2.7}$$

This theory states that the best predictor of long-term exchange rate change is the interest rate differential. However, this relationship is often rejected in empirical studies and one alternative proposed by the international asset pricing model concerns adding long-term currency risk premium components. In the case of an emerging market, one may view lack of liquidity as a major justification for adding such a long-term currency risk premium, defined by

$$CP_{\text{long-term}} \equiv \frac{(1+r_d)}{(1+r_f)} - E_0(s) \tag{2.8}$$

By replacing in equation (2.7), we obtain a modified version of long-term uncovered interest parity ($UIP'_{l.t.}$)

$$UIP'_{l.t.} : \ln\left[CP_{\text{long-term}} + E_0(s)\right] \approx r_d - r_f \tag{2.9}$$

[18] For a complete overview of the well-established relationships presented in this subsection, one may refer to Solnik and McLeavey (2004).

We can rewrite the firm's long-term optimal choice of foreign debt ratio of equation (2.2) as a function of this long-term currency premium:

$$\beta^* = \frac{CP_{\text{long-term}}}{R\sigma^2_{s,0}(1+r_f)} + \frac{\alpha(1+r_f^A)}{(1+r_f)} \tag{2.10}$$

A sufficient condition leading to a positive long-term currency mismatch is that for $r_f^A \geq r_f$,

$$CP_{\text{long-term}} > 0 \Leftrightarrow \frac{(1+r_d)}{(1+r_f)} > E_0(s) \Rightarrow (\beta^* - \alpha) > 0$$

Such a condition may well hold for the emerging market firm under study, provided that there exist speculative opportunities on foreign debt financing with lower expected cost. The factor that reinforces these opportunities and thus the probability of a positive value of the long-term currency mismatch is the international nature of our representative firm. Doidge et al. (2001) show that ADR firms attain lower cost of capital via full integration in world capital markets and via foreign investors sharing some of the firm's risk. As a result, a cross-listed company in our model has an idiosyncratic advantage that allows it cheaper access to foreign currency debt. For this reason, ceteris paribus, an ADR firm has an optimal foreign debt ratio β^* which is higher than a non-ADR firm[19]. For these reasons, the representative firm of our model is likely to exhibit short position in the foreign currency in the long-term horizon, since it is exposed to short-term interest payments in foreign currency which are superior to its short-term inflows in foreign currency.

In the short-term horizon, when the firm chooses its optimal γ^* ratio, we define short-term domestic and foreign interest rates by i_d and i_f respec-

[19] Cowan et al. (2005) document empirically a significant increase in the currency mismatch of ADR chilean firms. Allayannis et al. (2003) find a positive but not significant relation between the use of foreign debt and foreign listing for Asian firms. This makes the subsequent empirical study of particularly ADR's choice of debt and hedging patterns, an interesting task.

tively.[20] The covered interest rate parity suggests that

$$\begin{aligned} F_t &= S_t \frac{(1+i_d)}{(1+i_f)} \Leftrightarrow \frac{F_t}{S_t} \equiv f_t = \frac{(1+i_d)}{(1+i_f)} \Leftrightarrow \\ &\Leftrightarrow \ln f_t = \log(1+i_d) - \ln(1+i_f) \approx i_d - i_f \end{aligned} \tag{2.11}$$

The uncovered interest rate parity in the short-term is now given by

$$\begin{aligned} UIP_{s.t.} \quad : \quad & \frac{E_t(S_{t+1})}{S_t} = \frac{(1+i_d)}{(1+i_f)} \Leftrightarrow E_t(s_{t+1}) = \frac{(1+i_d)}{(1+i_f)} \Leftrightarrow \\ \Leftrightarrow \quad & \ln\left[E_t(s_{t+1})\right] \approx i_d - i_f \end{aligned} \tag{2.12}$$

Equilibrium conditions in the international asset pricing model suggest that market participants may add a short-term currency risk premium in the forward exchange market defined by

$$CP_{\text{short-term}} \equiv \frac{(1+i_d)}{(1+i_f)} - E_t(s_{t+1})$$

One can think of short-term currency risk premia as an investor's risk remuneration related to scenarios of currency crisis. These premia arise from the risk exposure of the average investor. In terms of uncovered interest rate parity, one may incorporate the short-term currency risk premium follows:

$$UIP'_{s.t.} : \ln\left[CP_{\text{short-term}} + E_t(s_{t+1})\right] \approx i_d - i_f \tag{2.13}$$

By combining equations (2.11) and (2.13), we obtain that

$$CP_{\text{short-term}} = f_t - E_t(s_{t+1}) \tag{2.14}$$

We can rewrite the firm's short-term optimal choice of currency derivatives ratio of equation (2.5) as a function of this short-term currency premium:

$$\gamma^* = -\frac{CP_{\text{short-term}}}{R\sigma^2_{s,t}} + \beta^*(1+r_f)^{(1/n)} - \alpha(1+r_f^A)^{(1/n)} \tag{2.15}$$

[20] Note that generally it may hold that $i_d \neq r_d$ and $i_f \neq r_f$ and their relationship depend on the term structure of interest rates in the two markets.

By replacing the optimal value of β^* as a constraint we can also write

$$\gamma^* = -\frac{CP_{\text{short-term}}}{R\sigma^2_{s,t}} + \frac{CP_{\text{long-term}}}{R\sigma^2_{s,0}} \cdot C_1 + \alpha \cdot C_2 \tag{2.16}$$

It is useful to analyze the expected sign of the short-term currency risk premium $CP_{\text{short-term}}$ for an emerging market vis-a-vis a developed market. As an example, we consider a Latin American market (as domestic - emerging) and the U.S.A. market (as foreign - developed). We assume that market participants exhibit the same risk aversion coefficient in both markets. The assumption that will determine the sign of the short-term currency premium is the sign of the difference in the net foreign currency positions of all market participants. We assume that the Latin American country has a net short exposure in U.S dollars, which can be mostly due to the important U.S. denominated indebtness of its corporate sector. Domestic market participants may need to partially or totally hedge their expected payments in U.S. dollars by buying dollars in the forward market. This will tend to increase the forward price (expressed in units of domestic currency per one dollar). Foreign (U.S.) participants need a positive expected return motive, the currency premium in order to enter in the transaction as counter-parties. In such a case, we have that

$$E_t(s_{t+1}) < f_t \Rightarrow CP_{\text{short-term}} > 0 \tag{2.17}$$

This example gives some intuition why the short-term currency premium $CP_{\text{short-term}}$ may be positive for emerging markets when compared to developed ones[21]. This has an important implication on the forward exchange market. It drives the foreign currency to be traded consistently at a premium on the forward market. This means that the difference $(E_t(s_{t+1}) - f_t)$

[21]Note that $CP_{\text{short-term}}$ as defined in our study is negative for a developped market when we consider U.S. as the domestic country and we define the exchange rate S in amount of U.S. dollars per one unit of emerging market currency.

is negative. We summarize below some comparative statics predictions to test in our subsequent empirical analysis.

$$\frac{\partial \beta^*}{\partial \left(CP_{\text{long-term}}\right)} > 0 \ , \ \frac{\partial \beta^*}{\partial \alpha} > 0 \ , \ \frac{\partial \gamma^*}{\partial \left(CP_{\text{short-term}}\right)} < 0 \qquad (2.18)$$

2.5 Data and methodology

2.5.1 Choice of region and time framework

A crucial issue that is related to empirically testing theoretical predictions concerning the optimal use of financial instruments such as foreign debt and currency derivatives is the functioning of the markets of these financial instruments. In an effort to circumvent issues of insufficient liquidity of derivative markets that appeared during the Asian crises, we focus on the most recent currency turmoils in Latin America. It is a fact that derivatives trading volume has been increased considerably in the examined period (2000-2003), which translates into a rapid development of a previously narrow market.[22] In alignment with the goal of this research, our time period includes events that caused abrupt changes in economic fundamentals and in particular abrupt changes in exchange rates. These events caused corporate risk management face real shocks. Under such volatile exchange rate environments, it is instructive to study which firms decide to use financial instruments and why.

The choice of emerging markets offers a context of highly volatile exchange rates. The five Latin American countries of our sample present 40 devaluation incidents of more than 5% on a quarter basis between 1993 and 2003. Exchange rate risk is thus relevant even for non-financial corporations.

[22] According to the BIS quarterly review in December 2004 (Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity) the total notional amounts outstanding for OTC foreign exchange derivatives has increased by 56% during the period 2000-2003.

Our time span (2000-2003) also includes three major currency crises, exceeding a 25% devaluation on a semi-annual basis: Argentina in December 2001 (-72.40% from 12/2001 till 5/2002), Brazil in summer 2002 (-36.09% from 4/2002 till 9/2002) and Venezuela in January 2003 (-29.99% from 8/2002 till 1/2003). Our data sample also includes firms from Chile and Mexico, two countries that exhibit highly volatile exchange rates but that do not suffer from major currency turmoils during that period.

2.5.2 Choice of representative firms

Financial market regulations in developing countries do not necessarily impose on firms to report data about off-balance sheet instruments or specific disaggregated data about balance sheet instruments. That explains also the disproportionate number of studies focusing on U.S. firms derivatives positions in comparison to studies focusing on emerging markets. On the contrary, all firms listed in U.S. stock markets[23] are obliged to report such information on an annual basis at the Securities and Exchange Commission (SEC). We thus focus on cross-listed firms from five Latin American countries for which this data is available. The choice of an ADR is suitable for a representative firm of our theoretical model, typically since it consists of a large firm with international orientation, usually being in the maturity stage of its life cycle. In addition, as seen in section 2.4, an ADR is highly likely to exhibit a non-zero speculative component of the optimal foreign debt ratio as well as a positive long-term currency mismatch.

In 2002, there were 1319 non-U.S. firms registered and reporting to SEC,

[23]These include the New York Stork Exchange (NYSE), the American Stock Exchange (AMEX), the Nasdaq Stock Market- National Market System (NMS) as well as the Small Cap Market (SM CAP). Some large non-U.S. firms with international orientation that trade over the counter may also need to register with SEC under Securities Exchange Act of 19341.

among which 127 based in Latin America. We only use non-financial firms because we do not want to include any market makers of the financial tools under study. We are thus restricted to a cross-section sample of 103 cross-listed firms as shown in panel A of table (2.1), which on average represent one quarter of each country's total market capitalization. Our time span is 3 years for each firm, with annual data on the day of publication of the report (usually December 31st of each year). After performing a "key-word" search in the annual reports of our 309 panel observations, we find that firms do not provide information about their use of foreign debt and/or foreign currency derivatives in 127 cases. We also exclude 40 additional observations for which we do not find accounting data from Datastream. We thus end up with 142 panel observations, among which 136 are foreign debt users and 103 derivatives users. For each one of these 142 firm observations in our sample we use accounting as well as off-balance sheet data from Datastream and the 20-F annual reports. Detailed information about the source and the definitions of each firm specific variable we use can be found in table (2.4).

As a measure of foreign currency derivatives (FCD) use, we use the net long foreign currency position in the forward, futures and swap markets, expressed in domestic currency at the day of publication of the firm's report. In other words, FCD includes positions in forwards, futures and cross currency swaps. We also include swaps, since essentially they are portfolios of forward contracts. The average maturity of these derivatives contracts remains short-term (lower than one year) even after the inclusion of swaps. We do not include option positions since there is not disaggregate information about their sign. Table (2.1) shows us how users of FCD split on average their derivatives portfolios among different products. The low proportion of use of currency option contracts shows that the bias induced by not including them in our proxy is small.

The firms we examine may not represent the average firm of each devel-

oping market. As table (2.1) shows, they are among the largest ones and by selection they are characterized by significant international orientation. These two characteristics of our sample firms produce a selection bias which, however, does not impede the purpose of our analysis. The first reason is that firms with international orientation exhibit significant elasticity of firm value with respect to exchange rates and are more likely to use foreign debt. The second reason is that there is evidence that large firms are more likely to use derivatives [Nance et al. (1993), Graham and Rogers (2002)]. These two characteristics offer us an ideal sample for testing the interactions between the choice of both financial instruments. We keep in mind, though, that the usage proxies we provide in this essay are biased upwards in relation to the average firm usage in each country.

Among some descriptive statistics, panel B of table (2.1) provides information about the percentage of users of FCD as well as of foreign debt (FD) at the years before and after the three major crises. Table (2.2) presents some more descriptive statistics data concerning the firms under study. It shows that the long-term currency mismatch ($\beta - \alpha$) for the firms' medians of all five countries exhibits the expected positive sign from section 2.4. One may not neglect the potential influence of public utilities sector firms towards this stylized fact. These firms have an intermediary role between their local governments and foreign credit markets, where the formers cover firms' exposure via derivatives contracts. This is often done when governments do not obtain as good terms in borrowing in foreign credit markets as these large firms can and they use them as intermediaries.[24]

[24] We thank Luc Laeven for his insightful comment on this issue.

2.5.3 Obtaining reliable proxies for country variables

Apart from table (2.4) with the firm specific variables' definitions collected from different sources described above, table (2.3) presents some country specific variables needed for the subsequent empirical analysis. These country specific variables exhibit quarterly frequency and are already available from the respective indicated sources. The goal of this subsection is to obtain reliable proxies for country specific variables, such as the short-term and long-term expected exchange rate change $E_t(s_{t+1})$ and $E_0(s)$ respectively, the short-term forward exchange rate f_t and the short-term $crisis$ dummy. Before explaining the estimation of each variable of table (2.5), we need to use an ad-hoc definition of the short and the long-term period. Following some observed average maturities of foreign debt and derivatives positions, we define one quarter period as short-term, and two years as long-term.[25] As a proxy for the foreign currency, we claim that the US dollar is a reliable benchmark for Latin American firms since their foreign sales and foreign liabilities involve mainly US dollars.

As far as the long-term expectation of the exchange rate change $E_0(s)$ is concerned, we base our estimation on the relative purchasing power parity theory (PPP). The long-term expected value of exchange rate changes can be written as a function of expected inflation rate differentials between the domestic (π_d) and the foreign (π_f) economy.

$$\begin{aligned} PPP \quad : \quad & \frac{E_0(S_T)}{S_0} = \frac{(1+E_0(\pi_d))}{(1+E_0(\pi_f))} \Leftrightarrow E_0(s) = \frac{(1+E_0(\pi_d))}{(1+E_0(\pi_f))} \Leftrightarrow \\ \Leftrightarrow \quad & \log(E_0(s)) = \log(1+E_0(\pi_d)) - \log(1+\pi_f) \approx E_0(\pi_d) - E_0(\pi_f) \end{aligned} \tag{2.19}$$

It is argued that PPP is not rejected for long-run data [Rogoff (1996), Taylor and Taylor (2004)]. Exchange rates tend to revert to fundamentals in the long-term. Datastream provides an expected inflation rate for each coun-

[25] We have varied the short-term period definition up to 6 months and the long-term from 1 to 3 years, without significant qualitative change of our empirical results.

try, based on the WES survey, which we use for our PPP ratio computation. We express the ratio over a two year horizon.

As far as the forward exchange rate f_t is concerned, we apply the covered interest rate parity and equation (2.11) on short-term prime lending rates. Volatility proxies for both short ($\sigma_{s,t}$) and long-term ($\sigma_{s,0}$) periods are calculated with the historical method on the basis of a rolling window of daily and quarterly data respectively.

In addition, we create a proxy for the short-term public expectation of the exchange rate change $E_t(s_{t+1})$. We base our estimation on the extensive literature aiming at developing models that could predict currency crises in the short-term. These models usually perform well in sample, but lack predictability out of sample. For the purpose of the present analysis, we use two existing models in order to obtain the short-term currency expectation change. In a simple version of the "leading indicators" (L_j) model developed by Kaminsky et al.(1998) and Kaminsky and Reinhart (1999), we write the expectation of the exchange rate change as the dependent variable in the following regression equation where L is a vector of explanatory factors

$$E_t(s_{t+1}) = a_t + b_t L_t + c_t s_t \tag{2.20}$$

For the choice of the regressors L_j, we rely on the tests of Inoue and Rossi (2008) and the model of Kumar et al. (2003) who choose some most significant macroeconomic indicators based on economic intuition. We thus end up with the variables described in table (2.3), available from January 1993 till June 2003 on a quarterly frequency (169 observations). These variables account for different macroeconomic characteristics in a country, such as the real sector, the balance of payments, the government's fiscal policy, the degrees of financial development and financial liberalization.

In table (2.6), we show the estimates of a pooled least squares regression of lagged macro variables on the continuous change in the effective exchange

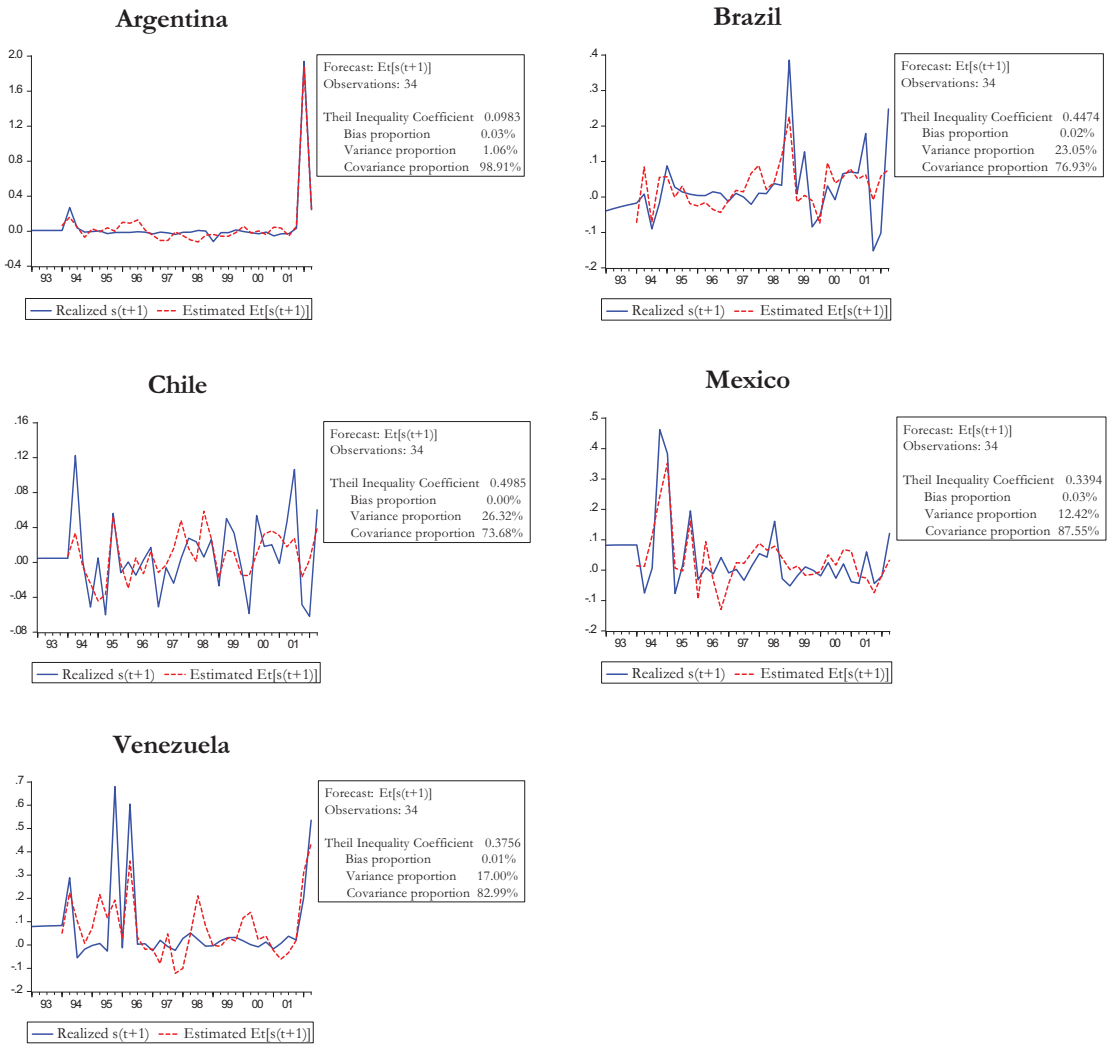
rate. Relatively high R^2 show that the chosen regressors explain a significant percentage of effective exchange rate variability. One may notice that, in consistence with previous findings in related literature, an increase in GDP growth rates, export and import ratio growth rates, reserve growth rates, export ratio, domestic credit ratio, or lending-deposit spread are among the significant factors increasing the probability of a currency depreciation in the next quarter. Similarly, the same effect is produced by a decrease in lagged effective exchange rate difference, in the difference of the terms of trade, or a decrease in the import and the reserves ratio. At each quarter t, we can thus retain the estimated by the equation $E_t(s_{t+1})$ as the public expectation of short-term exchange rate change.[26] We test the robustness and out-of-sample forecasting power of our proxy by drawing the expected versus the realized exchange rate changes in figure (2.2).

Reassuring evidence for our proxy shows that the two out of three major devaluation events in Argentina (end of 2001) and Venezuela (end of 2002) are captured by respective ex ante peaks on the graphs. The crisis event in Brazil (summer 2002) was under-predicted, but its crisis in 1998, as well as the Mexican crises of 1994-1995 are well approximated by our short-term proxy.

[26] We do not use proxies for unanticipated depreciation rates, since we want to obtain a variable incorporating public information accesible to non-financial firms. Similarly, in the definition of our dependent variable, we prefer using nominal exchange rates, instead of weighting average indices proxying for exchange rate pressure, since the former interest more the market participants such as the firms, whereas the latter are more of concern for policy makers.

Figure 2.2: Expected versus realized depreciation graphs

We provide graphs for the estimated short-term expectation of exchange rate change, on a quarterly basis, for the five Latin American countries. Our forecast sample begins in the first quarter of 1993 and ends in the second quarter of 2002. We show both the expected (dotted red lines) and the realized (solid lines) values of the exchange rate change. This constitutes a robustness test and an evaluation of the estimated proxy for the short-term exchange rate expectation change. From the Theil inequality test, we observe that the bias proportion value is quite small in all five countries. Note that the bias proportion shows how far the mean of the forecast is from the mean of the actual series. The variance proportion shows how far the variation of the forecast is from the variation of the actual series.



We have thus shown that $E_t(s_{t+1})$ is a reliable proxy for the short-term exchange rate change. Since we need all short-term variables $E_t(s_{t+1})$, f_t, and $CP_{\text{short-term}}$ on an annual frequency, we decide to use their value prevailing on the end of the fourth quarter of each year of our annual panel data.[27] This is thought suitable, given that most of the 20-F files we process reveal information at the end of each calendar year. We thus match the date of the short-term decision of the firm about γ^* with the date the public expectation $E_t(s_{t+1})$ and the forward rate f_t are formed. For the long-term country specific variables $E_0(s)$, $\frac{(1+r_d)}{(1+r_f)}$ and $CP_{\text{long-term}}$ used in the empirical section, we use their four quarters average value for each year of our annual panel data. An alternative proxy for $(-CP_{\text{long-term}})$ is also calculated by using the annual sovereign rating ($rating$) published by S&P, transformed on a scale from 0 to 1, where 0 corresponds to D and 1 to AAA rating.

2.5.4 Methodological issues

In order to explore the determinants of observed β^*, γ^* and FCD dummy (proxy for existence of a risk management department) we run regressions and evaluate their predictive power.[28] For β^* we use the maximum likelihood estimation procedure and the TOBIT specification since our dependent variable is truncated at value 0. The optimization algorithm used is the Quadratic Hill Climbing and we use the Huber/White method for robust covariances. We use different specifications in order to evaluate the stability of our para-

[27] Results do not change substantially when we use four quarters' averages for our annual proxies.

[28] Note that we do not include an FD dummy variable here. The few observations of firms with zero FD in our sample, do not help to provide an insight from estimating a binary model of "use" and "no use" of FD. We thus focus the analysis on the degree of use of foreign debt.

meters and present the trade-off between multicollinearity and specification error for calibrating our model. We also evaluate the relative importance of "firm specific" versus "country specific" variables, by performing likelihood ratio tests for redundant variables.

For the use of derivatives estimation, we use Cragg (1971) two stage model specification and follow Allayannis and Ofek (2001) since the manager's decision of whether to hedge or not is different from the decision of how much to hedge. The first stage is a binomial probit estimation which relates firm and country specific characteristics to a firm's likelihood of using FCD. We test its predictive power by comparing our estimated probability with a benchmark model of assigning constant probability to the two possible outcomes.

The second stage is a regression where we estimate the factors that influence the firm's decision on γ^*. We use both a pooled least squares estimation where only FCD users are considered, as well as a truncated regression with TOBIT specification. Least squares estimation uses White's heteroscedasticity consistent covariance matrix. Apart from standard robustness checks for multicollinearity (Variation Inflation Factor - VIF) and F tests, we evaluate each time the relative importance of "firm specific" versus "country specific" variables, by performing likelihood ratio tests for redundant variables. In order to address the issue of endogeneity between the two decisions (β^* and γ^*), we perform Hausman's test by introducing the residuals of the first regression as an independent variable in the second. The coefficient is marginally insignificant, suggesting that endogeneity is marginally rejected. This suggests that there is more evidence for a separation between one short and one long-term decision. Due to the marginal presence of this evidence, we also perform a simultaneous equation testing for both financial instruments' choice. This serves as a robustness check for the stability and the significance of our parameters.

2.6 Results

2.6.1 Motivation for the use of foreign debt

In this section, we empirically study the determinants of emerging market firms' use of foreign currency tools, starting by foreign debt FD (observed β^* ratio). In table (2.7), we present the maximum likelihood TOBIT estimations of regressions explaining the β^* ratio of equations (2.2) and (2.10). The three specifications presented (I, II and III) differ in the proxies of the country specific variables used. Specification (I) concerns a regression including separately the two variables ($\frac{1+r_d}{1+r_f}$ and $E_0(s)$) consisting the long-term currency premium, adjusted by the long-term exchange rate variance. The second specification (II) includes $CP_{\text{long-term}}$ directly as in equation (2.10) and the third (III) uses the adjusted sovereign rating as a proxy for the long-term currency premium ($-CP_{\text{long-term}}$). The rest of firm specific variables are included as control variables suggested by existing risk management literature. They may not be explicitly present in β^* of equations (2.2) and (2.10), but their impact is considered theoretically through the risk aversion coefficient R. One may note that no short-term variables are included in the estimation, since theoretical evidence from section 2.4 suggests that the choice of β^* concerns the long-term horizon.

One may first observe that, as expected, foreign currency generating assets (α) significantly increase the firm's foreign debt ratio. It shows that α and β^* are indeed used as complements among our sample firms. This confirms section 2.4 theoretical prediction of equations (2.2) and (2.10) that β^* increases in the currency exposure of α. It therefore confirms the hedging motivation for the use of foreign debt. It is also in line with Allayannis and Ofek (2001), Kedia and Mozumdar (2003) and Elliott et al. (2003) who find that large US firms hedge their exposure via foreign debt. An additional explanation for that is that α can often play the role of collateral for foreign

loans as well.

Another test of the theory predictions of section 2.4 concerns the "country specific" variables. According to the more detailed specification (I), the ratio β^* is decreasing in the long-term public expectation of devaluation and increasing in the long-term interest rate ratio. Firstly, this means that the rational expectations model holds with firms reducing their positions on foreign debt, when the expectation of devaluation increases. Secondly, the positive relation with the long-term interest rate ratio confirms Allayannis et al. (2003) findings on Asian firms that foreign debt is often induced by the lower cost of borrowing abroad. The novelty with respect to their finding is that this interest rate ratio is not the unique significant country factor and it can be viewed in relation to the long-term currency premium. Specification (II) confirms our model's prediction that β^* is increasing in the long-term currency premium $CP_{\text{long-term}}$. There is hence evidence that non-financial firms proceed to long-term speculation via the use of foreign debt.

The multicollinearity test for specification (I) gives a VIF ratio exceeding 25[29] due to high correlation between $\frac{1+r_d}{1+r_f}$ and $E_0(s)$ variables. We thus provide two alternative specifications (II) and (III), where we replace these variables by $CP_{\text{long-term}}$ directly or by the $rating$ variable proxying for $-CP_{\text{long-term}}$. These variables are also significant at the 90% confidence level with the expected sign and now multicollinearity tests are rejected without having induced any serious specification error.[30] We thus obtain robust empirical evidence that foreign debt decision is partly motivated by a long-term

[29] One rule of thumb about multicollinearity testing suggests that it is of a serious concern if the variance inflator factor (VIF) ratio exceeds 25.

[30] One may note that usually in order to confront multicollinearity one may drop some regressors that are highly correlated with each other. The risk in such a procedure is to omit an important variable suggested by the model, which induces a specification error. In our case, we prefer to use alternative proxies for the same variable in our three specifications and check for their robustness.

speculative term as well.

Another country variable, such as the "Dom Credit ratio" proxying for financial development does not seem significant and this could be related to the insignificance of "LCDebt ratio". A significantly negative "Dom Credit ratio" would indicate that the lack of domestic monetary credibility and depth of domestic debt market provides further motivation for issuing FD. This would mean that local debt and foreign debt are complements since local markets are insufficiently deep.[31] We would thus expect a significantly positive coefficient for "LCDebt ratio", which is not the case either. The alternative hypothesis is that local debt and foreign debt are substitutes and that firms just choose the lowest cost financing solution. The insignificance of these variables does not permit us reject any of the two hypotheses.

A theoretical prediction of equations (2.2) and (2.10) that can be proxied through various other "firm specific" variables is that the more risk averse the firm is, the less it is inclined to use FD $\left(\frac{\partial \beta^*}{\partial R} < 0\right)$. Note that this prediction holds under the condition that the long-term currency premium is positive, which is likely to be the case for emerging markets, as opposed to developed ones. We choose to state here the most significant determinants among these other "firm specific" factors that influence the decision of β^*. Firstly, we observe that the more liquid the firm is, the less it is induced to issue FD. This confirms Allayannis and Ofek (2001) finding for US firms. Another significant result for the choice of β^* suggests that profitability, as measured by "Gross margin" lowers significantly foreign debt use. This is also explained by Allayannis and Ofek (2001) for US firms by the fact that more profitable firms are able to generate internal funds more easily and less costly than less profitable firms; as a result, they need to use less FD. The positive impact of "CapExpenditures" suggests that foreign debt is also used as an important source of funding. Finally, the negative impact of size is the

[31] See Allayannis et al. (2003) finding on Asian firms.

least intuitive result and could be due the size bias inherent in our sample and thus introducing noise on our proxy used.

In order to emphasize the importance of the market context of our sample as opposed to various studies focusing on developed markets and depicting "firm specific" driving factors, we perform a test comparing the significance of two groups of variables: "firm specific" versus "country specific". The redundant variables test allows to test for the statistical significance of a subset of explanatory variables. The test hypothesis is whether a subset of variables in an equation all have zero coefficients and could thus be deleted from the equation. In table (2.8), we present the results of the F and likelihood ratio (LR) test statistic. The F-statistic has an exact finite sample F-distribution if the errors are independent and identically distributed normal random variables and the model is linear. The LR test is an asymptotic test. We reject the hypothesis that any group of variables is redundant according to the asymptotic test at the 99% confidence level. The total variability of β^* (R^2) is explained slightly more adequately in a model with exclusively "firm specific" variables, than a model with exclusively "country specific" variables. Still, the robustness test suggests that by omitting country specific factors when studying the optimal β^* choice, we introduce an important bias.

2.6.2 Motivation for the use of foreign currency derivatives

As explained in the methodology section, we separate the analysis of γ^* choice in two stages. The first stage, presented in table (2.9), is a binomial probit estimation which relates firm and country specific characteristics to a firm's likelihood of using FCD. The second stage, presented in table (2.11), includes an analysis of FCD users only, as well as a truncated regression of all firms, where we estimate the factors that influence the firm's decision on

the notional amount of the instruments used.

Table (2.9) presents the Probit estimates for "FCD dummy" which is defined as the firm's decision whether to use FCD or not. We argue that this variable signals the existence of an established risk management department within a firm. The creation of such a department is often associated with large sunk costs, but its maintenance is not considered as excessively costly. The general specification to test is

$$FCD \text{ dummy} = u_1 \cdot (\text{firm specific vatiables}) + u_2 \cdot (\text{country specific variables}) \tag{2.21}$$

This relationship concerns mostly the long-term horizon decision process and is not included in our theoretical model of section 2.4. Among the expected results from risk management literature we find a positive induction of creating such a department by a large long-term currency mismatch $\alpha - \beta$. In other words, the firm decides whether to establish a risk management department in relation to the long-term currency exposure. We also document a size effect suggesting that due to the large sunk costs of setting up a risk management department, large firms are more inclined to use one. Moreover, the creation of such department is more likely among firms with more financial distress, less profitability and more foreign debt proportions.

The most remarkable result of the reasons a firm decides to hedge or not is the relative importance of "country factors". In particular, the impact of $\frac{1+r_d}{1+r_f}, E(s), \sigma^2_{s,0}$ respectively on the FCD dummy decision is significant and with the expected sign. The multicollinearity test for specification (I) gives a VIF ratio exceeding 25 due to high correlation between $\frac{1+r_d}{1+r_f}$ and $E_0(s)$ variables. We thus provide an alternative specification (II), where we replace these variables by $CP_{\text{long-term}}$ directly. This variable is also significant at the 99% confidence level with the expected sign and now multicollinearity tests are rejected without having induced any serious specification error.

We perform again a test comparing the significance of two groups of

variables: "firm specific" versus "country specific". The redundant variables test allows to test for the statistical significance of a subset of explanatory variables. We reject the hypothesis that any group of variables is redundant according to the asymptotic test at the 99% confidence level. The total variability of FCD dummy (R^2) is explained more adequately in a model with exclusively "country specific" variables, than a model with exclusively "firm specific" variables. We thus conclude that they consist significant factors in explaining the decision of operating a risk management department.

For a robustness check, in table (2.10), we present a prediction evaluation of the suggested probit model, which shows that the estimated probability outperforms the benchmark model by more than 50%. Table (2.10) shows type I and type II errors of the estimation model compared to a benchmark model that assigns a constant 100% probability to a firm deciding to use FCD and a constant 0% probability to a firm not making use at all. We notice that our model predicts a 7.77% less correctly the observations of "use" (103 observations), but 58.97% more correctly the observations of "no use" (39 observations), thus resulting on an weighted total percentage gain of forecastability of 38.46%.

The second stage of our estimation concerns the optimal currency derivatives ratio γ^* derived from the theoretical model and equations (2.5), (2.6), (2.15) and (2.16) in section 2.4. In table (2.11), we present four specifications explaining the γ^* ratio. The first specification (I) concerns a least squares regression among FCD users that considers β^* as exogenous (equation 2.15). The second, third and fourth specifications (II, III, IV) test equations (2.6) and (2.16) where β^* is replaced by its long-term explicative variables. The three latter specifications differ in that each time we use different country specific variables to account for the robustness of the coefficients and multicollinearity.

The first specification (I) concerns a pooled least squares estimation

among FCD users and considers β as an exogenous regressor. Foreign currency derivatives appear to be used as complements to foreign debt and substitutes to foreign assets, as indicated by equation (2.5) as well. In specifications (II), (III) and (IV) there is an important change in these interrelationships. By replacing β^* optimal value from equation (2.2) with its long-term proxies there is a particular mechanism that leads γ^* appear as a significant complement of α [equations (2.6) and (2.16)]. This is due to the fact that an increase in the long-term inherent exposure of the firm α leads to a large increase in long-term β^*, which necessitates a simultaneous further increase in short-term γ^* in order for the firm to hedge its exposure (even though α and γ^* are both expressed in terms of long foreign currency positions). This is shown by the sign of α coefficient among the four different specifications and confirms that one motivation for γ^* use is hedging, in alignment with section 2.4 predictions. This means that FCD are used by our sample firms as complements to foreign revenues in covering exchange rate exposure contrary to Allayannis et al. (2003) finding on Asian firms.

For specifications (I) and (II) we reject all multicollinearity tests, however this is not the case for specifications (III) and (IV), where we obtain a VIF ratio exceeding 25 due to high correlation between f_t and $E_t(s_{t+1})$ variables. We decide nevertheless to report these specifications as well in order to confirm that the two components of the short-term currency premium $CP_{\text{short-term}}$ exhibit the expected sign. We finally include the truncated TOBIT specification (IV) in order to check the robustness of the estimates with respect to sample variations.

The results on "country specific" variables show that major motivations for the use of currency derivatives are hedging and adjusting the long-term speculative position, and to a lesser extent, speculating in the short-term. The significance of long-term currency premium with the expected positive sign reveals that currency derivatives are used indeed for adjusting the long-

term speculative position. On the other hand, short-term country variables are rarely significant even though they exhibit the expected sign. This shows us that currency derivatives are less used for short-term speculative purposes. Nevertheless, we find a significant negative impact of the short-term interest rate ratio as reflected in f_t on γ^*. This is evidence in favor of Stulz' (1996) selective hedging theory and Allayannis' et al. (2003) claim that foreign debt is often induced by the lower cost of borrowing abroad and that an increase in γ^* would increase this cost. Another country variable, such as "Dom Credit ratio", suggests that the more developed the local financial markets are, the higher is the degree of use of FCD tools.

As far as conclusions for the markets' functioning are concerned, an interesting question arises: Does a greater expectation (threat) of short-term currency depreciations induce firms to use FCD significantly more or are derivatives markets too costly to access? In other words, by considering $E_t(s_{t+1})$ as a proxy for aggregate country exposure to a short-term devaluation, do firms in more exposed countries to crises use FCD significantly more than in other countries? Table (2.11) (specifications III and IV) gives a positive answer to our research question. Knowing that $E_t(s_{t+1})$ is public information that is incorporated in the price of the different derivative instruments, we observe that firms still find it profitable to access these markets and insure themselves against a risk that is becoming higher. In other words, firms could use and access foreign currency derivatives markets when the need was greater. We thus draw the conclusion that derivatives markets functioned better during our sample period than during previous crisis periods, as documented in theoretical and empirical literature so far.[32]

[32] Allayannis et al.(2003) find that all other country specific variables become insignificant when interest rate differential is taken into account. In our case, currency premia proxy accurately a country's aggregate currency exposure, which allows us for further conclusions about the role of derivatives markets. Cowan et al. (2005) and Bartram et al.(2006) also study country specific effects but not grouped according to time horizon, as

We decide to use as control variables some firm specific variables proposed by traditional risk management literature as major motivation factors. Among them, there are three which are most often significant. Our size proxy surprisingly exhibits a negative coefficient, but Nance et al. (1993) proposed as an explanation the fact that smaller firms have proportionally higher bankruptcy costs and thus higher motivation for hedging. Gross margin also exhibits a negative sign indicating that profitability signals financial distress and is in alignment with US studies and contrary to Allayannis et al. (2003) finding and explanation for Asian firms. Finally, "CapExpenditures" have a rather positive impact on γ^*. Together with "Market to Book" (even though the latter is insignificant), this provides evidence in favor of Froot et al. (1993) and Clark and Judge (2005) suggesting that hedging is increasing in investment opportunities. On the contrary, we find no significant impact of liquidity or debt structure proxies on the γ^* ratio.

In order to emphasize the importance of the market context of our sample, we perform once more a test comparing the significance of the two groups of variables: "firm specific" versus "country specific". We reject the hypothesis that any group of variables is redundant according to the asymptotic test at the 99% confidence level for all four specifications. The total variability of γ^* (R^2) is explained on average slightly more adequately in a model with exclusively "firm specific" variables, than a model with exclusively "country specific" variables. Nevertheless, there is an omitted variable bias if one does not consider the group of "country specific" variables while exploring the determinants of γ^* in developing countries.

In order to address separately the problem of potential endogeneity between the β^* and γ^* choice, we also consider a simultaneous-equation specification presented in table (2.13). We choose a two-stage least squares estimation procedure in which we define foreign debt as a second endogenous

in our case.

variable in the optimal γ^* estimation. An encouraging result is that the sign and significance of the obtained coefficients are similar to the ones obtained with the ordinary least squares and TOBIT estimations. Among the most robust results, we first retain the complementary relationship between currency derivatives and foreign debt. In addition, currency derivatives' use is motivated by adjustments to the long-term speculative and hedging components created by foreign debt use.

2.7 Discussion on the impact of the use of financial tools

In the preceding sections, we analyze the possible motivations of the use of hedging financial instruments on a firm and country specific level. An interesting direction for further research is to study the implications of the use of these tools. This section sheds some preliminary light on whether the use of FCD and FD in developing corporate sectors had a significant effect on the firm's operating performance (gross margin) and capital structure choice (leverage) during our studied period. For this reason, we estimate the following specification

$$\text{Gross margin, leverage} = m_1 \cdot (\text{currency instruments}) + \text{controls} \quad (2.22)$$

On a univariate level, we use standard t-tests of differences in median change presented in table (2.14) and show that firms not only manage to roll-over, but even increase their derivatives' position after the major devaluation events. We thus contradict evidence from the Asian crisis of severe illiquidity and very large spreads that resulted in a decline in firms' derivatives positions during and after the crisis.[33] We also find that users significantly outperform

[33] See Allayannis et al. (2003).

(operationally) non-users in our pooled sample and both results can be due to the recent development of the derivatives markets.

On a multivariate level, table (2.15) presents two regressions in which financial instruments appear as explanatory variables for operating gross margin and leverage, respectively. In both estimations, multicollinearity tests are rejected. In the second estimation, α and β are omitted and γ is replaced by FCD in order to avoid endogeneity with the dependent variable (leverage).

The study of the impact of the use of financial tools on operating performance confirms univariate results. We find evidence that the extent of derivatives used (γ) has a positive impact on operating gross margin during the studied period. Derivatives markets' recent development has reduced the illiquidity problems that hedgers were facing in previous crises, particularly when in need to roll-over their short-term positions. Additionally, there is a positive impact of β on performance. Among the control variables, operating margin is increasing in size and decreasing in liquidity and leverage.[34]

As far as their effect on firm's capital structure (leverage) is concerned, we verify Leland (1998) that a firm increases its debt capacity by increasing its hedging ratio γ^*.[35] Leverage is significantly increasing in the amount of FCD used. This can be interpreted in relation with theories linking hedging and probability of financial distress,[36] according to which a potential signal (via hedging use disclosures for example) that a firm has lower risk of distress could facilitate its debt capacity. Among the control variables, leverage is decreasing in size and liquidity. Summarizing, one may see that the use of FCD and FD has an impact through different routes on performance, capital

[34] We reject Forbes (2002) claim that there is no robust relationship between performance variables and debt exposure.

[35] This confirms also Graham and Rogers' (2002) suggestion of motivation for using FCD for tax incentives since they increase interest tax deductions via the increase in debt capacity.

[36] As in Fehle and Tsyplakov (2005).

structure and investment decisions which merits further examination.

2.8 Conclusions

This study sheds light on the use of foreign exchange financial tools among emerging market cross-listed firms. We develop a simple model suited for the different characteristics of ADR firms, such as relatively large size and international orientation. On a two-horizon decision making process, we obtain the firm's optimal foreign debt ratio β^* and its optimal currency derivatives ratio γ^*. We link the first optimal choice to the long-term horizon and the second optimal choice to the short-term. Based on an emerging market context, we link both optimal choices to country currency risk premia for each corresponding time horizon. Both choices, thus, depend on firm as well as country specific factors, in particular the public expectations of devaluation in both time horizons.

We calibrate our model using a unique data set on Latin American ADRs around the currency turmoils of 2000-2003 in five countries of the region. We are able to sustain the hypothesis that an ADR firm's optimal use of financial tools is a positive function of both its idiosyncratic and country exposure. We find that rational expectations assumptions hold for the use of both financial instruments, since β^* and γ^* decrease and increase respectively as the probability of devaluation of their corresponding time horizon increases. We provide evidence that the choice of the two types of instruments cannot be treated independently. We finally show that country specific variables are important determinants of β^*, γ^* for our emerging market sample, since their non-consideration creates a significant omitted-variable bias. The significance of country specific factors as motivations for hedging gives us the chance to assess that derivatives markets are able to act as a hedging tool in developing countries in difficult periods, at least better than in the past.

Among the various firm specific determinants of β^* and γ^*, most evidence from extensive developed markets literature and scarce emerging market work is confirmed in the case of β^* (influence of long-term currency mismatch, profitability, liquidity and growth opportunities being the most significant). Evidence from the firm specific determinants of γ^* suggests that foreign currency generating assets may have a positive impact, due to the indirect effect of the long-term choice of β^*. Summarizing the motivation of use of these two categories of tools, we decompose and identify the speculative and hedging motivating factors for each one. We find evidence that foreign debt is used for hedging and speculation in the long-term, whereas derivatives are mostly used for adjusting the long-term speculative and hedging positions and less for speculating in the short-term.

In concluding, one limitation of this study is that its results are not automatically applicable for small firms, due to the characteristics of our representative firm. Undoubtedly, this is a topic for further research where one could consider more countries in different regions of the world and in a longer time series horizon, in order to draw conclusions with wider confidence intervals about how risk management varies across regions and countries. The question of speculation vs. hedging is topical and this study shows that both motivations are present in firms' use of financial tools in emerging markets. Studying derivatives markets and their accessibility by firms in emerging markets during difficult periods may help us bring together these firms' particular characteristics and needs with market characteristics, so as to make the latter more effective and the former more protected.

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2.10 Appendix - Optimal hedging ratio

Firm's maximization problem. We assume that net worth follows a normal distribution[37], hence the expected utility problem may be transformed to an equivalent mean variance optimization.

Step 1. Long-term decision

$$\max_{\beta} E_0(U(W_T)) \Leftrightarrow \max_{\beta} f\left(E_0(W_T), \sigma^2_{W_T}\right) \tag{2.23}$$

with

$$FOC : f_1 \frac{\partial E_0(W_T)}{\partial \beta} + f_2 \frac{\sigma^2_{W_T}}{\partial \beta} = 0 \Rightarrow \frac{\partial E_0(W_T)}{\partial \beta} + \frac{f_2}{f_1} \frac{\sigma^2_{W_T}}{\partial \beta} = 0 \tag{2.24}$$

where

$$\frac{f_2}{f_1} = \frac{1}{2} \frac{E_0(U''(W_T))}{E_0(U'(W_T))} = -\frac{1}{2W_0} R \text{ , and } R \equiv \text{ Relative Risk Aversion (firm)} \tag{2.25}$$

The firm's net wealth in the long run period T is given by

$$W_T = \frac{S_T}{S_0} W_0 \alpha (1+r_f^A) + (A_0 - \alpha W_0)(1+r_d^A) - \frac{S_T}{S_0} W_0 \beta (1+r_f) - (B_0 - \beta W_0)(1+r_d) \tag{2.26}$$

with first two moments:

$$E_0\left(W_T\right) = W_0 E_0(s) \left[\alpha(1+r_f^A) - \beta(1+r_f)\right] + (A_0 - \alpha W_0)(1+r_d^A) - (B_0 - \beta W_0)(1+r_d)$$

$$\sigma^2_{W_T} = W_0^2 \left[\alpha^2 (1+r_f^A)^2 + \beta^2 (1+r_f)^2 - 2\alpha\beta(1+r_f^A)(1+r_f)\right] \sigma^2_{s,0} \tag{2.27}$$

[37] It may be implausible to assume that the net worth is unbounded towards the left tail of its distribution. What is important here, though is to retain that, in this model, the firm's manager is a mean-variance optimizer.

By solving the FOC of equation (2.24), we obtain the optimal foreign debt ratio

$$\beta^* = \underbrace{\frac{\left[\frac{(1+r_d)}{(1+r_f)} - E_0(s)\right]}{R\sigma^2_{s,0}(1+r_f)}}_{\text{speculative component}} + \underbrace{\frac{\alpha(1+r_f^A)}{(1+r_f)}}_{\text{hedging component}} \quad (2.2)$$

The firm thus exhibits a net long-term currency mismatch equal to

$$\begin{aligned}(\beta^* - \alpha) &= \frac{1}{(1+r_f)R\sigma^2_{s,0}}\left[\left\{\frac{(1+r_d)}{(1+r_f)} - E_0(s)\right\} + \alpha(r_f^A - r_f)\sigma^2_{s,0}R\right] = \\ &= \frac{1}{(1+r_f)R\sigma^2_{s,0}}\left[CP_{\text{long-term}} + \alpha(r_f^A - r_f)\sigma^2_{s,0}R\right] \quad (2.28)\end{aligned}$$

The sign of the net long-term currency mismatch will be defined by the relation below

$$(\beta^* - \alpha) > 0 \Leftrightarrow CP_{\text{long-term}} + \alpha(r_f^A - r_f)\sigma^2_{s,0}R > 0 \quad (2.29)$$

Step 2. Short-term decision

$$\max_{\gamma} E_t(U(W_{t+1})) \Leftrightarrow \max_{\gamma} f\left(E_t(W_{t+1}), \sigma^2_{W_{t+1}}\right) \quad (2.30)$$

with

$$FOC : f_1\frac{\partial E_t(W_{t+1})}{\partial\gamma} + f_2\frac{\sigma^2_{W_{t+1}}}{\partial\gamma} = 0 \Rightarrow \frac{\partial E_t(W_{t+1})}{\partial\gamma} + \frac{f_2}{f_1}\frac{\sigma^2_{W_{t+1}}}{\partial\gamma} = 0 \quad (2.31)$$

The firm's net wealth in short run period $t+1$ is now given by

$$\begin{aligned}W_{t+1} &= \frac{S_{t+1}}{S_t}W_t\alpha(1+r_f^A)^{(1/n)} + (A_t - \alpha W_t)(1+r_d^A)^{(1/n)} - \\ &\quad -\frac{S_{t+1}}{S_t}W_t\beta^*(1+r_f)^{(1/n)} - (B_t - \beta^* W_t)(1+r_d)^{(1/n)} + \\ &\quad +W_t\gamma\left[\frac{(S_{t+1} - F_t)}{S_t}\right]\end{aligned}$$

$$W_{t+1} = W_t \left\{ \frac{S_{t+1}}{S_t} \left[\alpha(1+r_f^A)^{(1/n)} - \beta^*(1+r_f)^{(1/n)} + \gamma \right] - \gamma f_t \right\} + \\ +(A_t - \alpha W_t)(1+r_d^A)^{(1/n)} - (B_t - \beta^* W_t)(1+r_d)^{(1/n)} \quad (2.32)$$

$$E\left(W_{t+1}\right) = W_t \left\{ E(s_{t+1}) \left[\alpha(1+r_f^A)^{(1/n)} - \beta^*(1+r_f)^{(1/n)} + \gamma \right] - \gamma f_t \right\} + \\ +(A_t - \alpha W_t)(1+r_d^A)^{(1/n)} - (B_t - \beta^* W_t)(1+r_d)^{(1/n)} \quad (2.33)$$

$$\sigma^2_{W_{t+1}} = W_t^2 \left[\alpha(1+r_f^A)^{(1/n)} - \beta^*(1+r_f)^{(1/n)} + \gamma \right]^2 \sigma^2_{s,t} \quad (2.34)$$

- By solving the FOC of equation (2.31) and keeping β^* as an exogenous variable, for the most general case where $\alpha \geq 0$, we obtain the optimal foreign currency derivatives ratio

$$\gamma^* = \underbrace{\frac{[E_t(s_{t+1}) - f_t]}{R\sigma^2_{s,t}}}_{\text{speculative component}} \underbrace{+\beta^*(1+r_f)^{(1/n)} - \alpha(1+r_f^A)^{(1/n)}}_{\text{currency mismatch component}} \quad (2.5)$$

When replacing with the optimal β^* ratio of equation (2.2) for the long-term period, we end up with

$$\gamma^* = \underbrace{\frac{[E_t(s_{t+1}) - f_t]}{R\sigma^2_{s,t}}}_{\substack{\text{short-term} \\ \text{speculative component}}} \underbrace{+\frac{\left[\frac{(1+r_d)}{(1+r_f)} - E_0(s)\right]}{R\sigma^2_{s,0}}}_{\substack{\text{long-term} \\ \text{speculative component}}} \cdot C_1 + \alpha \cdot C_2 \quad (2.6)$$

with

$$C_1 \equiv \left(\frac{1}{(1+r_f)} \right)^{\left(\frac{n-1}{n}\right)} > 0 \quad (2.35)$$

$$C_2 \equiv (1+r_f^A)^{(\frac{1}{n})} \left\{ \left(\frac{(1+r_f^A)}{(1+r_f)} \right)^{\frac{n-1}{n}} - 1 \right\} > 0 \text{ for } r_f^A > r_f$$

The currency mismatch in the short-term period is measured with respect to the difference between the long-term mismatch $(\beta^* - \alpha)$ and

the optimal net foreign currency derivatives proportion γ^*. The firm thus exhibits a net short-term currency mismatch equal to

$$(\beta^* - \alpha - \gamma^*) = \frac{1}{(1+r_f)R\sigma^2_{s,0}\sigma^2_{s,t}} \cdot$$

$$\cdot \left[\begin{array}{c} \left(1-(1+r_f)^{\frac{1}{n}}\right)\sigma^2_{s,t}\left\{\frac{(1+r_d)}{(1+r_f)} - E_0(s)\right\} - [E_t(s_{t+1}) - f_t](1+r_f)\sigma^2_{s,0} + \\ +\alpha\left((1+r^A_f)\left(1-(1+r_f)^{\frac{1}{n}}\right) - (1+r_f)\left(1-(1+r^A_f)^{\frac{1}{n}}\right)\right)R\sigma^2_{s,0}\sigma^2_{s,t} \end{array} \right] \tag{2.36}$$

$$\Rightarrow (\beta^* - \alpha - \gamma^*) = \frac{1}{(1+r_f)R\sigma^2_{s,0}\sigma^2_{s,t}} \cdot$$

$$\cdot \left[\begin{array}{c} \left(1-(1+r_f)^{\frac{1}{n}}\right)\sigma^2_{s,t}CP_{\text{long-term}} + (1+r_f)\sigma^2_{s,0}CP_{\text{short-term}} + \\ +\alpha\left((1+r^A_f)\left(1-(1+r_f)^{\frac{1}{n}}\right) - (1+r_f)\left(1-(1+r^A_f)^{\frac{1}{n}}\right)\right)R\sigma^2_{s,0}\sigma^2_{s,t} \end{array} \right] \tag{2.37}$$

In the extreme case where the segmentation between the short-term and the long-term decision becomes extremely large, in other words, if there are $n \to \infty$ short-term periods in each long-term period, we then obtain

$$\lim_{n\to\infty}(1+r_f)^{\frac{1}{n}} = 1 \text{ and } \lim_{n\to\infty}(1+r^A_f)^{\frac{1}{n}} = 1 \tag{2.38}$$

and thus the net short-term currency mismatch is just a positive function of $CP_{\text{short-term}}$ as given by

$$(\beta^* - \alpha - \gamma^*) \simeq \frac{1}{R\sigma^2_{s,t}} \cdot CP_{\text{short-term}} \tag{2.39}$$

- For $\alpha = 0, \beta = 0$, there is no currency mismatch in the long-term and the optimal hedging ratio depends exclusively on the short-term speculative component. Thus the firm may still find it optimal to use FCD for speculative reasons if this short-term component is non-zero.

$$\gamma^* = \underbrace{\frac{[E_t(s_{t+1}) - f_t]}{R\sigma^2_{s,t}}}_{\begin{array}{c}\text{short-term}\\ \text{speculative component}\end{array}} \tag{2.40}$$

2.11 Tables

Table 2.1: Descriptive statistics of our sample firms and data on their use of financial instruments. Panel A presents our sample and time span. Panels B and C present information about the use of different financial tools during our sample period.

Panel A. Sample of firms, time span and emerging market environment

Country	Time span	# firms	% market cap	Major event (> 25% sem. depr.)
Argentina	2000-03	14	56.6%	Dec 01- May 02
Brazil	2000-03	34	26.1%	Apr 02- Sep 02
Venezuela	2000-03	3	5%	Aug 02- Jan 03
Chile	2000-03	17	17.4%	none
Mexico	2000-03	35	29.4%	none
Total		103	26.9%	

Panel B. Percentage of use of financial tools around the major events

Country	$\%FCD$ users (in our sample)		$\%\ FD$ users (in our sample)	
	Year before	Year after	Year before	Year after
Argentina	64.29%	50%	85.71%	100%
Brazil	67.65%	79.41%%	91.18%	94.12%
Venezuela	33.33%	33.33%	66.67%	100%
Chile	58.82%	82.35%	64.71%	82.35%
Mexico	25.71%	40%	80%	91.43%
Total	50.49%	61.17%	81.55%	92.23%

Panel C. Preference of use among different types of FCD in our sample

Country	% Forwards	% Futures	% Options	% FX swaps
Argentina	33.3%	11.1%	22.2%	33.3%
Brazil	13.5%	2.7%	16.2%	67.6%
Venezuela	25%	12.5%	12.5%	50%
Chile	46.2%	7.7%	7.7%	38.5%
Mexico	29.6%	3.7%	11.1%	55.6%
Total	29.5%	9.8%	11.8%	49%

Table 2.2: Descriptive statistics of medians of major firm specific variables by country

Country	Foreign Assets ratio α	Foreign Debt ratio β	FCD ratio γ	Mismatch $\beta - \alpha$	Leverage	Gross margin	STDebt ratio
Argentina	4.61%	41.81%	0.75%	37.20%	39.07%	2.03%	47.49%
Brazil	0.95%	36.16%	9.11%	35.22%	31.51%	19.63%	27.91%
Chile	37.99%	41.52%	13.87%	3.53%	34.42%	15.14%	15.91%
Mexico	34.25%	35.68%	4.11%	1.43%	28.80%	11.76%	20.72%
Venezuela	6.55%	17.62%	0.21%	11.07%	15.03%	5.16%	18.08%
TOTAL	16.00%	35.92%	4.10%	19.92%	30.77%	13.44%	22.37%

Table 2.3: Country specific variable definitions and sources

Variable	Definition	Category	Data source
$s_{t+1} \equiv \frac{S_{t+1}}{S_t}$	short-term US$ exchange rate change WMR index (increase=domestic depreciation)	exchange rate	Datastream
$s \equiv \frac{S_T}{S_0}$	long-term US$ exchange rate change WMR index (increase=domestic depreciation)	exchange rate	Datastream
i_d	short term lending (prime) rate in domestic market	short-term IR	Datastream
i_f	short term lending (prime) rate in US market	short-term IR	Datastream
$\dot{E}(\inf lation)$	WES expected inflation rate	long-term expected inflation	Datastream
$rating$	S&P sovereign rating	long-term currency premium	LatinFocus
Δ(Real GDP)	Real GDP in domestic currency 12-month % change	real sector	Datastream
Δ(Export ratio)	$\frac{\text{Exports}}{\text{GDP}}$ 12-month % change	current account	Datastream
Δ(Import ratio)	$\frac{\text{Imports}}{\text{GDP}}$ 12-month % change	current account	Datastream
Δ(Reserves)	Foreign currency reserves 12-month % change	capital account	Datastream
Δ(Reserves ratio)	$\frac{\text{Foreign currency reserves}}{\text{Imports}}$ 12-month % change	capital account	Datastream
TOT	Terms of Trade index	current account	Datastream
M2 ratio	$\frac{\text{M2}}{\text{Foreign currency reserves}}$	capital account	Datastream
Dom Credit ratio	$\frac{\text{Domestic credit}}{\text{GDP}}$	financial development	Datastream
Lend-Dep ratio	$\frac{\text{Lending rate}}{\text{Deposit rate}}$	financial liberalization	Datastream
Budget def	$\frac{\text{Budget deficit}}{\text{GDP}}$	fiscal policy	Datastream

Table 2.4: Firm specific variable definitions and sources

Variable	Definition*	Category	Data source
W	Net Worth = Total Assets - Total Liabilities (in local currency)	Balance Sheet	Datastream
FCD	Firm's net long foreign currency position on forwards/ futures/ swaps on the 20-F report publication date $\sim$ proxy for average annual use	off - Balance Sheet	20-F files
FCD dummy	equals 1 if firm uses forwards/ futures/ options/ or swaps	off - Balance Sheet	20-F files
γ	$\frac{FCD}{W} \sim$ proxy for derivatives use ratio	off - Balance Sheet	20-F files
β	$\frac{\text{Foreign Currency Debt}}{W} \sim$ proxy for foreign debt FD use ratio	off - Balance Sheet	20-F files
α	$\left(\frac{\text{Export Sales}}{\text{Total Sales}} \cdot \frac{Assets}{W}\right) \sim$ proxy for foreign currency generating assets ratio	Income Statement	20-F files
Tsales	the logarithmic value of total sales in local currency $\sim$ proxy for size	Income Statement	20-F files
Leverage	book value of ratio $\frac{\text{Total Debt}}{\text{Total Assets}} \sim$ proxy for financial distress	Balance Sheet	20-F files
Gross margin	$\frac{\text{Total EBIT}}{\text{Total Sales}} \sim$ proxy for profitability	Income Statement	Datastream
STDebt ratio	$\frac{\text{Short term debt (maturing up to one year)}}{\text{Total Debt}} \sim$ proxy for liabilities horizon $(-)$	Balance Sheet	Datastream
Market to Book	$\frac{\text{Market Value of Equity}}{\text{Book Value of Equity}} \sim$ proxy for growth opportunities	Balance Sheet, market	Datastream
CapExpenditures	the logarithmic value of capital expenditures in local currency	Cash flows	20-F files
LCDebt ratio	$\frac{\text{Local currency debt}}{\text{Total Assets}} \sim$ proxy for local currency leverage	off - Balance Sheet	20-F files
Liquidity ratio	$\frac{\text{Current Assets}}{\text{Current Liabilities}} \sim$ proxy for liquidity	Balance sheet	Datastream

*All ratios involve the same currency, refer to exchange rates of the day of publication of each category/data source and constant prices of 2002

Table 2.5: Estimated variables definitions and sources

Variable	Definition*	Category	Estimation
l.t. period	2 years period adjusting all annualized variables	long-term period	
s.t. period	1 quarter period adjusting all annualized variables	short-term period	
$\frac{(1+r_d)}{(1+r_f)}$	$\frac{\text{Domestic corporate lending rate (maturity of 2 to 5 years)}}{\text{US corporate lending rate (similar maturity)}}$	long-term IR ratio	computation
$E_0(s)$	$\frac{1+E(\text{inf}\,lation) \text{ in domestic market}}{1+E(\text{inf}\,lation) \text{ in US market}}$	long-term expected US ER	PPP
$E_t(s_{t+1})$	short-term expected ER change	short-term expected US ER	ML estimation
$\sigma^2_{s,0}$	long-term exchange rate variance (2 years)	long-term ER variance	historical method
$\sigma^2_{s,t}$	short-term exchange rate variance (1 quarter)	short-term ER variance	historical method
f_t	$\frac{1+i_d}{1+i_f}$	short-term US forward rate	covered IR Parity

* All ratios involve the same currency, are expressed on terms of their horizon maturity and refer to exchange rates of the day of publication of each category or data source and constant prices of 2002

Table 2.6: Pooled least squares estimation of quarterly exchange rate change

All dependent variables suggested by currency crises models are lagged by one quarter. We thus obtain a proxy for the short-term expectation $E_t(s_{t+1})$ in each quarter. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***,**,* respectively. P-values are shown in parenthesis.

Variable	Model*	Category	Equation (2.20) Short-term $s_{t+1} \equiv \frac{S_{t+1}}{S_t}$ Coefficient (p-value)	
Δ(Real GDP)	KR,KMP	real sector	0.331***	(0.001)
Δ(Export ratio)	KR,KMP	current account	0.277***	(0.003)
Δ(Import ratio)	KR	current account	0.115*	(0.078)
Δ(Reserves)	KMP	capital account	0.175***	(0.007)
Lag ER	KMP	current account	-0.423***	(0.000)
logarithmic $(i_d - i_f)$	KR,KMP	international	0.007***	(0.000)
Export ratio	KR,KMP	current account	1.739**	(0.019)
Import ratio	KR	current account	-3.324***	(0.001)
Dom Credit ratio	KR	fin. development	0.357***	(0.000)
Lend-Dep ratio	KR	fin. liberalization (−)	0.140***	(0.000)
Reserves ratio	KR,KMP	capital account	-0.032*	(0.089)
Budget def	KMP	fiscal policy	-0.206	(0.752)
Δ(TOT)	KR	current account	-0.366*	(0.055)
Fixed effects			YES	
Method			Pooled LS	
Observations			169 panel	
Estimation period			1993-2002	
R^2 (adjusted R^2)			63.71% (55.70%)	
p-value			0.000 (F stat)	

*Variables that were used in Kaminsky and Reinhart 1999 (KR) and/or Kumar, Moorthy and Perraudin 2003 (KMP) models

Table 2.7: Maximum likelihood TOBIT estimations of foreign debt ratio as the dependent variable

Our sample consists of 142 firm observations during 2000-2003, among which 6 observations are truncated to 0. Specifications I,II and III use different country specific variables to test equations (2.2) and (2.10). Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***,**,* respectively.

Three specifications		I: Equation (2.2)		II: Equation (2.10)		III: Equation (2.10)	
Variable	Proxying	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)
Firm specific							
c		1.157	(0.438)	0.595	(0.722)	1.067	(0.490)
α	Frevenues	0.642***	(0.000)	0.643***	(0.000)	0.638***	(0.000)
Tsales	size	-0.229**	(0.049)	-0.266**	(0.015)	-0.236**	(0.042)
LCDebt ratio	local currency leverage	0.865	(0.379)	0.945	(0.340)	0.911	(0.353)
Gross margin	profitability	-0.036**	(0.041)	-0.034*	(0.054)	-0.035**	(0.046)
STDebt ratio	liabilities horizon (−)	-0.000	(0.420)	-7E-05	(0.416)	-0.000	(0.430)
Liquidity ratio	liquidity	-0.250***	(0.004)	-0.252***	(0.004)	-0.253***	(0.004)
CapExpenditures	investments/growth op.	0.190*	(0.072)	0.208**	(0.047)	0.182*	(0.085)
Country specific							
$\frac{(1+r_d)}{(1+r_f)}/\sigma^2_{s,0}$	long-term IR ratio	2E-05*	(0.079)				
$E_0(s)/\sigma^2_{s,0}$	long-term expected ER	-2E-04*	(0.064)				
Dom Credit ratio	financial development	0.495	(0.358)				
$CP_{\text{long-term}}$	$CP_{\text{long-term}}$			1.314*	(0.099)		
$rating/\sigma^2_{s,0}$	$CP_{\text{long-term}}$ (−)					-1E-04*	(0.100)
Country Dummies	country particularities	YES		YES		YES	
Method		ML-TOBIT		ML-TOBIT		ML-TOBIT	
Observations		142		142		142	
R^2 (adjusted R^2)		38.25% (30.9%)		38.20% (31.93%)		38.12% (31.84%)	

Table 2.8: Comparison of firm versus country specific variables' importance on explaining foreign debt ratio
We perform two tests to show whether firm specific and/or country specific variables are redundant in β^* estimation.

Specification	I: Equation (2.2)	II: Equation (2.10)	III: Equation (2.10)
Test 1			
H_0 : all firm specific variables are redundant (they all have zero coefficients)			
p-value F stat	0.000	0.000	0.000
We reject H_0 in I, II and III.			
Adjusted R^2 of Table (2.7) regression with firm specific variables ONLY	15.07%	15.07%	15.07%
Test 2			
H_0 : all country specific variables are redundant (they all have zero coefficients)			
p-value F stat	0.000	0.000	0.000
We reject H_0 in I, II and III			
Adjusted R^2 of Table (2.7) regression with country specific variables ONLY	11.92%	12.83%	12.92%

Table 2.9: Probit estimations of the firm's binary decision to use foreign currency derivatives (FCD dummy) or not at all Our sample consists of 142 firm observations during 2000-2003. Specifications I and II use different country specific variables as a robustness test for potential multicollinearity bias. The last column presents two tests showing that neither firm specific nor country specific variables are redundant and stressing the importance of the latter.

Two specifications		I: Equation (2.21)		II: Equation (2.21)			
Variable	Proxying	Coefficient	(p-value)	Coefficient	(p-value)	firm vs. country specific variables	
Firm specific						H_0 : all firm specific variables	
c		7.224	(0.357)	-6.561	(0.050)	are redundant (have zero coefficients)	
$\alpha - \beta$	long-term mismatch	0.296**	(0.020)	0.285**	(0.021)	p-value F stat (I)	0.001
TSales	size	0.554*	(0.056)	0.537**	(0.044)	p-value F stat (II)	0.002
Leverage	financial distress	2.145**	(0.037)	2.007**	(0.037)	We reject H_0	
Gross margin	profitability	-0.085***	(0.000)	-0.054***	(0.000)	McFadden R^2 of regression with	
LCDebt ratio	local currency leverage	-7.096***	(0.001)	-6.507***	(0.001)	firm specific variables ONLY (I)	7.95%
						firm specific variables ONLY (II)	7.95%
Country specific						H_0 : all country specific variables	
$\frac{(1+r_d)}{(1+r_f)}$	long-term IR ratio	34.520**	(0.031)			are redundant (have zero coefficients)	
$E_0(s)$	long-term expected ER	-25.783***	(0.003)			p-value F stat (I)	0.000
Dom Credit ratio	financial development	7.565***	(0.002)			p-value F stat (II)	0.000
$rating$	$CP_{\text{long-term}}$ $(-)$	-64.950***	(0.000)			We reject H_0	
$CP_{\text{long-term}}$	$CP_{\text{long-term}}$			6.742***	(0.004)	McFadden R^2 of regression with	
Country Dummies	country particularities	YES		YES		country specific variables ONLY (I)	23.80%
						country specific variables ONLY (II)	22.51%
Method		Probit		Probit			
Observations FCD dummy=0		39		39			
Observations FCD dummy=1		103		103			
McFadden R^2		38.20%		33.93%			
p value LR stat		0.000		0.000			

Table 2.10: Robustness test for probit estimators of the firm's binary decision (FCD dummy)

We evaluate the out-of-sample predictability of the estimated probability that a firm uses foreign currency derivatives P(firm uses FCD), compared to a benchmark model that assigns 100% probability to the firm's decision to use foreign currency derivatives.

Robustness Test	Estimated probability with cutoff point 0.5			versus	Benchmark constant probability with $P(\text{firm uses } FCD) = 1$		
	No use FCD	Use FCD	Total		No use FCD	Use FCD	Total
% Correct predictions	58.97%	92.23%	83.10%		0%	100%	72.54%
% Incorrect predictions	41.03%	7.77%	16.90.%		100%	0%	27.46%
Percent Gain*	58.97%	-7.77%	38.46%				
Model tested	Probit						
Observations	39	103	142				

* Percent of incorrect prediction corrected by the estimated probit model

Table 2.11: Estimations of foreign currency derivatives ratio as the dependent variable

Specifications I, II and III present pooled least squares estimations and test equations (2.5) and (2.16) on 103 firm observations that use FCD during 2000-2003. Specification IV presents maximum likelihood TOBIT estimations on 142 firm observations, among which 39 observations are truncated to 0. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively.

Four specifications		I: Equation (2.5)		II: Equation (2.16)		III: Equation (2.16)		IV: Equation (2.16)	
Variable	Proxying	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)
Firm specific									
α	Frevenues	-0.027	(0.614)	0.129**	(0.014)	0.133***	(0.010)	0.133***	(0.008)
β	FD ratio	0.271***	(0.000)						
Tsales	size	-0.054	(0.278)	-0.123**	(0.012)	-0.113**	(0.019)	-0.090*	(0.079)
LCDebt ratio	local currency leverage	0.160	(0.535)	-0.033	(0.902)	-0.015	(0.958)	-0.341	(0.243)
Gross margin	profitability	-0.406***	(0.000)	-0.545***	(0.000)	-0.537***	(0.000)	-0.043	(0.694)
Market to Book	growth opportunities	0.042	(0.304)	0.039	(0.332)	0.038	(0.322)	0.037	(0.126)
CapExpenditures	investments / growth opp.	-1E-04	(0.997)	0.064*	(0.080)	0.060*	(0.100)	0.111***	(0.004)
Country specific									
$CP_{\text{short-term}}$	$CP_{\text{short-term}}$	-0.313	(0.146)	-0.066	(0.821)				
$CP_{\text{long-term}}$	$CP_{\text{long-term}}$			0.649**	(0.050)				
$rating$	$CP_{\text{long-term}}$ $(-)$					-0.794**	(0.034)	-0.998**	(0.016)
Dom Credit ratio	financial development			0.450*	(0.058)				
$E_t(s_{t+1})/\sigma^2_{s,t}$	short-term expected ER					0.001**	(0.026)	0.001**	(0.041)
$f_t/\sigma^2_{s,t}$	short-term forward rate					-0.001**	(0.026)	-0.001**	(0.043)
Country Dummies	country particularities	YES		YES		YES		YES	
Method		LEAST SQUARES		LEAST SQUARES		LEAST SQUARES		ML-TOBIT	
Observations		103 FCD users		103 FCD users		103 FCD users		142	
R^2 (adjusted R^2)		51.93% (45.52%)		38.63% (29.67%)		38.18% (29.15%)		32.77% (25.36%)	

Table 2.12: Comparison of firm versus country specific variables' importance on explaining foreign currency derivatives ratio
We perform two tests to show whether firm specific and / or country specific variables are redundant in γ^* ratio estimation.

Specification	I: Equation (2.5)	II: Equation (2.16)	III: Equation (2.16)	IV: Equation (2.16)
Test 1				
H_0 : all firm specific variables are redundant (they all have zero coefficients)				
p-value F stat	0.000	0.000	0.000	0.000
We reject H_0 in (I), (II), (III), (IV)				
Adjusted R^2 of Table (2.11) regression with firm specific variables ONLY	31.44%	13.61%	13.61%	13.14%
Test 2				
H_0 : all country specific variables are redundant (they all have zero coefficients)				
p-value F stat	0.000	0.000	0.000	0.000
We reject H_0 in (I), (II), (III), (IV)				
Adjusted R^2 of Table (2.11) regression with country specific variables ONLY	9.52%	11.55%	11.18%	14.64%

Table 2.13: Two stage least squares estimation for both FCD and FD ratios as dependent variables
The simultaneous equations specification is a robustness test for the sign and significance of the different coefficients in comparison to preceding results. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively.

Dependent variable		Ratio β^*		Ratio γ^*	
Explanatory variable	Proxying	Coefficient	(p-value)	Coefficient	(p-value)
Firm specific					
α	Frevenues	0.583***	(0.000)	Instrument	
β	FD ratio			0.311***	(0.000)
Tsales	size	-0.296***	(0.002)	Instrument	
LCDebt ratio	local currency leverage	0.121	(0.820)	Instrument	
Gross margin	profitability	-0.185	(0.485)	Instrument	
STDebt ratio	liabilities horizon $(-)$	-0.203	(0.305)	Instrument	
Liquidity ratio	liquidity	-0.194***	(0.000)	Instrument	
CapExpenditures	investments/growth op.	0.160*	(0.054)	Instrument	
Country specific					
$CP_{\text{short-term}}$	$CP_{\text{short-term}}$			-6E-05	(0.326)
$CP_{\text{long-term}}$	$CP_{\text{long-term}}$	0.409***	(0.005)	Instrument	
Country Dummies	country particularities	YES		Instrument	
Method		Two stage LS		Two stage LS	
Observations		103 FCD users		103 FCD users	
R^2 (adjusted R^2)		67.59% (63.27%)		26.74% (26.02%)	

Table 2.14: Univariate analysis on the impact of the use of financial tools

We present t-tests on 136 firm observations that use foreign debt (FD users). We first test for significant differences in the increase of FCD and FD ratios after a major devaluation event in the firm's country. We then test for significant differences in the change of market value and gross margin between FCD users and non-FCD users during 2000-2003.

Variable (% change in median)	Year before the major event	Year after the major event	p-values*
FCD ratio	+4.55%	+11.21%	0.099
FD ratio	+4.20%	+ 2.50%	0.399
Variable (% change in median)	Users of FD and FCD ("hedgers")	Non users of FCD ("non hedgers")	
Market Value of Equity	-22.92%	-18.07%	0.155
Gross margin	+14.08%	+ 5.47%	0.099

* p-values concern one-tailed t-tests for the difference in medians' change horizontally

Table 2.15: Multivariate analysis on the impact of use of FD and FCD instruments

Specification I presents pooled least squares estimations of gross margin, studying the impact of use of financial tools on operating performance. Specification II presents maximum likelihood TOBIT estimations of leverage. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively.

Dependent variable		I: Equation (2.22) Gross Margin		II: Equation (2.22) Leverage	
Explanatory variables	Proxying	Coefficient	(p-value)	Coefficient	(p-value)
Firm specific					
α	Frevenues	0.232	0.576		
β^*	FD ratio	0.789*	0.091		
γ^*	FCD ratio	2.357*	0.087		
Leverage	financial distress	-17.653**	0.043		
TSales	size	0.445*	0.053	-0.043*	0.077
Liquidity ratio	liquidity	-1.464*	0.051	-0.063***	0.000
FCD	FCD			4E-14**	0.014
Country specific					
Country Dummies	country particularities	YES		YES	
Method		Pooled LS		ML-TOBIT	
Observations		142		142	
R^2 (adjusted R^2)		19.57% (14.08%)		26.65% (22.23%)	
p-value F		0.000			

Chapter 3

Essay on ADR spreads

3.1 Title

"ADR Spreads and their Informational Content: the Role of Relative US Investor Sentiment"[1]

3.2 Abstract

ADR spreads are observed differences between returns on ADRs and returns on underlying shares after adjusting for exchange rate changes. While reflecting various sources of market segmentation, they can be considered as an indicator of US investors' relative optimism or pessimism. A panel data analysis of firms with ADR programs from 35 countries during the period 1997-2007, documents significant spread levels and suggests that spreads are as importantly affected by market microstructure differences as by relative investor sentiment. There is evidence that ADR spreads have significant predictive power over next period's ADR returns and over various active trading rules' returns. On a time series level, major events, such as the terrorist attacks of September, 11, are identified as structural breaks in the evolution of US investors' sentiment, as well as on its impact on ADR spreads. On a cross-sectional level, markets are "partially segmented" and the relative importance of spreads' factors varies between emerging and developed markets.

[1]This paper has been presented at the 7th Swiss Annual Doctoral workshop (Gerzensee 2008), the 7th Conference on Research on Economic Theory and Econometrics (Naxos 2008), the 6th INFINITI conference (Dublin 2008) and the Paris December 2008 Finance International Meeting AFFI-EUROFIDAI and the 12th Conference of the Swiss Society for Financial Market Research (Geneva). I would like to thank Henri Loubergé for supervising my work and Tony Berrada, Pierre-André Dumont, Dušan Isakov, René Stulz, Mathias Thoenig, Philipp Fasnacht, Jan Kulak, Jérôme Lahaye, as well as seminar participants for valuable feedback.

KEYWORDS: ADR, spread, investor sentiment, informational content
JEL classification: F31, F36

3.3 Introduction

This work examines discrepancies between returns on American Depositary Receipts (ADRs) and returns on their underlying shares (UND). We document that average worldwide ADR returns are on an annual level about 2% lower than underlying returns after adjusting for exchange rate changes. We observe that such "ADR spreads" are larger in absolute value for emerging market firms and more volatile after major events, such as the terrorist attacks of September 2001. It is natural to claim that ADR spreads, whatever their origin is, they do reflect market segmentation, otherwise arbitrage mechanisms should make them disappear. The main purpose of this study is to provide explanations as to the sources of these spreads and evaluate their informational content. Are ADR spreads mostly due to market microstructure reasons, such as illiquidity, short-selling practices, or the degree of a country's market development? Alternatively, are ADR spreads mostly due to different investors operating in various markets, thus introducing a degree of heterogeneous market perception, or the so-called "sentiment" effect? If both explanations are relevant, it would be useful to evaluate their relative economic importance. An additional goal related to explaining spreads is to study the nature of information that ADR spreads convey for international investors.

Our study provides answers by examining ADR spreads on a worldwide sample of firms during the period 1997-2007 and by analyzing their determinants and variation across time and regions. After controlling for market microstructure issues, such as market illiquidity, we claim that a significant part of ADR spreads reflects US investors' sentiment. The importance of ADR

spreads' factors varies across regions of the world, or after major events. ADR spread data provides us with a natural laboratory allowing us to test several additional hypotheses as well, such as the extent of markets' integration, or the predictive power of current ADR spreads in the future return generating process of financial assets. This work's focus is not on a firm's decision to cross-list and its valuation premium, but rather on whether returns of established ADR programs are affected by investor sentiment. Such evidence partly explains ADR spreads. The influence of sentiment is complementary to other sources of market segmentation related to arbitrage barriers due to market microstructure. Extensive literature on explaining similar pricing puzzles, has shed light on the role of each source of market segmentation separately, but less on the complementary relation of the role of both sentiment and market microstructure sources.

Two pricing puzzles that could be seen as "predecessors" of studies on ADR spreads include the closed-end fund discount[2] and the country fund discount puzzle.[3] The price discrepancy in their case concerns the difference between the share price of the fund and the Net Asset Value (NAV) of the weighted average of the assets in which it is invested. Researchers have proposed explanations from both market microstructure and sentiment approaches as sources of such market segmentation. Most of these explanations have their analogies in our ADR spreads context.

From a market microstructure point of view, there have been three major explanations put forward. The first concerns the fund's managerial skills, implying that they can be an asset or a liability not reflected in underlying NAV.[4] The second explanation refers to the fund's tax liabilities that are not captured in reported NAV. Thirdly, researchers have proposed the illiq-

[2] Among the first to document and propose explanations for this puzzle are Pratt (1966), Boudreaux (1973) and Malkiel (1977). For a summary, one may see Ross (2002).

[3] One may see Bonser-Neal et al. (1990), Bodurtha et al. (1995), Klibanoff et al. (1998).

[4] See Frankel and Schmuckler (2000), Berk and Stanton (2007).

uidity of fund assets and other barriers to arbitrage as an additional reason why NAV may be overvalued. These explanations have their analogies in our framework of ADRs and their underlying shares (UND). More specifically, managerial skills may correspond to asymmetric information among different investor groups, which may make UND assets less noisy. Instead of tax liabilities, one may consider differences in trading costs, including bid-ask spreads and brokerage fees. Typically, transaction costs are higher for example in emerging markets. Finally, illiquidity of underlying shares and markets versus illiquidity of ADRs may also account for significant pricing differences between the two markets.[5]

An additional explanatory factor for closed-end funds discounts has been proposed by investor sentiment theory.[6] Proponents of this theory claim that premium changes reflect differential sentiment of two distinct investor groups, institutionals and small individuals, with the latter dominating positions in closed-end funds. Critique on this theory[7] is based on limited economic significance of the sentiment index in explaining stock returns, as well as inability to control for market-wide sentiment. However, the development of country fund discount literature comes to confront the market-wide sentiment critique. NAV are established in local markets outside the US. Therefore, to the extent that foreign investors are unaffected by noise-trading and the so-called "pseudosignals", NAV can be safely used as a benchmark for evaluating US market sentiment. There is a clear analogy in ADR spreads. International capital barriers and costs of international transactions may make the distinction between US investors and local investors sound not implausible. UNDs are traded in local markets outside the US, therefore to the extent

[5] Acharya and Pedersen (2005) illustrate the mechanism in detail in their liquidity adjusted asset pricing model.

[6] See Zweig (1973), DeLong et al. (1990), Lee et al. (1991), Chopra et al. (1993), Barberis et al. (1998).

[7] See Chen et al. (1993), Elton et al. (1998), Doukas and Milonas (2004).

that foreign investors are unaffected by noise-trading, UNDs can be safely used as a benchmark for extracting US market sentiment.

The persistence of ADR spreads is a puzzle, since ADR securities represent claims on the same expected future cash-flows as their underlying assets. One would expect such spreads to disappear due to arbitrage mechanisms. There are, hence, several reasons that make examining such spreads a particularly instructive task. The advantage compared to both closed-end fund and foreign country fund study frameworks is that their firm-specific nature provides us with data on a more micro-level. Before testing any arbitrage opportunities that rise from such discrepancies, one should bear in mind two aspects. On one hand, in an ADR context it is easier to set up a replicating portfolio, as compared to country fund literature. On the other hand, it is costly to perform transactions on an international level and the importance of market microstructure issues is high in our framework.

In order to form our testable hypotheses, we use results from existing literature explaining discounts of the type of closed-end funds and country funds discussed above,[8] as well as on pricing of ADRs from an investor's perspective.[9] Studies on ADR spreads are quite recent, with Kwon et al. (2005) and Bae et al. (2007) focusing on exchange rate premium determinants and Aggarwal et al. (2007) and Chan et al. (2008) focusing on liquidity and other market microstructure explanatory factors. A group of papers that are closely related to ours include Suh (2003), Grossmann et al. (2007) and Arquette et al. (2008) that show evidence that arbitrage costs, ownership restrictions and consumer sentiment do explain to some extent the differences in prices between ADRs and UNDs. We extend their results on explaining ADR price discrepancies, by using direct measures for investor sentiment and

[8] Apart from market microstructure and sentiment factors, Froot and Ramadorai (2008) depict the role of institutional portfolio flows.

[9] Related literature includes studies by Kim et al. (2000), Fang and Loo (2002), Boldin et al. (2006), Aggarwal et al. (2007).

by showing that there is a persistent negative relation between US sentiment and ADR spreads. We also provide some theoretical interpretation for this persistent negative relation.

Our contribution can be summarized in four points. Firstly, we find evidence of a significant US investor sentiment component in the changes of ADR spreads. Secondly, we document other factors explaining part of the observed ADR spreads, such as relative market illiquidity, the degree of the home country's market development, the presence of short-selling constraints and investors' expectations about fundamentals. Moreover, we highlight cross-sectional differences of their impact on spreads across different regions of the world. Thirdly, we are able to identify structural breaks in the evolution of US investor sentiment as well as on its relation with ADR spreads. These breaks are observed around major events, such as the terrorist attacks of September 2001. Finally, we document that there is significant informational content in ADR spreads that could be used in order to create profitable active investment strategies. The information conveyed mostly concerns ADR future returns, rather than UND future returns. A similar argument holds for investor sentiment, since even though spreads reflect relative investor sentiment differential between US and local investors, evidence shows higher correlation with US specific sentiment than local sentiment.

3.4 Hypotheses to test

3.4.1 ADR spreads construction and their components

This study is, thus, inspired by a theoretical framework, where there is an on-going debate about two main issues. The first issue is how to explain the ADR pricing puzzle. The second issue is how we can extract useful information from such a stylized fact. Why do price discrepancies for securities giving right on the same dividend stream exist in the first place? Are

they satisfactorily explained by already proposed factors, such as barriers in arbitrage or sentiment? Is there an informational content hidden in these spreads that investors could potentially exploit? In this section we present those major research questions, as well as some secondary goals, that we subsequently test in the empirical part of section 3.6. The data we use is presented in detail in section 3.5.

Previous studies on the ADR pricing puzzle have focused their analysis on defining the so-called ADR premium.[10] They define it as the difference in the price between the ADR and the underlying security in US dollars, divided by the price of the underlying security in US dollars. The price of the underlying security is also adjusted with respect to the ADR factor. We find that such a definition provides us with non-stationary series, as well as series that are not cointegrated. We thus prefer to begin our analysis by defining a proxy for the pricing puzzle, based on the difference of the natural logarithm of the previously defined ADR premium. We obtain a measure that we define as ADR spread that is equal to

$$ADRspread_{j,t} = ADR_{j,t} - (UND_{j,t} - ER_{j,t}) \tag{3.1}$$

where $ADR_{j,t}$ is the US dollar return of the ADR security (or portfolio) of home country j at time t, $UND_{j,t}$ is the local currency return of the underlying security (or portfolio) in the stock market of country j, and $ER_{j,t}$ is the percentage change in the bilateral exchange rate, expressed in local currency units of country j per 1 US dollar.[11] In a perfectly integrated market, with no transaction costs and barriers in arbitrage, one would expect the ADR spread to be equal to zero. Pricing through absence of arbitrage would suggest that the dollar return in the ADR security at time t be equal to the dollar return of the underlying security $(UND - ER)$ at the same time period. In reality

[10] Such studies include Suh (2003), Grossmann et al (2007) and Arquette et al. (2008).

[11] We use continuous returns computed with the natural logarithm.

though, we observe ADR spreads that are significantly different from zero, with interesting time-series and cross-sectional characteristics.

Our variable is stationary and the cointegrating properties of its components will be useful in extracting the informational content of ADR pricing discrepancies. In addition, examining the factors explaining ADR spreads is the equivalent to examining the factors explaining changes in ADR premiums, whereas studying the factors explaining changes in ADR spreads would be equivalent to studying the factors explaining the rate of increase of ADR premiums. Furthermore, the absolute value of the ADR spread is a proxy for mispricing, whereas the absolute value of the change in the ADR spread proxies the speed of mean reversion to zero.

The fact that we build our proxy on returns observed ex post could suggest an explanation based on differences in expected returns of distinct investor groups, for example between US and local investors. This approach implicitly rejects the perfect market integration hypothesis and introduces additional risk premia for each investor group. The first risk premium that comes into one's mind is the exchange rate risk premium, since US investors bear the translation exposure of converting local currency returns into dollar returns. By incorporating exchange rate changes into our ADR spread variable of equation (3.1), we need to look for other risk factors that make us observe non-zero ADR spreads. Such risk premia could be related to market risk. Other reasons for non-zero ADR spreads could be related to barriers in arbitrage, such as transaction costs, short-selling restrictions and capital controls, especially in emerging markets, or they could be related to investor sentiment.

The channels through which investor sentiment affects stock returns are of central importance in this study. Following Baker and Wurgler (2006), investor sentiment can be viewed as "the propensity to speculate due to the subjectivity of valuations", or even broader it can be viewed as optimism or

pessimism about a security. There are two basic and closely related channels through which sentiment may affect the cross-sectional variation of ADR spreads. In the first channel, sentimental demand shocks vary across countries, while arbitrage limits are quite constant. In the second, sentiment is constant and barriers in arbitrage vary across markets and across time. In this study, we test whether the observed mispricing is the result of both an informed demand shock and limits in arbitrage.

In order to examine the above issues, we first need to define sentiment. Given a fixed underlying dividend growth rate d_i for an individual firm (or an aggregate dividend growth rate $\overline{d_j}$ for the economy as a whole), distinct investor groups are assigned different subjective beliefs μ_k. The weighted average $\overline{\mu}$ of such subjective beliefs can be seen as the sentiment of our investor group or economy. Literature on asset pricing under heterogeneous beliefs provide us with a solution for the market price of risk, being a decreasing function of $(\overline{\mu} - d_i)$. An increase in sentiment $\overline{\mu}$ leads thus to a decrease of the market price of risk and thus a decrease of excess stock returns. In other words, demand shocks due to an exogenous increase in optimism, without a change in fundamentals, lead to an increase in stock prices. The unchanged fundamentals mean that expected dividends were overvalued and thus observed stock returns decrease ex post. We therefore expect to find a negative relationship between changes in investor sentiment (increasing optimism) and stock returns. In the empirical part, we also examine how stock returns, are affected by the level and changes of optimism or pessimism as well as by measures of aggregate non-neutrality in expectations.

$$\begin{aligned} \text{Stock returns} \;=\; & a_{20} + a_{21}[\text{Sentiment}] + \\ & + a_{22}[\text{Changes in Sentiment}] \\ & + a_{23}[\text{Non-neutrality in expectations}] + \text{controls} \end{aligned} \tag{3.2}$$

In a first attempt to study and better understand the ADR spread, we

propose an analysis of its two main components, ADR and UND, following existing literature. Following Kim et al. (2000) and Bae et al. (2007), $ADR_{j,t}$ returns of a portfolio composed of ADR firms from country j, at time t, are affected by underlying returns $UND_{j,t}$, US excess market returns $R^{ex}_{US,t}$ and bilateral exchange rate changes $ER_{j,t}$. We add an analysis of how US investor sentiment and changes in US investor sentiment ($SENT_{US,t}$) affect ADR returns and introduce controls for US market's ADR illiquidity ($ILL_{ADRj,t}$):

$$\begin{aligned} ADR_{j,t} &= a_{00} + a_{01}UND_{j,t} + a_{02}R^{ex}_{US,t} + a_{03}ER_{j,t} + \\ &\quad + a_{04}SENT_{US,t} + a_{05}ILL_{ADRj,t} \end{aligned} \tag{3.3}$$

As far as underlying assets portfolio $UND_{j,t}$ returns are concerned, we use a specification where they depend on underlying market excess return $R^{ex}_{j,t}$, exchange rate changes $ER_{j,t}$ and US market excess return $R^{ex}_{US,t}$. On a limited subsample, on which local sentiment is available, we will test whether changes in local sentiment ($SENT_{j,t}$) affect UND returns. We also test whether underlying returns are affected by changes in US investor sentiment. Moreover, we introduce controls for local market's UND illiquidity ($ILL_{UNDj,t}$):

$$\begin{aligned} UND_{j,t} &= a_{10} + a_{11}R^{ex}_{j,t} + a_{12}ER_{j,t} + a_{13}R^{ex}_{US,t} + \\ &\quad + a_{14}SENT_{j,t} + a_{15}SENT_{US,t} + a_{16}ILL_{UNDj,t} \end{aligned} \tag{3.4}$$

Summarizing the goals of our preliminary analysis, a crucial hypothesis to be tested is whether the components of ADR spreads are affected, among others, by proxies for sentiment. There is an on-going debate which examines the impact of Lee et al. (1991) sentiment index on the return generating process of passive portfolios, individual stocks, as well as mutual fund returns. Empirical studies by Elton et al. (1998) and Doukas and Milonas (2004) question its significance by comparing it to other randomly chosen factors, widely considered as non systematic factors, such as industry indices. After

applying principal component analysis, they also show that sentiment index correlation with each one of the empirically derived factors is relatively low. The goal of this study is not to evaluate in an exhaustive manner whether market sentiment is a systematic risk factor. Nevertheless, it is useful for our subsequent analysis, to test the impact of investor sentiment on two types of portfolios of particular interest, the ADR and the UND. As a matter of fact, Brown and Cliff (2005) find evidence that sentiment significantly drives stock prices away from fundamentals and Baker and Wurgler (2006) associate firm characteristics (young, unprofitable firms with high growth opportunities) that amplify sentiment's impact.

3.4.2 Spreads due to market microstructure?

Once we have examined the determinants of ADR and UND returns, we focus on the factors explaining ADR spreads. A first possible explanation is related to market microstructure issues that constitute barriers to arbitrage. The importance of market microstructure is put forward by many empirical studies.[12] Towards this direction, literature suggests that, for portfolios of securities traded in non perfectly segmented multiple exchanges, trading tends to concentrate in the exchange with lower transaction costs. From an investor's point of view, industry participants often provide ease of trading argument as a reason for choosing ADR portfolios. Therefore, as Aggarwal et al. (2007) point out, one should control for market microstructure aspects, such as relative market illiquidity or relatively less developed stock market.

According to the partial market segmentation hypothesis, formulated among others by Stulz (1981), Adler and Dumas (1983), Bodurtha et al. (1995), ADR spreads are affected by common global factors plus some lo-

[12] See for instance Huang and Stoll (2001) for its importance around currency crises, or Rabinovitch et al. (2003) for emerging markets. Aggarwal et al. (2007) and Chan et al. (2008) emphasize the role of illiquidity.

cal factors. In other words, both local and common risk factors affect US and local markets and these factors are reflected in ADR spreads. Possible and intuitive candidates for testing the existence of global factors are US market returns and US investor sentiment. For local factors one may test local market returns, the degree of local market development and market-wide illiquidity on a country level. Following the traditional one-factor capital asset pricing model, we use the excess market returns factor differential ($R^{ex}_{US} - R^{ex}_{j}$) as a primary explanatory factor for the ADR spread, expecting it to have a positive impact.

Due to the absence of transaction cost data,[13] market illiquidity and proxies of market development will be our main indicators for market microstructure issues that may account for non-zero ADR spreads. According to a liquidity-based capital asset pricing model, market wide illiquidity is a systematic pricing factor.[14] Investors are willing to accept a lower expected return on an asset with high returns in times of high illiquidity. At the same time, if there is an illiquidity shock on an asset, its price decreases. This negative effect should prevail on the ADR spread as well. Our hypothesis to test is that the ADR spread decreases when the differential illiquidity shock between the US market and the local market ($ILL_{ADR} - ILL_{UND}$) increases. From the point of view of a substitution effect, we could explain the impact on the ADR spread as follows: if the relative illiquidity of the ADR portfolio compared to the illiquidity of the underlying UND portfolio is high, investors allocate larger fractions of their investments to the UND portfolio, and therefore the contemporaneous spread decreases. Aggarwal et al. (2007) and Chan et al. (2008) show the importance of relative illiquidity in ADR spreads and we expect to confirm their results. At this point, we implicitly perform a joint test, since in order for investors to be able to choose among

[13] This is especially true for bid-ask spreads in emerging markets and in some ADR data.

[14] Gibson and Mougeot (2004) provide empirical evidence that systematic liquidity risk is priced in the US market.

international markets, those latter cannot be perfectly segmented.

$$\begin{aligned} ADRspread_{j,t} &= a_{30} + a_{31}\left[R^{ex}_{US,t} - R^{ex}_{j,t}\right] \\ &\quad + a_{32}\left[ILL_{ADRj,t} - ILL_{UNDj,t}\right] + controls \end{aligned} \tag{3.5}$$

Other microstructure issues raising barriers to arbitrage, such as short-selling constraints, institutional capital or ownership restrictions and time-zone effects are emphasized by Bris et al. (2007) and Gagnon and Karolyi (2004). Consequently, in the empirical part, we need to control for such direct market market-based restrictions, but also for indirect market-based barriers, such as different accounting standards, legal framework, investor protection and degree of market development proxies proposed by LaPorta et al. (1998). On a cross-sectional level, our broad sample of 35 countries allows us to test whether the classification of the ADR's home country in emerging or developed, has an impact on ADR spreads. Following Aggarwal et al. (2007) findings in an integrated international framework, if a portfolio of firms is based in an emerging market, with consequently less developed financial institutions and higher trading costs, investors allocate larger fractions of their investment in the ADR portfolio of these companies relative to the underlying local portfolio. Microstructure factors' importance may thus differ according to the country or region of origin of the firm.

3.4.3 Spreads due to sentiment?

Apart from market and liquidity factors, we test whether differences in investor sentiment between US investors and local investors from various countries/zones of the world ($SENT_{US} - SENT_j$) has a significant impact on spreads. As explained in the preceding subsections, there is controversy over the role of sentiment in asset valuation. Recent studies shed light on an explanation of ADR premiums through investor sentiment arguments. Suh (2003) first captures the stylized fact using US aggregate market returns as

a proxy for market sentiment. Grossmann et al. (2007) use survey based indices as proxies for consumer sentiment and find that the more relatively optimistic US consumers become, the smaller the ADR premiums. Their result is though not persistent when it comes to the sentiment's impact on ADR or other asset portfolios. Arquette et al. (2008) also find a negative impact on a reduced sample of Chinese securities by using P/E ratios as proxies for market wide and firm specific sentiment.

This study's first contribution in that direction is to estimate equation (3.2) and show how optimism, changes in optimism and non-neutrality in sentiment consistently affect asset returns. In addition, we shed more light on the debate by testing whether increasing relative US investor optimism consistently negatively affects ADR spreads. Based on specification (3.6), we examine potential variations of the impact of explanatory factors on ADR spreads on either a time-series or cross-sectional dimension. We are also able to compare the economic significance of sentiment variables in relation to that of market microstructure variables.

$$\begin{aligned} ADRspread_{j,t} &= a_{40} + a_{41}\left[R^{ex}_{US,t} - R^{ex}_{j,t}\right] + a_{42}\left[ILL_{ADRj,t} - ILL_{UNDj,t}\right] \\ &\quad + a_{43}\left[SENT_{US,t} - SENT_{j,t}\right] + \ controls \end{aligned} \tag{3.6}$$

Another concept which is related to investor sentiment is investors expectations. This leads us examine the following question: do investors' expectations about the evolution of fundamentals, such as exchange rates and market returns, explain part of ADR spreads evolution? A rigorous answer to this question would involve the development of a model of investors' expectations. For the objectives of this research, we follow the proposition of Chan et al. (2008) who assume the martingale property of asset returns and use current realized asset returns as the best predictors for next period's realization. A plausible hypothesis would be that US investors prefer to invest in ADRs from countries on which they expect a local currency exchange rate

appreciation, an increase in local market returns, or a decrease in US market returns. Therefore, we need to test whether ADR spreads are decreasing in our definition of exchange rate change and US market returns and increasing in local market returns. We thus end up with the following specification:

$$\begin{aligned} ADRspread_{j,t} &= a_{50} + a_{51}E(ER_{j,t+1}) + a_{52}\ E\left(R^{ex}_{US,t+1}\right) \\ &\quad + a_{53}\ E\left(R^{ex}_{j,t+1}\right) + \ controls \end{aligned} \tag{3.7}$$

3.4.4 Informational content of spreads

We focus on two different directions in order to test how we can extract information from ADR spreads. The first is to identify structural breaks in the impact pattern of variables like the relative sentiment change and provide a concrete interpretation. The second is to evaluate the predictive power of current ADR spreads in relation to future stock returns.

In relation to the first direction and given the 10 years time span of our sample, we choose one major event that is prone to be related to a structural break in US investor sentiment. We believe that the terrorist attacks on US territory on September 11, 2001 may have provoked an exogenous shock on market sentiment or structural parameters, such as risk aversion of US investors. We thus look for an answer to the following research question: do we observe any structural break around the terrorist attacks of September 11, 2001 in relation to the impact of American investors' relative optimism on ADR spreads? If yes, how can we interpret such a break?

We interpret such potential breaks by well-established results of the impact of investors' optimism changes on asset returns in a framework where there is heterogeneity of information among agents.[15] In our case, heterogeneity arises in beliefs between two major types of agents, one representative US investor and one representative local investor. If the perfect integra-

[15] See Cecchetti et al. (2000), Abel (2002), Berrada (2006).

tion hypothesis is rejected and the two types of investors mostly proceed to transactions in their respective markets (ADR and underlying market respectively), then for the same underlying risky dividend yield, ADR spreads can be perceived as differences in the subjective market price of risk of the two types of agents. As a result, observed structural breaks in the way US investors' relative optimism has an impact on ADR spreads could largely be due to changes in a fundamental parameter of one investor group. A plausible explanation would be a structural change in the risk aversion coefficient of one of the two types of investors.

Finally, among the most important research questions raised in this study is the extent at which ADR spreads convey information about future asset returns. A possible vehicle of information would be its mean-reverting characteristics. We test the cointegrating properties of its components. Such questions have been examined in the context of the closed-end funds and country funds.[16] The interest for investors is obvious, since it could eventually allow the creation of investment strategies exploiting this information and obtaining abnormal returns.

According to the investor sentiment hypothesis, higher ADR spreads tend to be associated with lower future ADR returns and vice versa. Is it true in our case? Does it also hold for the underlying securities returns, in other words, do future UND returns correlate as well with current ADR spread levels? In his seminal paper about the theory of investor expectations, Zweig (1973) separates market participants into professionals and non-professionals. When non-professional investors' expectations become "sufficiently" one-sided, there exists a high probability that stock prices will reverse towards the unanticipated direction. We could think in our case in an analogous manner, where non-professionals correspond to US investors facing a

[16] See for instance Thompson (1978), Brauer (1988), Hardouvelis et al. (1994), Bodurtha et al. (1995), Elton et al. (1998), Doukas and Milonas (2004).

relative illiquid ADR market and professionals correspond to local investors, potentially being better informed on the UND securities. Mean reversion in spreads would imply that a given ADR spread at period t may predict a change in the spread at period $t+1$. It remains to be tested whether the spreads' prediction power is asymmetric towards future ADR returns compared to future UND returns. For this purpose, we create several "buy & hold" investment strategies in order to test the potential information conveyed by ADR spreads. Before we test the above hypotheses and provide some answers in our empirical section, we now need to present in some more detail the data we use.

3.5 Data and methodology

We focus on non-US firms that have established an American Depository Receipt program earlier than July 1997, which is still running.[17] Therefore, their stock price has been trading on US financial markets,[18] as well as on their local stock markets for at least 10 years. The total universe of these firms mounts to 581 from 46 countries. We do not impose any restrictions on the type of ADR program; nonetheless in order to avoid very illiquid ADR programs (usually the non-listed ones, or those representing a small percentage of a firm's total market capitalization), we apply a filtering process according to which we eliminate the firms for which there are no transactions for more than 2/3 of our time span. This filter, as well as lack of price data for both the ADR and the underlying share in some cases, leads us to a

[17] There is a survivorship bias issue with such data selection. The fact that we do not account for firms which decide to delist or firms which go bankrupt, should neither alter the determinants of ADR spreads, nor magnify their informational content.

[18] Depending on the type of ADR program chosen by the firm, trading on US financial markets may involve an organized stock exchange (for ADRs of levels 2 and 3) or is executed over-the-counter (for ADRs of level 1, unsponsored shares, 144-A and Regulation S).

final sample of 315 firms from 35 countries. In order to distinguish between developed and emerging markets, we follow the MSCI Barra classification as of 2008 and thus end up with 15 emerging markets and 20 developed ones.[19]

For each firm, we collect weekly closing prices and volume data from *Thomson - Datastream* for both share quotes, US and local. Typically, each local quote is valued in local currency and is thus translated into US dollars using the exchange rate in effect on each trading date. For all 35 countries we also collect from *Thomson - Datastream* total market return data, bilateral US exchange rates defined as the local currency value of 1 US dollar and risk free rates. The choice of risk free rates differs among countries due to unavailability of standardized proxies. We minimize that bias by choosing the shortest term interest rate available in each country (usually government bond yield with 1 month maturity).

For the purposes of this study, we choose each country as the cross-section identity j of our panel. We form equally weighted ADR portfolios at each observation date with the number of firms with available data from each country. In such a way, we enable our empirical analysis identify regional and country effects. Their average annualized returns as well as the average annualized returns of their respective underlying shares portfolios are presented in tables (3.1), (3.2) and (3.3). In order to compute an adjusted ADR spread, local portfolios' returns (UND) are translated in U.S. dollars and the spread is thus computed as the difference of two U.S. dollars returns. Figures (3.1), (3.2) and table (3.1) present some time series plots, histograms, and descriptive statistics, respectively, of adjusted ADR spreads means for our sample country-based portfolios between July 1997 and August 2007.

[19]The classification we use is presented in table (3.2). There were three countries, Argentina, Israel and South Korea for which the classification was ambiguous. Since we do not consider any intermediate "frontier" type of market, after comparing with other sources' classifications and in order to split the bias, we decide to consider Argentina and Israel as emerging and South Korea as a developed market.

Figure 3.1: Average weekly ADR spread across 35 countries between July 1997 and August 2007

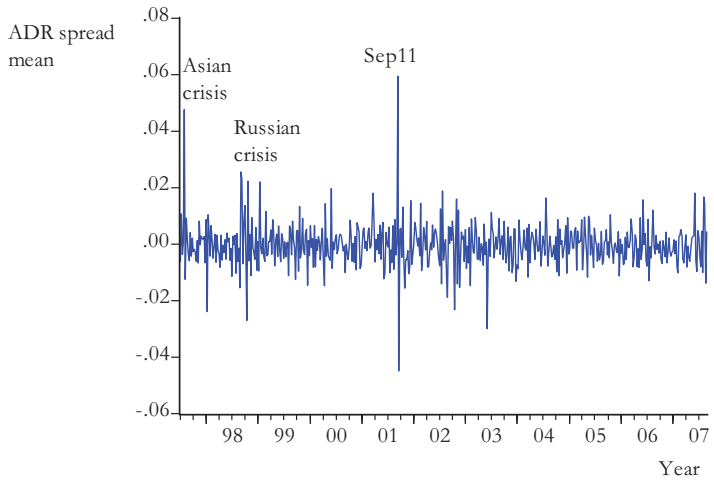
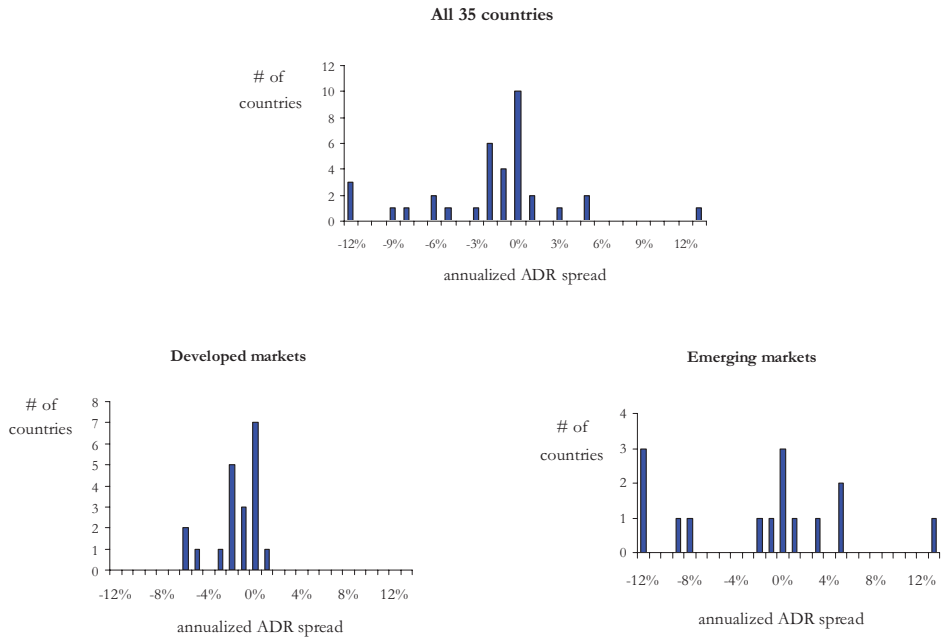


Figure 3.2: Histograms of ADR spreads means for our sample country-based portfolios between July 1997 and August 2007



The figures above illustrate that the adjusted ADR spread is on average negative, around 2.33% on an annual basis for the whole sample, with a higher dispersion and absolute value among emerging market firms than developed market firms.

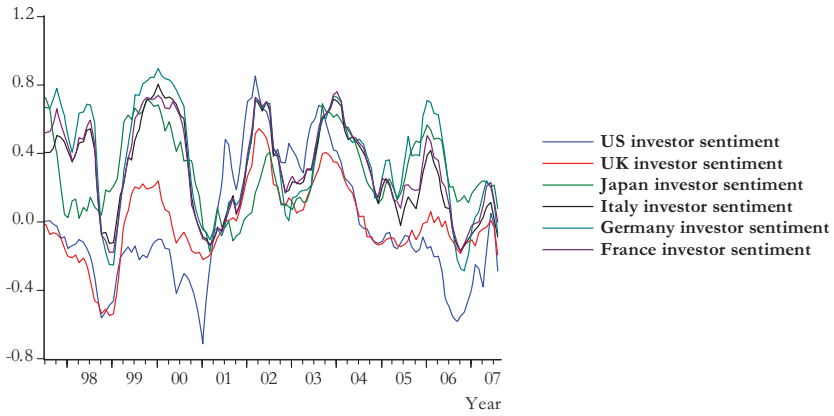
For the choice of a proxy for market wide investor sentiment, we use survey based indices. Survey based information is in accordance with our definition of investor sentiment, since it captures subjective beliefs about the economic prospects of different regions. Distinct investor groups, such as different types of investor analysts interviewed in these surveys, are assigned different subjective beliefs μ_k. The weighted average $\overline{\mu}$ of such subjective beliefs can be seen as the sentiment of our investor group or economy. Such sentiment indices are provided by several institutions.

Our main source is the German ZEW institute, which on a monthly basis conducts the ZEW Financial Market Survey and publishes the ZEW Indicator of Economic Sentiment on 6 major world economies: U.S., U.K., Japan, France, Germany and Italy.[20] The ZEW indices are constructed as the difference between the percentage share of analysts that are optimistic and the share of analysts that are pessimistic for the six different economies. They represent the average level of optimism or pessimism about each one of the six countries. These indices are available in *Reuters* and *Thomson - Datastream*. Figure (3.3) presents the time series plots of the ZEW six sentiment level series. A second source is the European Commission, which publishes monthly sentiment indices representing the percentage change in optimism or pessimism about 13 EU countries of our sample. We do not find sentiment data for any of our emerging markets, we thus limit our relative sentiment

[20]The exact question leading to the extraction of the sentiment index, which is raised for each economy separately in the ZEW questionnaire is the following. "In the medium-term the overall macroeconomic situation will improve, will worsen or will not change?"

estimation to the six big economies for which ZEW provides data. For the rest of the countries we test the impact of US investor sentiment.

Figure 3.3: Time series plots of sentiment levels among 6 developed economies between July 1997 and August 2007



We denote with $SENTl_{j,t}$ the average level of sentiment in country j during period t, whereas $SENT_{j,t}$ corresponds to the percentage change in investor sentiment for country j, during period t. For example, if the UK economy at time t has $SENTl_{UK,t} = 10\%$ and $SENT_{UK,t} = -10\%$, this means that at time t, there are 10% more optimistic analysts about the UK economy than pessimistic, but that there is a decrease of 10% in this average optimism with respect to $t-1$. We also define the absolute value of the average level of sentiment $abs(SENTl_{j,t})$ as a measure of non-neutrality in expectations, since the higher it is, the less percentage of analysts have a neutral view. Alternatively, one may view the absolute value of the sentiment index as a proxy for the convergence of investors' beliefs, since the higher it gets on magnitude, the more investors agree on strong optimism

or strong pessimism. Finally, the absolute value of the change in sentiment $abs\,(SENT_{j,t})$ would proxy the size of a shock on sentiment at period t.

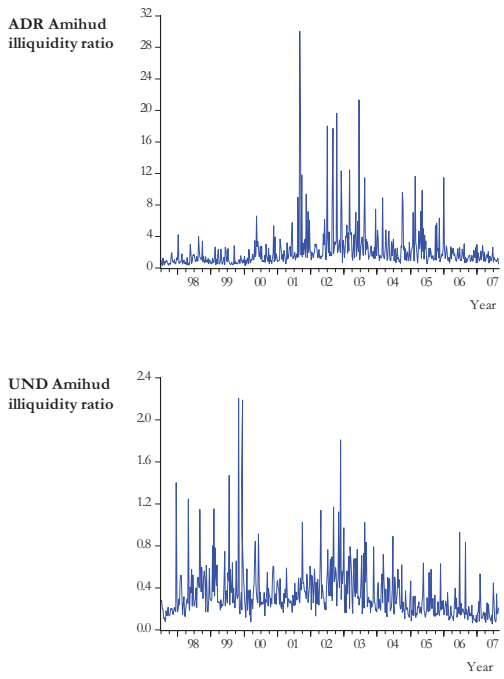
The choice we make to use weekly frequency is also suggested by previous empirical literature. The basic reason concerns non-synchronous trading bias due to different time zones of our 35 countries. We choose to use closing Friday prices for all our variables and this reduces the bias of non-synchronous trading compared to daily frequency. At the same time, it does convey richer information than monthly frequency for the relatively restricted time span of 10 years of our study. Investor sentiment indices are the only data series not available on a higher than monthly frequency, we therefore need to interpolate them on a weekly basis. The results remain robust while we use two interpolation methods: one in which we keep the index value constant between two monthly data points and one in which we interpolate linearly and estimate the missing values between two monthly observations. We repeat the estimations with monthly frequency data and the statistical significance of the results is not different.

The need to proxy for market microstructure issues and control our estimations with respect to market wide liquidity leads us create two different illiquidity proxies.[21] In relation to studies by Acharya and Pedersen (2005) and Hasbrouck (2009), who suggest and compare different illiquidity proxies, we choose to use the following two illiquidity measures: the first one ($ILL_{i,j,t}$) is "Amihud's illiquidity measure", defined as the ratio of firm's i absolute weekly returns on its weekly volume. Once we compute the monthly average ratio on a firm level, we compute the country wide average $ILL_{j,t}$ on two portfolio levels, the ADR portfolio ($ILL_{ADRj,t}$) and the UND portfolio ($ILL_{UNDj,t}$). The second illiquidity proxy is the "trading infrequency measure" measured as the number of shares traded in a week over the total

[21] Aggarwal et al. (2007) and Chan et al. (2008) show the importance of controlling for liquidity when identifying ADR premium explanatory factors.

number of existing shares. The latter is mostly used as a robustness test of the more widely accepted "Amihud's illiquidity measure", in particular to account for cases of stocks with many observations of zero returns due to zero weekly volume that would be undefined in the first proxy. We do not manage to obtain volume data for the Malaysian and Taiwan ADR portfolios, so whenever we use ADR illiquidity proxies, we limit our data sample to 33 countries. Figure (3.4) presents time series plots for the average weekly ADR and UND portfolios illiquidity measures. We notice that ADR portfolios are on average much more illiquid than UND securities.

Figure 3.4: Average weekly Amihud illiquidity measures for ADR and UND portfolios across 33 countries between July 1997 and August 2007



In order to control for other market microstructure issues often proxying market development, we use creditor protection ($RightsCred_j$), low expropri-

ation risk ($RightsExpr_j$) and accounting standards ($Accounting_j$) variables from the LaPorta et al. (1998) database. In addition, we use Bris et al. (2007) data on short-selling restrictions for 34 of our countries, by using time series of dummies for short-selling permission ($DumNSth_{j,t}$), securities lending permission and practice of short-selling ($DumNSpr_{j,t}$) in each country j.

In order to test the informational content of ADR spreads, we define several investment strategies. These strategies are based on theories of pair-trading, suggesting that two return series whose joint distribution is stationary, they converge and thus investors may profit from observed spreads. The returns of our equally-weighted portfolios according to these trading rules are computed under the assumption of weekly rebalancing. Previous studies by Hardouvelis et al. (1994) apply similar methodology on country fund premiums and show that their informational content is even less present in short-term rebalancing, therefore our frequency choice may simply reduce the significance of our results. Indeed, we repeat our estimations by using a monthly rebalancing and our conclusions do not change in a substantial manner.

For the first proposed active investment strategy, $ISR_{ADR\ spread_{j,t}}$, the rule at time t consists of taking a long position in the $ADR_{j,t}$ portfolio and a short position in the $UND_{j,t}$ portfolio if $ADRspread_{j,t-1} < 0$ and vice versa. The first strategy is only feasible in integrated financial markets. The second strategy $ISR_{ADR_{j,t}}$, implies taking a long position in $ADR_{j,t}$ when $ADRspread_{j,t-1} < 0$ and a short position in $ADR_{j,t}$ otherwise. The third strategy $ISR_{UND_{j,t}}$, consists of taking a long position in the $UND_{j,t}$ portfolio at time t when $ADRspread_{j,t-1} > 0$ and a short position in $UND_{j,t}$ otherwise. The second and third strategies are feasible even in segmented markets, where the investor can take position either in the US or in the local market. Moreover, we define two modified versions ($ISRns_{ADR_{j,t}}$ and

$ISRns_{UND_{j,t}}$) of the second and third strategy, where short-selling is not allowed and therefore a neutral position replaces the short position cases. In other words, the $ISRns_{ADR_{j,t}}$ rule suggests that the investor takes a long position in $ADR_{j,t}$ when $ADRspread_{j,t-1} < 0$ and a neutral position in $ADR_{j,t}$ otherwise. In the case of neutral positions, we replace as actual return the average return of the "buy and hold" strategy over the whole period.

Finally, we define two last active strategies as combinations of some of the above. In particular, in order to account for partial market segmentation the $ISR_{seg_{j,t}}$ strategy consists of using the $ISR_{ADR\ spread_{j,t}}$ rule for developed markets and the $ISR_{ADR_{j,t}}$ rule for emerging markets. The intuition behind such a strategy is that the investor usually faces ownership restrictions, or high transaction costs in UND portfolios of emerging markets and may thus apply two different rules according to the home market j of the ADR firm. The returns of such a strategy can be noted as

$$ISR_{seg_{j,t}} = ISR_{ADR\ spread_{j,t}} \mathbf{1}_{j=Developed} + ISR_{ADR_{j,t}} \mathbf{1}_{j=Emerging} \tag{3.8}$$

In order to account for the presence of short-selling restrictions in several countries, we define the $ISR_{ss_{j,t}}$ strategy. The investor follows the $ISR_{ADR\ spread_{j,t}}$ rule in panel observations where, according to Bris et al. (2007) data short-selling is allowed and practiced, whereas she uses the $ISRns_{ADR_{j,t}}$ rule when and where short-selling is prohibited. The returns of such a strategy can be written as

$$ISR_{ss_{j,t}} = ISR_{ADR\ spread_{j,t}} \mathbf{1}_{DumNSpr_{j,t}=1} + ISRns_{ADR_{j,t}} \mathbf{1}_{DumNSpr_{j,t}=0} \tag{3.9}$$

Our final sample consists, thus, of 35 countries identified as our cross-sectional identities, with 531 weekly observations for each variable, or otherwise stated, 18'585 pooled panel observations for each variable, including returns, illiquidity measures, bilateral exchange rates, ADR spreads, sentiment proxies. For a complete list of the variables used in the empirical part,

one may refer to table (3.4). After performing stationarity tests and given the first order auto-correlation of our returns and ADR spreads, we decide to use mostly level variables for our estimations. As far as the methodology is concerned, we mostly use fixed-effect generalized least squares estimations with White heteroscedasticity consistent covariance matrix. We perform evaluation tests of our forecast series and robustness tests of all our estimated equations by using the method of seemingly unrelated regressions, without showing the results since they do not vary substantially.

3.6 Results

3.6.1 ADR spreads properties and their components

It is first interesting to highlight the main indications from descriptive statistics and univariate analysis. On a cross-sectional level, figure (3.2) reveals that adjusted ADR spreads exhibit higher dispersion and absolute value among emerging market firms than developed market firms. On a time-series level, the pairwise correlation matrix of ADR spreads shows that more than 75% of pairwise correlation coefficients is positive, among of which 45% is significant at the 95% confidence level. There is therefore evidence that ADR spreads could be due, at least to some extent to various common factors.

The definition we use for adjusted ADR spreads is based on two portfolios, the ADR and the exchange rate adjusted $(UND - ER)$ portfolio, which are cointegrated. This property is very useful in the subsequent part where we extract information incorporated in ADR spreads. In addition, unit root tests on both time series ADR and UND of the spreads components, are rejected. We therefore can safely use levels of these variables in the multivariate analysis. Both series exhibit significant first and second order autocorrelation, we thus include two lags of each dependent variable in our

estimations. ADR spreads exhibit significant first order autocorrelation, we thus include only one lag of the dependent variable in our estimations.

The results on the factors that drive each one of the two components of ADR spreads, help us understand their structure. In such a way, we have a better idea of what to expect from the subsequent factor analysis on spreads themselves. As far as the determinants of ADR returns are concerned, we estimate equation (3.3) and the first column of table (3.5) confirms most previously established results. In particular, ADR returns are positively affected by the underlying security returns and US excess market returns. They are negatively affected by US dollar appreciations with respect to the local currency, as well as by increasing ADR market illiquidity. It is interesting to note that the coefficient of the underlying returns UND is significantly inferior to 1, indicating that the ADR return is consistently lower than the underlying return.

We further examine the channels through which investor sentiment affects stock returns. Table (3.5) estimates equation (3.2) and confirms most of our hypotheses of section 3.4. We thus provide answers to the following question: Are US investor sentiment levels, changes in sentiment or non-neutrality in investors' expectations determinants of ADR returns? Even though the impact of sentiment levels is statistically insignificant, the answer to the two latter questions is yes. We note that the relationship is economically more significant for changes in sentiment, but statistically more significant for non-neutrality in expectations. Increases in US optimism ($SENT_{US}$) negatively affect ADR returns as we expect from theory presented in section 3.4.[22] At the same time, an increase in non-neutrality in expectations, as proxied by $abs(SENTl_{US})$ has a positive impact on expected ADR returns. A possible

[22] One should note that all sentiment proxies, by construction and due to the intrapolation method used, incorporate to some extent lagged information about optimism. This is why it is not puzzling to find that increasing optimism leads to decreasing observed returns ex post.

interpretation could be that periods when analysts express firm non-neutral views are usually associated with increased assets' volatility. Such a volatile environment could increase the risk premium required by investors and thus their expected return on assets, such as the ADR portfolios. We note that the negative impact of sentiment changes contradicts the positive impact of consumer sentiment on ADR returns found by Grossmann et al. (2007).

Robustness tests for our estimations not presented in the tables include replacing ADR returns by excess ADR returns as the dependent variable. When we compare the estimations between ADRs based in emerging and ADRs based in developed markets, the statistical significance is non- surprisingly much higher for the latter, whereas the economic significance of US excess returns is surprisingly higher among emerging markets. Finally, dummies for the after-September 11 era have a positive significant impact on ADR returns. Dummies related to countries short-selling restrictions, or the LaPorta (1998) proxies for legal framework are omitted from table (3.5), since although they exhibit the expected sign, they are not significant.

In the second column of table (3.5) we show the main determinants of UND portfolio returns by estimating equation (3.4). One may notice that the economic importance of US market returns decreases, nevertheless it remains statistically significant. UND portfolios are as expected largely explained by local market returns. They are positively affected by US dollar appreciations; an explanation would be that, often, firms active on ADR programs are export oriented and thus have an important exchange rate exposure. The UND portfolio wide illiquidity proxy has also a negative impact. Finally, on the second column, we see that UND returns are significantly positively affected by US sentiment changes, confirming results by Grossmann et al.(2007).[23] An explanation could be that the captured effect in this case

[23] When we decompose the effect of US sentiment changes between developed and emerging countries, we find that the significant positive impact on UND remains only among

is contemporaneous indeed. In other words, despite the lagged information in our sentiment proxies by construction, we find evidence of a lead and lag relationship between US and local sentiment proxies.[24] As a result, the positive impact of US increasing optimism is due to a contemporaneous positive effect of local optimism, which follows the US sentiment. The positive effect of non-neutrality in expectations is valid for UND returns as well. When we try proxies for local sentiment though,[25] such as the sentiment indices for the 13 EU countries, there is no significant impact, so we do not include them in the estimations. We perform robustness tests by estimating the same specification with seemingly unrelated regressions and all previous conclusions remain unchanged.

Before presenting the results on the multivariate factor analysis of ADR spreads with various control variables, we test on a preliminary level how US investor sentiment may explain ADR mispricing ($abs(ADRspread)$). The third and fourth column of table (3.5) gives us a first idea of how ADR spreads account for US investor sentiment. In total, sentiment related variables seem to account for at least 10% of the total variation of ADR spreads. Levels of sentiment and non-neutrality in expectations do not significantly affect spreads, but they both seem to increase mispricing in absolute terms. A persistent result, however, is that increasing US optimism is associated with decreasing ADR spreads as well as decreasing mispricing in absolute value. In other words, the more US investors become pessimistic about future dividend yields relatively to local investors, the more ADR spreads will increase.

It is interesting to provide some interpretation for this negative relation.

developed markets, which have a higher degree of market integration.

[24] As a matter of fact we find that US increasing optimism at period t significantly Granger causes optimism in the UK, Germany and Japan, at period $t+1$, whereas the causality is also positive but not significant for France and Italy.

[25] We note that for most emerging markets, we do not have a proxy for local sentiment. We are thus unable to test the impact of local sentiment on UND portfolios on a large cross-section of our sample.

When US investors become over-pessimistic, they under-estimate expected dividend yields and as a consequence their realized ADR returns are higher. As explained in section 3.4 using heterogeneous asset pricing arguments, over-pessimism leads to an increase in the US market price of risk and an increase in ADR excess returns. On the other hand, when US investor sentiment improves, ceteris paribus, there is a tendency for US overoptimism. This leads to a decrease in the US market price of risk and a decrease in ADR excess returns. Given that UND returns are even positively affected by US sentiment changes (as shown in specification B), it comes with no surprise our finding that the impact of US sentiment changes on ADR spreads is significantly negative.

3.6.2 Spreads due to market microstructure

The results of this subsection show the importance of market microstructure variables that explain ADR spreads. Such variables may affect spreads via imposing barriers to arbitrage, as for example short-selling constraints do. They may also affect spreads via the introduction of additional risk premia, or via a combination of the two paths, as for example the relative market wide illiquidity measures do.

In the framework of estimating equation (3.5), we confirm the results by Aggarwal et al. (2007) and Chan et al. (2008) who show the importance of relative illiquidity in explaining ADR spreads. Table (3.6) shows evidence that relative illiquidity is among the main determinants of ADR spreads, with the expected negative sign. If one observes an illiquidity shock on and ADR, this reduces its price with respect to its underlying asset and thus the ADR spread decreases. Even though in our estimations, we present results using only the Amihud illiquidity measure, results do not change much when using the "infrequency" measure. They are slightly more significant for emerging market firms and slightly less for developed markets. All specifications of

table (3.6) that are based on equation (3.5), show that the impact of relative illiquidity remains important for explaining both ADR spreads and their absolute values, which proxy mispricing in a more general way. Intuitively, the impact of higher illiquidity difference between two markets has a positive impact on the absolute value of "mispricing". One point that does not appear in the tables, but that is worth to comment on, is that illiquidity in the US market appears to have a more important effect on ADR spreads than illiquidity in local markets. This could be due to the claim that ADR spreads are mostly determined by investors in the US market, than investors in the local market. When examining the impact of sentiment proxies on spreads, we find a similar pattern, which also justifies the focus of this study in how ADR spreads reflect mostly US market sentiment than local sentiment.

Our results show that we cannot reject the partial market segmentation hypothesis, since ADR spreads are affected by both common global factors and local factors. In other words, different and common risk factors affect US and local markets and these factors are reflected in ADR spreads. We already depicted one such global risk factor, being the US investor sentiment changes. Estimations of equation (3.5) in table (3.6) show evidence that US excess market returns are also among the global factors affecting ADR spreads. In alignment with the country fund premium literature and Bodurtha et al. (1995), we find an analogous result that ADR spread changes correlate positively with contemporaneous excess US market returns. A reason for this is that the magnitude of sensitivity to the US market factor is higher indeed for ADRs than UNDs as it is shown in table (3.5). However, contrary to Bodurtha et al. (1995), we find that UNDs remain positively correlated with excess US market returns, even after controlling for local market returns and exchange rate fluctuations. Findings by Lee et al. (1991) on domestic fund premiums differ in that they do not find significant correlation between fund premium changes and US market returns. Our findings support

evidence of higher degree of markets' integration as reflected by the globally systematic pricing of US market factor. On the other hand, local factors such as local excess market returns, proxies for local market development, or local illiquidity also significantly affect ADR spreads. These findings support evidence against markets' perfect integration hypothesis and in favor of a so-called "partial market segmentation".

As far as explaining the cross-sectional variation of ADR spreads is concerned, we find that the degree of market development of an ADR's home country, as well as the country's classification as an emerging or developed economy, affect spreads in a significant way. According to Aggarwal et al. (2007), if a portfolio of firms is based in an emerging market, with consequently higher trading costs, investors allocate larger fractions of their investment in the ADR portfolio of these companies relative to the underlying local portfolio. As a result, demand for ADR securities increases and ADR spread increases. Evidence from univariate analysis, table (3.1) and figure (3.2), all confirm such a prior, since firms from emerging markets exhibit higher absolute ADR spreads. In addition, specification C of table (3.6), includes a dummy variable for each emerging market UND portfolio and shows that mispricing is consistently higher in those markets.

The impact of several LaPorta et al. (1998) country variables as well as the impact of Bris et al. (2007) proxies for short-selling regulations appear to be significant. In particular, our proxy for "mispricing" ($abs(ADRspread)$) is lower in countries where short-sales are legally permitted ($DumNSth$), as well as in countries where short-sales are a common practice ($DumNSpr$). This is intuitive, since short-sales restrictions create barriers to arbitrage and lead to an increase in mispricing. Furthermore, countries where the risk of expropriation is low and thus investor protection is high, exhibit lower mispricing proxies. Countries where accounting standards are low surprisingly have lower mispricing proxies as well. The negative expected impact of cred-

itors' protection is only verified in our subsample of developed market firms. As stated in the introduction, microstructure related explanations of these cross-sectional variations of spreads are only one part of the picture. The objective of the next subsection is to study whether sentiment related variables is another important part of it.

3.6.3 Spreads due to sentiment

In order to interpret ADR spreads in terms of aggregate US investor sentiment, one may rely on studies introducing heterogeneity of information among agents, as in Berrada (2006). They show that US aggregate pessimism drives US market price of risk at a higher level than what full information asset pricing models would suggest. Higher US market price of risk, ceteris paribus means positive ADR spread. In alignment with theoretical predictions, it is interesting to observe in figure (3.1), that the three dates on which ADR spread takes the maximum positive value are the observations immediately after the terrorist attacks of September 11,[26] the 30th ASEAN Ministerial Meeting announcing serious concerns during the Asian crisis of 1997 and the Russian decision to float the ruble during the crisis of 1998. There is therefore evidence that positive ADR spreads express to some extent US investors' aggregate relative pessimism.

Nevertheless, on average for our 10 year period, we observe negative ADR spreads across the 35 countries. The average negative spreads are interpreted by aggregate US optimism and can be due to three effects. Firstly, because agents with lower beliefs have less wealth (wealth effect). Secondly, agents with lower beliefs have higher risk aversion coefficients (risk aversion effect). Thirdly, agents do not face a symmetric dispersion of beliefs, in our case meaning that optimistic agents are far more optimistic than how pessimistic

[26] This still holds when taking into account the fact that the US stock markets remained closed during our first calendar weekly observation after September 11.

agents are with respect to the true value.

On a multivariate level, results of tests on the theoretical section's equation (3.6) are shown in table (3.7). We find evidence that ADR spreads are significantly negatively affected by relative US sentiment changes. In other words, the more pessimistic are the changes in sentiment for the representative US investor, compared to the changes in sentiment for the foreign investor, the more ADR spreads will increase. As far as the economic significance is concerned, specification A shows that relative investor sentiment is at least as important as relative market wide illiquidity. In terms of R^2, we notice that specification A of table (3.7) exhibits a higher explanatory power of at least 8% compared to the one of specification A of table (3.6), where no sentiment proxies are used.

It is interesting to check through specifications B and C, how different US sentiment proxies affect the absolute value of ADR spreads, which represents mispricing in a more general way. We find that all three proxies related to US sentiment significantly increase mispricing. In particular, the bigger the shock on US sentiment, the more optimism US sentiment levels reveal, as well as high convergence of beliefs (meaning stronger market view and low neutrality) among investors, all lead to an increase in mispricing. The absolute value of the US investor sentiment variable can be viewed as a measure of non-neutrality in investors' expectations, since it shows how much investors' average opinion differs from the neutral view. Some intuition, especially for this last result could be that high non-neutrality in expectations increases assets' volatility and therefore the assets' expected returns.

An additional question, which relates to the notion of sentiment through a different perspective and which examines equation (3.7), is the following: do investors' expectations about the evolution of fundamentals, such as exchange rates and market returns, explain part of ADR spreads evolution? The answer is yes and this is shown in specification D of table (3.7). Com-

pared to Chan et al. (2008) who perform the same test but find contradictory results for US excess market returns, we find a significant impact of expectations with the predicted sign for both local and US market returns. The issue here once again was the choice of proxies for expectations about future exchange rate and stock market changes. Following the martingale property hypothesis, we use the most recent changes as a proxy for such expectations.

Our definition of the exchange rate implies that a positive exchange rate change corresponds to a depreciation of the local currency. An investor in an ADR of a firm from country j is therefore willing to pay a higher premium if she expects the currency of country j to appreciate in the next period (negative exchange rate change). The expected sign on the coefficient of exchange rate changes is negative. The same investor is also willing to pay a higher premium if she expects the stock market of country j to perform relatively better than the US stock market. Expected local stock market returns are supposed to have a positive impact on ADR spread, whereas expected US stock market returns are supposed to affect negatively ADR spreads. Empirical estimations of table (3.7) cannot reject theoretical predictions with the exception of exchange rate expectations' impact that is insignificant.

3.6.4 Informational content of spreads

We examine the information that ADR spreads convey by focusing on two directions. The first one concerns the identification of structural breaks in the impact of either sentiment or microstructure related variables on spreads. This allows us to draw conclusions about implicit variations in parameters of different investor groups, such as their degree of risk aversion. The second direction is to evaluate the predictive power of spreads on returns of different active investment strategies generating abnormal returns.

As far as structural breaks are concerned, we consider two major events: the introduction of the euro and the terrorist attacks of September 11, 2001.

Our main interest is to examine the impact of American investors' relative optimism change on ADR spreads before and after each event. We use a window period of 3 years around the event for our estimations. Interaction effects and potential breaks in the impact of determinants of ADR spreads on these latter are presented in table (3.8). For comparison purposes, we use only the ZEW source of sentiment proxies in this estimation. Since ZEW indices of market sentiment are only available for 6 major world economies (U.S., U.K., Japan, France, Germany and Italy), we make the following simplifications while computing local sentiment proxies ($SENT_j$): for developed markets we use the weighted average of U.K., Japan, France, Germany and Italy; for the EMU region, the weighted average of France, Germany and Italy, whereas for Asia, the Japan index. For emerging markets, we are obliged to consider exclusively the US market sentiment index, since there is no such benchmark index in emerging markets. The coefficient for the emerging markets is no longer significant, showing that absolute US market sentiment does not affect significantly emerging market ADR spread.

Specifications A and B of panel I show that there is a structural break around September 11, 2001, as to the impact of relative U.S. investor sentiment on ADR spreads. A negative shock on US investor sentiment (exogenous increase of pessimism) would lead to a significant increase in ADR spreads before September 11. This in line with traditional theory linking pessimism with higher market price of risk.[27] However, it is interesting to note that for some period after September 11, an increasing US relative pessimism leads to a decrease in ADR spreads. This positive impact dissipates with time, in a way that the overall impact of relative sentiment change on spreads for our initial 10-year sample remains negative.

As discussed earlier, let's suppose that there exists heterogeneity in beliefs between two major types of agents, one representative US investor and one

[27] See Cecchetti et al. (2000), Abel (2002), Berrada (2006).

representative local investor. Given that the perfect integration hypothesis is rejected and that the two types of investors mostly proceed to transactions in their respective markets (ADR or underlying market), then for the same underlying stochastic dividend, ADR spreads can be perceived as differences in the subjective market price of risk of the two types of agents. As a result, the observed structural break of the impact of US investors' relative pessimism or optimism on ADR spreads could be largely due to a sudden increase in the risk aversion coefficient of the representative US investor, ceteris paribus.[28] This is an interesting result, since it shows that ADR spreads could be used in order to extract risk aversion coefficients between different groups of investors. Furthermore, structural breaks on the impact of sentiment on ADR spreads allow us to extract shocks in risk aversion differences between groups of investors.

A similar argument can be used in order to interpret the change of sign in panel II for eurozone based firms, around the date of the introduction of the euro currency. Even though the signs are not significant, the change from a negative to a positive sign shows a tendency, ceteris paribus, that investors of the eurozone become less risk averse after the introduction of the common currency. The insignificance of the reported signs could also have to do with the fact that, as shown earlier, ADR spreads rather reflect the US than local investors' sentiments. As far as microstructure proxies are concerned, specifications C and D present a break around September 11, where suddenly relative illiquidity becomes a significant pricing factor for ADR spreads in emerging markets. For robustness purposes, we perform Chow tests for these dates that confirm our structural break hypothesis.

The second direction in which we find that ADR spreads convey useful information for investors is their predictive power on several passive as well

[28] By ceteris paribus in these models of heterogeneous information, we suppose that the consumption proportions of each type of investor, as well as the volatility of the unique (for each firm) underlying stochastic dividend stream remain constant.

as active investment trading strategies. A critical aspect of the spreads that is exploited here is their mean reversion property, as well as the cointegrating properties of spreads' components that we previously discussed. Among our main results, table (3.9) shows that we cannot reject the investor sentiment hypothesis as presented by Bodurtha et al.(1995). Specification A shows that higher (lower) ADR spreads tend to be associated with lower (higher) future ADR returns. There is a clear negative relationship between ADR spreads at time t and ADR returns at time $t+1$. The relationship is robust among both developed or emerging market groups. Its economic significance, though, is much higher among developed markets. This reveals that there is a cross-sectional variation in the magnitude of information conveyed by ADR spreads for different countries. The reason could be related to higher asymmetries in information and transaction costs in emerging markets, that undermine the information provided in a given level of spread. Spreads' significant impact persists even after controlling for market returns, market wide illiquidity, US investor sentiment changes, and non-neutrality in expectations. We claim that, in such a case, ADR spreads can be viewed as proxies for US *relative* sentiment change. In relation to our control variables, we find that future ADR return is increasing in the lagged change in US investor sentiment, as well as increasing in non-neutrality in expectations.

On the contrary, specification B of table (3.9) reveals that current ADR spreads do not have any significant impact on future UND returns. We therefore conclude that relative US sentiment change is a component of the return generating process of an ADR, but not of its underlying asset, UND. This result reveals the existence of an asymmetry between the important impact of US relative sentiment on ADRs and the insignificant one on UNDs. We deduce that US investors are prone to trade on sentiment and noisily perceive fundamental values as in Hardouvelis et al. (1994). Only a small component of the ADR spreads capture the sentiment of local investors. This

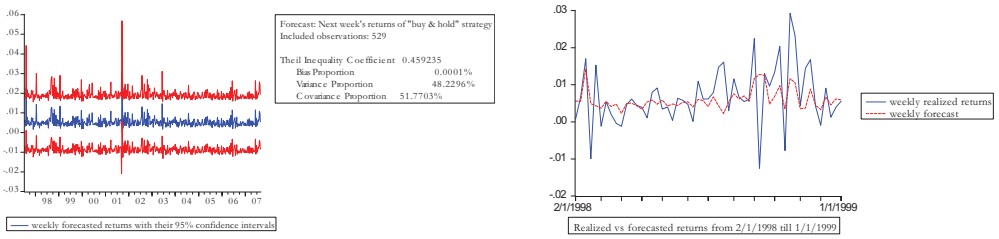
result should however be interpreted with caution: it does not necessarily mean that investor sentiment is a systematic pricing factor for ADRs. Using a single market factor pricing model, we do not find any significant positive alphas that would imply that there are other missing systematic factors.

An additional goal is to test whether the various active investment strategies, defined in section 3.4, generate abnormal returns and to what extent these returns are due to the absolute size of ADR spreads, which proxies for mispricing. The first proposed active investment strategy, $ISR_{ADR\ spread}$, the rule consists of taking a long position in the ADR portfolio and a short position in the UND portfolio if $ADRspread_{t-1} < 0$ and vice versa. Such a strategy exploits the mean reversion observed in spreads and shows that ADR spread at period t does predict to some extent a change in the spread at period $t+1$. It further assumes that investors can take positions in international markets without restrictions and that there are no short-selling constraints. The other four proposed strategies are also considered, so as to account for cases of market segmentation (strategies ISR_{ADR} and ISR_{UND}), as well as for frameworks of both market segmentation and presence of short-selling constraints ($ISRns_{ADR}$ and $ISRns_{UND}$).

The informational content of the size of the ADR spread, as measured by its absolute value, is shown in table (3.10). With the exception of the two investment strategies based only on UND portfolios, we find that the larger the observed ADR spread in absolute value, the higher the return (expressed in basis points) of each strategy in the subsequent period. Furthermore, the impact of our "mispricing" proxy has a high economic significance. Once again, we find that the impact of ADR spreads is asymmetric, since they convey far more useful information for future ADR returns than for future UND returns. For illustrative purposes, we choose the $ISR_{ADR\ spread}$ strategy in order to evaluate the forecast of its weekly returns, as shown in figure (3.5).

From both the Theil Inequality test,[29] as well as the arbitrary zoom of subfigure b, we draw the conclusion that our mean return is correctly forecasted, whereas its volatility is under-estimated. Levels of R^2 for the $ISR_{ADR\ spread}$ strategy are acceptable for out-of-sample estimations. We do not explicitly control for transaction costs, due to unavailability of data, but we use market wide illiquidity as a control for market microstructure issues. We draw the conclusion that the informational content of ADR spreads is important, even though asymmetric and could be further exploited and analyzed.

Figure 3.5: Evaluation forecast for active investment strategies. Subfigure 3.5a shows a forecast evaluation of weekly returns of the "ISRadrspread" strategy exploiting information in past ADR spreads. Subfigure 3.5b shows a forecast evaluation arbitrary zoom in one year of our sample.



Finally, it is interesting to compare our various strategies' performance by using a classical three-factor asset pricing model as a benchmark. Table (3.11) presents three panels. In panel I, we evaluate the performance of the $ISR_{ADR\ spread}$ strategy, which assumes integrated markets and no short-selling constraints. Panel II evaluates the ISR_{seg} strategy, which is feasible in a framework of partial market segmentation, since it allows the investor to use

[29] The higher the covariance proportion in comparison to the bias and variance proportion the better the forecast.

the ISR_{ADR} rule for emerging market UND portfolios, where there usually exist costly barriers in foreign trading. Panel III evaluates the performance of the ISR_{ss} strategy, which is feasible in a framework of both partial market segmentation and variations in the presence of short-selling constraints. Such a strategy allows the investor to use the $ISRns_{ADR}$ rule for observations when and where short-selling in the country of the UND portfolio is not allowed.

If we do not control for sentiment proxies, table (3.11) shows that in all three panels we obtain an average weekly abnormal return (alpha) varying from 36 to 32 basis points. The fact that abnormal returns decrease from panel I to panel III is intuitive, because the assumed framework becomes more segmented and short-selling constraints become possible; such barriers restrict our investment strategies exploiting ADR spreads' implicit information on an international level. The magnitude of such abnormal returns is nevertheless attractive when compared to previous literature's estimated transaction costs levels for developed markets. What is even more interesting, is that factors related to US investor sentiment, such as last period's US investor sentiment and non-neutrality in analysts' expectations, seem to account for more than 5 basis points of the abnormal return. The importance of sentiment related factors is shown in each of the three panels' second column, where the abnormal return is reduced on average by 5 to 6 basis points on a weekly basis. We can therefore draw the conclusion that the informational content of sentiment levels and non-neutrality in expectations proxies could be further exploited in asset pricing models.

3.7 Conclusions

Building on the strands of literature analyzing price discrepancies, this study tests several existing and new hypotheses on ADR spreads. Among our main findings is that we show that ADR spreads do indeed reflect to some

significant extent relative US investor optimism. These spreads are also affected by market, exchange rate and liquidity factors, as well as proxies more generally related to differences in market microstructure aspects between the US and the ADR's home county. The degree of the home country's market development and its regulatory framework related to barriers in arbitrage, through for instance the presence of short-selling constraints, are also important explanatory factors. Investors' expectations about the evolution of market returns and exchange rates have a significant influence on the sign and size of ADR spreads. In addition, September 11, appears as a structural break, when US investors become relatively more risk averse with respect to the rest of the world.

On a cross-sectional level, the perfect market integration hypothesis is rejected, even though developed markets seem more integrated than emerging markets. An important finding is that current ADR spreads contain valuable information with respect to the future evolution of ADR returns. The economic significance of this informational content is higher for developed markets. Their predictive power is asymmetric, since it does not concern future UND returns. ADR spreads also convey valuable information in relation to the future returns of various active trading rules defined on the basis of past spreads. Finally, US sentiment and non-neutrality in investors' expectations account for a significant part of the abnormal returns generated by these active trading strategies.

The choice of ADR price discrepancies as our "natural experiment" for the extraction of US investors' sentiment is rather convenient. There is one aspect, though, that is not fully exploited in this study. That is the possibility to use additional firm-specific data accounting for capital structure and profitability characteristics. There is plenty of room, hence, for further research towards at least two directions. First, there are interesting perspectives in relation to the inclusion of other firm specific variables, that would

probably add explanatory power in the ADR spread factor analysis. Second, one may shed more light on the informational content and predictability power of ADR spreads by evaluating the performance of a large variety of active trading rules and testing their persistence.

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3.9 Tables

Table 3.1: Descriptive statistics of annualized adjusted ADR spread and its components for the whole sample. The adjusted ADR spread is computed as the difference between returns on ADR and returns on UND, after adjusting for bilateral exchange rate changes ER. Annual returns for the ADR portfolio and the exchange rate adjusted underlying portfolio UND-ER are expressed in US dollars. Our time span is from July 1997 until July 2007.

Country of origin	Number of countries	Number of firms	ADR portfolio annual return (US dollars)	UND-ER portfolio annual return (US dollars)	Adjusted annualized ADR spread (US dollars)
Developed markets	20	240	7.21%	9.13%	-1.92%
Emerging markets	15	75	1.10%	3.92%	-2.82%
Total sample	35	315	4.42%	6.75%	-2.33%

Table 3.2: Descriptive statistics of annualized adjusted ADR spreads and their components for each country of our sample. Countries are followed by (D) if they are classified as developed and by (E) if they are classified as emerging. The adjusted ADR spread is computed as the difference between returns on ADR and returns on UND, after adjusting for bilateral exchange rate changes ER. Annual returns for the ADR portfolio and the exchange rate adjusted underlying portfolio UND-ER are expressed in US dollars. Our time span is from July 1997 until July 2007.

Country of origin	Number of firms	ADR portfolio annual return (US dollars)	UND-ER portfolio annual return (US dollars)	Adjusted annualized ADR spread (US dollars)
Argentina (E)	7	-3.14%	-5.53%	2.39%
Australia (D)	24	0.97%	1.88%	-0.91%
Austria (D)	6	7.15%	8.61%	-1.46%
Brazil (E)	15	6.35%	1.60%	4.75%
Chile (E)	11	-0.67%	0.18%	-0.85%
China (E)	4	2.73%	11.42%	-8.69%
Denmark (D)	1	17.23%	19.38%	-2.15%
Finland (D)	3	13.60%	15.22%	-1.62%
France (D)	17	6.59%	8.89%	-2.30%
Germany (D)	14	7.92%	8.72%	-0.80%
Greece (D)	1	10.73%	13.68%	-2.95%
Hong Kong (D)	34	1.13%	2.48%	-1.35%
Indonesia (E)	2	3.72%	4.61%	-0.89%
Ireland (D)	6	16.91%	16.30%	0.61%
Israel (E)	2	13.14%	13.98%	-0.84%
Italy (D)	4	2.83%	6.76%	-3.93%

Table 3.3: Descriptive statistics of annualized adjusted ADR spreads and their components for each country of our sample. Countries are followed by (D) if they are classified as developed and by (E) if they are classified as emerging. The adjusted ADR spread is computed as the difference between returns on ADR and returns on UND, after adjusting for bilateral exchange rate changes ER. Annual returns for the ADR portfolio and the exchange rate adjusted underlying portfolio UND-ER are expressed in US dollars. Our time span is from July 1997 until July 2007.

(...continuation of Table 2)

Country of origin	Number of firms	ADR portfolio annual return (US dollars)	UND-ER portfolio annual return (US dollars)	Adjusted annualized ADR spread (US dollars)
Japan (D)	40	1.90%	2.16%	-0.26%
Malaysia (E)	1	-7.13%	6.94%	-14.06%
Mexico (E)	7	4.86%	6.67%	-1.79%
Netherlands (D)	13	3.72%	3.97%	-0.25%
Norway (D)	2	4.28%	10.11%	-5.83%
Peru (E)	3	-0.27%	9.48%	-9.75%
Philippines (E)	3	-2.13%	0.80%	-2.93%
Portugal (D)	2	4.91%	5.16%	-0.25%
Russia (E)	4	12.48%	-1.92%	14.40%
Singapore (D)	8	7.44%	13.81%	-6.37%
South Africa (E)	11	7.83%	7.67%	0.16%
South Korea (D)	3	9.75%	16.13%	-6.38%
Spain (D)	5	10.32%	10.45%	-0.13%
Sweden (D)	6	10.40%	13.24%	-2.84%
Switzerland (D)	4	6.70%	7.69%	-0.99%
Taiwan (E)	1	-10.26%	-14.61%	4.35%
Thailand (E)	4	-3.39%	8.69%	-12.08%
United Kingdom (D)	44	2.27%	4.95%	-2.68%
Venezuela (E)	3	-16.19%	-3.35%	-12.84%
TOTAL	315	4.42%	6.75%	-2.33%

Table 3.4: Variable definitions and sources

Variables used hereafter are expressed in weekly frequency. For each variable, we provide a short definition, its type (category), as well as the source from which they were accessible (data source).

Variable	Definition	Category	Data source
$ADR_{j,t}$	Equally weighted average of weekly return on ADR shares closing price of country j	portfolio	Thomson - Datastream
$UND_{j,t}$	Equally weighted average of weekly return on underlying shares closing price of country j	portfolio	Thomson - Datastream
$ER_{j,t}$	Nominal exchange rate change (GTIS) of country j Value of 1 USD expressed in local currency	country	Thomson - Datastream
$ADRspread_{j,t}$	Adjusted ADR spread $ADR_{j,t} - UND_{j,t} + ER_{j,t}$	portfolio	created
$R^{ex}_{j,t}$	Excess market return (Market index- Risk free rate)	country	Thomson - Datastream
$ILL_{j,t}$	Illiquidity measure (Amihud or Infrequency)	portfolio	created
$SENT_{j,t}$	Investor Sentiment index for country j (ZEW or EU)	country	Thomson - Datastream & Reuters
$ISR_{j,t}$	Weekly return of investment strategy	portfolio	created
$DumSep11_{t}$	Dummy for period after the terrorist attacks of September 11, 2001	general	created
$DumNS_{j,t}$	Dummy for absence of short-selling constraints	country	Bris et al. (2007)
$RightsCred_{j}$	Variable proxying for creditor rights	country	LaPorta et al. (1998)
$RightsExpr_{j}$	Variable proxying for low risk of expropriation	country	LaPorta et al. (1998)
$Accounting_{j}$	Variable proxying for accounting standards	country	LaPorta et al. (1998)
$DumEmerging_{j}$	Dummy for emerging country	country	IMF

Table 3.5: Estimates from panel regressions on level variables

Specifications A and B use contemporaneous ADR and UND portfolio returns as the dependent variable. Specifications C and D use contemporaneous ADR spreads and their absolute value (which is used as a proxy for mispricing) as the dependent variable. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***,**,* respectively. P-values are shown in parenthesis.

Variable	Proxying	A: $ADR_{j,t}$ portfolio Coefficient	(p-value)	B: $UND_{j,t}$ portfolio Coefficient	(p-value)	C: $ADRspread_{j,t}$ Coefficient	(p-value)	D: $abs(ADRspread_{j,t})$ Coefficient	(p-value)
AR(1)	1^{st} lag	-0.377***	(0.000)	-0.024**	(0.017)	-0.324***	(0.000)	0.332***	(0.000)
AR(2)	2^{nd} lag	-0.134***	(0.000)	-0.003	(0.752)				
$UND_{j,t}$	Underlying return	0.871***	(0.000)						
$R^{ex}_{US,t}$	US excess return	0.103***	(0.000)	0.041***	(0.000)				
$R^{ex}_{j,t}$	Local excess return			0.973***	(0.000)				
$ER_{j,t}$	US bilateral ER change	-0.818***	(0.000)	0.054***	(0.000)				
$ILL_{ADRj,t}$	Amihud illiquidity	-0.001**	(0.050)						
$ILL_{UNDj,t}$	Amihud illiquidity			-0.002**	(0.015)				
$SENTl_{US,t}$	US sentiment level	1E-05	(0.629)	-0.001	(0.420)	0.001	(0.437)	0.002***	(0.000)
$SENT_{US,t}$	US sentiment change	-0.005**	(0.037)	0.028***	(0.000)	-0.009***	(0.000)	-0.009***	(0.002)
$abs(SENTl_{US,t})$	Non-neutrality in expectations	0.001***	(0.000)	0.001***	(0.002)	0.001	(0.331)	0.003***	(0.000)
$DumSep11_t$	Post September 11, 2001	0.001***	(0.000)	-1E-05	(0.655)				
Fixed Effects		YES		YES		YES		YES	
Method		GLS White correction cross section weights		GLS White correction cross section weights		GLS White correction cross section weights		GLS White correction cross section weights	
Countries		33		35		35		35	
Panel observations		15'621		18'176		18'401		18'401	
R^2 (adjusted R^2)		81.90%	(81.85%)	71.81%	(71.75%)	10.56%	(10.37%)	14.99%	(14.81%)

Table 3.6: Estimates from regressions explaining ADR spreads via market microstructure variables

Specification A uses contemporaneous ADR spread as the dependent variable. Specifications B, C and D use the absolute value of contemporaneous ADR spread (proxy for mispricing) as the dependent variable. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively. P-values are shown in parenthesis.

Variable	Proxying	A:ADRspread$_{j,t}$ Coefficient	(p-value)	B:abs(ADRspread$_{j,t}$) Coefficient	(p-value)	C:abs(ADRspread$_{j,t}$) Coefficient	(p-value)	D:abs(ADRspread$_{j,t}$) Coefficient	(p-value)
AR(1)	1st lag	-0.321***	(0.000)	0.349***	(0.000)	0.355***	(0.000)	0.339***	(0.000)
c	constant	-0.001**	(0.028)	0.027***		0.006***	(0.000)	0.042***	
$R^{ex}_{US,t}$-$R^{ex}_{j,t}$	Market factors differential	0.136***	(0.000)						
abs($R^{ex}_{US,t}$-$R^{ex}_{j,t}$)				0.108***	(0.000)	0.118***	(0.000)	0.109***	(0.000)
$ILL_{ADRj,t}$-$ILL_{UNDj,t}$	Relative market illiquidity	-4E-06**	(0.049)						
abs($ILL_{ADRj,t}$-$ILL_{UNDj,t}$)				5E-06**	(0.029)	5E-06***	(0.024)	4E-06**	(0.021)
$DumNSth_{j,t}$	Short selling allowed	0.001**	(0.034)	-0.004***	(0.000)			-0.006**	(0.039)
$DumNSpr_{j,t}$	Short selling practised	-2E-04	(0.450)	-0.002***	(0.001)			-0.003***	(0.000)
$RightsCred_j$	Country creditor rights			5E-05	(0.476)			-2E-04***	(0.009)
$RightsExpr_j$	Country low expropriation risk			-0.002***	(0.000)			-0.003***	(0.000)
$Accounting_j$	Country accounting standards			5E-05***	(0.000)			5E-05***	(0.000)
$DumSep11_t$	Post September 11, 2001	2E-04**	(0.038)	4E-04**	(0.034)			3E-05	(0.880)
$DumEmerging_j$	Dummy for emerging economy					0.006***	(0.000)		
Method		GLS White correction		GLS White correction		GLS White correction		GLS White correction	
Countries		32		28		33		19 developed	
Panel observations		15'409		13'847		15'745		9'344	
R^2 (adjusted R^2)		15.64%	(15.61%)	15.90%	(15.85%)	14.01%	(13.99%)	17.38%	(17.30%)

Table 3.7: Estimates from regressions explaining contemporaneous ADR spread via sentiment and market microstructure variables.

Specifications A and D explain ADRspread for 5 countries on which $SENT_j$ is available by ZEW. Specifications B and C explain abs(ADR spread), or "mispricing" by including sentiment variables. Specification D includes investor expectations. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***,**,* respectively. P-values are shown in parenthesis.

		A: $ADRspread_{j,t}$		B:$abs(ADRspread_{j,t})$		C:$abs(ADRspread_{j,t})$		D: $ADRspread_{j,t}$	
Variable	Proxying	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)
AR(1)	1^{st} lag	-0.342***	(0.000)	0.292***	(0.000)	0.335***	(0.000)	-0.351***	(0.000)
c	constant					0.027***	(0.000)		
$R^{ex}_{US,t}$-$R^{ex}_{j,t}$	Market factors differential	0.177***	(0.000)					0.189***	(0.000)
$abs(R^{ex}_{US,t}$-$R^{ex}_{j,t})$				0.114***	(0.000)	0.105***	(0.000)		
$ILL_{ADRj,t}$-$ILL_{UNDj,t}$	Relative illiquidity	-4E-04**	(0.039)					-4E-04**	(0.045)
$abs(ILL_{ADRj,t}$-$ILL_{UNDj,t})$				5E-06**	(0.029)	5E-06**	(0.031)		
$SENT_{US,t}$-$SENT_{j,t}$	Relative US sentiment	-0.026***	(0.003)					-0.019**	(0.026)
$SENTl_{US,t}$	US market sentiment level			0.003***	(0.000)	0.003***	(0.000)		
$abs(SENT_{US,t})$	Size of shock on US sentiment			0.053***	(0.000)	0.053***	(0.000)		
$abs(SENTl_{US,t})$	Non-neutrality in expectations			0.002***	(0.000)	0.003***	(0.000)		
$DumNSpr_{j,t}$	Short selling practised					-0.002***	(0.000)		
$RightsExpr_j$	Country low expropriation risk					-0.002***	(0.000)		
$ER_{j,t-1}$	Expected ER change							-0.005	(0.751)
$R^{ex}_{US,t-1}$	Expected US market return							-0.078***	(0.000)
$R^{ex}_{j,t-1}$	Expected local market return							0.082***	(0.000)
Fixed Effects		YES		YES		Dummies		YES	
Method		GLS		GLS		GLS		GLS	
		White correction		White correction		White correction		White correction	
Countries		5 with ZEW data		33		31		5 with ZEW data	
Panel observations		2'630		15'652		14'795		2'630	
R^2 (adjusted R^2)		24.17% (23.94%)		17.74% (17.54%)		16.55% (16.51%)		24.74% (24.42%)	

Table 3.8: Interaction effects estimates from regressions on change variables using contemporaneous ADR spread as the dependent variable

Using the changes of the regression specification A of table (3.7), we present here the impact of major explanatory variables around two major events. Panels I and II study the impact of the terrorist attacks of September 11 and the introduction of the euro on the influence of different explanatory variables. Coefficients' sign significance at 99%, 95% and 90% confidence level is noted by $---$, $--$, $-$ or $+++$, $++$, $+$ respectively. Not significant signs are presented in parenthesis. Specifications A, B, C and D contain all countries, developed, emerging and eurozone markets respectively. Note that wherever (for 20 countries) there is no data for $SENT_j$, we use a proxy for $SENT_{region}$ or $SENT_{US}$ instead of $SENT_{US} - SENT_j$.

Variable		Proxying	A: All countries Coefficient	B: Developed Coefficient	C: Emerging Coefficient	D: EMU Coefficient
Panel I: September 11, 2001						
$SENT_{US}-SENT_j$	$Before$	Relative US sentiment ex ante	$--$	$--$	$(-)$	$(-)$
	$After$	Relative US sentiment ex post	$++$	$+++$	$(-)$	$+$
$ILL_{ADR}-ILL_{UND}$	$Before$	Relative illiquidity ex ante	$---$	$---$	$(-)$	$(+)$
	$After$	Relative illiquidity ex post	$---$	$--$	$--$	$---$
Panel II: Introduction of the euro, January 1, 1999						
$SENT_{US}-SENT_j$	$Before$	Relative US sentiment ex ante				$(-)$
	$After$	Relative US sentiment ex post				$(+)$
$ILL_{ADR}-ILL_{UND}$	$Before$	Relative illiquidity ex ante				$-$
	$After$	Relative illiquidity ex post				$---$

Table 3.9: Estimates from regressions with future ADR and UND returns as dependent variables

We use one period lagged variables as explanatory factors. The lagged ADR spread is multiplied with the emerging market dummy. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively. P-values are shown in parenthesis.

Lagged Variables	Proxying	A: $ADR_{j,t}$ Coefficient	(p-value)	B: $UND_{j,t}$ Coefficient	(p-value)
$R^{ex}_{US,t-1}$	US excess market return	0.011	(0.449)	0.053***	(0.000)
$R^{ex}_{j,t-1}$	Local excess market return	0.0455***	(0.005)	0.027**	(0.036)
$ILL_{ADRj,t-1}$	U.S. Amihud illiquidity	1E-06	(0.609)		
$ILL_{UNDj,t-1}$	Local market illiquidity			7E-06	(0.961)
$SENT_{US,t-1}$	US sentiment change	0.094***	(0.000)	0.142***	(0.000)
abs($SENTl_{US,t-1}$)	Non-neutrality in expectations	0.003**	(0.016)	-0.001	(0.806)
DumEmerging$*\left(ADRspread_{j,t-1}\right)$	ADR spread for emerging UNDs	-0.162***	(0.001)	0.008	(0.684)
(1−DumEmerging)$*\left(ADRspread_{j,t-1}\right)$	ADR spread for developed UNDs	-0.295***	(0.000)	-0.005	(0.690)
Fixed Effects		YES		YES	
Method		GLS -White correction		GLS -White correction	
Countries		33		35	
Panel observations		16'119		18'271	
R^2 (adjusted R^2)		3.46%	(3.22%)	1.27%	(1.05%)

Table 3.10: Estimates from regressions with five investment strategies' future returns as dependent variables (GLS White method with fixed effects)

Panel I strategies allow for short-selling positions, whereas Panel II strategies do not. The $ISR_{ADR\ spread}$ strategy. implies a long position in ADR, short in UND if $ADRspread_{j,t-1} < 0$ and vice versa. Specifications B and C explain strategies implying a long position in ADR (ISR_{ADR}) or a short position in UND (ISR_{UND}) if $ADRspread_{j,t-1} < 0$ and vice versa. Specifications D, E explain strategies implying a long position in ADR ($ISRns_{ADR}$) or a neutral position in UND ($ISRns_{UND}$) if $ADRspread_{j,t-1} < 0$ and vice versa. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***,**,* respectively. P-values are in parenthesis.

Panel I : Framework with no short-selling constraints		A: $ISR_{ADR\ spread_{j,t}}$		B: $ISR_{ADR_{j,t}}$		C: $ISR_{UND_{j,t}}$	
Lagged Variables	Proxying	Coefficient	(p-value)	Coefficient	(p-value)	Coefficient	(p-value)
AR(1)	1^{st} lag	-0.096***	(0.000)	-0.014	(0.333)	0.005	(0.581)
$\lvert$ADRspread$_{j,t-1}\rvert$	ADR spread absolute value	33.108***	(0.000)	29.256***	(0.000)	-0.017	(0.289)
$R^{ex}_{US,t-1}$	US excess market return	1.098**	(0.023)	3.220**	(0.029)	-0.017	(0.180)
$R^{ex}_{j,t-1}$	Local excess market return	-2.841***	(0.000)	-2.928*	(0.062)	0.002	(0.886)
ILL$_{ADRj,t-1}$	U.S. Amihud illiquidity	1E-04*	(0.099)	2E-05	(0.891)		
ILL$_{UNDj,t-1}$	Local market illiquidity	0.015	(0.674)			-24-05	(0.792)
Countries		33		33		35	
Panel observations		15'714		16'173		18'298	
R^2 (adjusted R^2)		9.34%	(9.12%)	2.60%	(2.37%)	0.43%	(0.22%)

Panel II : Framework with short-selling constraints		D: $ISRns_{ADR_{j,t}}$		E: $ISRns_{UND_{j,t}}$	
Lagged Variables	Proxying	Coefficient	(p-value)	Coefficient	(p-value)
AR(1)	1^{st} lag	-0.071***	(0.000)	-0.019	(0.143)
$\lvert$ADRspread$_{j,t-1}\rvert$	ADR spread absolute value	16.371***	(0.000)	-0.005	(0.678)
$R^{ex}_{US,t-1}$	US excess market return	2.033*	(0.064)	0.024***	(0.005)
$R^{ex}_{j,t-1}$	Local excess market return	5.729***	(0.000)	0.028**	(0.012)
ILL$_{ADRj,t-1}$	U.S. Amihud illiquidity	6E-05	(0.656)		
ILL$_{UNDj,t-1}$	Local market illiquidity			-3E-05	(0.704)
Countries		33		35	
Panel observations		15'888		18'298	
R^2 (adjusted R^2)		2.35%	(2.12%)	0.43%	(0.22%)

Table 3.11: Estimates from regressions with three investment strategies' future returns as dependent variables (GLS White method with constant and AR(1))

Panel I considers a framework with integration and short-selling. The $ISR_{ADR\ spread}$ strategy implies a long position in ADR, short in UND if $ADRspread_{t-1} < 0$ and vice versa. Panel II allows for partial segmentation. The ISR_{seg} strategy mixes $ISR_{ADR\ spread}$ strategy for developed and ISR_{ADR} strategy for emerging markets. Panel III allows for short-selling constraints. The ISR_{ss} strategy mixes $ISR_{ADR\ spread}$ strategy for observations with no short-selling restrictions and $ISRns_{ADR}$ strategy for observations with short-selling restrictions. Market, SMB and HML refer to the three standard Fama French factors of market, size and book-to-market. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively. P-values are shown in parenthesis.

		Panel I : Integration & short-selling				Panel II : Allow partial segmentation			
Lagged Variables	Proxying	A: $ISR_{ADR\ spread_{j,t}}$		B: $ISR_{ADR\ spread_{j,t}}$		C: $ISR_{seg_{j,t}}$		D: $ISR_{seg_{j,t}}$	
alpha	abnormal return	0.360***	(0.000)	0.303***	(0.000)	0.335***	(0.000)	0.285***	(0.000)
$\text{Market}_{\text{US,t-1}}$	market	-0.022***	(0.000)	-0.021***	(0.000)	-0.018***	(0.000)	-0.018***	(0.000)
$\text{SMB}_{\text{US,t-1}}$	size	-0.009*	(0.071)	-0.013**	(0.014)	-0.009**	(0.049)	-0.012***	(0.009)
$\text{HML}_{\text{US,t-1}}$	book-to-market	-0.023***	(0.000)	-0.027***	(0.000)	-0.024***	(0.000)	-0.028***	(0.000)
$\text{SENTl}_{\text{US,t-1}}$	US sentiment level			0.042**	(0.027)			0.021	(0.212)
$\text{SENT}_{\text{US,t-1}}$	US sentiment change			0.041	(0.451)			0.061	(0.185)
$\text{abs}(\text{SENTl}_{\text{US,t-1}})$	market non-neutrality			0.198***	(0.000)			0.172***	(0.000)
Panel observations		18'515 (35 countries)		18'445 (35 countries)		18'515 (35 countries)		18'445 (35 countries)	
R^2 (adjusted R^2)		0.10%	(0.08%)	0.17%	(0.13%)	0.49%	(0.47%)	0.52%	(0.48%)

		Panel III : Allow short-selling constraints			
Lagged Variables	Proxying	E: $ISR_{ss_{j,t}}$		F: $ISR_{ss_{j,t}}$	
alpha	abnormal return	0.320***	(0.000)	0.256***	(0.000)
$\text{Market}_{\text{US,t-1}}$	market	-0.014***	(0.000)	-0.014***	(0.000)
$\text{SMB}_{\text{US,t-1}}$	size	-0.006	(0.248)	-0.010*	(0.057)
$\text{HML}_{\text{US,t-1}}$	book-to-market	-0.022***	(0.000)	-0.027***	(0.000)
$\text{SENTl}_{\text{US,t-1}}$	US sentiment level			0.025	(0.204)
$\text{SENT}_{\text{US,t-1}}$	US sentiment change			0.117**	(0.033)
$\text{abs}(\text{SENTl}_{\text{US,t-1}})$	market non-neutrality			0.219***	(0.000)
Panel observations		17'986 (34 countries)		17'918 (34 countries)	
R^2 (adjusted R^2)		0.74%	(0.72%)	0.82%	(0.79%)

Chapter 4

Essay on firm currency exposure

4.1 Title

"Explaining Firms' Exchange Rate Exposure: the Role of Country Factors"[1]

4.2 Abstract

We focus on a worldwide panel of firms with international presence. We document significant variations of firms' exchange rate exposure between developed and emerging markets. We find that country specific factors account for about 30% of the variability of firms' exposure after controlling for firm and industry level determinants. Among such country factors, high use of foreign currency derivatives, deeper financial markets, as well as small and balanced current accounts significantly decrease firms' sensitivity with respect to exchange rate changes in both developed and emerging markets.

KEYWORDS: exchange rate exposure, foreign currency derivatives, emerging markets
JEL classification: F31, F41, G15

4.3 Introduction

In the post Bretton Woods era, high exchange rate volatilities have become a crucial element in international financial markets. The interest for correct measuring, as well as understanding of exchange rate exposure is high among an increasing number of firms. This is also due to the rapidly growing international operations of firms. This essay contributes to the empirical debate about both correct measurement and interpretations of cross-sectional variations of firms' exchange rate exposure by focusing on two axes. The first

[1]I would like to thank Henri Loubergé for supervising my work.

axis is the importance of country specific explanatory factors, and the second is the role of the type of the firm's home market, meaning whether it is a developed or an emerging economy. The main research questions studied are the following. How do firm sensitivities with respect to exchange rates vary across time and type of markets? How do country factors, such as the degree of financial development or the aggregate use of foreign currency derivatives affect the firms' sensitivity to exchange rate movements?

We focus our analysis on firms with important international activities, since we consider firms whose equity is traded in more than one country. We compute two measures of a firm's sensitivity with respect to its country's effective exchange rate. The first is the firm's sensitivity with respect to exchange rate changes (first moment exchange rate exposure) and the second is a the firm's sensitivity with respect to changes in exchange rate volatility (second moment exchange rate exposure). We find evidence that developed market firms are on average negatively affected by domestic effective exchange rate appreciations, whereas the opposite is true for emerging market firms. As far as explaining exposure is concerned, we find that the country's aggregate use of foreign currency instruments, such as currency derivatives, decreases the first moment exposure for all firms, and the impact on emerging markets is high. The depth of a country's local bond market also decreases the first moment exposure of firms in all types of markets, with higher economic significance in the developed world.

There is extensive literature on measuring, as well as explaining exchange rate exposure, on a firm level, on an industry level and more recently on a country level. Even though, theoretically, exchange rate exposure is well documented on all three levels, there is only partial empirical evidence supporting its economic importance. This divergence between theoretical predictions and empirical results, is often also referred to as the "exchange rate exposure puzzle".

From a theoretical point of view, exchange rate changes affect stock returns, either by varying the firm's expected cash flows, or through variation of the cost of capital used to discount these cash flows. Among seminal papers in this field, Adler and Dumas (1984), Jorion (1990, 1991) highlight the importance of a firm's foreign sales in its degree of exchange rate exposure. From an empirical point of view, evidence on the significance of exposure coefficients is often rather weak and several measurement issues have been raised. Such issues include the sensitivity of the exposure estimations on the length of the chosen time horizon, as in Chow et al. (1997), the choice of the exchange rate factor, or the choice of the market portfolio, as in Bodnar and Wong (2003).[2]

Apart from the debate on how to measure exposure, extensive literature has studied the question of how to explain it. Bodnar and Gentry (1993) emphasize the importance of a firm's industry characteristics, Griffin and Stulz (2001) the role of the competition framework, Allayannis and Ihrig (2001) the link with potential markups, whereas Allayannis and Ofek (2001) the importance of financial hedging through foreign currency derivatives. A recent study by Bartram et al. (2010) assesses several firm specific factors that could explain the exchange rate exposure puzzle. By order of importance, these variables are the firm's use of foreign debt, its use of foreign currency derivatives, pass-through to prices and operational hedging. The importance of the use of currency derivatives and foreign debt on a firm level inspires this essay to examine the role of the same factors on a country level. We believe that the role of such country factors is crucial, especially when tested on a large cross-section of both emerging and developed markets.

Even though most research has focused on developed market firms exposure, there exist some studies on emerging market firms as well. They

[2]For a complete survey with an overview of several measurement related issues, one may see Muller and Verschoor (2006).

often find a negative exposure of emerging firms to local depreciation, as is the case for Thailand in the study by Dominguez and Tesar (2006). Parsley and Popper (2006) show that the existence of an exchange rate peg does not reduce a country's exchange rate exposure. Country factors that have been proposed as exposure determinants, among others, are trade balance, as in Entorf et al. (2007) and an economy's openness, as in Hutson and Stevenson (2009). On a large cross-sectional sample of countries, Bartram and Bodnar (2009) provide evidence of a significant conditional return premium per unit of exposure, which is more important among emerging markets. They also find that the exchange rate impact on stock returns is more due to a cash flow effect, than a discount rate effect.

Inspired by empirical evidence that stock correlations within country are higher for emerging than for developed markets, Chue and Cook (2008) emphasize the importance of measuring total exposure at the national level. They, also, distinguish between the direct effect of exchange rate changes on firm stock returns and the effect of other macroeconomic shocks on both firm stock returns and exchange rates. Foreign debt on both firm and country levels, are among their most important explanatory factors. Nevertheless, they surprisingly find that their impact is not consistent across time, which could be due to non-controlling for other important country factors. Our study, hence, contributes on the debate, by proposing new country level factors that explain firms' total exposure. These include the relative degree of development of local bond markets and the aggregate use of foreign currency instruments in a country.

We use a large cross-section of firms from 37 countries, representing both emerging and developed economies. In the measurement stage of this study, we identify all firms' exposure and document several time varying and cross-sectional patterns. Among others, we find a reversal of sign in emerging

market firms exposure before and after the turbulent year of 1998.[3] In the exposure determinants stage of this study, we test the significance of new country specific variables, while allowing for differences between emerging and developed markets. There is evidence that higher financial market development allows all firms to decrease both their first and second moment exposures.

This essay is organized as follows. In the subsequent section, we present the data in some detail, by showing some descriptive statistics on our sample firms, the country specific, as well as the firm specific variables we use. Section 4.5 presents the exchange rate exposure measurement stage, with some summary statistics of our estimated exposure coefficients and their variation across time and countries. Section 4.6 refers to the identification of the main determinants of exchange rate exposure. In section 4.7, there are some concluding remarks.

4.4 Data

4.4.1 Selection of sample firms

In this study, we concentrate on firms that have an international orientation. By international orientation, one may think of multinational corporations, cross-listed companies, firms with high export ratios, firms with significant bond issues in foreign currency, or other parameters. The criterion we use in this study is to focus on firms which have an on-going American Depositary Receipt program.[4] Such firms are characterized by relatively easy access on international sources of financing (both debt and equity markets). They usually have presence in more countries than just their home market.

[3] This year corresponds to the aftermath of the Asian crisis and the turbulent period due to the Russian crisis.

[4] An American Depositary Receipt is a certificate traded in the US, which represents ownership in the ordinary shares of a non-US firm.

Furthermore, their obligation to report their financial statements in compliance with the SEC, offers a high degree of comparability with respect to accounting variables needed in the second stage of the essay.

This sample of firms is of particular interest in both axes of this study, on the measurement as well as the determinants stage of exchange rate exposure. In the measurement aspect, on one hand, ADR firms' international presence is documented by higher percentage of foreign sales with respect to their market average, thus probably higher exchange rate exposure than non-ADR firms. On the other hand, empirical work, such as Dominguez and Tesar (2006) find that firms which are more vulnerable to exposure, they actively hedge more. Therefore an open question is which between the two offsetting effects prevails? Is the observed exposure stable over time and among different countries?

The choice of firms with a depositary receipt program aligns as well with the second objective of the essay, which is analyzing new candidates as determinants of exposure, such as the use of foreign currency derivatives and foreign debt. ADR firms are known to be firms highly prone to use such financial instruments. This allows us to test the impact of the use of such tools on internationally oriented firms. We acknowledge that there is some US bias in the ADR firms' international orientation, but this does not reduce their exposure. There is also a selection bias issue, in the sense that our sample firms are not necessarily representative firms of each country's economy. For sure, our sample firms are among the biggest firms of each local market, but size could either have a positive effect on exposure (biggest firms are more internationally exposed) or a negative effect on exposure (biggest firms use more hedging instruments if there exist fixed costs in hedging). Therefore, the selection bias of our sample does not undermine the interest of examining our research objective of depicting the main determinants of exposure of such firms. On the contrary, it will give us more insight on the role of country

factors on explaining exposure among highly comparable firms within a large cross-section of countries.

The criterion we use in this study is to focus on firms which have an on-going American Depositary Receipt program in the beginning of 2008. This may exclude US and Canadian firms, it provides us though with a sufficiently large cross-section of countries represented by firms with international orientation.[5] The population of all firms satisfying our criterion consists of 1'129 firms from 56 countries.[6] We apply a country filter in order to eliminate firms from countries that have less than 5 active DR programs and thus eliminate firms from 18 countries. Firms from Ukraine as well as some firms from other countries represented in our sample are eliminated due to unavailability of local market stock data from Thomson Financial. We thus end up with a sample of 870 firms from 37 countries as shown in table (4.3). In the same table, one may see some summary statistics of the sample firms. For instance, it is confirmed that the average ADR firm is relatively big, with a high percentage of foreign sales, especially among developed countries. We use a time span of 15 years, from January 1994 until December 2008. The reason we begin in 1994 is due to the availability of crucial for the analysis country specific data, such as the trade-weighted exchange rates, from that year onwards.

All the country specific variables we use are presented in table (4.1). We hereafter explain their choice and what they proxy for, one by one.

[5]The absence of US firms introduces a possibility to use US market macroeconomic variables as instruments for our robustness estimation tests via the GMM method.

[6]We include all types of ADR firms traded either over the counter, or in one of the following three markets: American Stock Exchange, NASDAQ, or New York Stock Exchange.

4.4.2 Country specific variables

One important issue thoroughly examined in the exchange rate exposure literature is the choice of the exchange rate factor to be used in the estimations. Undoubtedly, an accurate measure used by Khoo (1994) would be to use a firm specific exchange rate that would weight each firm's proportion of foreign activities by currency, times the corresponding bilateral exchange rate.[7] Unfortunately, data disaggregated on this level was impossible to find for our sample firms. Another option would be to use for each firm's home market, the bilateral exchange rate of the country's main trading partner. Many studies use the US dollar bilateral exchange rate, since it is considered as a "global currency" and benchmark in such estimations. The disadvantage of this proxy is that it often neglects the exposure that firms face due to exchange rate changes of their local currency vis-a-vis non US dollar currencies. For an Argentinian firm for instance, which is a main importer from the USA, the Eurozone and Japan, its exposure would be correctly captured by this proxy, as long as at a given date, the peso devaluates with respect to all three currencies, US dollar, euro and yen. Using the bilateral US dollar exchange rate as a proxy would distort though the Argentinian firm's exposure, in case the peso depreciates only with respect to the US dollar, but appreciates with respect to the euro and the yen.

In this study we use the effective exchange rate, meaning a country specific trade related weighted average of bilateral exchange rates. The weights are derived from manufacturing trade flows. BIS provides data of time-varying country specific trade weights comprising 58 economies (potential trading partners). We use these weights in order to compute the arithmetic weighted

[7] The accuracy of this measure has been criticized by the fact that a firm is also exposed indirectly to currencies of zones where it may not be present, but either its competitors or its main inputs come from. Fraser and Pantzalis (2004) find evidence supporting this argument.

average of nominal weekly bilateral exchange rates.[8] We hence construct weekly effective exchange rates based on the time varying trade weights.[9] In the empirical estimations, we use continuous time changes of the effective exchange rates at date t, denoted by $ER_{m,t}$. The nominal effective exchange rate represents the weighted average value of a currency with respect to all currencies of its trade partners. By construction, an increase in our effective exchange rate corresponds to an appreciation of the domestic currency. The appreciation corresponds to higher domestic prices and relative cost, meaning a decrease in the country's international competitiveness.[10] Effective rates are used more generally in literature as measures of a country's competitiveness, or as components of financial condition indices.

In figure (4.1) we plot the effective exchange rates evolution among the 37 countries represented through the sample. For the purposes of the graph, we set the first week of 1994 as a base date. We present all countries in our sample by order of higher to lower effective exchange rate on 2/1/2009 (end date). Countries like Singapore, Japan and Switzerland are countries whose currency has gained most in value (with respect to the broad basket of currencies of their trading partners) since 1994, whereas Turkey, Venezuela and Indonesia are countries whose currency has lost in value the most. Another

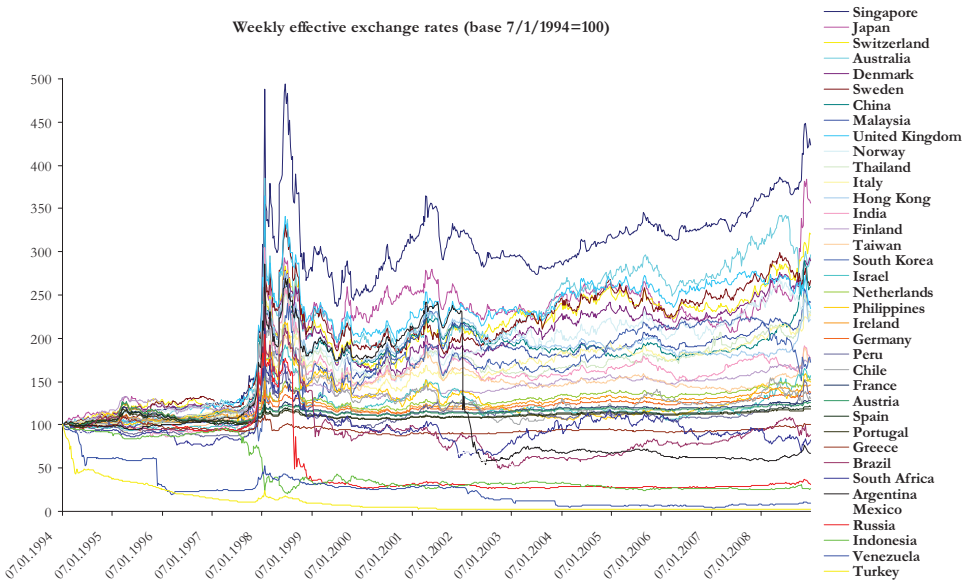
[8] Billateral nominal spot exchange rates of each currency with respect to the US dollar are provided by WM/Reuters and GTIS. We use them in order to compute the cross exchange rate of each country's currency with respect to all its trading partners. This latter, by construction, is defined in amounts of foreign currency per one unit of domestic currency.

[9] The time varying trade weights proposed by BIS are re-computed every three years. For a robustness test, we alternatively compute weekly effective exchange rates using exclusively the most recent weights published for 2005-2007. The correlation between the two types of exchange rate series is higher than 0.98 for all countries.

[10] Of course, such deterioration, as Turner and Van't Dack (1993) point out, would be a "symptom of success, not of failure", since appreciation was probably due to successful and innovative economic performance in the first place. Once the appreciation takes place though, the country becomes relatively more expensive internationally and hence less competitive.

interesting observation is that there seems to be periods of increased volatility in effective exchange rates, such as around the year 1998 and the Russian crisis. This is an indication that we should control for heteroscedasticity in our estimations. Furthermore, there is indication that it could be interesting to consider two proxies for exchange rate exposure. One concerning its first moment and another one related to its second moment. This is what we do in the subsequent empirical specifications.

Figure 4.1: Evolution of weekly effective exchange rates across countries



There are two clarifications to be made about our use of nominal effective exchange rates. First, Miller and Reuer (1998) point out that the use of a trade-weighted exchange rate factor leads to an underestimation of the true exchange rate exposure of a firm. The reason is that such indices tend to average out competitive effects resulting from bilateral exchange rate shocks.

This bias would tend to undermine the significance of our results, meaning that our results are quite conservative and would be stronger without it.[11]. The second issue to clarify is that the use of nominal, instead of real, exchange rates is common in this strand of literature, as suggested by Bodnar and Gentry (1993) for two reasons: first because financial markets do not observe inflation and therefore investors first incorporate the impact of nominal exchange rate changes on stock prices; second, inflation differentials vary very little with respect to exchange rate changes, therefore the use of real rates has a negligible effect on exposure estimates.

Among the most important country specific variables of this study are the variables proxying for the aggregate use of foreign exchange instruments in each country. The BIS coordinates a global central bank survey of foreign exchange and derivatives market activity every three years and the results are published in the Triennial Central Bank Survey. The objective of the survey is to provide "comprehensive and internationally consistent information" on turnover and amounts of contracts outstanding around several countries. We are able to collect such data from 1994 for our 20 developed markets and from 1996 for most of our emerging markets.[12] The incovenience with this dataset is that it is only available in a three-annual frequency. We choose to interpolate linearly the missing yearly observations in order to complete our dataset.[13]

[11] In a certain way, it also balances out the bias created by the sample firms selection, which tend to have high degree of international orientation and probably high degree of exposure with respect to their market average.

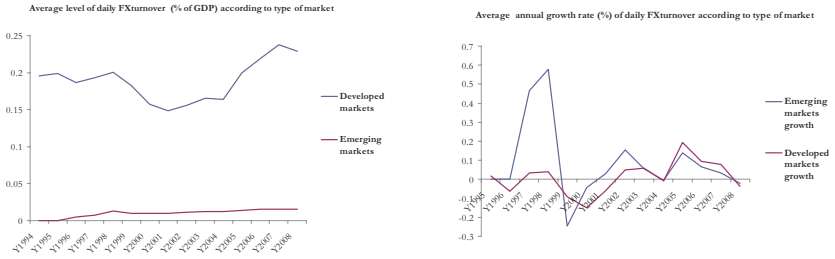
[12] There is no such data at all for Venezuela, whereas for Israel, Peru and Turkey such data is only available since 1999. We would like to thank Carlos Mallo from the BIS for providing us with the electronic data of the Triennial Surveys published in 1995, 1998, 2001, 2004 and 2007.

[13] In order to feel more comfortable about the robustness of our intrapolation we collect annual foreign exchange derivatives (including a broader range of derivatives instruments) data from BIS available for 13 strong currencies. We compare them with our constructed indices for the same thirteen strong currencies and all correlations are significant and high.

The four variables we obtain from the BIS global central bank survey for each country are i) the total foreign exchange turnover ii) the outright forward foreign exchange turnover iii) the foreign exchange swap turnover and iv) the spot foreign exchange turnover. All four variables are measured as daily averages in US dollars. For comparability purposes, we normalize the proxy for each country and divide it by the US dollar denominated Gross Domestic Product at PPP (Purchasing Power Parity) prices. This measure of GDP is available through Thomson Datastream. We thus denote our four variables by FXturnover, FXforward, FXswap and FXspot respectively.

In figure (4.2), one may notice the average evolution of FXturnover between 1994 and 2008, between developed and emerging market firms represented in our sample. It is noteworthy that the use of foreign currency instruments is on average significantly higher in developed markets. For instance the average FXturnover in all developed markets is around 18% in 2008, compared to a slight 1% in emerging markets. When we compute its annual growth rate, though, this is around 10% in emerging markets compared to an only 1% among developed markets over the same time span. This shows that the gap of use is diminishing between the two types of market. Finally, we notice that there is significant time series variation in the FXturnover variable, which differs from one country to the other. This shows that in the stage of explaining exposure, a panel data analysis could be more adequate than cross-sectional analyses used so far in literature examining the impact of other country variables.

Figure 4.2: Evolution of FXturnover variable across types of market



A general issue which may particularly influence exchange rate exposure is the degree of financial development of a market. The question to be examined is how does increasing financial development affect exposure? We hence need proxies for a country's financial development. Apart from foreign currency instruments presented above, we use two other variables for a more complete coverage of that research question. The Bank of International Settlements publishes in a quarterly frequency data on the outstanding amounts of domestic debt securities, as well as on the outstanding amounts of international bonds and notes. This data can be found disaggregated by the residence of the issuer. One expects that the more a financial market becomes sophisticated, the more its domestic bond market will be large relatively to its foreign debt alternatives. We thus compute the ratio IntDebt as the ratio between international over domestic bonds in a given country. The lower this ratio is, the higher the degree of the country's financial development should be. Another proxy we use is the total amount of domestic credit as provided by the IMF International Financial Statistics (in an annual frequency) divided by the GDP of each country. We denote this variable by DomCredit and the higher it is, the more a country's financial markets are

mature.

It is the case that we do not have access to data for foreign debt on a firm level, we do account, though, for external debt on a country level. Chue and Cook (2008) emphasize the relevance of a country's external debt, even though its impact on exposure inverses sign in their two sub periods. In this work we test whether this is still the case in our sample, or if the fact that we also account for financial development and use of foreign currency derivatives alters the results. The proxy for net foreign debt as a percentage of GDP is available through Thomson Datastream (in an annual frequency) and is constructed by the Economist Intelligence Unit. We denote it by FXdebt.

We also include some variables related to the balance of payments of each country. The first such variable is the current account (CA) balance as a percentage of GDP. Other two variables are a country's total exports and imports of goods and services, as a percentage of GDP. All these variables are available through Thomson Datastream (in an annual frequency) and are constructed by the Economist Intelligence Unit. Hutson and Stevenson (2009) confirm that openness as measured by the sum of exports and imports as percentages of GDP are important determinants of exposure. As a result we define such a variable and denote it by Openness. Finally, we use a proxy for a government's ability to stabilize its currency, which is more relevant for emerging markets. We denote it by FXreserves and we define it as the foreign exchange reserves variable provided by Thomson Datastream, divided by the GDP at PPP.

4.4.3 Firm specific variables

All the firm specific variables we use are presented in table (4.2). Firm accounting variables are available through Worldscope and Thomson One Banker. Among the most relevant firm specific variables to be considered are foreign sales. In Worldscope's definition, a firm's foreign sales percentage

corresponds to its sales by foreign affiliates divided by its total sales. We denote this variable by Fsales. We also collect firm's leverage ratio, defined as the ratio of total debt over total assets. We collect data on each firm's market capitalization as a proxy for size, data on dividend yield as a proxy for profitability and also data on volume as a proxy for liquidity.

In order to take into account the type of industry in which a firm operates, we form six dummy variables according to the six types proposed in Worldscope's general industry classification code. These six types are industrials, utilities, transportation, banks, insurances and other financials. Even though the purpose of this study is to focus on the firm as well as the country factors explaining exchange rate exposure, extensive literature suggests that one needs to control for the firm's industry dimension as well. Finally, we use a dummy whether a firm's home country is an emerging market or a developed one. We follow the MSCI Barra classification as of 2008 and thus end up with 17 emerging markets and 20 developed ones.[14] This is of particular interest in our tests, since our large cross-section of countries allows us to reveal differences in the determinants of exposure between the two types of markets.

4.5 Measuring exchange rate exposure

There are two approaches in measuring a firm's exchange rate exposure. The first is based on accounting variables and the second on studying the sensitivity of a firm's stock returns with respect to exchange rate changes. We focus on this second approach which unavoidably assumes a high degree of financial markets efficiency. In two seminal studies in this strand of liter-

[14]The classification we use is presented in table (4.3). There were three countries, Argentina, Israel and South Korea for which the classification was ambiguous. Since we do not consider any intermediate "frontier" type of market, after comparing with other sources' classifications and in order to split the bias, we decide to consider Argentina and Israel as emerging and South Korea as a developed market.

ature, Adler and Dumas (1984) and Jorion (1990) define the concepts of a firm's total and marginal exchange rate exposure, respectively. They propose regressing the firm's stock return on exchange rate changes (total exposure), or regressing the firm's stock return on both exchange rate changes and the stock market return (marginal exposure after controlling for the market factor), respectively. Since then, there has been extensive literature proposing several refinements in these two estimation methods.[15]

In this study, the fact that sample firms come from very heterogeneous countries suggests that we opt for a measure of total exposure. Studies that focus on emerging markets as the one by Chue and Cook (2008), suggest that exposure estimates should reflect how firm returns are affected by exchange rate fluctuations, not just how they perform relative to their national market. This is particularly important here as well, where the research objective in the second part is to test the importance of country specific determinants of exposure. If we use a measure of marginal exposure, we would neutralize any country specific effects on our estimates. Furthermore, in order to compare the absolute magnitude of firm exposure for the 37 countries in our sample, it is better to obtain total exposure estimates.

On the other hand, using a total exposure model that just regresses firms' returns on exchange rate changes may lead to largely overestimated exposure estimates. The reason is that there often exist other macroeconomic variables that simultaneously covary with both exchange rates and stock returns. The need is to control at least for some market factor, without creating multicollinearity problems among the regressors. We thus follow Bris et al. (2004) two steps estimation of exchange rate exposure, while augmenting their model by adding a variable in the second stage in order to capture both first moment and second moment exposure. In the first step of the estimation, we regress the country's m stock market returns $R_{m,t}$ at date t, on the

[15] One may see Muller and Verschoor (2006) for a thorough literature review.

exchange rate changes $ER_{m,t}$ as follows:

$$R_{m,t} = \gamma_{0,m} + \gamma_{1,m} \cdot ER_{m,t} + \varepsilon_{m,t} \tag{4.1}$$

The coefficient $\gamma_{1,m}$ corresponds to the country's m overall exposure as a whole. For the stock market return we use an equally weighted market portfolio index, since Bodnar and Wong (2003) and Pritamani et al. (2004) suggest that value weighted portfolios overestimate exposure due to the overloading of large and more exposed firms. In the second step, we use the residuals of specification (4.1), in other words the component of a country's market return which is orthogonal to its effective exchange rate change and estimate the following model:

$$R_{i,t} = \beta_{0,i} + \beta_{1,i}\widehat{\varepsilon}_{m,t} + \beta_{2,i}ER_{m,t} + \beta_{3,i}\,|ER_{m,t}| + u_{i,t} \tag{4.2}$$

where the dependent variable $R_{i,t}$ is the firm's i stock return at date t. On the right hand side, $\widehat{\varepsilon}_{m,t}$ is the part of market returns of country m unexplained by exchange rate fluctuations from equation (4.1), $ER_{m,t}$ and $|ER_{m,t}|$ are the effective exchange rate changes of country m, and their absolute value, respectively. The coefficient $\beta_{2,i}$ corresponds to firm's i exchange rate exposure. A negative sign for $\beta_{2,i}$ means that as the effective exchange rate increases and thus (by construction) the country's local currency appreciates, then the firm's value decreases. This is typically the case for export oriented firms, among others. The coefficient $\beta_{3,i}$ is proposed by Griffin and Stulz (2001) and Koutmos and Martin (2003) and corresponds to the firm's i exposure with respect to a proxy for the volatility (second moment) of the exchange rate. A negative sign for $\beta_{3,i}$ means that the more volatile the exchange rate becomes, the less the firm is worth.

It is important to note that the coefficient $\beta_{2,i}$ reflects both the direct and indirect exposure of firm i. The indirect effect is due to the interaction between the market's exchange rate exposure $\gamma_{1,m}$ and the firm's sensitivity

with respect to market movements that are due to exchange rate fluctuations. The regressor $\widehat{\varepsilon}_{m,t}$ does not include market movements that are related to exchange rate fluctuations and as a result, they are all captured in our firm exposure estimates. This is why this method provides us with total exposure estimates as needed by our research questions. The same holds for the second moment exchange rate exposure $\beta_{3,i}$.

One should not see equation (4.2) neither as an asset pricing model, nor as a test of whether exchange rate risk is remunerated. We only need to isolate the relationship between exchange rates and firm value. By choosing an effective exchange rate $ER_{m,t}$, one may claim that the exposure estimate is broader than a strictly bilateral exchange rate sensitivity. One may think of such a measure, as an exposure with respect to a country's international competitiveness, which could be affected by several country specific variables to be tested in the second part.

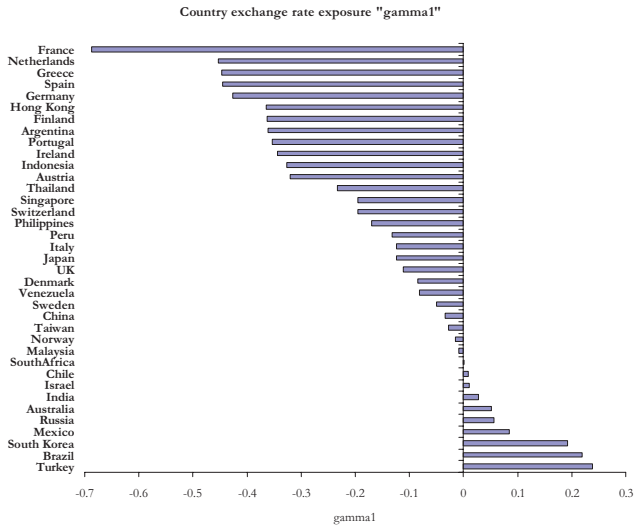
We use weekly frequency for our estimations. There is empirical evidence, as in Bartov and Bodnar (1994), Chow et al. (1997), or Dominguez and Tesar (2006), that exposure estimates are increasing in the return horizon used. By choosing weekly frequency, there is a possible under-estimation bias for our estimates, but this only makes the results appear more conservative. We do not use rolling windows in the estimations and thus do not have any serious serial correlation bias. We are suspicious of the presence of heteroscedasticity and thus use the White corrected covariance matrix.

The results of equation (4.1) estimation by country are presented in table (4.4). We notice that slightly more than half of the estimated country exposures $\widehat{\gamma}_{1,m}$ are significant.[16] A strong result is that among all the significant

[16]Studies using alternative specifications, where exposure is estimated in one step, as in Chue and Cook (2008), show that GMM estimation provides more robust estimates, since it takes out the effect of country-level macroeconomic shocks. In their case, ordinary least squares estimates overestimate exposure. Even though in our two-step estimation, we do account for non exchange rate related country level macroeconomic shocks through the

country exposures, about 90% are negative. This shows that there is a strong negative relationship on average between a country's currency value and its market returns. This is in line with the idea that following a currency appreciation, a country's economy becomes relatively less competitive. In terms of magnitude of exposure, figure (4.3) presents the values of estimated $\widehat{\gamma}_{1,m}$ (gamma1) by country, starting from the most negative (France) and ending with the most positive (Turkey).

Figure 4.3: Gamma1 estimations



In the second step, we estimate equation (4.2) and obtain the proxies for

inclusion of the $\widehat{\varepsilon}_{m,t}$ variable, we perform GMM estimations as a robustness test for our country exposures $\gamma_{1,m}$. For this purpose we use global and US specific macro variables as instruments. These include the stock return of a worldwide market index, the effective exchange rate for US and the risk free rate in the US. By using Hansen's J-statistic, we reject the hypothesis of mis-specification and endogeneity of these instruments. The results are almost unchanged with a 54% of countries with significant $\widehat{\gamma}_{1,m}$ (compared to 57% with generalized least squares) and 80% of those significant that are negative (compared to 90% with generalized least squares). Since the relevance of global instruments can be criticized, we only present hereafter the results based on generalized least squares estimations.

firm specific first moment and second moment exchange rate exposures, $\widehat{\beta}_{2,i}$ and $\widehat{\beta}_{3,i}$ respectively. In order to get a better idea of the estimated betas, we present in table (4.5) the results of pooled estimations over all countries. Summarizing the main points, apart from the proxy for the market factor $\widehat{\beta}_{1,i}$ which is positive (as expected), the two exchange rate exposure betas are significantly negative on average across our whole sample. The firm's exposure $\widehat{\beta}_{1,i}$ with respect to the non-exchange rate related market variations is high, around 0.94. The sample representative firm's "traditional" first moment exchange rate exposure $\widehat{\beta}_{2,i}$ is about equal to -0.09. This means that on average, an appreciation of the effective exchange rate by 1% leads to a decrease in a firm's returns by 0.09%. The firm's second moment exposure $\widehat{\beta}_{3,i}$ is about equal to -0.2, meaning that, on average, an increase in the effective exchange rate volatility, decreases firms' returns. Pooling estimations from such a large sample may hide some aggregation bias, we hence try to refine the global picture of estimated betas by supplementary tests.

In an attempt to identify different trends between developed and emerging markets, we estimate equation (4.2) separately for developed and emerging market firms. We find indeed that over the whole sample the sign of exchange rate exposure $\widehat{\beta}_{2,i}$ is negative only for developed market firms, whereas it is significantly positive for emerging market firms. This means that internationally oriented emerging market firms benefit on average from appreciations of their local currency. In addition, second moment exposure appears significant only for developed market firms.

Inspired by the apparent more volatile effective exchange rates since 1998, as shown in figure (4.1), we perform the same estimations in two subsamples. The first subsample is between 1994 and 1997, whereas the second begins in 1998 and ends in 2008.[17] The first interesting result is that, when considering

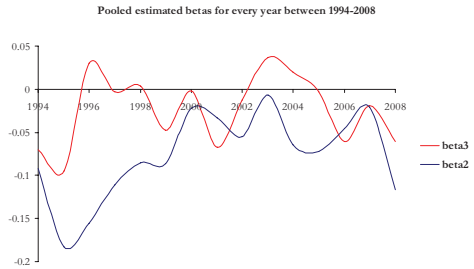
[17]We perform robusteness tests running the same estimations on more than these two time sub-samples. The results are quite stable within these two sub-periods.

separately the exposure with respect to exchange rate volatility $\widehat{\beta}_{3,i}$ of developed or emerging market firms, none is significant until 1997. Since 1998, though, developed markets are significantly negatively affected by increases in such volatility. A second noteworthy result is that the exchange rate exposure $\widehat{\beta}_{2,i}$ of emerging market firms reverses sign in the two sub-periods. Until 1997, emerging market firms are negatively affected by exchange rate appreciations, whereas the prevailing result on our overall sample is valid only since 1998 onwards. This could be related to Chambet et al (2008) evidence that shocks may occur on emerging markets' degree of integration during financial crises.

In tables (4.6) and (4.7), we present some summary statistics by country, with respect to the estimated exposures $\widehat{\beta}_{2,i}$ and $\widehat{\beta}_{3,i}$, respectively. We notice that nearly half of the estimated firm first moment exposures are significant, which is a rather high percentage compared to previous literature. The percentage of negative $\widehat{\beta}_{2,i}$'s is higher among developed markets, while the same holds for negative $\widehat{\beta}_{3,i}$'s. The average levels of significance are higher for the $\widehat{\beta}_{2,i}$ (beta2) coefficients than for $\widehat{\beta}_{3,i}$ (beta3). This could be also due to the changes in these measures occurred from 1998 onwards.

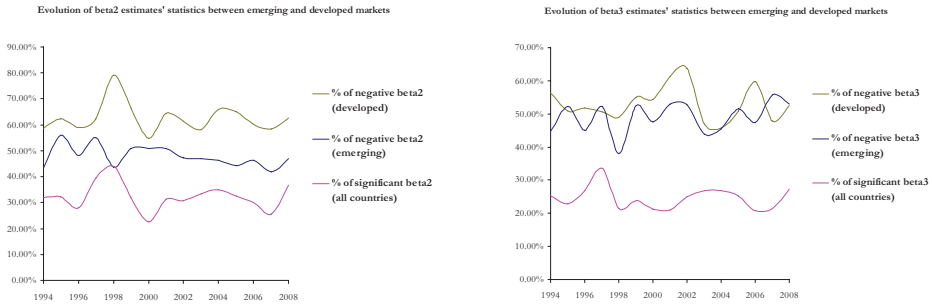
Due to the observed significant cross-sectional, as well as time series variation of our estimates, we perform separate pooling estimations over each calendar year (52 weekly observations) and obtain firm specific beta coefficients per year. We thus obtain, between 1994 and 2008, 15 yearly beta estimated coefficients for each firm. Figure (4.4) illustrates the evolution of our pooled yearly $\widehat{\beta}_{2,i}$ and $\widehat{\beta}_{3,i}$ coefficients. We observe that our first moment exchange rate exposure remains negative during all 15 years and does not oscillate outside the range of -0.2 and 0.

Figure 4.4: Evolution of pooled beta estimates across time



Additionally, we present some time varying statistics on the evolution of the number of firms with negative exposure estimates. Figure (4.5) shows that the number of negative first moment exposures remains higher in developed than emerging markets, during the whole time span. The two types of markets exhibit a similar percentage of negative second moment exposure across time, however its significant ratio is much lower. The time varying as well as cross-sectional characteristics of our beta estimates leads us to use panel data estimations in the subsequent part of the estimation, where the goal is to identify their main determinants.

Figure 4.5: Evolution of beta2 and beta3 estimates statistics across time



4.6 Explaining exchange rate exposure

In this part of our study, we explain the estimated levels of exchange rate exposure of equation (4.2) through firm specific and country specific variables, after controlling for the industry level of each firm as well. The relevance of firm specific accounting variables is straightforward, since they are related to the definition and the origins of exposure. The relevance of industry specific variables is emphasized by extensive literature, though it is not of central interest in this study.

The relevance of country specific variables is explained as follows. Let's focus on the impact of using the residuals of equation (4.1) in order to control for a market factor that influences firm returns in equation (4.2). Can it make country factors seem independent with respect to exchange rate exposure $\beta_{2,i}$ or $\beta_{3,i}$? This is not true for the following reason. The regressor $\widehat{\varepsilon}_{m,t}$ only includes market fluctuations that are orthogonal to exchange rate fluctuations. Hence, it does not include market movements that are related to exchange rate fluctuations. These latter are thus all captured in our $\beta_{2,i}$ and $\beta_{3,i}$. The use of a broad effective exchange rate, which measures a country's international competitiveness and is often used as a component of financial condition indices, exhibits a non zero correlation with most of the country variables considered hereafter. In such a way, our estimates of firms' total exposure could as well be explained by country specific variables.

Country factors could impact firms' total exposure either through a direct channel or through an indirect one. The indirect channel refers to the interaction between the market's exchange rate exposure $\gamma_{1,m}$ and the firm's sensitivity with respect to market movements related to exchange rate fluctuations. The direct channel refers to the direct impact of exchange rate fluctuations on firm value. This could be significant in our case, because of the particular nature of the sample firms which exhibit high international

orientation with respect to their market average.

4.6.1 Explaining first moment exposure

In order to identify the impact of several factors on firms's i first moment exchange rate exposure, we estimate the following model:

$$\widehat{\beta}_{2,i,t} = \alpha_{0,j} + \alpha_1 X_{i,t} + \alpha_2 \Psi_{m,t} + \eta_{i,t} \tag{4.3}$$

where $\widehat{\beta}_{2,i,t}$ is the estimated annual firm specific first moment exchange rate exposure. On the right hand side, $X_{i,t}$ represents a vector of firm i specific variables, $\Psi_{m,t}$ is a vector of country specific variables and the constant $\alpha_{0,j}$ is industry j specific. Our panel data consists of 870 cross-sectional firm observations across 15 years, between 1994 and 2008. We use annual data for our pooled generalized least squares estimations, correcting for heteroscedasticity, and the firm is used as the cross-sectional identity. There is an issue with a bias introduced in the standard errors due to the use of an estimated variable as the dependent variable. As a test of robustness, we weight each observation with the inverse of the standard error of the estimated $\widehat{\beta}_2$ coefficient from equation (4.2). Alternative specifications that we test for robustness include using only the significant $\widehat{\beta}_2$ coefficients from equation (4.2), or using the t-stats of $\widehat{\beta}_2$ from equation (4.2), instead of the coefficients themselves. In these alternative specifications, the sign and magnitude of the impact of the main determinants remain the same, thus such results are not presented in the tables.

The main results concerning the determinants of first moment exchange rate exposure are presented in table (4.8). Panel I presents some results on all the raw first moment exposures $\widehat{\beta}_2$. These results though are often hard to interpret without, either examining the impact of factors on the magnitude of exposure $\left|\widehat{\beta}_2\right|$, as in panel II, or separating firms with positive and negative betas, as in panel III.

Consequently, apart from the impact of several variables on the sign of exposure, panel II examines the impact of such variables on the magnitude of exposure. For this reason, we test the determinants of a measure of the absolute value of exchange rate exposure $\left|\widehat{\beta}_2\right|$ in columns D, E and F of table (4.8). In reality, as in Dominguez and Tesar (2006) and Hutson and Stevenson (2009), we use as the dependent variable the square root of the absolute value of the $\widehat{\beta}_2$ exposure coefficient. The reason for this is that by simply taking the absolute value, we create a bias since the error term is not normal. We thus correct for that, by using a monotonic transformation of the absolute value of $\widehat{\beta}_2$, without altering our determinants' impact direction.

Columns G and H of table (4.8) estimate equation (4.3) on two separate subsamples. The first one includes firm observations with negative exposure estimates $\widehat{\beta}_2$, while the second includes firm observations with positive exposures. Due to our definition of the exchange rate, negative exposures can be a feature, among others, of a firm's export orientation, whereas negative exposure, that of a firm's import orientation. Similar specifications have been used in previous literature, as by He and Ng (1998) and Pritamani et al. (2004), in order to interpret easier the sign of the impact of different determinants. Due to the fact that most of our emerging market firms exhibit positive exposures, over-identification problems prevent us from estimating disaggregated columns G and H for emerging and developed markets.

As far as firm specific variables are concerned, we notice that firms with higher foreign sales are more likely to have a low, or even negative exposure $\widehat{\beta}_2$. This means that they tend to be negatively affected by their domestic currency's appreciation. In terms of magnitude of exposure, foreign sales significantly increase exposure only among developed market firms. This means that for developed market firms, foreign sales are not the result of an operational hedging strategy. Panel III goes one step further and shows that foreign sales make firms with inherently negative exposure to be more

sensitive to exchange rate changes in both developed and emerging market firms. The same holds for developed market firms that have an inherent positive exposure $\widehat{\beta}_2$. The only case where foreign sales appear to play a hedging role and decrease exposure is among emerging market firms with an inherent positive exposure $\widehat{\beta}_2 > 0$.

In relation to firms' size, big firms tend to be negatively affected by their domestic currency's appreciation in developed markets (column B), whereas the same effect is positive for big firms in emerging markets (column C). On the other hand, big size appears to increase exposure in absolute terms in all types of market (columns D,E and F). This rejects the hypothesis that there are important fixed costs in hedging that allow only to large firms to use relevant hedging tools. When we consider separate estimations according to the sign of the dependent variable $\widehat{\beta}_2$, we confirm that exposure becomes more negative for already negatively exposed firms, whereas exposure becomes more positive for inherently positively exposed firms. One may note that the overall positive effect of size in column C is related to the fact that, as we showed in the measurement section, the majority of emerging market firms have positive first moment exposures.

Total leverage is another firm level variable that is tested in table (4.8) and shows a similar pattern with the impact of size. In the case of developed markets, more indebted firms appear to be negatively affected by domestic currency appreciations, whereas this is the case for less indebted firms in emerging markets. The fact that high leveraged firms in emerging markets are negatively affected by domestic currency depreciations, is probably due to the significant use of foreign debt, as documented in previous studies. On absolute terms, leverage seems to increase exposure, in a significant way in emerging markets. This indicates that total leverage is positively correlated with foreign debt use among emerging market firms. The increasing impact on inherent exposure is confirmed by columns G and H, where negatively ex-

posed firms are negatively affected and positively exposed firms are positively affected.

In terms of profitability, as measured by the dividend yield proxy, we find evidence that more profitable firms tend to be more positively affected by domestic currency appreciations. On average, this results on a decrease in the magnitude of exposure, particularly for developed market firms, which exhibit in their majority negative exposures. As a matter of fact, the decreasing impact on inherent exposure is confirmed in columns G and H, for both export oriented (with $\widehat{\beta}_2 < 0$ that becomes more less negative) and import oriented firms (with $\widehat{\beta}_2 > 0$ that becomes less positive).

As far as country specific variables are concerned, we first notice the significant impact of the aggregate use of currency derivatives, such as forwards and currency swaps, measured by "FXtools". The higher aggregate use of foreign exchange instruments in a country leads to a reduction of exposure in absolute terms for all types of market. The results of columns D, E and F reveal that exposure decreases in all markets, with particular economic significance among emerging market firms. Results are robust in columns G and H showing that exposure becomes less negative for already negatively exposed firms, whereas exposure becomes less positive for inherently positively exposed firms. In addition, raw results of columns A, B and C are in alignment with the fact that developed market firms have in majority negative exposure, and emerging firms positive exposure. A side result not reported in the table is that when we replace these derivatives level of use proxies by their annual growth rate, there is evidence that an increase in their growth rate reduces emerging market firms exposure $\widehat{\beta}_2$. These results actually show that derivatives markets help internationally oriented firms to decrease their exposure, particularly for emerging markets, where the results are of high economic importance. In this case, our sample firms mostly use foreign exchange instrument markets for hedging purposes and not for spec-

ulation. The impact of these markets on decreasing firm exposure is high among all firms.

A similar result holds with respect to a market's financial development as measured by the inverse of "IntDebt". The more domestic financial markets develop, the less the exchange rate exposure $\widehat{\beta}_2$ becomes in absolute terms, for all firms. The result is less economically significant, though, for emerging market firms. This finding shows that financial development and more specifically the development of domestic bond markets has a more pronounced negative impact on the magnitude of developed market firms' exposure than emerging market firms' exposure. This could be due to the fact that local bond market are still relatively shallow in emerging markets and thus affect less exposure. Results are robust in columns G and H showing that in shallow financial markets exposure becomes more negative for already negatively exposed firms, and more positive for inherently positively exposed firms.

Finally, table (4.8) finds evidence of significant negative impact of a country's current account on the firm's raw exposure $\widehat{\beta}_2$. This means that the more a country's trade balance improves or net income from abroad increases, the more its firms will tend to be negatively affected by their domestic currency's appreciation. This is intuitive, since current account in this case captures a country's net export orientation or net flow of foreign income. The impact of current surpluses is robust in column G, whereas the positive sign of column H is only due to the developed market firms with inherent positive exposure. In order to test the impact on the magnitude of exposure in columns D, E and F, we consider the absolute value of a country's current account, representing thus its size or imbalance. We find that current account absolute size (either deficit or surplus) increases firms' absolute exposure.

In all estimations presented in table (4.8), we include an industry specific constant, due to the need to control for a firm's nature of activities. They are all significant, but we do not observe a significant difference or pattern among

industries. In order to assess the relative importance of firm, industry and country level determinants of exposure, we compute the average distribution of R^2 by level of variables. Firm specific variables remain on average the most important ones, accounting for about 55% of the adjusted R^2. Industry level variables account for about 15%, whereas country level variables are responsible for about 30% of our adjusted R^2. For this reason, we claim that country specific variables are important in explaining firms' exchange rate exposure.

4.6.2 Explaining second moment exposure

Apart from the traditional exchange rate exposure coefficient $\widehat{\beta}_2$, we explain the estimated levels of the firm's exposure with respect to the volatility of the exchange rate $\widehat{\beta}_3$ of equation (4.2) through firm specific and country specific variables.

$$\widehat{\beta}_{3,i,t} = \delta_{0,j} + \delta_1 X_{i,t} + \delta_2 \Psi_{m,t} + \theta_{i,t} \tag{4.4}$$

where $\widehat{\beta}_{3,i,t}$ is the estimated annual firm specific second moment exchange rate exposure. On the right hand side, $X_{i,t}$ represents a vector of firm i specific variables, $\Psi_{m,t}$ is a vector of country specific variables and the constant $\alpha_{0,j}$ is industry j specific. We thus test the same explanatory variables as when explaining $\widehat{\beta}_2$.

One may see the main results concerning the determinants of second moment exchange rate exposure in table (4.9). Panel I presents some results on all the raw first moment exposures $\widehat{\beta}_3$. As in the previous subsection, panel II examines the impact of factors on the magnitude of exposure $\left|\widehat{\beta}_3\right|$. Panel III separates firms on two separate subsamples. The first one includes firm observations with negative volatility exposure estimates $\widehat{\beta}_3$, while the second includes firm observations with positive exposures.

As far as firm specific variables are concerned, we notice that developed

firms with higher foreign sales are more likely to have a low, or even negative exposure $\widehat{\beta}_3$. This means that they tend to be negatively affected by an increase in their domestic currency's volatility. The opposite holds for emerging market firms. In terms of magnitude of exposure, foreign sales significantly increase second moment exposure among all firms, as it was the case for first moment exposure. This means that for developed market firms, foreign sales are not the result of an operational hedging strategy. The result is confirmed as well in columns G and H, where foreign sales have a negative impact on already negative second moment exposures and a positive impact on already positive exposures.

Similar to the case of first moment exposure, firm's size seems to increase absolute second moment exposure for firms in all types of market (columns D, E and F), for firms with negative volatility exposure (column G), as well as for firms with positive volatility exposure (column H). We also find that leverage may not significantly increase absolute second moment exposure of firms in emerging markets, however it increases exposure for firms with positive and negative volatility exposure. This indicates again that total leverage is probably highly correlated with foreign debt use, which in turn increases volatility exposure. On the other hand, more profitable firms manage to reduce second moment exposure, with the exception of firms with negative volatility exposure (column G).

Among the country specific variables of table (4.9), it is noteworthy that the aggregate use of foreign exchange instruments (forwards and currency swaps) significantly decreases second moment exposure among both developed and emerging market firms. The decrease in exposure is particularly economic significant among emerging market firms. Results are robust in columns G and H, showing that in countries with high use of forwards and currency swaps, exposure becomes less negative for negatively exposed firms, whereas exposure becomes less positive for inherently positively exposed

firms. As a matter of fact, this shows that firms use currency derivatives markets to hedge not only against specific directional moves of the exchange rate, but also hedge against exchange rate volatility. These results actually show that derivatives markets are mostly used as a hedge for exchange rate volatility in both developed and emerging markets. When we replace the "FXtools" by "FXturnover" which comprises all spot transaction volume, the impact on volatility exposure becomes positive. This means that spot transactions tend to increase exposure, in contrast to currency derivatives linked transactions. Another side result not reported in the table is that when we replace the level of derivatives use proxies by their annual growth rate, there is evidence that an increase in their growth rate reduces emerging market firms exposure $\widehat{\beta}_3$.

The results on financial development (as proxied by the inverse of "Int-Debt") are also in the same direction. The more domestic financial markets develop, the less the volatility exposure $\widehat{\beta}_3$ becomes in absolute terms, for all firms. The result is less economically significant, though, for emerging market firms. This reveals that the development of domestic bond markets has a more pronounced negative impact on the magnitude of developed market firms' exposure than emerging market firms' exposure. This could be due once again to the fact that local bond markets are still relatively shallow in emerging markets and thus affect less exposure. Results are robust in columns G and H, showing that in shallow financial markets, volatility exposure becomes more negative for already negatively exposed firms, and more positive for inherently positively exposed firms.

As far as a country's current account is concerned, it has a clearly positive impact on the firm's volatility exposure $\widehat{\beta}_3$. This means that the more a country's trade balance or net income from abroad increases, the more its firms will tend to positively affected by their domestic currency's increase in volatility. In addition, the more a country's current account is balanced, the

less its firms are affected by their domestic currency's volatility fluctuations.

In relation to both first and second moment exposures, we perform several robustness tests, not presented in the tables. For instance, we control for other variables that either appear less economically significant, or are highly correlated with some of our regressors and are thus excluded to avoid multicollinearity. An example includes a firm specific measure of liquidity, which appears to slightly increase first moment exposure, but without any significant impact. Some country variables that are tested include a country's "Openness", which significantly increases absolute exposure, but is highly correlated with "FXtools" and is thus excluded. The role of a country's external debt through "FXdebt" appears to significantly increase both first and second order exposure. We do not include it in the estimations due to multicollinearity issues that arise when we combine it with the other three country variables used.

We finally perform a robustness test where we use country wide portfolios and test the equations (4.3) and (4.4), while using the country as the cross-sectional identity. We construct such portfolios by computing the equally weighted beta2 and beta3 estimates for every country per year. For each firm specific accounting variable, we compute the equally weighted averages of all firms from the same country in a given year. We thus end up with a panel data with 37 cross sections (countries) and 15 yearly observations. The results are not reported here, since the importance and sign of the impact of country variables remain the same as the ones presented above.

4.7 Conclusions

This study sheds light on two axes related to the exchange rate exposure of internationally oriented firms. On the first axis, by using a large panel data of firms, we measure and document significant variations in firms' first

and second moment exchange rate exposure across time, as well as among countries. Developed market firms are on average negatively affected by domestic effective exchange rate appreciations. Emerging market firms' exposure reverses sign during our time span and such firms now exhibit on average positive returns when their country's currency appreciate.

On the second axis, we find new country specific factors that serve as channels of the observed exposures, after accounting for what literature proposes as firm and industry level determinants. We quantify the importance of these new country factors as powerful to explain about 30% of observed first and second moment exposure variability. The country's aggregate use of foreign currency instruments, such as currency derivatives, decreases the first moment exposure for all firms, and the impact on emerging markets is particularly important. The degree of a country's domestic corporate bond market development also decreases both first and second moment exposures of firms in all types of markets, with higher economic significance in the developed world.

In summary, the country factors used in this study are important in explaining the variations of observed first and second moment exchange rate exposures at the firm level. Firms seem to use currency derivatives markets and benefit from the country's level of financial sophistication in order to decrease both their first and second moment exposures. In addition, firms in countries with large current accounts tend to be more sensitive to exchange rate changes. These results, apart from their relevance on a firm's exposure identification and explanation level, can help induce some references about the impact of derivatives markets on different groups of firms and types of market. This latter could also be of some interest for policy makers and financial market regulators.

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4.9 Tables

Table 4.1: Country specific variable definitions and sources

Variable	Definition	Unit	Data source
R	Stock return	%	Thomson Datastream
ER	Effective exchange rate change	%	Bank of International Settlements
GDP_{PPP}	Gross Domestic Product at PPP (billions USD)	USD	Thomson Datastream- Economist Intelligence Unit
FXturnover*	Total foreign exchange turnover / GDP_{PPP}	%	Bank of International Settlements
FXfor*	Outright forward foreign exchange turnover / GDP_{PPP}	%	Bank of International Settlements
FXspot*	Spot foreign exchange turnover / GDP_{PPP}	%	Bank of International Settlements
FXswap*	Foreign exchange swap turnover / GDP_{PPP}	%	Bank of International Settlements
FXtools*	FXfor+FXswap	%	Thomson Datastream- Economist Intelligence Unit
IntDebt	$\frac{\text{International bonds notional amounts outstanding (billions USD)}}{\text{Domestic debt notional amounts outstanding (billions USD)}}$	%	Bank of International Settlements
CA	Current account balance (% of GDP)	%	Thomson Datastream- Economist Intelligence Unit
Export	Exports of goods and services (% of GDP)	%	Thomson Datastream-Economist Intelligence Unit
Import	Imports of goods and services (% of GDP)	%	Thomson Datastream- Economist Intelligence Unit
Openness	Export+Import	%	
FXdebt	Net foreign debt (% of GDP)	%	Thomson Datastream- Economist Intelligence Unit

* The turnover provided by the BIS is a daily average in billions USD

Table 4.2: Firm specific variable definitions and sources

Variable	Definition	Unit	Data source
R	Stock return	%	Thomson Datastream
FSales	Sales from operations in foreign countries / Total sales	%	Worldscope (field 08731)
Leverage	Total Debt / Total Assets	%	Worldscope (field 08236)
Market Cap	ln(Year end market capitalization in USD)	USD	Worldscope (field 07210)
Dividend	Dividend yield close	%	Worldscope (field 09404)
Industry	Dummy following the General Industry Classification Code		Worldscope (field 06010)
Emerging	Dummy=1 if firm's home market is emerging		computed based on MSCI Barra
β_2	Exchange rate exposure with respect to levels of ER		Estimated
β_3	Exchange rate exposure with respect to volatility of ER		Estimated

Table 4.3: Summary descriptive statistics of sample firms.

The table shows all sample firms' distribution by country, type of market and industry. Countries are followed by (D) if they are classified as developed and by (E) if they are classified as emerging. The table also presents the arithmetic mean of major accounting variables across firms as of 2008.

Number of firms by country

Argentina (E)	17	France (D)	34	Italy (D)	13	Portugal (D)	3	Taiwan (E)	7
Australia (D)	78	Germany (D)	38	Japan (D)	57	Russia (E)	31	Thailand (E)	10
Austria (D)	12	Greece (D)	5	Malaysia (E)	10	Singapore (D)	17	Turkey (E)	7
Brazil (E)	51	Hong Kong (D)	107	Mexico (E)	42	South Africa (E)	33	U.K. (D)	95
Chile (E)	16	India (E)	12	Netherlands (D)	28	South Korea (D)	16	Venezuela (E)	10
China (E)	28	Indonesia (E)	2	Norway (D)	8	Spain (D)	8		
Denmark (D)	4	Ireland (D)	17	Peru (E)	7	Sweden (D)	11		
Finland (D)	5	Israel (E)	9	Philippines (E)	7	Switzerland (D)	15	Total	870

Number of firms by type of market

Emerging	299	Developed	571

Number of firms by industry

Industrial	614	Utilities	123	Transportation	28	Banks, insurances & other financial firms	111

Descriptive statistics of sample firms (as of 2008)

All sample firms							
Market Capitalization (millions USD)	10'846	FSales	49.37%	Leverage	25.75%	Dividend yield	3.21%
Developed market firms							
Market Capitalization (millions USD)	13'355	FSales	56.57%	Leverage	26.58%	Dividend yield	2.91%
Emerging market firms							
Market Capitalization (millions USD)	6'026	FSales	25.41%	Leverage	24.06%	Dividend yield	3.88%

Table 4.4: Pooled generalized least squares estimates of country overall exchange rate exposure (gamma1)
Country exposure is estimated from equation (4.1) using data for the entire time span in weekly frequency. The estimates are obtained by separate generalized least squares estimation in each country, with 783 time observations. We use White's heteroscedasticity consistent standard errors and covariance matrix. Adjusted R^2 oscillate between 1% and 2%.

*Estimated country exposure $\widehat{\gamma}_{1,m}$ (** denotes significance at the 95% level)*

Argentina	-0.36**	France	-0.69**	Italy	-0.12**	Portugal	-0.35**	Taiwan	-0.03
Australia	0.05**	Germany	-0.43**	Japan	-0.12**	Russia	0.06	Thailand	-0.23
Austria	-0.32**	Greece	-0.45	Malaysia	-0.01	Singapore	-0.20	Turkey	0.24
Brazil	0.22**	Hong Kong	-0.36**	Mexico	0.08	South Africa	0.01	United Kingdom	-0.11**
Chile	0.01	India	0.03	Netherlands	-0.45**	South Korea	0.19	Venezuela	-0.08**
China	-0.03	Indonesia	-0.33	Norway	-0.01	Spain	-0.45**		
Denmark	-0.08**	Ireland	-0.34**	Peru	-0.13**	Sweden	-0.05		
Finland	-0.36**	Israel	0.01	Philippines	-0.17**	Switzerland	-0.19**	All countries	-0.07**

Table 4.5: Pooled generalized least squares estimates of firm market exposure (beta1), first moment exchange rate exposure (beta2) and second moment exchange rate exposure (beta3)

Firm exposure coefficients are estimated from equation (4.2) using data in weekly frequency. The estimates are obtained by pooled generalized least squares estimation, with 541'575 panel observations for the whole sample between 1994 and 2008. We use White's heteroscedasticity consistent standard errors and covariance matrix. Adjusted R^2 oscillate between 26% and 32%. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively.

Pooled estimation of equation (4.2) for groups of countries

Coefficients	$\widehat{\beta}_{1,i}$	$\widehat{\beta}_{2,i}$	$\widehat{\beta}_{3,i}$
All countries 1994-2008	0.943***	-0.088***	-0.019***
Developed countries 1994-2008	0.926***	-0.134***	-0.013***
Emerging countries 1994-2008	0.972***	0.022***	0.009
Developed countries 1994-1997	0.939***	-0.164***	-0.007
Emerging countries 1994-1997	0.971***	-0.032***	0.005
Developed countries 1998-2008	0.925***	-0.131***	-0.010***
Emerging countries 1998-2008	0.975***	0.040***	0.014*

Table 4.6: Pooled generalized least squares estimates of firm first moment exchange rate exposure (beta2)
Firm exposure coefficients are estimated from equation (4.2) using data in weekly frequency. Summary statistics by country and type of market below show i) %Neg refers to the percentage of firms with negative first moment exposure estimate ii) % Sig refers to the percentage of firms with significant (at the 95% level) first moment exposure estimate and iii) %Neg/Sig refers to the percentage of firms with negative first moment exposure, given that the latter is statistically significant.

Estimated first moment firm exposure $\widehat{\beta}_{2,i}$ by country or groups of countries

	% Neg	% Sig	%Neg/Sig		% Neg	% Sig	%Neg/Sig		% Neg	% Sig	%Neg/Sig
Argentina	100%	62.5%	100%	Indonesia	50%	50%	0	Singapore	94.1%	82.3%	100%
Australia	23.1%	19.2%	6.7%	Ireland	93.7%	25%	100%	South Africa	48.5%	45.4%	40%
Austria	91.7%	50%	100%	Israel	44.4%	44.4%	75%	South Korea	31.2%	68.4%	97.4%
Brazil	19.6%	52.9%	0%	Italy	84.6%	46.1%	100%	Spain	87.5%	87.5%	100%
Chile	25%	18.7%	66.7%	Japan	98.2%	68.4%	97.4%	Sweden	45.4%	36.4%	100%
China	82.1%	53.6%	100%	Malaysia	33.3%	55.6%	60%	Switzerland	100%	92.8%	100%
Denmark	100%	50%	100%	Mexico	20.5%	41%	6.2%	Taiwan	42.9%	0%	-
Finland	80%	40%	100%	Netherlands	96.4%	71.4%	100%	Thailand	90%	50%	100%
France	80%	76.7%	95.6%	Norway	62.5%	75%	66.7%	Turkey	0%	100%	0%
Germany	84.2%	52.6%	100%	Peru	71.4%	28.6%	50%	United Kingdom	75.6%	41.1%	91.9%
Greece	80%	60%	100%	Philippines	100%	42.8%	100%	Venezuela	77.8%	33.3%	100%
Hong Kong	96.2%	61.9%	100%	Portugal	100%	66.7%	100%	All developed	77.3%	52.1%	91.1%
India	75%	0%	-	Russia	40%	16.7%	80%	All emerging	47.1%	41.2%	46.7%
								All countries	67%	48.4%	78.3%

Table 4.7: Pooled generalized least squares estimates of firm second moment exchange rate exposure (beta3)
Firm exposure coefficients are estimated from equation (4.2) using data in weekly frequency. Summary statistics by country and type of market below show i) %Neg refers to the percentage of firms with negative second moment exposure estimate ii) % Sig refers to the percentage of firms with significant (at the 95% level) second moment exposure estimate and iii) %Neg/Sig refers to the percentage of firms with negative second moment exposure, given that the latter is statistically significant.

Estimated second moment firm exposure $\widehat{\beta}_{3,i}$ by country or groups of countries

	% Neg	% Sig	%Neg/Sig		% Neg	% Sig	%Neg/Sig		% Neg	% Sig	%Neg/Sig
Argentina	62.5%	18.7%	66.7%	Indonesia	0%	0%	-	Singapore	64.7%	5.9%	100%
Australia	61.5%	11.5%	22.2%	Ireland	62.5%	6.2%	0%	South Africa	54.5%	18.2%	33.3%
Austria	25%	41.7%	0%	Israel	44.4%	11.1%	0%	South Korea	62.5%	12.5%	100%
Brazil	41.1%	9.8%	40%	Italy	61.5%	30.8%	50%	Spain	87.5%	87.5%	100%
Chile	18.7%	25%	0%	Japan	64.9%	15.8%	77.8%	Sweden	45.4%	36.4%	100%
China	42.8%	7.1%	100%	Malaysia	55.6%	11.1%	100%	Switzerland	42.8%	14.3%	0%
Denmark	50%	75%	33.3%	Mexico	61.5%	28.2%	45.4%	Taiwan	28.6%	28.6%	0%
Finland	80%	40%	50%	Netherlands	64.3%	7.1%	0%	Thailand	30%	0%	-
France	46.7%	23.3%	28.6%	Norway	37.5%	25%	0%	Turkey	16.7%	33.3%	0%
Germany	60.5%	18.4%	14.3%	Peru	28.6%	0%	-	United Kingdom	57.8%	12.2%	36.4%
Greece	40%	40%	50%	Philippines	71.4%	28.6%	50%	Venezuela	55.6%	11.1%	0%
Hong Kong	81%	15.2%	87.5%	Portugal	100%	33.3%	100%	All developed	62.8%	15.4%	44.8%
India	50%	16.7%	0%	Russia	50%	13.3%	25%	All emerging	46.7%	15.8%	34.8%
								All countries	57.3%	15.6%	41.3%

Table 4.8: Estimates from regressions with beta2 as the dependent variable

The table presents different estimation specifications of equation (4.3) using data in annual frequency from 1994 till 2008. The estimates are obtained by pooled generalized least squares, with White's heteroscedasticity consistent standard errors and covariance matrix. Panel I considers all raw betas as the dependent variable. Panel II uses absolute betas as the dependent variable. Panel III considers either only positive betas or only negative betas as the dependent variable. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively.

		Panel I : Raw estimations on all betas			Panel II : Estimations on absolute betas		
		all markets	developed	emerging	all markets	developed	emerging
Variables	Proxying	A: $\widehat{\beta}_{2,i,t}$	B: $\widehat{\beta}_{2,i,t}$	C: $\widehat{\beta}_{2,i,t}$	D: $\left\|\widehat{\beta}_{2,i,t}\right\|$	E: $\left\|\widehat{\beta}_{2,i,t}\right\|$	F: $\left\|\widehat{\beta}_{2,i,t}\right\|$
FSales	firm foreign activities	-0.144***	-0.079***	-0.164***	0.154***	0.168***	0.013
Market Cap	firm size	-0.009***	-0.011***	0.023***	0.027***	0.029***	0.043***
Leverage	firm leverage	-0.009***	-0.011***	0.101***	0.027	0.016	0.269***
Dividend	firm profitability	0.008***	0.007***	0.004***	-0.001	-0.004***	-0.001
FXtools	use of FX instruments	-0.007***	0.185***	-6.100**	-0.204***	-0.273***	-1.795***
IntDebt	1/financial development	-0.016**	-0.065***	0.044***	0.077***	0.106***	0.029***
CA	current account	-1.705***	-2.449***	-0.763***			
|CA|	absolute current account				2.120***	2.724***	0.950***
Adjusted R^2	(6'413 observations)	7.06%	34.21%	34.21%	27.35%	34.75%	34.75%

Panel III : Separate estimations on firm observations with $\widehat{\beta}_{2,i,t} < 0$ or firm observations with $\widehat{\beta}_{2,i,t} > 0$

Variables	Proxying	G: $\widehat{\beta}_{2,i,t} < 0$			H: $\widehat{\beta}_{2,i,t} > 0$		
FSales	firm foreign activities	-0.096***	-0.028***	-0.626***	0.111***	0.133***	-0.178***
Market Cap	firm size	-0.065***			0.082***		
Leverage	firm leverage	-0.032***			0.274***		
Dividend	firm profitability	0.001***			-0.003***		
FXtools	use of FX instruments	0.089***			-0.412***		
IntDebt	1/financial development	-0.120***			0.003***		
CA	current account	-1.389***			0.888***		
Panel observations		3'162			2'340		
Adjusted R^2		64.96%			72.18%		

Table 4.9: Estimates from regressions with beta3 as the dependent variable

The table presents different estimation specifications of equation (4.4) using data in annual frequency from 1994 till 2008. The estimates are obtained by pooled generalized least squares, with White's heteroscedasticity consistent standard errors and covariance matrix. Panel I considers all raw betas as the dependent variable. Panel II uses absolute betas as the dependent variable. Panel III considers either only positive betas or only negative betas as the dependent variable. Coefficients' significance at 99%, 95% and 90% confidence level is noted by ***, **, * respectively.

		Panel I : Raw estimations on all betas			Panel II : Estimations on absolute betas		
		all markets	developed	emerging	all markets	developed	emerging
Variables	Proxying	A: $\widehat{\beta}_{3,i,t}$	B: $\widehat{\beta}_{3,i,t}$	C: $\widehat{\beta}_{3,i,t}$	D: $\left\|\widehat{\beta}_{3,i,t}\right\|$	E: $\left\|\widehat{\beta}_{3,i,t}\right\|$	F: $\left\|\widehat{\beta}_{3,i,t}\right\|$
FSales	firm foreign activities	-0.066***	-0.036***	0.091***	0.075***	0.057***	0.048**
Market Cap	firm size	0.012***	0.012***	0.013***	0.044***	0.044***	0.041***
Leverage	firm leverage	-0.053***	-0.066***	-0.141***	0.012	0.013	-0.181
Dividend	firm profitability	-0.005***	-0.003***	-0.004***	-0.009***	-0.015***	-0.002**
FXtools	use of FX instruments	-0.092***	0.003	-0.643**	-0.239***	-0.334***	-3.996***
IntDebt	1/financial development	0.015***	-0.004	0.037***	0.075***	0.097***	0.018***
CA	relative current account	0.457***	0.255***	0.452***			
|CA|	absolute current account				0.909***	1.121***	0.638***
Adjusted R^2	(6'412 observations)	1.51%	1.66%	1.66%	58.10%	21.20%	21.20%

Panel III : Separate estimations on firm observations with $\widehat{\beta}_{3,i,t} < 0$ or firm observations with $\widehat{\beta}_{3,i,t} > 0$

Variables	Proxying	G: $\widehat{\beta}_{3,i,t} < 0$			H: $\widehat{\beta}_{3,i,t} > 0$		
FSales	firm foreign activities	-0.085***	-0.075***	-0.087***	0.042***	0.030***	0.175***
Market Cap	firm size	-0.071***			0.047***		
Leverage	firm leverage	-0.004***			0.247***		
Dividend	firm profitability	-0.001***			-0.001		
FXtools	use of FX instruments	0.415***			-0.140***		
IntDebt	1/financial development	-0.024***			0.036***		
|CA|	absolute current account	-1.608***			1.390***		
Panel observations		2'896			2'605		
Adjusted R^2		38.84%			71.02%		

Chapter 5

Conclusions

5.1 Main contributions

This thesis tackles questions that have emerged from three stylized facts of the increasingly globalized modern financial system. Firstly, the rapid growth of currency derivatives markets, secondly, the large number of firms being tradable in foreign markets and thirdly, the increasing global importance of the role of emerging markets motivate the thesis contribution on two directions.

The first direction of this thesis contribution is related to corporate exchange rate exposure. Chapters 2 and 4 propose ways of how to manage, how to measure and how to explain firms' exchange rate exposure. Focusing on large non-financial emerging market firms, chapter 2 reveals that foreign currency debt is a useful tool for hedging and speculation in the long-term. At the same time, currency derivatives are mostly used for adjusting the long-term speculative and hedging positions and less for speculating in the short-term. Chapter 4 measures firm currency exposure on a worldwide panel of firms and depicts the importance of country specific features in explaining the observed patterns. There is evidence that proxies for higher financial market development allow firms from both emerging and developed countries to decrease their currency exposure.

The second direction of this thesis contribution is related to documenting and explaining an international finance puzzle, known as the ADR spreads. Chapter 3 proposes and assesses two broad explanation approaches for this puzzle, a first based on investor sentiment and a second based on market microstructure and barriers on arbitrage. The two explanations seem to be valid and of comparable economic importance. After controlling for market microstructure issues, such as market illiquidity, a significant part of ADR spreads reflects US investors' sentiment. Finally, spreads contain valuable information with respect to the future evolution of ADR returns, as well as

with respect to breaks on structural parameters around crises events.

This thesis' findings are of particular interest for the following three types of economic agents, namely for large corporations, international investors and policy makers. Large firms from emerging markets and corporate management get insights about the optimal use of increasingly popular financial instruments in order to manage currency exposure. Investors can evaluate the sources that explain ADR spreads, their economic significance and can extract information by analyzing spreads' evolution. Policy makers and regulators draw useful conclusions about the impact of a market's financial sophistication on exchange rate exposure of large firms.

5.2 Further research

Naturally, as with every piece of research, findings propose answers to existing problems, but at the same time give rise to new questions. Academic debates are dynamic and through this thesis, one comes across with various ideas for further research.

In the context of emerging market firm currency exposure management, there is a need to study in more detail the dynamic theoretical mechanism of firm choice of use of financial tools and their interdependence. A further limitation of chapter 2, is that its findings are not automatically applicable for small firms, due to the assumed characteristics of the representative firm. Therefore, some caution is needed when one makes inferences about the validity of the results on all emerging market firms.

As far as the ADR spreads puzzle is concerned, one may analyze their informational content even further. From a corporate point of view, there could be an interest to test spreads implications on firms financing policy and link chapter 3 with the literature about cross-listing discounts measured through accounting variables. For instance, it could be interesting to test whether

the spread observed mostly due to ADR investors has a "feedback-effect" on the firm's home market valuation and cost of capital. From an international investor point of view, one may shed more light on the predictability power of ADR spreads by evaluating the performance of a large variety of active trading rules and testing their persistence. From a policy maker point of view, ADR spreads can be used as a tool of extracting the implicit market exchange rate on countries that use fixed or semi-fixed exchange rate regimes.

Finally, on the aftermath of the severe global financial crisis of 2008, the impact of increasing financial sophistication needs to be studied further. Hence, there is plenty of room for research, particularly in relation to the stance of policy makers and market regulators as to the functioning of derivatives markets. Chapter 4 shows indications that currency derivative and local bond market development can help firms diversify risks away. This needs to be clearly monitored though, especially in the post-2008 era.

Chapter 6

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