Financial globalization and the implications for monetary and exchange rate policy

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Chapter 1

Introduction

The last three decades saw an extraordinary increase in cross-border capital flows and the elimination of barriers to free capital mobility. From a historical perspective, however, financial globalization is not a new phenomenon. A first wave of globalization started in the middle of the 19th century and came to an abrupt end with World War I. This era was characterized by a high level of integration reached again only in the 1990s. Obstfeld and Taylor (2004) characterize the development stages of global financial markets, connecting financial globalization in the 19th century with the present, by the exchange rate regimes and their consequences for capital flows. During the period from 1870 until 1914, most countries successively adopted the classical gold standard and both capital and labor markets were highly integrated. Policymakers followed a laissez-faire policy and few restrictions were imposed on financial markets. The following period, between 1914 to 1945, was shaped by the two World Wars and the Great Depression leading to a rise in nationalism. During this time, policymakers increasingly focused on domestic goals and pursued protectionist policies. Capital controls were put in place to pursue monetary policy under more flexible exchange rates. As a consequence, private capital flows ceased and national financial markets decoupled. The Bretton Woods system characterized the period between 1945 and 1971 when currencies were linked through a system of fixed but adjustable exchange rates to the US-Dollar. However, significant capital controls were in place and allowed countries some policy autonomy. Financial markets started to reintegrate; the process, however, was slow and mainly driven by international trade flows. After the breakdown of the Bretton Woods system in 1971, the developed countries moved towards more flexible exchange rates, capital account restrictions were successively lifted and capital increasingly flowed across borders. However, Obstfeld and Taylor (2004) and others estimate that only in the 1990s did capital mobility regain the degree achieved in 1914.

The development phases of global financial markets are strongly influenced by the

macroeconomic policy trilemma between free capital mobility, fixed exchange rates, and independent monetary policy (Obstfeld and Taylor, 1998). High capital mobility is only reconcilable with fixed exchange rates when monetary policy is subordinated to these goals and with the pursuit of domestic goals only when the exchange rate is allowed to adjust to market conditions. The simultaneous achievement of domestic policy goals and exchange rate stability is only feasible when capital controls are in place. This trilemma helps in understanding the ups and downs in financial integration.

After the breakdown of Bretton Woods and the financial liberalization in the 1970s, countries did not only experience increased real and nominal exchange rate volatility but also a variety of crises. Hence, financial integration poses significant challenges for policymaking. This thesis consists of three self-contained chapters studying financial globalization and the implications for monetary and exchange rate policy. Chapter 2 analyzes the empirical patterns underlying exchange rate regime announcements and deviations in de facto policies and highlights the role of financial integration. Chapter 3 focuses on the consequences of financial openness for monetary policy, more specifically, for inflation targeting. Financial globalization in the 19th century is the focus of chapter 4 which examines the role of Germany as a financial center.

The increasing capital mobility and the emerging market crises in the 1990s led to the *bipolar view* and the observation of *fear of floating* which are the starting points for the analysis in chapter 2. In accordance with the policy trilemma, the bipolar view states that countries should move towards the extreme corners of exchange rate flexibility by either joining a monetary union, unilaterally adopting the currency of another country, or operating a currency board, thereby, surrendering monetary independence, or by having a freely floating exchange rate (Fischer, 2001). Intermediate exchange rate regimes, more precisely soft pegs, are not considered viable as long as capital is internationally mobile. Figure 2.2 illustrates that for the two reference years of Fischer, 1991 and 1999, there was indeed a shift from announced (de jure) intermediate exchange rate regimes to fixed and flexible ones. A more continuous appraisal of regime choices, however, is much less clear-cut and the high share of de facto intermediate regimes throughout the 1990s further challenges the bipolar view. Furthermore, there is widespread agreement that it is not uncommon for countries to declare a different exchange rate regime than they actually follow (Calvo and Reinhart, 2002). However, the observation of *fear of floating* raises the question: If countries indeed have good reasons to manage their exchange rate actively, why would they not announce a regime consistent with optimal policies?

Starting from this observation, chapter 2 studies the apparent disconnect between what countries announce to be their exchange rate regime and what they de facto implement.[1] Discrepancies between announcements and de facto policies are a quantitatively important phenomenon describing policies in roughly 40 per cent of all countries. Nevertheless, there is still a lack of understanding of actual patterns and underlying reasons. The aim of chapter 2 is to fill some of the gaps present in existing studies. Starting from the hypothesis that observed regime discrepancies are *systematic*, i.e., not the result of random policy errors, it provides evidence for the existence of systematic elements in observed regime discrepancies by linking them to specific country characteristics. The main empirical finding is that countries tend to communicate exchange rate regimes at the corners of the flexibility spectrum, i.e., either fixed or flexible regimes, but to operate intermediate regimes. Whether countries announce a fixed or flexible exchange rate depends on country characteristics, in particular related to trade structure, financial development, and financial openness. Also, countries at different stages of economic and financial development differ in the nature of regime discrepancies. Finally, the decreasing frequency of countries managing their exchange rate less than announced and the increasing occurrence of countries intervening more than announced align with broader economic trends and developments worldwide related to financial globalization and changes in monetary policy design.

The separation of communication and implementation of exchange rate policy may provide policymakers with an additional tool to tackle challenges from financial globalization. In an era of high financial integration and capital mobility, countries may not be restrained to choose between pursuing an independent monetary policy and stable exchange rates while refraining from capital controls. For numerous countries the optimal policy may be neither of the two extremes but a combination. However, as intermediate exchange rate regimes are difficult to communicate, see, e.g., Frankel, Fajnzylber, Schmukler and Serven (2001), countries may find it optimal to use exchange rate regime announcements and a diverging implementation as a second best policy.

The empirical patterns point at the role of monetary policy within the macroeconomic policy trilemma. Especially emerging market economies that adopted inflation targeting and, hence, announce flexible exchange rates, manage their exchange rate more than announced. This is not surprising as the exchange rate is one, if not the most important price in an open economy. As small open economies steadily move away from fixed

[1] Chapter 2 is based on joint work with Uli Klüh.

exchange rates towards a more independent monetary policy, open economy aspects become increasingly important in analyzing monetary policy. The literature frequently resorts to two simple concepts in international economics, *purchasing power parity* and *uncovered interest rate parity*, to describe the relation between prices, interest rates, and exchange rates between countries. Although the empirical relevance of these two concepts is subject to an ongoing debate, they are frequently used in theoretical models. Chapter 3 examines the implications of these concepts on the implementation of monetary policy. Monetary policy is analyzed in an open economy version of the standard New Keynesian framework described by Clarida, Galí and Gertler (1999). More specifically, *flexible inflation targeting* as characterized by Svensson (2007) is the monetary policy under scrutiny. A central bank operating under flexible inflation targeting is not only concerned about stabilizing the inflation rate around the target but additionally about stabilizing the real economy.

Purchasing power parity is based on the idea that international goods arbitrage keeps the relative purchasing power of two currencies constant over time. Uncovered interest rate parity is derived from arbitrage in international financial markets according to which the nominal exchange rate adjusts to interest rate differentials. Chapter 3 contributes to the literature by analyzing in a unified framework how these two concepts and possible alternatives used in the literature affect monetary policy. More specifically, the implications for the interest rate reaction function describing monetary policy responses to shocks under flexible inflation targeting are examined. Thereby, useful insights into the consequences of using the simple concepts of purchasing power parity and uncovered interest rate parity in monetary policy analysis are provided.

The main insight is that the interest rate reaction function is affected when purchasing power parity and uncovered interest rate parity are relaxed. As long as purchasing power parity holds, monetary policy reacts only to cost-push shocks and excess-demand shocks. If, however, purchasing power parity does not hold, monetary policy also fully offsets the effects of foreign shocks. Furthermore, not the direction but the strength of the interest rate response to cost-push shocks and excess-demand shocks is affected. Whether the relation between interest rates and exchange rates is described by uncovered interest rate parity or in the more generic way proposed by Ball (1999) does affect both to which type of shocks monetary policy responds and how strong the response is.

Then, chapter 4 turns to the earlier period of financial globalization. Here, financial globalization in the late 19th century is analyzed from the perspective of Germany

as a financial center.[2] Feis (1930) describes Europe as *the world's banker* during the 19th century, lending capital to countries around the world. The main capital exporter was Great Britain, followed by France and Germany, and their capital cities were the main financial centers intermediating credit through their stock exchanges and bankers. London emerged as an important financial center following the Napoleonic Wars and became the undisputed international financial center in the 1870s. Paris was another important financial center in the 19th century, second only to London, and contributed significantly to the financing of foreign governments and railroads since the 1820s. At the beginning of the 19th century, Frankfurt was the financial center of Germany and also of importance on an international level. Following the political and economic restructurings during the mid 1860s, Berlin developed as Germany's financial center. The construction of the railroads and the development of heavy industries in the 19th century posed new challenges to the financial sector until then dominated by private bankers. The immense demand for capital of these newly developing sectors required the use of a broader capital base and the introduction of tradable securities allowed private investors to put their savings into productive use. The stock exchanges and the newly created joint-stock banks contributed significantly in expanding financial intermediation.

The capital exports of a country are one way to quantify its importance as an international financial center. While the characteristics of British capital flows have been studied extensively, France and Germany as smaller capital exporters have been investigated to a lesser degree and to our knowledge no extensive data sets are available. Chapter 4 contributes to the literature by providing new insights into the role of Germany as a financial center. The development and functioning of the German capital markets in the late 19th and early 20th century are described with a special focus on the intermediation of foreign securities provided by the stock exchanges. Then, the capital intermediated by German stock exchanges in the thirty years prior to World War I and its composition, especially of foreign investment, is analyzed. The main findings are that neighboring countries were the main recipients of German capital and that the perceived riskiness of a country was an important determinant in investment decisions. Borrowers frequently floated their securities simultaneously in the main financial centers. To give a first idea of the integration between financial centers at that time, we examine if foreign issuances in Germany reacted to shocks in the other financial centers. The main finding is that the conditions in financial markets in Germany and relative to other

[2]This chapter is based on joint work with Graciela Kaminsky.

financial centers mattered for the amount of foreign securities floated in Germany. More specifically, France and Germany seem to be substitute financial centers for borrowing countries while the relation between Germany and the UK is unclear.

The present thesis provides insights into financial globalization and the challenges it poses. Increasing capital mobility calls policymakers to choose between the pursuit of exchange rate objectives and domestic goals. However, optimal choices are likely to be neither of the two extremes and chapter 2 provides evidence of actual policy choices aiming at intermediate solutions. Chapter 3 studies how the implementation of monetary policy is affected by the financial and economic openness of an economy. By analyzing financial globalization in a historical perspective, the last chapter spurs our understanding of fundamental patterns in financial markets and integration. All three chapters are part of a broader research agenda that aims at improving our understanding of the pieces jointly forming the macroeconomic policy trilemma, how they relate theoretically and empirically. This broader research agenda can hopefully be pursued in the future.

Chapter 2

When countries do not do what they say: Systematic discrepancies between exchange rate regime announcements and de facto policies[1]

2.1 Introduction

A look at the exchange rate regime choices of 133 countries over the period 1973-2004 reveals a striking phenomenon: nearly one half of all observations show inconsistencies between what countries officially declare to be their chosen regime, and what countries actually do with respect to exchange rate management. Moreover, the exact nature of deviations seems to follow secular trends. In the early 1970s, countries that managed their exchange rate less than what could be expected given their announcement dominated the picture, but their share has decreased over time. The frequency of observing a country intervening more than announced, however, has been increasing, in particular in the 1990s and 2000s, a trend that has recently attracted substantial attention from policymakers and academics (see, for example, Barajas, Erickson and Steiner (2008)). Only the proportion of consistent regimes has remained roughly constant.

The finding that countries often do not follow their exchange rate regime announcement has important implications for research and policy. Most importantly, studies on the relationship between exchange rate policies and economic development (Aghion, Bacchetta, Ranciere and Rogoff, 2006)[2], financial stability (Bubula and Ötker-Robe, 2003), or the emergence of inflation targeting as a preferred monetary policy regime for emerging

[1] This chapter is based on joint work with Uli Klüh.

[2] Genberg and Swoboda (2005) show that both announcement and actual exchange rate policy matter for the economic performance of a country.

markets (Goldstein, 2002) will remain incomplete without an understanding of regime discrepancies. It is therefore not surprising that recent years saw the emergence of a whole body of literature reviewing the proper definition, nature and implication of de jure and de facto exchange rate regime choices, including the seminal contributions by Reinhart and Rogoff (2004) and Levy-Yeyati and Sturzenegger (2003a; 2003b; 2005).

We know that discrepancies between announced and de facto exchange rate policies are common, but we have a poor understanding of the underlying reasons. Most importantly, and contrary to some statements in related contributions, the literature on the *fear of floating* phenomenon initiated by Calvo and Reinhart (2002) does not provide an answer to the question: If countries indeed have good reasons to manage their exchange rate actively, why would they not announce a regime consistent with optimal policies? Put differently, while the literature offers several theoretical explanations why countries dislike exchange rate fluctuations[3] and why countries may be forced to abandon fixed exchange rate regimes[4], we know little about systematic and potentially voluntary deviations between announced and actual exchange rate policies.

Related literature

To the best of our knowledge, there are only four contributions that address this question more or less directly. Carmignani, Colombo and Tirelli (2006) study the role of political factors in explaining regime choices more broadly, also touching upon the issue of "broken promises". The authors argue that, in general, countries attempt to choose de facto and de jure regimes consistently, except for those cases in which political incentives lead to some form of cheating or dynamic inconsistency. While the authors do not attempt to provide an "immediate theoretical interpretation" for their findings, an implicit assumption of the study seems to be that the stronger the incentive to peg or float the stronger the incentive to do so consistently, and that deviations from this policy either mirror politically motivated or wrong decision-making.

Von Hagen and Zhou (2006) view regime gaps as part of an error-correction mechanism that allows governments to adjust their actual policies in case the de jure regime has been chosen sub-optimally. Such a view, however, does not explain why de jure regimes are chosen sub-optimally in the first place. This is particularly troublesome since many of the significant explanatory variables used in their regression analysis do not change

[3]See, in particular, the literature on *fear of floating* started by the seminal contribution of Calvo and Reinhart (2002).

[4]See the literature on currency crises, e.g. Krugman (1979) and Obstfeld (1996).

much over time, implying that they could have been taken into account by policymakers ex ante. Similarly, a dynamic error-correction mechanism should allow for the possibility of adapting the de jure regime to changing circumstances or policy misjudgments. Such a mechanism, however, cannot be identified in the data, since regime discrepancies display substantial persistence.

Alesina and Wagner (2006) analyze the relationship between regime discrepancies and the quality of institutions. They find that countries with low institutional quality tend to announce pegs, but are unable to sustain them. At the same time, countries with high institutional quality tend to either consistently float or to actively manage the exchange rate without announcing it. Alesina and Wagner (2006) interpret this behavior as indication of a signaling game, in which countries with relatively good institutions try to distinguish themselves from countries with low institutional quality. While signaling might indeed play an important role in explaining regime discrepancies, the evidence provided to support this view suffers from two major shortcomings. First, proxies for institutional quality display very little variation over time. Consequently, the quality of institutions cannot explain trends in the data. Second, Alesina and Wagner do not explain why countries with low-quality institutions announce a peg in this signaling setting. This, in turn, also calls into question the validity of the signaling strategy more generally, since policymakers confronted with low-quality institutions have a clear incentive to imitate their counterparts, given that the expected reputation gain of an announced but not consistently implemented peg is likely to be small. Consequently, a crucial question becomes how markets and the public actually react to attempts of "signaling by inconsistency".

Starting from this last observation, Barajas, Erickson and Steiner (2008) study the reaction of emerging market bond spreads to de jure and de facto exchange rate regime choices. They test the hypothesis that countries classified towards a flexible exchange rate regime are rewarded with lower spreads. As to the potential reasons for fearing to declare a more interventionist regime, the authors argue that markets might have a subjective bias against officially fixed exchange rate regimes. This bias could be either due to the fact that fixed exchange rates have received much of the blame for the emerging market crises in the 1990s, or be the result of the perceived advantage of operating an inflation targeting regime. Their main finding is that contrary to the working hypothesis both the announcement of a more heavily managed regime and the actual intensity of intervention lower spreads significantly. This leaves the puzzle why countries are

reluctant to declare that they are intervening given that international capital markets do not reward either de facto or de jure floaters.

Aim and outline of the study

While none of the mentioned contributions offers a clear-cut theoretical explanation for the observed discrepancies, they all start from certain implicit presumptions about the underlying phenomenon. Implicit in the analysis is either the view that deviations between announced and implemented policies are the result of sub-optimal policies, or the reflection of some underlying political or institutional reality, or a subjective bias in market perceptions. Apart from Alesina and Wagner (2006), existing contributions usually assume that inconsistencies to one side or the other can be analyzed separately. Also, issues of policy communication are treated very lightly, in spite of the fact that inflation targeting (a communication framework) is sometimes suspected to underpin more recent trends in the data. Finally, trends over time are usually not studied but taken for granted, in that the *fear of floating* phenomenon represents the motivation for the inquiry.

The aim of this study is to fill some of the gaps present in existing studies. First and foremost, we believe that the existing knowledge of time-series and cross-sectional patterns of regime discrepancies is highly incomplete. Before testing specific hypotheses about the reasons for and the consequences of different arrangements, it is therefore essential to first identify empirical regularities that could form the basis of establishing a set of robust stylized facts. To this end, we extend the existing de jure regime classification for the years 2000 until 2004 and pay particular attention to regional patterns and clustering, methodological issues in defining regimes, as well as country characteristics.

While our main interest lies in establishing a series of patterns *without* starting from restrictive presumptions, it is obviously impossible to operate in a theory vacuum: As indicated in the title, our working hypothesis is that observed regime discrepancies are *systematic*, i.e. not the result of random policy errors. In fact, one of our main objectives is to provide evidence for the existence of systematic elements in observed regime discrepancies, by linking them to specific country characteristics. Put differently, we show that there indeed are country characteristics that systematically lead decision-makers to favor one type of deviation from consistency. For the case of regime discrepancies, this either means that there are actual or perceived benefits from not declaring that a certain intervention strategy is being followed, or from declaring a policy that will not

be always followed.

In providing evidence for systematic discrepancies between declaration and implementation, we highlight the importance of regime announcements as elements of a more comprehensive communication framework for monetary and exchange rate policies. At first glance, the idea that inconsistencies between announcements and policies could serve a purpose seems difficult to maintain, as markets and the public would either anticipate ex ante or punish ex post deviations from announcements. This, however, is not necessarily the case if one takes into account the potentially constructive role of ambiguity. As pointed out in Best (2005), a work closely related to ours, ambiguity can serve a purpose by keeping policy regimes flexible enough to adapt to changing economic and political circumstances as well as to re-equilibrate conflicting interests.

Our main empirical finding is that countries tend to communicate exchange rate regimes at the corners of the flexibility spectrum, i.e. either fixed or flexible regimes, but to operate intermediate regimes. Whether countries announce a fixed or a freely floating exchange rate regime depends on country characteristics, in particular related to trade structure, financial development, and financial openness. Countries at different stages of economic and financial development differ in the nature of regime discrepancies. Finally, the decreasing frequency of countries managing their exchange rate less than announced and the increasing occurrence of countries intervening more than announced align with broader economic trends and developments worldwide.

The rest of the chapter is organized as follows. Section 2.2 describes the data; section 2.3 analyzes time trends and joint factors of regime discrepancies. In section 2.4 a descriptive statistical analysis of deviations of de facto from announced exchange rate regimes is presented. Section 2.5 contains the econometric analysis and an interpretation of the findings. The last section concludes and gives an outlook on future research.

2.2 Data

Our sample covers 133 countries from 1973 to 2004. The countries are classified as high, upper middle, lower middle, or low income countries according to the classification provided by the World Bank for 2004. Table 2.2 in the appendix lists the countries included in the sample.

2.2.1 Exchange rate regimes and discrepancies

Our analysis focuses on the announcement and actual implementation of exchange rate policy. Until 1999, the *announcement strategy* is measured by the de jure exchange rate regimes as categorized by Ghosh, Gulde and Wolf (2002) based on the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) data. The AREAER contains the intended exchange rate policies that member countries reported to the IMF on an annual basis[5]. To cover more recent trends, we extend the de jure regime classification for the years 2000-2004, allowing us to employ a new and unique dataset. To update regime announcements, we start with information from AREAER, which since 1998 does not report de jure classifications anymore, but contains additional verbal information that often allows identification of a country's stated regime choice. We combine this information with other sources, such as IMF staff reports and central banks reports, to complete and cross-check our data. Due to data limitations and consistency concerns, we only distinguish between fixed, intermediate, and flexible exchange rate regimes, consolidating the more detailed classification of Ghosh et al. (2002) into these three groups.[6]

We capture the actual *intervention strategy* through the de facto exchange rate regime classification ("natural" classification) developed by Reinhart and Rogoff (2004). One of the key characteristics of this classification method is the use of data on parallel and dual exchange rate markets. These market-determined exchange rates are often a better measure of actual and expected future monetary policy. In addition, they usually capture the economic impact of exchange rate changes more directly than official exchange rates, and do thus display a closer relationship to other variables of interest. To identify exchange rate regimes, Reinhart and Rogoff separate observations with unified exchange markets from those with parallel or dual markets. The de facto classification of the former is then obtained by statistical verification of regime announcements or, in cases without announcement, by direct statistical interference, which is also used for country-year observations with dual or parallel markets. The statistical evaluation

[5]In most of the years covered by our sample, countries were required to assign themselves to one of four categories (fixed, limited flexibility, managed floating, and independently floating). For an exposition of the IMF classification and changes over time, see e.g. Reinhart and Rogoff (2002). Ghosh et al. (2002) extended these groups to fifteen buckets, see table 2.1.

[6]The exact mapping is shown in table 2.1. Our coarse classification corresponds to the one used by Ghosh et al. (2002) with the exception of the secret basket pegs which we include into the intermediate category instead of the fixed one. We explain the reasons in section 2.A.1 in the appendix.

measures de facto exchange rate behavior via the mean absolute monthly change in the market-determined (official or parallel) nominal exchange rate, based on a five-year moving window.

Reinhart and Rogoff (2004) use fourteen buckets for their regime classification. However, as the categorizations of de jure and de facto exchange rate regimes are not congruent, we regroup them into three broad categories: fixed, intermediate, and floating regimes; the precise mapping is presented in table 2.1.[7] The Reinhart and Rogoff dataset covers 153 countries for the period 1946-2001. For the years 2002-2004 we use the update of the "natural" classification provided by Eichengreen and Razo-Garcia (2006).[8] Compared to other de facto classifications, e.g., the widely used dataset by Levy-Yeyati and Sturzenegger (2005), the IMF de facto classification used in Bubula and Ötker-Robe (2002), or the recent compilation by Klein and Shambaugh (2006), the Reinhart and Rogoff dataset has the advantage of offering the most extensive country and time coverage[9]. Moreover, we see at least two methodological reasons to prefer the Reinhart and Rogoff classification. First, the use of market-determined exchange rates seems to provide a much better picture of the underlying economic policies than official rates do and all other de facto classifications rely on official exchange rates. Reinhart and Rogoff point out that parallel markets are frequently used as back-door floating, in most cases with simultaneous exchange controls. In these situations, the use of official rates would strongly bias the results towards observing consistency between de jure and de facto fixed regimes. Second, Reinhart and Rogoff take the perspective of larger and more continuous regimes by using a five-year moving window, making it less likely to wrongly identify a one-time devaluation or shock as a regime change.

A drawback of the Reinhart and Rogoff approach is that only the unconditional volatility of the nominal exchange rate is used, so measures of intervention intensity such as international reserve and interest rate changes are not taken into account. Thus, no clear distinction can be made between exchange rate stability arising from active poli-

[7] Our three groups correspond to the coarse classification provided by Reinhart and Rogoff (2004) when categories 2 and 3 are subsumed as intermediate and 4 and 5 as floating regimes.

[8] This data covers the years 1990-2004. If observations not classified by Reinhart and Rogoff (2004) during that period were classified by Eichengreen and Razo-Garcia (2006) we use the improved data.

[9] The IMF de facto classification is available only since 1990. The Levy-Yeyati and Sturzenegger (2005) classification suffers from a substantial number of unclassified observations due to a lack of data, especially on international reserves. Klein and Shambaugh's (2006) classification distinguishes only between fixed and floating exchange rates which we consider insufficient as intermediate regimes are quantitatively important and different in nature from fixed and floating regimes as discussed later on. Frankel and Wei (2008) propose a novel synthesis of techniques to determine de facto exchange rate regimes.

cies or from the absence of shocks, leading to a potential overestimation of de facto fixed exchange rate regimes. Although Reinhart and Rogoff provide evidence that potential biases are limited, the possibility should be kept in mind. Nonetheless, we consider the Reinhart and Rogoff classification the one most suitable to the questions we post. To check robustness, we test the sensitivity of our results against Levy-Yeyati and Sturzenegger's (2005) classification, which includes the volatility of international reserves, but does not take into account interest rate policy.

Figure 2.1: Taxonomy of de jure and de facto exchange rate regime combinations.

Communication Framework / Intervention strategy	de jure fixed	de jure intermediate	de jure flexible
de facto fixed	C	IMA	IMA
de facto intermediate	ILA	C	IMA
de facto flexible	ILA	ILA	C

With respect to the concrete alternatives policymakers are facing, it is useful to start with a taxonomy of de jure and de facto regime combinations (figure 2.1). Our aim is to find empirical regularities related to a country's choice to locate either to the northeast (with a strategy combination in which policymakers intervene more than announced, or IMA) or to the southwest (with a strategy combination in which policymakers intervene less than announced, or ILA) of the main diagonal (consistency between de jure and de facto, or C).[10] Obviously, conscious choice will never explain fully the observed combi-

[10]We consider the labels *fear of floating* and *fear of pegging* used by other authors inappropriate in the present context. Consider *fear of floating* as introduced by Calvo and Reinhart (2002): it describes the desire of a country to limit exchange rate fluctuations but it does not embrace why

nation of the jure and de facto regimes, since policymakers will usually not take into account all the possible future states of the world. In fact, the de jure exchange rate regime is an ex ante stated policy intention while the de facto regime resembles the ex post policy decisions. However, we show that there indeed are country characteristics that systematically lead decision-makers to favor one type of deviation from consistency.

2.2.2 Explanatory variables

We use a wide set of macroeconomic, structural, institutional, and financial indicators to identify those characteristics that are associated with regime discrepancies of a specific kind. The complete dataset is described in table 2.3. Our choice of variables is mainly guided by previous studies on the determinants of exchange rate regimes, as we expect that many of the variables relevant for the choice of de jure and de facto regimes separately can also explain part of the variation in regime discrepancies. Underlying this expectation is our view that regime discrepancies are a reflection of conflicting views and agendas on exchange rate policies that give ambiguity a potentially constructive role.

Starting with trade-related variables, we measure the degree of openness as the sum of exports and imports relative to GDP. The importance of primary commodity exports is proxied by the sum of agricultural raw materials, ores, metals, and fuel exports as a share of all merchandise exports while trade concentration is measured as the share of total exports to the three largest trading partners. Furthermore, we include the three year centered standard deviation of the terms of trade growth rate to measure the volatility of an economy's external environment.

The degree of financial market development seems to influence the choice of exchange rate policies (Husain, Mody and Rogoff, 2005). Stages of development are captured by two different types of country classifications: the World Bank concept of income groups and the Morgan Stanley Capital International Index (MSCI) concept of emerging markets and developed economies. We consider the income categories of the World Bank (low, lower middle, upper middle, and high income) based on GNI per capita the most suitable indicator of economic development. The low and middle income countries are

countries do not announce their actual intervention strategy. *Fear of pegging* has been used by Alesina and Wagner (2006) and by von Hagen and Zhou (2006) to describe a situation where the de jure exchange rate regime is more rigid than the de facto one (what we label ILA). However, Levy-Yeyati and Sturzenegger (2005) have used the term to describe situations in which a country having a de facto fixed exchange rate regime is unwilling to explicitly announce it (*fear of floating* in a narrow sense).

often referred to as developing countries. The MSCI distinguishes between developing, emerging market, and developed economies. The separating feature of emerging market economies (EMEs) from other developing countries is the level of market capitalization. The MSCI differentiates between EMEs and advanced economies using a combination of macroeconomic and financial indicators, such as GDP per capita, the extent and quality of financial regulation and restrictions, and perceived investment and/or country risk. Thus, starting from a threshold level of financial market development, the separating line between the country groups is drawn based on financial sector and institutional strength. We mainly use the World Bank groups for our analysis while controlling for the robustness of our findings with respect to the alternative MSCI categorization. Additionally, we use a time-varying MSCI dummy as explanatory variable, which is equal to 1 from the year of inclusion of a country in the MSCI onwards and 0 otherwise.

Two alternative measures of financial openness are used to account for the distinction between de facto and de jure policies.[11] The degree of financial openness and the actual integration into international financial markets are very likely to affect a country's choice of an exchange rate regime and of how to communicate this choice. When capital markets are open and financial integration is high, the potential for market discipline increases. If capital controls are in place or the capital account is open but no capital actually flows across borders, these possibilities are limited or absent and policymakers have additional leverage on domestic monetary policy. As de jure measure, we use the indicator of financial openness constructed by Chinn and Ito (2006) which is based on the intensity of official restrictions on capital account transactions as reported in the AREAER. To capture the degree of actual financial integration, we follow Kose et al. (2006) and construct an additional measure based on the sum of external assets and liabilities over GDP, using the data provided by Lane and Milesi-Ferretti (2007).

In addition to variables related to trade and financial structure and openness, we assess the role of country size (measured by population or GDP) and the level of economic development (GDP per capita). In some of the regressions in section 2.5 year dummies are included. We also look at regional dummies to account for the geographic clustering found in the statistical analysis.

[11] For a discussion of how to measure financial openness and financial integration, see, e.g., Kose, Prasad, Rogoff and Wei (2006).

2.3 Time trends and joint factors

As already pointed out by Reinhart and Rogoff (2004) and Rogoff, Husain, Mody, Brooks and Oomes (2003) the type of discrepancy between announced and de facto policy has been subject to an important shift over time, from "labeling something as a peg when it is not, to labeling something as floating when the degree of exchange rate flexibility has in fact been very limited" (Reinhart and Rogoff, 2004, p.37). However, neither of the two publications has pursued this aspect further, so it is worthwhile to lay out some important patterns we find in the data. Over the whole sample period (1973-2004) only 60 per cent of the total observations[12] involve consistent regimes while 22 per cent are associated with ILA and 18 per cent with IMA. However, as illustrated in figure 2.2c, the occurrence of ILA has been decreasing over time, from 28 per cent in the 1970s to 10 per cent in the 2000s, while the frequency of observing IMA has been increasing, from 10 per cent in the 1970s to 27 per cent in the 2000s. The proportion of consistent regimes has remained roughly constant.

It is instructive to look at the de facto and de jure exchange rate regimes accompanying observed discrepancies. Not surprisingly, the higher the proportion of de jure fixed or floating regimes, the higher is the potential for ILA and IMA, respectively. For the whole sample, 47 per cent of the total observations are de jure fixed, 33 per cent intermediate, and 20 per cent floating exchange rate regimes. However, the distribution of de facto regimes differs substantially: only 36 per cent of all observations are associated with fixed exchange rate regimes (11 percentage points less than de jure), 49 per cent with intermediate (16 percentage points more), and 15 per cent with floating regimes, which can be separated into 10 per cent of freely falling and, thus, only 5 per cent truly freely floating regimes. Note that it is important to separate out the freely falling category, characterized by (very) high inflation rates which lead to important distortions (Reinhart and Rogoff, 2004).[13]

As figure 2.2a illustrates, de jure regimes exhibited a clear trend from fixed towards flexible regimes: fixed regimes declined from 66 per cent in the 1970s to 42 per cent in the 2000s, while floating regimes increased from 7 per cent in the 1970s to 33 per cent in 2000s. In contrast, the distribution of de facto regimes remained more stable (figure

[12] With observation we mean a country-year data point.

[13] The freely falling category encompasses observations when the twelve-month inflation rate is equal to or exceeds 40 per cent per annum and, additionally, includes the first six months following an exchange rate crisis if it marked a transition from a peg or quasi-peg to a managed or independent float. (Reinhart and Rogoff, 2004, p.3-4)

2.2b). Fixed regimes decreased from 44 per cent in the 1970s to 31 per cent in the 1980s and increased to 40 per cent in the 2000s. The floating regimes increased from 8 per cent in the 1970s to 13 per cent in the 2000s while intermediate exchange rate regimes remained at 40 to 50 per cent of all observations.[14]

Another interesting feature is that discrepancies between announced and de facto exchange rate policies are highly persistent over time, as documented by von Hagen and Zhou (2006). Discrepancies are not single observations that occur from time to time but they seem to follow systematic patterns. Some countries display ILA or IMA over nearly the whole sample period, while others moved from ILA to IMA following the overall trend, sometimes transitioning through consistent combinations. Most of the countries sticking to one type of discrepancies have changed their de facto and/or de jure policies quite frequently. The transition from announcing more rigid regimes than de facto followed towards announcing more flexible regimes has been accompanied by increased financial liberalization and financial integration (see figure 2.3a and 2.3b). While the years around the transition from ILA towards IMA were characterized by particularly high world inflation rates, they decreased to extraordinary low levels afterwards (see figure 2.3c).

2.4 Descriptive statistical analysis

2.4.1 Consistent regime combinations

Before analyzing discrepancies between announced and de facto exchange rate regimes it is useful to point out some stylized facts and country characteristics which may induce policymakers to explicitly choose consistent regime combinations. A first observation is that the overwhelming part of consistent regimes are fixed (50 per cent), closely followed by intermediate exchange rate regimes (39 per cent) while only 11 per cent of the observations are related to floating regimes.

One reason for this observation is that extreme forms of fixed regimes (monetary unions, dollarization, and currency boards) are chosen to signal the impossibility of deviation from the announced regime. Failures to follow the announcements are imme-

[14] Additionally, we observe important differences in regime choices between country groups, specifically between high, upper middle, lower middle, and low income countries. For a graphical analysis of de facto and de jure exchange rates regimes as well as resulting discrepancies, see Bersch and Klüh (2007).

diately visible and the cost of exit is extremely high.[15] Indeed, these regimes represent a significant share of consistent observations.[16] Extreme forms of fixed regimes are mostly chosen by very small and open economies, such as the members of the CFA French franc zone and the Eastern Caribbean Dollar zone, or by countries with a long history of high inflation and crises such as Argentina and Ecuador, but also by advanced economies in the EMU.

Among the consistent free floaters one can distinguish two main country groups. The first group consists of countries that have experienced crises and high inflation rates over the majority of years in the sample. These countries usually are characterized as freely falling within the de facto classification, sometimes showing short and infrequent events to stabilize expectations through exchange-rate based stabilization programs. The second group consists of highly developed countries like Australia, Japan, and the United States.

2.4.2 Intervening less than announced (ILA)

Over the whole sample the number of ILA observations is surprisingly high. Although the occurrence of ILA clearly declined over time, still 14 per cent of all observations are related to ILA in the 1990s and 2000s. How can this widespread phenomenon be explained? The announcement of a rigid exchange rate regime is a means to import credibility for tough monetary policy from the anchor country. Then, pursuing a more flexible exchange rate policy, e.g., through frequent parity adjustments, should result in a loss of credibility. As a consequence, any new attempt to build up credibility via a rigid exchange rate regime will most likely prove even harder. Consequently, the existing literature would not consider ILA to be the result of actual policy choices. Instead, it would be considered a crisis phenomenon resulting from the actual *inability* of a country to pursue the rigid policy (*inability to peg*).[17]

Before taking a closer look at the economic characteristics of the countries that have a history of ILA, it is useful to point out two aspects of the data that in our view have not received enough attention in related contributions. When studying the countries identified as those operating under ILA, we were surprised about the sensitivity of the

[15] The exit of Argentina from its currency board arrangement in 2001/2002 started a new discussion about the transparency and disciplining capacity of this exchange rate arrangement.

[16] The share is 29 per cent of the consistent regime combinations until 1999; afterwards we do not have detailed information.

[17] This is also the perspective taken in Alesina and Wagner (2006).

results with respect to (i.) the classification of some of the more rare or exotic exchange rate regimes, specifically secret basket pegs, and (ii.) the choice of reference currencies for cooperative systems. Not accounting for this sensitivity leads to potentially severe measurement errors and implies an often counter-intuitive classification with respect to the regime discrepancy.[18]

Turning to the characterization of countries that are mainly associated with ILA, exploring our data allowed us to identify a number of interesting empirical regularities. Most importantly, it is apparent from our data that ILA is not just a crisis phenomenon or a mere inability to peg. While the de jure exchange rate regimes predominately related to ILA are fixed regimes (77 per cent), the dominating intervention strategies are de facto intermediate exchange rate regimes with 64 per cent of all ILA observations. Only 33 per cent of all ILA observations were characterized as de facto freely falling. Since the latter can be interpreted as a proxy for crises episodes and, more generally, for the inability to implement restrictive monetary policies, crises and high inflation episodes account for an important, but limited proportion of ILA observations.[19] The view that ILA represents an inability to stick to the announced rigid exchange rate regime is thus only partially supported. In this respect, it is worth mentioning that such "failures" only result in ILA if policymakers do not change their announced exchange rate regime during the crisis. One reason for such a behavior may be some form of announcement inertia, e.g., due to the time-consuming political process necessary to change the legal framework.[20]

An important corollary to this observation is that de facto intermediate regimes are over-represented in the ILA group, as intermediate exchange rate regimes constitute "only" half of the de facto regime observations. Although intermediate exchange rate regimes account for a significant proportion of intervention strategy choices, there seems

[18] Secret basket pegs are exchange rate regimes where the national currency is pegged to a basket of at least two currencies based on country-specific criteria with the weights of the currencies and/or the composition of the basket being secret and possibly variable (Ghosh et al., 2002). A detailed discussion of the distinguishing features of intermediate regimes is provided in the appendix 2.A.1.

[19] Of all ILA observations 28 per cent are indeed preceded or accompanied by a currency crisis and this proportion is higher than for IMA and consistent observations, 21 and 17 per cent, respectively. These figures refer only to 1975-1997 due to data availability.

[20] As the de jure regime is reported only once a year (ex ante) to the IMF, it is sufficient that policymakers are unable to follow their announced policy to generate a single ILA observation. Also, an announced change in the exchange rate regime may not be reflected in the official de jure classification when it occurs over the year. However, if at least two consecutive years of ILA are observed, other forces have to be in place, e.g., some form of announcement inertia. Note that only 22 ILA observations out of 812 are neither preceded nor followed by an ILA or missing observation.

to be a preference of not communicating such choice, and rather operate against the benchmark of an announced peg, or announced float, as argued below. Only half of all de facto intermediate exchange rate regime observations are actually announced, and countries choose instead a strategy of more intervention (a fixed exchange rate regime) in 28 per cent of the cases, resulting in ILA, or of no intervention (a floating regime), resulting in IMA.[21]

A closer look at the countries predominately characterized by ILA reveals some further interesting patterns. First, with respect to geographic distribution, low and middle income countries in the Middle East and North Africa show a particularly strong tendency of following less rigid exchange rate policies than announced, see table 2.4. The high proportion of observations involving ILA in this country group is mirrored in the dominance of ILA in OPEC countries. Controlling for the higher prevalence of de jure fixed regimes does not qualitatively alter these results. The high incidence of ILA among Middle Eastern and North African as well as OPEC countries raises the question of whether there could be a potential link between the share of primary exports, in particular fuel export, and the occurrence of ILA. While we do not want to jump to a conclusion prematurely, it is interesting to note that primary exports belong to the group of variables for which the data shows a significant difference in group means, medians, and distribution considering all observations, see table 2.6. However, fuel exports show significantly different means, medians, and distribution only for ILA observations related to de jure fixed regimes (see table 2.6, lower panel). Moreover, countries with a large share of mineral exports seem to follow ILA policies in most world regions. For example, a significant share of the ILA observations in Sub-Saharan Africa, approximately 25 per cent, is related to the cases of Botswana with its dominant diamond industry and Zambia, long dominated by copper. Similarly, most large mineral exporters in South America, excluding Chile, have at least one substantial data spell characterized by ILA. Finally, Norway is among the few European countries that show a substantial ILA spell, together with its Scandinavian neighbors.

We performed parametric and non-parametric tests for the equality of means, medians, and distributions for several economic characteristics of countries that have ILA observations against consistent and IMA observations. As the assumption of a normal distribution of economic variables seems strong, the comparison of medians and dis-

[21] However, if an intermediate exchange rate regime is announced, the likelihood of actually observing it is relatively high: 70 per cent of the announced intermediate regimes are consistent and, therewith, it is the exchange rate category with the highest proportion of consistent regimes.

tributions may provide a more meaningful picture of average performance in the two groups than the comparison of means. For robustness, we provide all three. The results, reported in table 2.6, suggest that variables related to inflation, trade openness, and financial openness as well as to institutional quality do differ between the groups operating under ILA and non-ILA regime combinations, in addition to the export structure described above. The inflation rates for ILA observations are significantly higher while trade openness and the import share are significantly lower. Financial openness, both de jure and de facto, and institutional quality (across different measures) are significantly higher for non-ILA observations. Measures of economic development (GDP per capita, in USD and PPP corrected) and economic size (GDP and population), however, show only a weak relationship with ILA observations.

2.4.3 Intervening more than announced (IMA)

Over the whole sample period from 1973 until 2004 we observe IMA in only 18 per cent of all observations. However, while ILA has been decreasing, the frequency of observing IMA has been increasing over time. The literature on *fear of floating* started by the seminal work of Calvo and Reinhart (2002) provides numerous explanations for the reluctance of countries to tolerate substantial fluctuations in the exchange rate. The most prominent reasons are significant balance-sheet effects, mostly due to high liability dollarization, and high pass-through from exchange rates to prices.[22] Nevertheless, this literature does not offer a comprehensive justification for countries' choices to announce a more flexible exchange rate regime. If there are no credibility gains through the announcement of a rigid exchange rate regime, policymaker may refrain from exchange rate commitments altogether and, thus, retain full flexibility.[23]

Analyzing under which circumstances countries predominantly exhibit IMA reveals some interesting patterns. Remarkably, the relative frequency of observing IMA differs between country groups at different stages of economic and financial development, and there has been an important shift over time. Over the whole sample period, advanced economies have the highest frequency of IMA (34 per cent of the observations in the country group) followed by EMEs with 21 per cent, see table 2.5. Developing countries only choose IMA in 11 per cent of all cases. However, while until the beginning of

[22] Rationales for *fear of floating* are provided by Hausmann, Panizza and Stein (2001), Lahiri and Végh (2001), Caballero and Krishnamurthy (2001), and others.

[23] Rogoff et al. (2003) find that only countries at a low level of financial development are able to gain low inflation credibility through the announcement of rigid exchange rate regimes.

the 1990s IMA is nearly an exclusive phenomenon of advanced economies, it is rapidly gaining importance in EMEs.[24] Especially lower middle income countries display a high and increasing share of IMA observations. Additionally, IMA observations are clearly dominated by de facto intermediate exchange rate regimes, which account for 66 per cent of the total IMA observations, with little time variation.[25] Thus, de facto intermediate regimes are over-represented in the IMA observations as they are in the ILA ones. With respect to announcement choices, floating regimes dominate accordingly (72 per cent).

These figures suggest that IMA is in important ways related to the choice of intermediate intervention strategies. Furthermore, the level of economic and financial development to which the difference between country groups can ultimately be pinned down seems to matter. It is interesting to note, however, that IMA is more widespread amongst lower middle than upper middle income countries. Among the countries showing considerable IMA spells we can additionally identify the following two groups. (i) EMU members prior to the adoption of the euro in 1999, and (ii) advanced economies which have well developed financial markets and are very open, economically and financially: Switzerland, Canada, and New Zealand. The considerable increase of IMA as regime choice in recent years, in particular for EMEs, suggests that worldwide economic trends such as capital account liberalizations, increasing capital flows, and declining inflations rate may be of importance for its explanation as discussed in section 2.3.

For a better understanding of the key macroeconomic variables related to IMA, we look again at differences in means, medians, and distributions of central economic and financial variables between the countries operating under IMA and those with consistent or ILA regimes. The results are reported in table 2.7. For IMA observations, inflation rates are significantly lower, institutional quality and financial openness significantly higher.[26] The differences in other variables are not significant across specifications. Furthermore, conditional on having announced a flexible exchange rate regime, countries with IMA have a significantly higher degree of trade openness and of trade concentration.

[24] This change comes along with the adoption of inflation targeting frameworks in EMEs which involve the announcement of a free float. Due to the particular economic and financial situation in many EMEs, however, they are reluctant to tolerate excessive exchange rate volatility, thus exhibiting *fear of floating* and mostly also IMA. This is the subject of ongoing research. The apparently reverting trend in 1999 is entirely due to the EU member countries adopting the euro which through a very strict implementation of the rule-based de jure regime to fulfill the Maastricht criteria have exhibited IMA.

[25] Among the de facto intermediate exchange rate regimes, crawling bands dominate with 30 per cent of all IMA observations closely followed by managed floats (26 per cent).

[26] The large difference of average inflation rates conditional on having announced a flexible regime is due to the freely falling observations in the non-IMA groups.

For the whole sample, the degree of trade concentration and imports to GDP ratios are lower for IMA observations. Overall, countries operating under IMA have lower primary exports, are richer, and economically more developed while conditioning on de jure flexible regimes does not deliver significant differences.

2.5 Econometric analysis

To give a more accurate picture of the potential links between country characteristics and regime discrepancies, we regress indicators of regime discrepancies on a broad set of variables using a pooled probit approach. After briefly discussing methodology and explanatory variables, we outline the main results of our empirical exercise. We then discuss the robustness of our results and provide an interpretation of the results.

2.5.1 Methodological considerations

Our main interest lies in explaining the choice variable y^*, defined as the desired combination of communication and intervention strategy. y^* is a latent variable that depends on a vector of explanatory variables x

$$y^* = G(x\beta) + u$$

where u is an error term independent of x with mean zero. Instead of the unobserved y^*, we have data on the combination y of de jure and de facto exchange rate regimes. If the announced exchange rate regime is more rigid than the de facto regime, y equals -1 (ILA), if the two regimes are of the same degree of flexibility, y equals 0 (consistent), and if the announced regime is more flexible than the de facto one, y equals 1 (IMA).

Given this characterization, one way to proceed would be to use a multinomial response model. Instead we opt for a binary approach, merging consistent and IMA (ILA) observations as control group when analyzing ILA (IMA), and then using pooled probit estimation techniques. One reason not to use a multinomial approach is that this would require assuming independence of irrelevant alternatives, a condition that is unlikely to hold in the present case. Similarly, there is no natural ordering for the three alternatives, precluding the use of an ordered discrete choice model. Finally, by using a binary specification, we make our results comparable to the related contribution of Alesina and Wagner (2006), who also compare ILA and IMA separately against the remaining obser-

vations.[27] We do not use fixed effects estimations since many of our variables display no or very little variation over time. Also the use of a random effects estimator appears inappropriate because we have a very large country sample which cannot be considered as randomly drawn from the underlying population. Finally, we prefer to follow an explicit binary choice model and then test our results against a linear probability model.

In addition to using the complete dataset, we create sub-samples, assessing the probability that a country chooses a certain regime combination conditional on observing certain de facto or de jure regimes. For both IMA and ILA, we first code the endogenous variable as 1 if we observe a specific discrepancy, and 0 otherwise. However, with this approach we cannot disentangle the general incentives to announce a more fixed or more flexible exchange rate regime. Therefore, in a second set of regressions, we will restrict our sample to those observations involving de jure fixed (in the case of ILA) or flexible (in the case of IMA) regimes, and then look at characteristics of countries sticking to their announcement against those that do not. As noted above, both types of discrepancies are dominated by intermediate de facto policies combined with the announcement of corner solutions, i.e., fixed or floating exchange rate regimes. Thus, in a last set of regressions we confine our sample to those observations involving de facto intermediate regimes and analyze what distinguishes countries with a de jure fixed (floating) regime from others.

As our aim is to identify a set of stylized facts, we use a broad set of potential explanatory variables and report best regression results, both in terms of robustness and significance. Starting from the observations in section 2.4, we focus on the degree of trade openness, the importance of primary commodity exports, as well as measures of price stability, financial openness, and economic and financial development.

With respect to price stability, it is worth pointing out that the inflation rate is not only a likely determinant of exchange rate regime choices and possible deviations of de facto from announced policies but is itself determined by the exchange rate regime.[28] However, the exchange rate policy is likely to have only a lagged effect on the inflation rate. Thus, by using the lagged yearly CPI inflation rate, the scope for endogeneity is reduced. Furthermore, the effect of the inflation rate on exchange rate regime choices is most likely not linear. Very high inflation rates have a different effect than moderate

[27] In contrast to our approach, Alesina and Wagner differentiate between degrees of distance between de facto and de jure policies, i.e., conditional on de jure flexible regimes, de facto intermediate regimes are treated differently than de facto fixed, and apply an ordered logit approach.

[28] Ghosh et al. (2002) and Kuttner and Posen (2001) study the macroeconomic effects of different exchange rate regimes.

rates of price increases.[29] Therefore, we also include a (lagged) high inflation dummy for observations involving inflation rates of 40 per cent or more on an annual basis. Additionally, we include the ratio of imports to GDP to proxy the extent to which domestic prices are exogenously determined.

In our baseline specifications, we do not include measures of institutional quality, mainly because of the effect on sample size: Including standard measures of institutional quality reduces the sample substantially and systematically since data is only available for a sub-set of countries and only starting in 1984. However, to account for the importance of institutional quality and the evidence provided by Alesina and Wagner (2006), we run robustness checks, the results of which are reported below.

As pointed out above, we use two measures of financial openness: a de jure and a de facto measure. As with inflation, regime choices may affect financial integration and the incentives to change official restrictions on capital account transactions. On the one hand, if a country has a floating exchange rate regime, capital restrictions should not play a role. On the other hand, goods and capital markets dislike substantial uncertainties with respect to exchange rate fluctuations. While financial openness affects a country's exchange rate policy choice, exchange rate policy is likely to affect actual financial integration only with some delay. Still, to mitigate potential endogeneity problems when using measures of financial openness as explanatory variables, we lag them by one period.

To account for important differences in the relation between regime choices and country characteristics at different stages of economic and financial development, we perform separate regressions for each country group. It is likely that economic and financial structure matter in different ways for countries at different stages of financial and/or economic development. For example, the stability implications of financial and trade openness change as domestic financial markets develop, additional liquidity, insurance, hedging, and risk diversification services are provided, and credit constraints are relaxed. The development of financial markets and institutions thus influences an economy's ability to deal with and profit from international capital flows, and vice versa. A minimum level of financial development seems to be required to attract capital flows but countries without deep financial markets may be restricted in their capacity to absorb large capital inflows. Furthermore, if a country has important external financial positions, it is more sensitive to exchange rate volatility but it may suffer additional volatility if the positions

[29] High inflation is defined as inflation rates of 40 per cent or more per year following the definition of the World Bank, and Reinhart and Rogoff (2004) for the freely falling category.

are frequently changed due to high capital flows.

2.5.2 Baseline results

The results of the pooled probit estimations for ILA and IMA for the whole sample and separated by income groups are reported in tables 2.8 and 2.9 - 2.12, respectively.[30] A first important insight is that the separate treatment of countries at different stages of economic and financial development is important. For example, higher terms of trade volatility increases the probability of ILA when a de jure regime is announced but has no significant effect otherwise when considering all countries jointly. When analyzing countries at different stages of economic development separately, either through sub-samples or interaction terms, higher terms of trade volatility is associated with a significantly higher probability for ILA and a lower probability for IMA for lower middle income countries. For high income countries it reduces the likelihood of both IMA and ILA, thus making consistent combinations more likely.

With respect to other *trade-related variables*, a higher degree of trade openness reduces the probability of IMA, except for high income countries, and increases the probability of ILA for low and lower middle income countries while reducing it for upper middle income countries. More interestingly, higher exports of primary commodities increase the probability of consistent regime combinations (reduces it for both IMA and ILA) for low income countries. For lower middle income countries, however, the effect tends towards the opposite: higher primary commodity exports increase the probability of ILA. Conditional on a de facto intermediate exchange rate regime, upper middle income countries tend also significantly towards ILA.

In general, *high inflation* makes ILA more and IMA less likely, supporting the view that crises and inability to peg are part of the explanation. However, lower middle income countries having de facto intermediate regimes and having experienced high inflation in the previous year tend to be more cautious and to announce a flexible exchange rate regime.

Turning to *financial openness*, a de jure more open capital account significantly reduces the probability of ILA. Furthermore, it tends to increase the probability of IMA for all country groups except low income countries. The evidence for de facto financial openness is mixed, with the exception of high income countries for which a higher de facto financial

[30] We use the same regressors for all sets of estimations whenever possible to avoid additional selection problems due to data availability.

openness makes IMA significantly more and ILA less likely.

A *listing in the MSCI index*, a proxy for the crossing of a critical level of financial market development, increases the likelihood of experiencing inconsistent regime combinations, both ILA and IMA, for lower middle income countries while reducing it for upper middle income countries. Conditional on de facto intermediate regimes, all countries have a higher probability of announcing a more flexible exchange rate regime when included in the MSCI. More specifically, the inclusion in the MSCI increases the probability of IMA for upper middle income countries while increasing the probability of deviations from consistent regimes for lower middle income countries.

Furthermore, we get the following insights from the regressions conditional on specific exchange rate regime announcements. On the one hand, *conditional on de jure fixed regimes*, higher terms of trade volatility, lower trade openness, and higher de facto financial openness reduce the likelihood of ILA for high income countries. However, lower middle income countries are more likely to have ILA when included in the MSCI index, when they have higher primary commodity exports, and higher terms of trade volatility. The probability of ILA is higher for low income countries when they have lower primary commodity exports and high inflation in the previous year. On the other hand, *conditional on the announcement of a flexible exchange rate regime*, higher trade openness, lower terms of trade volatility, and higher financial openness (both de facto and de jure) make it more likely for high income countries to operate under IMA. Upper middle income countries are more likely to have IMA when they are not included in the MSCI, are less open to trade, have low inflation, and higher de jure financial openness. For lower middle income countries, higher primary commodity exports, lower terms of trade volatility, and low inflation are positively related with IMA. Lower trade openness and de jure financial openness makes IMA more likely for low income countries.

2.5.3 Robustness checks - sensitivity analysis

As to methodological robustness, we checked all our results with a linear probability model and used interaction terms instead of sub-samples and the signs of the coefficients remained unchanged. Furthermore, regressions for narrower samples, excluding small countries with a population of less than one million and considering only a number of economically important countries, confirmed our key results. Neither did the exclusion of the observations since 2000 for which we construed the de jure exchange rate regimes qualitatively alter the results. As previously discussed, freely falling observations may

distort our results. However, regressions excluding these observations did not change the main results.

Alesina and Wagner's (2006) results suggest that institutional quality is pivotal for explaining discrepancies between exchange rate regime announcements and de facto policies. As institutional quality data is only available for a sub-set of countries and since 1984, the sample is substantially and systematically changed. Nevertheless, we ran robustness checks including indicators of country risk (composite risk rating), bureaucratic quality, and democratic accountability. The main insight is that better institutional quality significantly increases the likelihood of IMA while institutional quality has no effect on the probability of ILA across different specifications. Furthermore, the signs of the coefficients of variables related to IMA are mostly unchanged while primary commodity exports (related to ILA) are not significantly related to regime discrepancies anymore. This, however, is not surprising since ILA is predominantly observed during the 1970s and 1980s for which institutional quality data is not available and which are thus not included.

The results, however, are not very robust to the use of the de facto exchange rate regime classification of Levy-Yeyati and Sturzenegger (2005). The main reason is that the classification differs fundamentally from Reinhart and Rogoff's (2004), the correlation is only 0.5. Therefore, we consider only observations for which the two classifications coincide. This reduces the number of observations involving deviations between announcements and de facto policies significantly.[31] However, using only observations for which Reinhart and Rogoff and Levy-Yeyati and Sturzenegger agree in their de facto classifications, we can broadly confirm our results. As discussed in section 2.2, we nevertheless consider the Reinhart and Rogoff de facto classification the more appropriate for our questions.

2.5.4 Interpretation of the empirical evidence

To interpret these findings, it is essential to first go back to the two fundamental insights of the descriptive analysis above. **First**, there is a clear tendency for countries to announce either a fixed or floating exchange rate regime. This move to the corners of the exchange rate flexibility spectrum, however, is not mirrored in actual intervention strategies. Countries with a higher degree of de jure financial openness and countries

[31] The overall frequency of ILA and IMA is reduced from 22 to 7 per cent and from 18 to 13 per cent, respectively.

that cross a critical level of financial market development tend to intervene more than announced. At the same time, higher inflation and a higher share of primary commodities make it more likely that countries allow their exchange rate to float more than announced.

Second, the tendency towards announcing extreme exchange rate regimes goes hand in hand with a tendency towards de facto intermediate regimes. Countries for which an intermediate exchange rate regime is the optimal choice face the following problem. Intermediate exchange rate regimes have the reputation of being highly vulnerable to crises.[32] Partly as a consequence, communicating intermediate regimes is complicated: In principle, policymakers could announce the parameters that will guide day-to-day policy decisions, for example, through publication of the threshold levels of shocks that will trigger intervention. This, however, involves substantial communication risks since the states of the world that would have to be specified ex ante would be too large to be effectively displayed in a transparent manner. In addition, communicating the intermediate nature of the regime would reduce its benefits substantially, since the desired flexibility would be reduced by any attempt to formalize the intervention strategy. Furthermore, there will be always situations in which the expectations created by a certain regime announcement will be frustrated. A policymaker aware of this might want to choose a communication framework that does not aim at preventing the impossible, but at providing a suitable framework for explaining deviations. It may therefore be a viable alternative to announce a floating or fixed exchange rate regime as benchmark to explain policy deviations against a clear arrangement. Put differently, since ambiguity cannot be avoided, the policymaker's task is to manage it appropriately. Financial markets and the public might not even be averse to such an approach: For markets, ambiguities might actually represent opportunities worth exploring (Best, 2005).

The announcement of a more flexible exchange rate regime than de facto implemented is more likely the more financially open and developed countries are. As countries develop economically and financially, they increasingly benefit from flexible exchange rate regimes (Rogoff et al., 2003). Advanced countries often exhibit important nominal rigidities and rely on the nominal exchange rate as an adjustment mechanism. At the same time, they generally do not have severe currency mismatch problems as financial

[32] Bubula and Ötker-Robe (2003) find that for developed and emerging market economies more integrated with international capital markets, pegged exchange rate regimes are more prone to currency crises than floating regimes (they use the IMF de facto regimes). However, intermediate exchange rate regimes are the most crisis prones independent of the degree of financial integration.

instruments in their own currencies and adequate hedging instruments are available. Nevertheless, these countries may opt to choose IMA. The announcement of a free float may be central for signaling an advanced stage of development, while the high openness may require intervention on a regular basis to smooth exchange rate variations.

Countries at an intermediate level of financial development often face important currency mismatches[33] and are confronted with large and volatile capital inflows, making a more active exchange rate intervention strategy more likely. At the same time, these countries usually prefer a communication strategy that exposes the financial system's ability to manage exchange rate risks on its own. Doing so conveys the economy's ability to partly absorb external shocks without policy intervention, and may thus signal a certain degree of financial market development and a relatively resilient macroeconomic environment. Closely related, IMA provides a tool for *learning to float*[34] as policymakers signal to financial markets the need to develop skills and instruments and, at the same time, intervene sufficiently to support weak and not fully developed markets. In this context, IMA may open a channel for reputation building by allowing the public to learn about policymakers' abilities to stabilize the exchange rate in an otherwise market-determined system, either directly or through the stabilization of fundamentals that spill over to the exchange rate. It may in fact be easier to stabilize the exchange rate when the commitment to stabilization is not excessive due to the existence of escape clauses. Drazen and Masson (1994) show that announcing an overly tough policy stance towards exchange rate changes may force policymakers to maneuver the economy into a situation in which subsequent exchange rate changes become more difficult to avoid. If carrying out an announced tough policy has lasting effects on the underlying policy trade-off, the signaling benefits of such a strategy may be outweighed by the now larger cost of continuing to be tough.

Furthermore, middle income countries have been particularly prone to banking and twin crises, especially with rigid exchange rate regimes, and may thus be very cautious in providing any kind of explicit target.[35] Clear exchange rate targets may not only

[33] Currency mismatches in the economy are a prominent explanation for countries exhibiting *fear of floating* and, thus, a reluctance to let their exchange rate float freely.

[34] Countries have to fulfil certain criteria to be able to take fully advantage of a flexible exchange rate regime and usually it takes time and effort to achieve critical levels. Duttagupta, Fernandez and Karacadag (2004), Asici and Wyplosz (2003), and Hakura (2005) discuss recommendable prerequisites.

[35] Twin crises have almost exclusively been an emerging market phenomenon (Rogoff et al., 2003). Kaminsky and Reinhart (1999) show that twin crises typically occur in the aftermath of financial liberalization and that the coincidence of banking and currency crises is particularly costly.

trigger speculative attacks but also distort investment and borrowing decisions. High capital flows combined with financial and institutional weaknesses may exacerbate these distortions. If the perceived risk level is high, frequent and sudden reversals of capitals are not unusual and may be triggered by minor events.[36] However, exchange rate fluctuations may be perceived as increasing the overall risk of a country calling for an active exchange rate management. Thus, middle income countries may find themselves facing a difficult policy dilemma to which IMA may provide a possible solution. Through the announcement of a flexible exchange rate regime, countries do not provide explicit guidance and thus no direct target for expectations. However, through active exchange rate management they limit the detrimental effects of large exchange rate fluctuations.

An interpretation of the relation between primary commodity exports and ILA can be found in discussions on exchange rate policies in countries characterized by a predominant export staple. On the one hand, these countries are vulnerable to large changes in the terms of trade, which, in theory, would require the exchange rate to depreciate (appreciate) after large negative (positive) shocks. On the other hand, the respective economies face difficult trade-offs when choosing a nominal anchor other than the exchange rate. The tension between these two policy concerns has led some observers to propose non-standard exchange rate anchors, such as pegging the export price (Frankel, 2005).

But trading off the need for flexibility and the viability of a nominal anchor is not the only challenge for these countries. The respective economies are also vulnerable to *dutch disease*-type phenomena (Corden and Neary, 1982; van Wijnbergen, 1984)[37]: In order to diversify over the medium term, policymakers may want to keep the real exchange rate at a competitive and stable level. However, if the country is experiencing high foreign capital inflows, e.g., due to booming primary commodity exports or large-scale remittances, this may lead to a steady real appreciation which threatens the competitiveness of other export sectors.[38] A policymaker concerned about competitiveness may thus

[36] Calvo, Izquierdo and Mejía (2004) present empirical evidence on sudden stops.

[37] The basic mechanism of *dutch disease* can be described as follows. Consider the discovery of natural resources that leads to an export boom where foreign capital inflows increase, putting pressure on the nominal exchange rate. Also real income rises and part of it is spend on non-traded goods. If the exchange rate is fixed, this leads to an increase in domestic prices and, thus, to a real exchange rate appreciation (world prices are given). In case the country has a flexible exchange rate the capital inflows will appreciate the nominal exchange rate and, thus, the real exchange rate. The real appreciation deteriorates the external competitiveness of the other traded good sectors in the economy. In the extreme case, other export sectors may be crowded out completely, increasing the country's vulnerability to external shocks (especially to primary commodity prices).

[38] High domestic inflation may have the same effect.

want to limit real appreciations by adjusting the nominal exchange rate accordingly. This policy, however, results in an increase in foreign reserves that, if not sterilized, increases domestic money supply and inflation.[39]

In many countries, the monetary challenges of such a policy are reinforced by two factors. First, money markets in the respective countries are often underdeveloped, limiting the effectiveness of standard approaches to monetary management. Second, many of the large primary exporters are also heavily dependent on imports and are thus characterized by a high pass-through from exchange rates to prices. Both factors tend to increase the role of the exchange rate in stabilizing prices and require authorities to provide clear signals with respect to the future level and volatility of the exchange rate, which are also important for emerging export sectors. It may thus be necessary to give clear guidance as to future exchange rate movements, especially in the short term, while preserving the flexibility to restore competitiveness in the medium term. Put differently, the exchange rate is used to communicate with two different audiences. In specific circumstances, ILA may provide a way out of the policy dilemma. Through the announcement of a fixed exchange rate regime the policymaker can emphasize a willingness to maintain price stability, while using frequent parity realignments to avoid excessive real appreciations (or depreciations).[40]

As an example, consider Botswana, a country that is considered by many as having successfully avoided *dutch disease* in the presence of large resource exports and for which we observe ILA since 1980.[41] Botswana's main stated policy goals are to maintain the inflation rate at reasonable levels, to promote external competitiveness, and to successfully deal with external shocks (International Monetary Fund, 2004). It is interesting to note that the first goal can, in principle, be supported by nominal exchange rate stability while the second and third may require occasional exchange rate adjustments, which may partly explain Botswana's relative diversification successes.

[39] The monetary expansion may be limited by partial sterilization. However, the viability of sterilization is questionable and may induce an increase in domestic interest rates, triggering further capital inflows. A possible way out of the dilemma may be to impose temporary capital controls.

[40] Given that these adjustments take place frequently, maybe in small steps, e.g., to smooth variations in the nominal exchange rate as well, the de facto exchange rate regime may be considered a relatively flexible one, resulting in ILA. In this specific context, the expression ILA may be misleading as policymakers are actually intervening more than announced although not to keep the nominal exchange rate stable but the real one.

[41] According to the chronologies accompanying the Reinhart and Rogoff (2004) classification, there was also a parallel market 1986-1996.

2.6 Conclusions and outlook

Our empirical analysis of discrepancies between announced and de facto exchange rate regimes suggests that discrepancies are systematic and we identify a number of stylized facts. Most importantly, both types of discrepancies are clearly dominated by intermediate de facto policies. Since countries at the same time tend to communicate exchange rate regimes at the corners of the flexibility spectrum, inconsistencies emerge.

Whether ILA or IMA is observed depends on country characteristics. For example, *intervening less than announced* is related to high shares of primary commodity exports and low financial openness. A potential explanation is that ILA offers a way to simultaneously achieve short term nominal exchange rate stability while preserving medium term flexibility. Additionally, crises situations and high inflation periods are associated with ILA. *Intervening more than announced*, in turn, is a widespread phenomenon amongst countries with medium to high levels of economic and financial development and high financial openness. IMA may provide an instrument to signal and foster financial market development while insulating the economy from extreme financial and economic disruptions due to high exchange rate fluctuations. Finally, we observe a significant secular trend from ILA towards IMA which matches the movement towards financial liberalization, the rapid development of financial markets, increasing capital mobility, and financial integration, as well as of worldwide reductions in inflation rates.[42] These developments coincide in many aspects with the individual country characteristics related with ILA and IMA. A detailed analysis of the time trends in exchange rate regime discrepancies is planned for future research.

Our study provides novel insights into the empirical regularities related to discrepancies between de jure and de facto exchange rate regimes. Still, there is significant work to be done to improve our understanding of the implementation and communication of exchange rate policies.[43] A theoretical analysis of our findings is left for future research. Recently, countries have emphasized the benefits of bounded de facto flexibility combined with a well-defined communication strategy and have been successful in following this approach as inflation rates and the occurrence of crises have declined. One important

[42] Kose et al. (2006) and Kaminsky and Schmukler (2008) study recent developments in financial markets.

[43] Recently, Reinhart and Rogoff released an update of their de facto classification for the years 2002 until 2007 and an IMF de jure classification spanning the period from 1970 until 2007, see http://www.wam.umd.edu/~creinhar/Papers.html. An update of our analysis is planned for the future.

manifestation is that the communication of explicit exchange rate targets is increasingly being substituted by the communication of explicit inflation targets. Inflation targeting as preferred monetary policy framework in small open economies is analyzed in the next chapter.

2.A Appendix

2.A.1 Data issues

The first example of a potentially misleading classification is related to the choice of reference currencies. To understand the potential measurement errors resulting from an inadequate approach, consider as an example Germany. Its de jure exchange rate regime is classified as cooperative system, EMS or predecessor, during 1973-1998 and, thus, as intermediate regime. However, the de facto regime is classified as freely floating by Reinhart and Rogoff (2004) as they use the US-Dollar, instead of a basket of the other European currencies relative to which the announcement is made, as reference currency. Also Levy-Yeyati and Sturzenegger (2003a) use the USD as reference currency for Germany and come to the same conclusion: the exchange rate regime was a floating one until 1998. Thus, between 1973 and 1998 Germany displays ILA, even though there was neither unwillingness nor inability to stick to the announced policy. In fact, with 25 years of ILA Germany belongs to the small country group in which ILA has been observed nearly throughout the sample period. To account for this problem, we drop Germany from our sample.

A second interesting finding along these lines is that the results are very sensitive to the classification of de jure secret basket pegs. Secret basket pegs are exchange rate regimes where the national currency is pegged to a basket of at least two currencies based on country-specific criteria with the weights of the currencies and/or the composition of the basket being secret and possibly variable (Ghosh et al., 2002). When secret basket pegs are included in the fixed exchange rate regimes as it is standard in the literature, e.g., Ghosh et al. (2002), Alesina and Wagner (2006), and von Hagen and Zhou (2006), the occurrence of ILA increases substantially.[44] Indeed, nearly all secret basket peg observations, i.e., 87 per cent between 1973 and 1999, are associated with intermediate

[44]The detailed de jure classification is only available until 1999. The share of ILA until 1999 is 24 per cent when secret basket pegs are included in the intermediate category and 33 per cent when they are included in the fixed regimes.

de facto regimes. Secret basket pegs are special in the sense that, depending on policy implementation, they can be either considered fixed or intermediate regimes. If we regard easy verifiability of the exchange rate regime as a distinguishing feature of fixed regimes as put forward by Frankel et al. (2001), then secret basket pegs are closer in nature to intermediate than to fixed regimes. A basket peg may have significant variations in the composition and relative weights of the included currencies. If, in addition, the composition or the relative weights are not public information, as in the case of secret basket pegs, the exchange rate regime may be very difficult or even impossible to verify in a reasonable amount of time. Specifically, the exchange rate regime may be perceived as intermediate without implying a diverging announcement and intervention policy. As an interesting illustration, consider Malta, which announced a basket peg with a secret composition until 1997 and published thereafter. During the same time, the country followed a de facto narrow moving band (Reinhart and Rogoff, 2004).[45] If the composition and the relative weight of currencies in the basket change frequently without this being public information, the exchange rate may indeed be fixed to a difficult-to-infer central parity and appear as floating in a narrow band around some reference currency (in the case of Malta, first the UK pound, then the DM, and finally the Euro). If we categorize secret basket pegs as fixed, we would classify all the observations as ILA, if we consider them as pertaining to the intermediate category, we would have consistent regime combinations until 1997. Thus, by including the secret basket pegs into the de jure intermediate regime category we get a more accurate picture of exchange rate regime choices while being more conservative in favor of consistent regime combinations. All statements in this study refer to the sample when Germany is excluded and secret basket pegs are included in the intermediate exchange rate category.

[45]Malta has not been classified by Levy-Yeyati and Sturzenegger (2005).

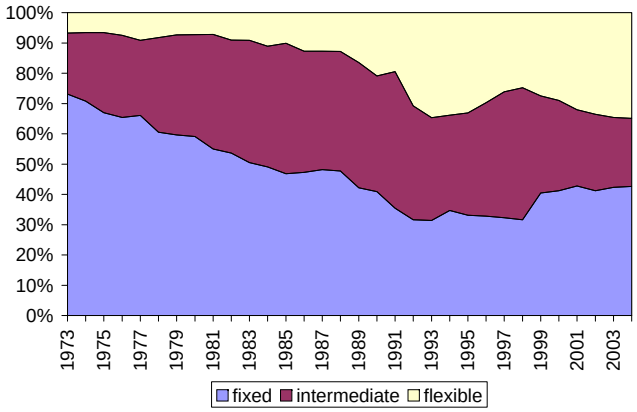
2.A.2 Graphs and tables

Table 2.1: Exchange rate regimes.

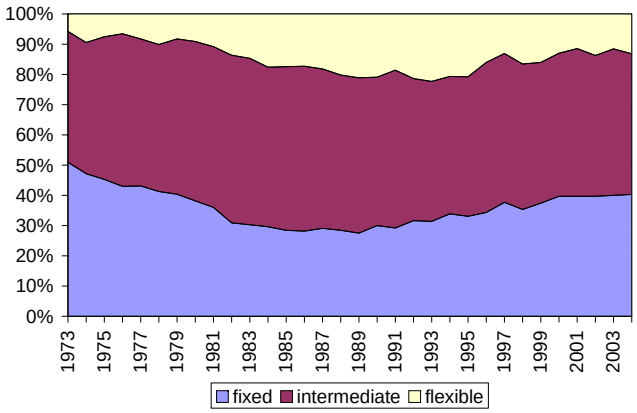
	De jure exchange rate regimes, Ghosh, Gulde and Wolf (2002)	**De facto exchange rate regimes**, Reinhart and Rogoff (2004)
Fixed	Dollarized	No separate legal tender
	Currency board	Pre announced peg or currency board arrangement
	Monetary union to outside (CFA) or inside (EMU) set of countries	Pre announced horizontal band that is narrower than or equal to $+/-2\%$
	Single currency peg	De facto peg
	Published basket peg (SDR or non-SDR)	
Intermediate	Secret basket peg	Pre announced crawling peg
	Cooperative system (EMS or predecessor)	Pre announced crawling band that is narrower than or equal to $+/-2\%$
	Crawling peg	De facto crawling peg
	Target zone	De facto crawling band that is narrower than or equal to $+/-2\%$
	Unclassified rule-based intervention	Pre announced crawling band that is wider than or equal to $+/-2\%$
	Managed float with heavy intervention	De facto crawling band that is narrower than or equal to $+/-5\%$
	Unclassified managed float	Moving band that is narrower than or equal to $+/-2\%$ (i.e., allows for both appreciation and depreciation over time)
	Other floats	Managed floating
Floating	Float with light intervention	Freely floating
	Float with no intervention	Freely falling

Figure 2.2: Exchange rate regimes and discrepancies over time - all countries.

(a) De jure exchange rate regimes, 1973-2004.



(b) De facto exchange rate regimes, 1973-2004.



(c) Exchange rate regime discrepancies, 1973-2004.

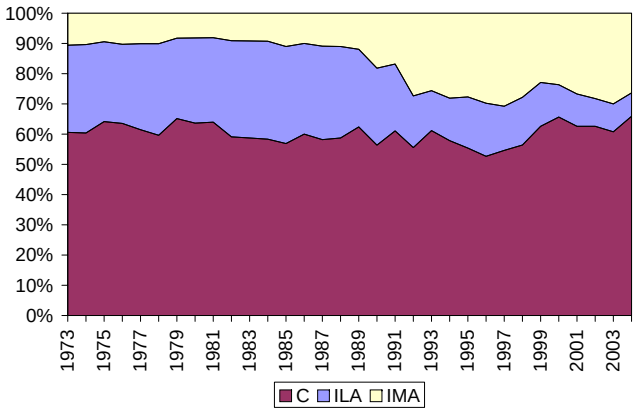
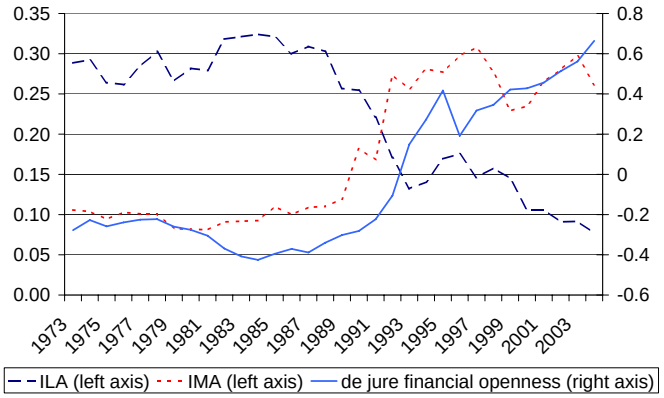
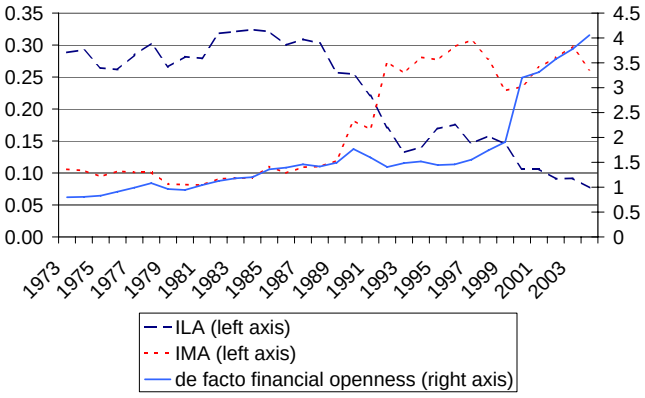


Figure 2.3: Exchange rate regime discrepancies, financial openness, and world inflation.

(a) De jure financial openness.



(b) De facto financial openness (financial integration).



(c) World inflation rates (per cent p.a.).

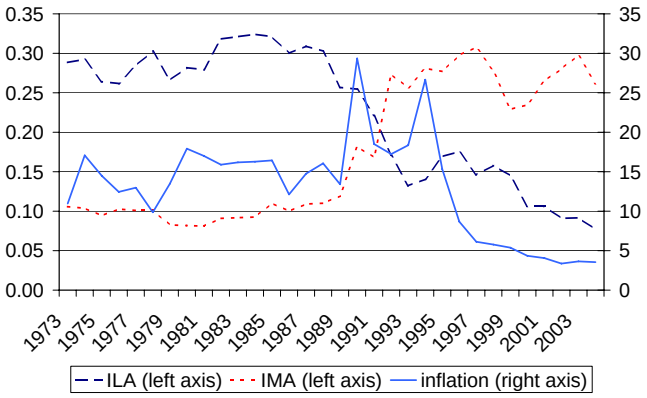


Table 2.2: Country coverage.

High income	**Upper middle income**	**Lower middle income**	**Low income**
Australia	Antigua & Barbuda	Albania	Benin
Austria	Argentina*	Algeria	Burkina Faso
Belgium	Botswana	Armenia	Burundi
Canada	Chile*	Azerbaijan	Cameroon
Cyprus	Costa Rica	Belarus	Central African Rep.
Denmark	Czech Republic*	Bolivia	Chad
Finland	Dominica	Brazil*	Cote D'Ivoire
France	Equatorial Guinea	Bulgaria	Gambia
Greece	Estonia	China, P.R.*	Ghana
Hong Kong	Gabon	Colombia*	Guinea
Iceland	Grenada	Dominican Republic	Guinea-Bissau
Ireland	Hungary*	Ecuador	Haiti
Israel*	Latvia	Egypt*	India*
Italy	Lebanon	El Salvador	Kenya
Japan	Libya	Georgia	Kyrgyz Republic
Korea*	Lithuania	Guatemala	Lao P.D.R.
Kuwait	Malaysia*	Guyana	Lesotho
Luxemburg	Mauritius	Honduras	Liberia
Malta	Mexico*	Indonesia*	Madagascar
Netherlands	Panama	Iran, I.R. of	Malawi
New Zealand	Poland*	Iraq	Mali
Norway	Russia*	Jamaica	Mauritania
Portugal	Slovak Republic	Jordan*	Moldova
Singapore	South Africa*	Kazakhstan	Myanmar
Slovenia	St.Kitts & Nevis	Morocco*	Nepal
Spain	St.Lucia	Paraguay	Nicaragua
Sweden	St.Vincent & Grenadines	Peru*	Niger
Switzerland	Turkey*	Philippines*	Nigeria
United Kingdom	Uruguay	Rumania	Pakistan*
United States	Venezuela*	Sri Lanka*	Senegal
		Suriname	Tajikistan
		Swaziland	Tanzania
		Syrian Arab Republic	Togo
		Thailand*	Uganda
		Tunisia	Zambia
		Turkmenistan	Zimbabwe
		Ukraine	

The distinction between income groups follows the World Bank methodology which is based on GNI per capita in USD. Countries are categorized as of their status in 2004. Low income countries are those with a GNI per capita < 825 USD, lower middle income with $826 - 3,255$ USD, upper middle income with $3,256 - 10,065$ USD and high income countries $> 10,065$ USD. Countries with a star (*) are emerging market economies as defined by the Morgan Stanley Capital International (MSCI) index.

Table 2.3: Data sources.

Variable	**Source**
Exchange rate regimes:	
de jure	Ghosh, Gulde and Wolf (2002), AREAER (various issues), information of national authorities and international institutions
de facto	Reinhart and Rogoff (2004), Eichengreen and Razo-Garcia (2006), Levy-Yeyati and Sturzenegger (2005)
Financial openness:	
de jure	Chinn and Ito (2006)
de facto	Lane and Milesi-Ferretti (2006), and authors' calculations: (external assets + external liabilities)/GDP
Macroeconomic indicators:	
CPI inflation rate	International Financial Statistics
GDP per capita (in PPP)	World Economic Outlook
Population	International Financial Statistics
Primary commodity exports	World Development Indicators and authors' calculation
Terms of trade volatility	World Economic Outlook and authors' calculations: terms of trade growth, 3 year centered standard deviation
Trade concentration	Ghosh, Gulde and Wolf (2002); Direction of Trade Statistics
Trade openness	World Economic Outlook and authors' calculations: (exports + imports)/GDP
Currency crises	Glick and Hutchison (2001)
Institutional quality	The PRS Group, Inc., 1979-2006, East Syracuse, NY 13057 USA.
Regional dummies	World Bank

Table 2.4: Distribution of regime discrepancies by regions and country groups - ILA.

	ILA	Overall	Share	P(ILA|de jure = fixed)
East Asia & Pacific*	70	221	31.7%	74.7%
Europe & Central Asia*	69	281	24.6%	35.5%
Latin America & Caribbean*	224	884	25.3%	30.1%
Middle East & North Africa*	133	314	42.4%	78.3%
South Asia*	29	118	24.6%	58.0%
Sub-Saharan Africa*	171	975	17.5%	20.4%
OECD	122	860	14.2%	47.0%
OPEC	103	248	41.5%	80.5%
Transition countries	85	323	26.3%	50.6%
Developing countries	533	2,119	25.2%	31.9%
Emerging market economies	183	738	24.8%	57.6%
Advanced countries	96	877	10.9%	40.7%
Time-varying:				
Developing countries^{+}	667	2,530	26.4%	35.2%
Emerging market economies^{+}	50	363	13.8%	42.9%
Advanced countries^{+}	95	841	11.3%	40.4%
Low income countries	233	1,040	22.4%	27.9%
Lower middle income countries	287	952	30.1%	58.8%
Upper middle income countries	176	801	22.0%	24.4%
High income countries	116	941	12.3%	44.6%
Time-varying:				
Low income countries^{+}	228	1,034	22.1%	30.4%
Lower middle income countries^{+}	305	1,222	25.0%	37.2%
Upper middle income countries^{+}	168	651	25.8%	38.0%
High income countries^{+}	111	827	13.4%	44.7%
All observations	812	3,734	21.7%	36.0%

* Only low and middle income countries are included. $^{+}$ The composition of these country groups changes over time. We use the historical country classification of the World Bank since 1987 and changes in lending categories for the preceding years to account for changes in income levels of countries over time (available at http://siteresources.worldbank.org/DATASTATISTICS/Resources/OGHIST.xls).

Table 2.5: Distribution of regime discrepancies by regions and country groups - IMA.

	IMA	Overall	Share	P(IMA|de jure = floating)
East Asia & Pacific*	61	221	27.6%	75.5%
Europe & Central Asia*	54	281	19.2%	52.0%
Latin America & Caribbean*	109	884	12.3%	70.5%
Middle East & North Africa*	39	314	12.4%	72.7%
South Asia*	21	118	17.8%	100.0%
Sub-Saharan Africa*	95	975	9.7%	58.4%
OECD	305	860	35.5%	68.6%
OPEC	10	248	4.0%	36.4%
Transition countries	62	323	19.2%	56.4%
Developing countries	230	2,119	10.9%	63.5%
Emerging market economies	152	738	20.6%	62.6%
Advanced countries	294	877	33.5%	71.0%
Time-varying:				
Developing countries^{+}	272	2,530	10.8%	62.3%
Emerging market economies^{+}	126	363	34.7%	66.4%
Advanced countries^{+}	278	841	33.1%	70.8%
Low income countries	113	1,040	10.9%	58.7%
Lower middle income countries	188	952	19.7%	70.7%
Upper middle income countries	78	801	9.7%	61.9%
High income countries	297	941	31.6%	67.7%
Time-varying:				
Low income countries^{+}	139	1,034	13.4%	58.2%
Lower middle income countries^{+}	190	1,222	15.5%	69.2%
Upper middle income countries^{+}	58	651	8.9%	67.2%
High income countries^{+}	289	827	34.9%	68.3%
All observations	676	3,734	18.1%	65.7%

* Only low and middle income countries are included. $^{+}$ The composition of these country groups changes over time. We use the historical country classification of the World Bank since 1987 and changes in lending categories for the preceding years to account for changes in income levels of countries over time (available at http://siteresources.worldbank.org/DATASTATISTICS/Resources/OGHIST.xls).

Table 2.6: ILA - tests for equality of means, medians, and distributions.

all observations	Mean		t-test[1]	Median test[2]	Mann-Whitney test[3]
	ILA = 1	ILA = 0			
Macro					
GDP per capita (PPP)	4271.1	6830.9	0.000	0.000	0.000
Population	35.7	36.6	0.852	0.074	0.000
CPI inflation	107.5	23.0	0.002	0.000	0.000
Trade regime					
Openness	0.6	0.9	0.000	0.000	0.000
Trade concentration	52.1	52.9	0.275	0.289	0.193
Imports to GDP	0.3	0.5	0.000	0.000	0.000
Primary exports	34.7	25.6	0.000	0.000	0.000
Fuel exports	20.3	11.9	0.000	1.000	0.033
Institutions					
Bureaucratic quality	1.8	2.4	0.000	0.000	0.000
Accountability	3.3	4.0	0.000	0.000	0.000
Country risk	58.1	67.7	0.000	0.000	0.000
Financial openness					
De jure	-0.9	0.3	0.000	0.000	0.000
De facto	1.0	2.0	0.000	0.000	0.000

conditional on de jure fixed regime	Mean		t-test[1]	Median test[2]	Mann-Whitney test[3]
	ILA = 1	ILA = 0			
Macro					
GDP per capita (PPP)	4374.4	4859.3	0.122	0.000	0.197
Population	36.7	14.5	0.000	0.000	0.000
CPI inflation	102.8	12.1	0.010	0.000	0.000
Trade regime					
Openness	0.6	1.0	0.000	0.000	0.000
Trade concentration	53.6	59.2	0.000	0.000	0.000
Imports to GDP	0.3	0.6	0.000	0.000	0.000
Primary exports	37.6	27.8	0.000	0.372	0.000
Fuel exports	22.7	9.7	0.000	0.000	0.000
Institutions					
Bureaucratic quality	1.8	2.1	0.001	0.000	0.000
Accountability	3.2	3.6	0.002	0.003	0.002
Country risk	59.0	66.2	0.000	0.048	0.000
Financial openness					
De jure	-0.9	0.1	0.000	0.000	0.000
De facto	1.1	3.0	0.000	0.000	0.000

Notes: (1) The p-values are reported for the two means being different. The groups are not assumed to have equal variance. (2) The p-values are reported for the nonparametric test on the equality of medians testing the null hypothesis of the two samples being drawn from populations with the same median. The test chi-squared statistic is continuity corrected. (3) Nonparametric test on the equality of distributions testing the null hypothesis of the two samples being drawn from populations with equal distribution. The p-values are reported for two-tailed tests and corrected for ties.

Table 2.7: IMA - tests for equality of means, medians, and distributions.

all observations	Mean		t-test[1]	Median test[2]	Mann-Whitney test[3]
	IMA = 1	IMA = 0			
Macro					
GDP per capita (PPP)	9883.5	5478.5	0.000	0.000	0.000
Population	56.5	31.9	0.001	0.000	0.000
CPI inflation	9.5	47.5	0.000	0.000	0.000
Trade regime					
Openness	0.71	0.83	0.000	0.149	0.040
Trade concentration	50.8	53.1	0.007	0.001	0.001
Imports to GDP	0.37	0.45	0.000	0.004	0.003
Primary exports	20.0	29.3	0.000	0.000	0.000
Fuel exports	7.8	15.1	0.000	0.577	0.153
Institutions					
Bureaucratic quality	2.7	2.1	0.000	0.000	0.000
Accountability	4.5	3.7	0.000	0.000	0.000
Country risk	71.4	64.0	0.000	0.000	0.000
Financial openness					
De jure	0.94	-0.18	0.000	0.000	0.000
De facto	1.76	1.73	0.884	0.000	0.000

conditional on de jure flexible regime	Mean		t-test[1]	Median test[2]	Mann-Whitney test[3]
	IMA = 1	IMA = 0			
Macro					
GDP per capita (PPP)	8538.1	8681.6	0.830	0.585	0.430
Population	52.3	60.9	0.328	0.163	0.001
CPI inflation	9.4	143.0	0.003	0.000	0.000
Trade regime					
Openness	0.71	0.62	0.006	0.073	0.000
Trade concentration	52.1	47.4	0.001	0.000	0.012
Imports to GDP	0.38	0.34	0.022	0.483	0.001
Primary exports	20.6	25.1	0.028	0.234	0.145
Fuel exports	6.9	8.2	0.276	0.122	0.015
Institutions					
Bureaucratic quality	2.5	2.2	0.007	0.031	0.006
Accountability	4.4	4.1	0.055	0.054	0.071
Country risk	69.2	64.3	0.000	0.001	0.000
Financial openness					
De jure	0.93	0.68	0.063	0.031	0.039
De facto	1.72	1.28	0.000	0.076	0.000

Notes: (1) The p-values are reported for the two means being different. The groups are not assumed to have equal variance. (2) The p-values are reported for the nonparametric test on the equality of medians testing the null hypothesis of the two samples being drawn from populations with the same median. The test chi-squared statistic is continuity corrected. (3) Nonparametric test on the equality of distributions testing the null hypothesis of the two samples being drawn from populations with equal distribution. The p-values are reported for two-tailed tests and corrected for ties.

Table 2.8: Pooled probit estimations for whole sample.

	ILA	ILA | de jure fixed	IMA	IMA | de jure flexible	ILA | de facto intermediate	IMA | de facto intermediate
Openness	-0.078	-0.400*	-0.259***	0.714	-0.280***	-0.664***
	(0.104)	(0.228)	(0.091)	(0.547)	(0.099)	(0.172)
Primary commodity exports	5.533e-04*	2.592e-03***	-8.945e-04**	-3.750e-03**	8.784e-04**	-1.127e-03**
	(3.186e-04)	(9.465e-04)	(4.266e-04)	(1.502e-03)	(4.184e-04)	(5.712e-04)
Volatility of terms of trade	0.024	0.250**	-0.118	0.082	-0.051	-0.160
	(0.051)	(0.126)	(0.146)	(0.346)	(0.074)	(0.152)
Imports to GDP	-0.011	0.228	0.237	-0.669	0.341**	0.679**
	(0.196)	(0.399)	(0.178)	(1.053)	(0.171)	(0.334)
Lagged inflation rate	-1.874e-05	-7.303e-06	-1.280e-04	-2.620e-03	2.096e-04**	-2.605e-04**
	(1.520e-05)	(3.975e-05)	(8.260e-05)	(2.306e-03)	(9.774e-05)	(1.085e-04)
Lagged high inflation dummy	0.363***	0.435***	-0.097***	-0.391***	0.047	0.060
	(0.047)	(0.099)	(0.027)	(0.145)	(0.064)	(0.084)
Lagged de jure financial openness	-0.055***	-0.217***	0.031***	0.020	-0.047***	0.048***
	(0.006)	(0.021)	(0.007)	(0.022)	(0.009)	(0.010)
Lagged de facto financial openness	-0.014**	-0.031**	0.011**	0.161***	-0.006	0.083***
	(0.007)	(0.015)	(0.005)	(0.035)	(0.011)	(0.014)
MSCI dummy	-0.068***	-0.053	0.165***	-0.103	-0.097***	0.210***
	(0.020)	(0.069)	(0.025)	(0.093)	(0.025)	(0.033)
Observations	2327	822	2327	509	1302	1302
Pseudo R-squared	0.24	0.45	0.20	0.23	0.18	0.33
Percent correctly predicted	84.44%	82.24%	79.80%	78.39%	81.34%	81.80%
Percent correctly predicted for dependent variable = 0	96.53%	87.40%	94.60%	52.69%	96.30%	91.38%
Percent correctly predicted for dependent variable = 1	30.19%	73.89%	27.34%	90.94%	17.41%	54.57%

The coding of the dependent variable is the following. (1) ILA = 1 if de jure regime more rigid than de facto; 0 otherwise. (2) Conditional on de jure fixed regimes: ILA = 1 if de facto intermediate or floating; 0 otherwise. (3) IMA = 1 if de jure regime less rigid than de facto; 0 otherwise. (4) Conditional on de jure flexible regimes: IMA = 1 if de facto intermediate or fixed; 0 otherwise. (5) Conditional on de facto intermediate: ILA = 1 if de jure fixed; 0 otherwise. (6) Conditional on de facto intermediate: IMA = 1 if de jure flexible; 0 otherwise.
Marginal effects are reported. Robust standard errors are reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. GDP per capita (PPP based), population, year, regional, and income group dummies have been included as additional controls in all regressions.

Table 2.9: Pooled probit estimations for low income countries.

	ILA	ILA | de jure fixed	IMA	IMA | de jure flexible	ILA | de facto intermediate	IMA | de facto intermediate
Openness	0.311**	0.130	-0.351*	-3.555*	-0.729	-1.166
	(0.147)	(0.271)	(0.197)	(2.063)	(0.606)	(0.984)
Primary commodity exports	-0.002***	-0.003**	-0.002**	-0.002	0.000	-0.002
	(0.001)	(0.002)	(0.001)	(0.003)	(0.002)	(0.003)
Volatility of terms of trade	0.063	0.181	0.088	-0.955	0.249*	0.080
	(0.047)	(0.110)	(0.082)	(0.610)	(0.150)	(0.247)
Imports to GDP	-0.590**	-0.344	0.537	5.445	0.802	2.794*
	(0.287)	(0.453)	(0.373)	(3.575)	(1.043)	(1.644)
Lagged inflation rate	-2.773e-06	-1.009e-05	2.878e-06	-0.003	0.007**	-0.007
	(1.536e-05)	(1.963e-05)	(2.347e-05)	(0.004)	(0.003)	(0.006)
Lagged high inflation dummy	0.412**	0.414**	-0.011		-0.079	0.451
	(0.171)	(0.207)	(0.020)		(0.067)	(0.292)
Lagged de jure financial openness	-0.090***	-0.272***	-0.007	-0.106**	-0.090**	-0.051
	(0.023)	(0.051)	(0.008)	(0.052)	(0.038)	(0.045)
Lagged de facto financial openness	-0.013	-0.008	-0.022	-0.203	-0.020	-0.121**
	(0.014)	(0.010)	(0.026)	(0.181)	(0.037)	(0.058)
Observations	410	229	410	82	147	147
Pseudo R-squared	0.47	0.41	0.47	0.34	0.19	0.09
Percent correctly predicted	89.02%	86.03%	90.98%	78.05%	86.39%	72.11%
Percent correctly predicted for dependent variable = 0	96.78%	96.11%	97.72%	55.17%	99.17%	96.00%
Percent correctly predicted for dependent variable = 1	50.00%	48.98%	50.85%	90.57%	26.92%	21.28%

For the coding of the dependent variable see table 2.8. Marginal effects are reported. Robust standard errors are reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. GDP per capita (PPP based) and population have been included as additional controls in all regressions and year and regional dummies in (1) and (3).

Table 2.10: Pooled probit estimations for lower middle income countries.

	ILA	ILA | de jure fixed	IMA	IMA | de jure flexible	ILA | de facto intermediate	IMA | de facto intermediate
Openness	0.533***	0.813	-0.458**	-0.520	0.213	-0.229
	(0.145)	(1.334)	(0.215)	(0.661)	(0.287)	(0.321)
Primary commodity exports	0.002***	0.014***	0.001	0.010**	0.002***	-0.001*
	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.001)
Volatility of terms of trade	0.217*	1.672***	-0.467**	-2.718**	0.365**	-0.253
	(0.122)	(0.583)	(0.185)	(1.188)	(0.143)	(0.163)
Imports to GDP	-0.962***	-2.550	0.673*	1.379	-0.684	0.400
	(0.299)	(2.092)	(0.396)	(1.410)	(0.492)	(0.562)
Lagged inflation rate	-6.395e-05***	-1.201e-04	-3.905e-04	-7.342e-04	2.339e-04**	-1.717e-04
	(1.774e-05)	(2.586e-04)	(2.477e-04)	(9.816e-04)	(1.043e-04)	(1.282e-04)
Lagged high inflation dummy	0.568***	0.170	-0.073**	-0.441**	0.131	0.257*
	(0.100)	(0.176)	(0.033)	(0.174)	(0.149)	(0.147)
Lagged de jure financial openness	-0.117***	-0.524***	-0.020*	0.002	-0.129***	0.091***
	(0.016)	(0.135)	(0.012)	(0.034)	(0.017)	(0.015)
Lagged de facto financial openness	-0.142***	-0.148	0.016	0.052	0.020	-0.014
	(0.036)	(0.243)	(0.011)	(0.121)	(0.041)	(0.050)
MSCI dummy	0.181**	0.788***	0.158***	0.105	0.212**	0.265***
	(0.073)	(0.091)	(0.057)	(0.111)	(0.092)	(0.075)
Observations	682	245	682	160	437	437
Pseudo R-squared	0.41	0.70	0.34	0.48	0.30	0.21
Percent correctly predicted	84.75%	93.47%	82.26%	88.75%	80.32%	79.18%
Percent correctly predicted for dependent variable = 0	91.83%	91.67%	93.47%	63.64%	91.41%	90.71%
Percent correctly predicted for dependent variable = 1	63.10%	94.89%	45.96%	95.28%	47.75%	46.49%

For the coding of the dependent variable see table 2.8. Marginal effects are reported. Robust standard errors are reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. GDP per capita (PPP based) and population have been included as additional controls in all regressions. Year dummies are included in (1), (2), and (3) and regional dummies in (1) to (4).

Table 2.11: Pooled probit estimations for upper middle income countries.

	ILA	ILA | de jure fixed	IMA	IMA | de jure flexible	ILA | de facto intermediate	IMA | de facto intermediate
Openness	-0.181	-0.640***	-0.302**	-7.462***	-0.285**	-0.100
	(0.171)	(0.224)	(0.128)	(2.673)	(0.136)	(0.417)
Primary commodity exports	-1.138e-04	-6.728e-05	-4.401e-04	0.010	0.001*	-0.005***
	(5.306e-04)	(1.072e-03)	(4.302e-04)	(0.006)	(0.000)	(0.001)
Volatility of terms of trade	-0.220**	-0.459	0.083	0.673	-0.034	0.091
	(0.108)	(0.329)	(0.068)	(0.516)	(0.042)	(0.149)
Imports to GDP	0.154	0.902***	0.484**	14.610***	0.429*	-0.593
	(0.308)	(0.305)	(0.231)	(5.046)	(0.235)	(0.809)
Lagged inflation rate	3.273e-05	-2.678e-04**	-3.893e-06	0.018*	-0.003*	-0.005*
	(4.506e-05)	(1.245e-04)	(4.086e-05)	(0.009)	(0.002)	(0.003)
Lagged high inflation dummy	0.379***	0.282	-0.050**	-0.699***	0.089	0.251
	(0.083)	(0.271)	(0.020)	(0.211)	(0.187)	(0.315)
Lagged de jure financial openness	-0.017	-0.153***	0.002	0.144**	-0.013*	0.038**
	(0.011)	(0.038)	(0.008)	(0.072)	(0.007)	(0.018)
Lagged de facto financial openness	-0.061***	-0.007	-0.042***	0.156	-0.047	0.103**
	(0.023)	(0.013)	(0.014)	(0.173)	(0.035)	(0.050)
MSCI dummy	0.041	-0.155**	-0.059**	-0.655***	-0.089**	0.115*
	(0.048)	(0.063)	(0.029)	(0.156)	(0.040)	(0.059)
Observations	403	142	403	64	191	191
Pseudo R-squared	0.47	0.61	0.29	0.47	0.35	0.19
Percent correctly predicted	86.10%	90.85%	87.34%	82.81%	92.67%	83.77%
Percent correctly predicted for dependent variable = 0	92.60%	92.38%	97.14%	70.83%	97.63%	97.35%
Percent correctly predicted for dependent variable = 1	64.13%	86.49%	22.64%	90.00%	54.55%	32.50%

For the coding of the dependent variable see table 2.8. Marginal effects are reported. Robust standard errors are reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. GDP per capita (PPP based) and population have been included as additional controls in all regressions, year and regional dummies in (1) and (3).

Table 2.12: Pooled probit estimations for high income countries.

	ILA	ILA | de jure fixed	IMA	IMA | de jure flexible	ILA | de facto intermediate	IMA | de facto intermediate
Openness	-0.113	1.728**	-0.250	4.475***	-0.174**	-0.880***
	(0.072)	(0.850)	(0.319)	(1.274)	(0.077)	(0.159)
Primary commodity exports	1.568e-04	0.029	0.001	-0.003	2.518e-04	0.002**
	(5.023e-04)	(0.018)	(0.001)	(0.002)	(3.579e-04)	(0.001)
Volatility of terms of trade	-0.096	-3.276**	-2.023***	-2.723**	-0.083	-1.430***
	(0.095)	(1.390)	(0.524)	(1.339)	(0.086)	(0.334)
Imports to GDP	0.123	-1.781	-0.024	-7.083***	0.210*	1.134***
	(0.133)	(1.666)	(0.645)	(2.674)	(0.119)	(0.252)
Lagged inflation rate	0.001	0.023**	-0.004	0.012	-0.001	0.002
	(0.000)	(0.012)	(0.004)	(0.012)	(0.001)	(0.003)
Lagged high inflation dummy	-0.051**					
	(0.023)					
Lagged de jure financial openness	-0.014*	-0.167*	0.062***	0.080**	-0.015*	0.062***
	(0.008)	(0.089)	(0.017)	(0.037)	(0.009)	(0.018)
Lagged de facto financial openness	-0.014**	-0.253***	0.030***	0.180***	-0.006	0.086***
	(0.007)	(0.060)	(0.009)	(0.039)	(0.006)	(0.020)
MSCI dummy	-0.060*	0.023	0.185***	0.389	0.010	0.084**
	(0.033)	(0.104)	(0.037)	(0.274)	(0.016)	(0.035)
Observations	832	204	823	215	525	525
Pseudo R-squared	0.18	0.62	0.22	0.47	0.22	0.54
Percent correctly predicted	87.98%	91.67%	79.34%	86.98%	83.24%	89.14%
Percent correctly predicted for dependent variable = 0	99.18%	89.57%	91.44%	81.33%	99.54%	95.09%
Percent correctly predicted for dependent variable = 1	2.08%	94.38%	49.79%	90.00%	0.00%	72.46%

For the coding of the dependent variable see table 2.8. Marginal effects are reported. Robust standard errors are reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. GDP per capita (PPP based) and population have been included as additional controls in all regressions, year dummies in (1), (3), and (4).

Chapter 3

Inflation targeting in small open economies

3.1 Introduction

Many emerging and developing countries have moved away from fixed exchange rates towards a more independent monetary policy in recent years, mostly towards inflation targeting. Thus, open economy aspects have become increasingly important in analyzing monetary policy. The literature frequently resorts to two simple concepts in international economics, *purchasing power parity* and *uncovered interest rate parity*, to describe the relation between prices, interest rates, and exchange rates between countries. Although the empirical relevance of these two concepts is subject to an ongoing debate, they are frequently used in theoretical models. The present study examines the implications of these concepts on the implementation of monetary policy.

Monetary policy is analyzed in an open economy version of the standard New Keynesian framework described by Clarida, Galí and Gertler (1999). More specifically, flexible inflation targeting as characterized by Svensson (2007) is the monetary policy under scrutiny. A central bank operating under flexible inflation targeting is not only concerned about stabilizing the inflation rate around the target but additionally about stabilizing the real economy. According to Svensson (2007) "all real world inflation targeting is flexible". Most theoretical work building on the New Keynesian model resorts to purchasing power parity and/or uncovered interest rate parity to describe international goods and capital markets, respectively. Purchasing power parity is based on the idea that international goods arbitrage keeps the relative purchasing power of two currencies constant over time. However, purchasing power parity frequently fails empirically, especially in the short-run; an overview of the evidence and explanations is provided by Taylor and Taylor (2004). Uncovered interest rate parity is derived from arbitrage in international financial markets according to which the nominal exchange rate adjusts to interest rate differentials. As the underlying assumption of risk neutral investors may

be too restrictive, in general, a time-varying risk premium is included. Still, uncovered interest rate parity is frequently rejected in empirical studies, for an overview see Froot and Thaler (1990) and McCallum (1994).

Notwithstanding their empirical weakness, purchasing power parity and/ or uncovered interest rate parity are frequently used as concepts in monetary policy analysis in open economies. The present study contributes to the literature by analyzing in a unified framework how these two concepts and possible alternatives used in the literature affect monetary policy. More specifically, the implications for the interest rate reaction function describing monetary policy responses to shocks under flexible inflation targeting are examined. Thereby, useful insights into the consequences of using the simple but empirically problematic concepts of purchasing power parity and uncovered interest rate parity in monetary policy analysis are provided.

The main insight is that the interest rate reaction function is affected when purchasing power parity and uncovered interest rate parity are relaxed. As long as purchasing power parity holds, monetary policy reacts only to cost-push shocks and excess-demand shocks. If, however, purchasing power parity does not hold, monetary policy also fully offsets the effects of foreign shocks. Furthermore, not the direction but the strength of the interest rate response to cost-push shocks and excess-demand shocks is affected. Whether the relation between interest rates and exchange rates is described by uncovered interest rate parity or in the more generic way proposed by Ball (1999) does affect both to which type of shocks monetary policy responds and how strong the response is.

The remainder of this chapter is organized as follows. Section 3.2 provides an overview of the related literature and stylized facts. In section 3.3 the theoretical model is developed. Then, in section 3.4 the interest rate reaction functions are analyzed for the basic model and for hybrid models allowing deviations from purchasing power parity and uncovered interest rate parity. First, in 3.4.1 the optimality condition for monetary policy and the interest rate reaction function are derived for the basic model which assumes that both purchasing power parity and uncovered interest rate parity hold. Then, in 3.4.2 purchasing power parity is relaxed while 3.4.3 studies the implications of additionally relaxing uncovered interest rate parity. The case that purchasing power parity holds while uncovered interest rate parity does not, is briefly discussed within the basic model. Section 3.5 discusses the main results and section 3.6 concludes.

3.2 Literature review and stylized facts

Most central banks declare price stability as the primary or one of the main policy goals; additional goals being to minimize the volatility of other economic variables such as output and exchange rates, to smooth interest rate changes, to act as Lender of Last Resort, and recently also to perform a supervisory role. In recent years, inflation targeting has attracted considerable attention as a framework to pursue price stability objectives and has been adopted also in many emerging and developing countries.[1] However, no unanimity has been achieved about what inflation targeting exactly is. Widely accepted characteristics of an inflation targeting framework are (i.) the announcement of a numerical inflation target or target range as primary monetary policy objective, with increasingly explicit concerns beyond the stability of inflation, mostly about the stability of the real economy, and (ii.) a high degree of transparency and accountability of the central bank, generally through the regular publication of inflation reports, policy decisions, etc., see, e.g., Svensson (2007), Bernanke and Mishkin (1997), and McCallum (2003).

The standard welfare analytic framework for monetary policy is due to Kydland and Prescott (1977) and Barro and Gordon (1983) and is also used to study inflation targeting. The policymaker minimizes the losses from inflation and output variability around target rates in an intertemporal setting in which output can be increased through unexpected inflation. When the policymaker aims at an output above the natural level, incentives to create surprise inflation are present. However, private agents are aware of the time-inconsistency in policymaking and internalize it in setting wages, leading to higher inflation without output gains, the so-called inflation bias. Several suggestions have been made on how to improve upon this discretionary outcome: reputation building, delegation, timeless perspective, escape clauses, etc. Inflation targeting seems to be another possibility even though the literature disagrees on what inflation targeting is exactly in this framework.

Svensson (2007) distinguishes strict and flexible inflation targeting. A central bank operating under strict inflation targeting is only concerned about stabilizing the inflation

[1] The following developing and emerging market economies have adopted inflation targeting; the year of adoption is reported in parenthesis: Brazil (1999), Chile (1991), Colombia (1999), Czech Republic (1998), Ghana (2007), Hungary (2001), Indonesia (2005), Israel (1992), Korea (1998), Mexico (1999), Peru (1994), Philippines (2002), Poland (1998), Rumania (2005), South Africa (2000), Thailand (2000), and Turkey (2006). (Mishkin and Schmidt-Hebbel (2001); Fraga, Goldfajn and Minella (2003); Roger and Stone (2005); web-pages of the International Monetary Fund and Central Banks)

rate around the target while a central bank operating under flexible inflation targeting is additionally concerned about stabilizing the real economy. Strict inflation targeting is considered a theoretical benchmark while central banks practically implement flexible inflation targeting. Additionally, Svensson (1999) argues that the recognition that monetary policy cannot systematically affect capacity output, the *natural-rate hypothesis*, can be considered one of the foundations of inflation targeting. Therewith, Svensson justifies the assumption that a central bank operating under flexible inflation targeting has an implicit output target equal to the natural output level. As a consequence, no inflation bias arises. Furthermore, the high degree of transparency and accountability peculiar to inflation targeting creates appropriate incentives for the central bank not to deviate from the assigned objective function. Consequently, Svensson (2007) models flexible inflation targeting through the standard loss function over inflation and output gap variability with a zero output gap target. Whether a central bank then implements the commitment solution or the discretionary solution, depends on the ability and the willingness of a central bank to commit to future policies. Even a central bank not aiming at an output level above the natural rate, can gain from committing to a monetary policy rule, eliminating the so-called stabilization bias as shown by, e.g., Clarida et al. (1999). The stabilization bias arises when a central bank unable to precommit to a policy rule cannot respond gradually to shocks by influencing private sector expectations, see, e.g., Dennis and Söderström (2006). The present study follows Svensson's (2007) approach and assumes that the central bank optimizes under discretion although the adequateness of this approach may be questioned. Alternative perspectives on inflation targeting are exposed by, e.g., Bernanke and Mishkin (1997), McCallum (2000), and King (1997); Kuttner and Posen (1999) provide additional interpretations.

The present study takes flexible inflation targeting as given and does not discuss its optimality as a monetary policy framework for small open economies. Instead, the implementation through an interest rate reaction function is analyzed. Interest rate reaction functions relate the monetary policy instrument, in general a short-term interest rate, to predetermined variables and exogenous shocks. They are a valuable tool to theoretically analyze monetary policy responses although their practical value may be limited as shocks are difficult to identify. For practical purposes, interest rate reaction functions are in general transformed into Taylor-type rules relating the policy interest rate to observables such as output and inflation; a discussion of Taylor-type rules is provided by Kozicki (1999). The interest of the present study centers around the role of

the concepts of purchasing power parity and uncovered interest rate parity for the interest rate reaction function describing the implementation of flexible inflation targeting in small open economies.

Purchasing power parity and uncovered interest rate parity relate to two of the *six major puzzles in international macroeconomics*, the purchasing power parity puzzle and the exchange rate disconnect puzzle of which the forward premium puzzle is a manifestation (Obstfeld and Rogoff, 2000). Purchasing power parity states that the percentage change of the nominal exchange rate between two currencies should just offset the inflation differential between these countries, thus keeping the relative purchasing power of the two currencies constant. The basic idea is that international goods arbitrage leads to the equalization of the prices of tradable goods. Empirically, it seems to be relevant only as a long-run concept, for an overview see, e.g., Taylor and Taylor (2004). The *purchasing power parity puzzle* in this context refers to the surprisingly weak empirical connection between exchange rates and national price levels (Rogoff, 1996). Reasons for the empirical failure of purchasing power parity holding in the short-run are, for example, sticky prices combined with highly volatile nominal exchange rates as in Dornbusch's (1976) overshooting model and differences in productivity growth between countries as captured in the Balassa-Samuelson effect.

Uncovered interest rate parity is derived from arbitrage in international financial markets and states that the expected percentage change in the nominal exchange rate should equal the interest rate differential. As the underlying assumptions of risk neutral investors and no country specific risk may be too restrictive, in general, a time-varying risk premium is included. Despite this, uncovered interest rate parity is frequently rejected in empirical studies; an overview is provided by Froot and Thaler (1990) and McCallum (1994). In this context, the *exchange rate disconnect puzzle* describes the more general, weak relation between the exchange rate and virtually any macroeconomic variable. The related *forward premium puzzle* states that the forward premium incorrectly predicts the direction of future changes in the exchange rate, implying a rejection of uncovered interest rate parity, see Obstfeld and Rogoff (2000) and McCallum (1994). Abstracting from rational expectations or assuming that the time-varying risk premium is negatively correlated with an expected depreciation may explain the empirical facts, see Froot and Thaler (1990). McCallum (1994) explains the apparent empirical failure of uncovered interest rate parity with the hypothesis that central banks systematically manage interest rate differentials to avoid frequent changes in the exchange rate.

Even though their empirical validity may be questioned, purchasing power parity and uncovered interest rate parity are such neat concepts that they are frequently used for monetary policy analysis. The aim of the present study is to theoretically analyze how the implementation of flexible inflation targeting in small open economies is affected by the assumption of purchasing power parity and uncovered interest rate parity holding or not. The implementation of monetary policy is described by interest rate reaction functions that relate the monetary policy instrument, the nominal interest rate, to predetermined variables and shocks.

The theoretical model exposed in the following section combines the standard New Keynesian monetary policy framework by Clarida, Galí and Gertler (1999), which is augmented to include open economy aspects, with the inflation targeting framework proposed by Svensson (2007). The description of aggregate demand and the price adjustment mechanism follows Clarida et al. (1999). To take into account open economy aspects, an exchange rate channel is introduced. Real exchange rate depreciations raise aggregate demand as the relative price between domestic and foreign goods changes and, hence, the domestic and foreign demand for domestic goods. This is included in the standard fashion of the Mundell-Fleming model by adding an exchange rate term in aggregate demand. Another special aspect of small open economies is that they are frequently hit by external shocks which have considerable effects on the domestic economy. Therefore, shocks to foreign output and inflation as well as foreign monetary policy responses are explicitly taken into account following Svensson (2000). By allowing external shocks to affect the domestic economy and, thus, to induce monetary policy responses, the present study goes a step further than most of the simple monetary policy models.

The resulting theoretical framework is simple enough to analyze the implication of purchasing power parity and uncovered interest rate parity on the interest rate reaction function with closed form solutions and rich enough to include essential features of small open economies. This approach has the advantage that the implications of deviating from the relatively standard assumptions of purchasing power parity and uncovered interest rate parity can be analyzed in a unified open economy framework. Previous work does not lend itself to that end as the models differs also in other aspects. Clarida, Galí and Gertler (2001), for example, analyze monetary policy in an open economy version of Clarida et al. (1999) while assuming that both purchasing power parity and uncovered interest rate parity hold. In contrast, the open economy version of Clarida et al. (1999) used by Detken and Gaspar (2003) relaxes purchasing power parity in the

standard fashion by including an exchange rate term in the aggregate demand relation while uncovered interest rate parity describes international financial markets. Ball (1999) analyzes monetary policy rules while allowing for deviations from both purchasing power parity and uncovered interest rate parity. International financial markets are instead described by a simple proportional relation between the real interest rate and the real exchange rate with all other effects aggregated in a random term. Ball's (1999) approach is used as alternative condition to uncovered interest rate parity. The model developed by Svensson (2000) to analyze different forms of inflation targeting in a small open economy model is too complex to obtain closed form solutions. Compared to Svensson (2000), the present analysis simplifies on the dynamic structure by abstracting from lags in the transmission mechanism of monetary policy and setting aside direct effects of exchange rate changes on inflation in order to obtain simple analytical solutions.

3.3 Theoretical model

To analyze the interest rate reaction functions arising under flexible inflation targeting in small open economies, the standard monetary policy model of Clarida et al. (1999) is augmented to include open economy aspects. Furthermore, inflation targeting is characterized following Svensson (2007) and foreign monetary policy following Svensson (2000). The resulting model is simple enough to analyze the implications of purchasing power parity and uncovered interest rate parity on the interest rate reaction function with closed form solutions and rich enough to include essential features of small open economies.

Monetary policy objective

The central bank operates under flexible inflation targeting which is characterized following Svensson (2007), i.e., the central bank minimizes deviations of the inflation rate π from its target (normalized to zero) and deviations of output y from its natural rate y^n, thus targeting a zero output gap. When flexible inflation targeting is implemented, the central bank is not only concerned about stabilizing inflation around the target as would be the case for strict inflation targeting, but is additionally concerned about stabilizing real economic fluctuations as captured by the output gap. No average inflation bias arises because the implicit output target is the natural output level. Svensson (1999) argues that the natural-rate hypothesis, the perception that monetary policy cannot systematically affect capacity output, can be considered one of the foundations of inflation

targeting and, thus, justifies the assumption of a zero output gap target. Furthermore, the high degree of transparency and accountability peculiar to inflation targeting creates appropriate incentives for the central bank not to deviate. The resulting standard intertemporal loss function is

$$L = E_t \left\{ \sum_{n=0}^{\infty} \beta^n \left[\pi_{t+n}^2 + \alpha x_{t+n}^2 \right] \right\} \tag{3.1}$$

β is the discount factor, π_t the inflation rate, and x_t the output gap, $x_t \equiv y_t - y^n$, α is the relative weight on the output stabilization objective. In the model all variables are expressed as deviations from a deterministic long-run trend and, with the exception of the interest rates, as natural logarithms and all parameters are defined as being positive. E_t is the expectations operator conditional on information available at time t.

Aggregate demand

Aggregate demand expressed in terms of the output gap is characterized by equation (3.2) and depends negatively on the real interest rate, $i_t - E_t\pi_{t+1}$, positively on the expected future output gap and log-deviations of the real exchange rate from its equilibrium level, q_t.

$$x_t = -\varphi[i_t - E_t\pi_{t+1}] + E_t x_{t+1} + \nu q_t + g_t \tag{3.2}$$

g_t is an excess-demand shock described by

$$g_t = \mu g_{t-1} + \hat{g}_t \tag{3.3}$$

where $0 \leq \mu \leq 1$ and $\hat{g}_t$ is an i.i.d. random variable with zero mean and variance σ_g^2. The basic aggregate demand equation for a closed economy (with $\nu = 0$) can be obtained by log-linearization of the consumption Euler equation from household's intertemporal optimization, see Clarida et al. (1999). The expected future output gap raises the present output gap as a consequence of the consumption smoothing objective while the negative effect of the real interest rate arises due to the intertemporal substitution of consumption. The excess-demand shock captures expected changes in government spending and in potential output.

A special aspect of open economies is that changes in the real exchange rate affect aggregate demand. Real exchange rate depreciations raise aggregate demand as the relative price between domestic and foreign goods changes and, hence, the domestic and

foreign demand for domestic goods. This is included in the standard fashion of the Mundell-Fleming model. Exchange rate depreciations are assumed to be expansionary. However, that is not necessarily the case as illustrated by the J-curve effect and discussed by, e.g., Sánchez (2005). If purchasing power parity holds, however, the log-deviation of the real exchange rate from the steady-state is zero. Hence, the aggregate demand equation for an open economy simplifies to:

$$x_t = -\varphi[i_t - E_t\pi_{t+1}] + E_t x_{t+1} + g_t \tag{3.2'}$$

The real exchange rate q_t is defined as

$$q_t \equiv e_t + p_t^* - p_t \tag{3.4}$$

where e_t is the nominal exchange rate defined as domestic price of foreign currency and p_t^* the log of foreign prices. An increase in q_t corresponds to a real depreciation.

Price adjustment mechanism

The price adjustment mechanism in the economy is described by an expectations augmented Phillips-curve:

$$\pi_t = \lambda x_t + \beta E_t\pi_{t+1} + u_t \tag{3.5}$$

Inflation depends on the current output gap, expected future inflation, and the cost-push shock u_t described by

$$u_t = \gamma u_{t-1} + \hat{u}_t \tag{3.6}$$

with $0 \leq \gamma \leq 1$ and $\hat{u}_t$ being an i.i.d. random term with mean zero and variance σ_u^2. This Phillips-curve specification can be derived from staggered price setting as developed by Calvo (1983) and used by Clarida et al. (1999). Forward iteration of (3.5) reveals that present inflation depends on current and expected future economic conditions as captured by output gaps and cost-push shocks. Price setting decisions of firms are based on expected changes in marginal costs. Those related to variations in excess demand are captured through the expected future output gaps (x_{t+n}) while the cost-push shocks (u_{t+n}) capture everything else affecting marginal costs, see Clarida et al. (1999). The cost-push shock introduces a short-run trade-off between inflation and output.

International goods and financial markets

Purchasing power parity describes the adjustment of the nominal exchange rate to the inflation differential such as to keep the relative purchasing power of the currencies constant:

$$e_t - e_{t-1} = \pi_t - \pi_t^* \tag{3.7}$$

International financial markets are described by uncovered interest rate parity including a time-varying risk premium ρ_t:

$$i_t = i_t^* + E_t e_{t+1} - e_t + \rho_t \tag{3.8}$$

where i_t is the domestic nominal interest rate, i_t^* the foreign nominal interest rate, and, following Svensson (2000), the risk premium is characterized by

$$\rho_t = \eta \rho_{t-1} + \hat{\rho}_t \tag{3.9}$$

with $0 \leq \eta < 1$ and $\hat{\rho}_t$ being an i.i.d. random term with mean zero and variance σ_ρ^2.

Expectations are a crucial element in forward-looking models and the process driving their formation may affect the results, see, e.g., the discussion by Taylor (2002). Following most of the literature, expectations are assumed to be formed rationally.

Foreign shocks

Small open economies are frequently hit by external shocks and their effect on the domestic economies is considerable. Therefore, shocks to foreign output and inflation as well as foreign monetary policy responses are explicitly taken into account. By allowing external shocks to affect the domestic economy and, thus, to induce monetary policy responses, the present study goes a step further than most of the related literature.

Following Svensson (2000) the foreign inflation rate and foreign output are assumed to follow stationary univariate AR (1) processes,

$$\pi_t^* = \rho_\pi^* \pi_{t-1}^* + \eta_t^* \tag{3.10}$$

$$y_t^* = \rho_y^* y_{t-1}^* + \xi_t^* \tag{3.11}$$

where $0 \leq \rho_\pi^*, \rho_y^* < 1$ and η_t^* and ξ_t^* are i.i.d. random shocks with zero mean and

variances $\sigma^2_{\pi^*}$ and $\sigma^2_{y^*}$, respectively. Furthermore, the foreign interest rate is assumed to follow a Taylor-type rule as described by Svensson (2000):

$$i^*_t = f^*_\pi \pi^*_t + f^*_y y^*_t + \epsilon^*_t \tag{3.12}$$

with f^*_π, f^*_y being positive and ϵ^*_t an i.i.d. shock with zero mean and variance $\sigma^2_{\epsilon^*}$.

These relations describe the economy in a sufficiently simple way to analyze the implementation of monetary policy and the implications of purchasing power parity and uncovered interest rate parity with closed form solutions. By abstracting from lags in the transmission mechanism of monetary policy and a direct effect of exchange rate changes on inflation included by Svensson (2000), a tractable model is obtained.

3.4 Implementing flexible inflation targeting

Based on the model exposed in the preceding section, the implementation of flexible inflation targeting as described by an interest rate reaction function is studied. First, in section 3.4.1 the optimality condition for monetary policy and the interest rate reaction function are derived in a basic model assuming that both purchasing power parity and uncovered interest rate parity hold. As purchasing power parity and uncovered interest rate parity may not hold empirically, the consequences of allowing for deviations from these conditions are then studied in the following sections. In section 3.4.2 the implications of relaxing purchasing power parity are analyzed. Then, uncovered interest rate parity is additionally relaxed in section 3.4.3. The case of purchasing power parity holding while uncovered interest rate parity does not, affects the basic model only with respect to the determination of the nominal exchange rate. Therefore, it is not analyzed explicitly but only briefly discussed within the basic model. The interest rate reaction functions derived under these alternatives are then compared in section 3.5.

3.4.1 Basic model

In the basic model purchasing power parity and uncovered interest rate parity are assumed to hold both.

Optimality condition for monetary policy

The monetary policy framework under consideration is flexible inflation targeting which is described following Svensson (2007). By operating under flexible inflation targeting, the central bank is assigned the loss function (3.1) which implies the absence of an inflation bias because of a zero output gap target. The central bank is assumed to be unable to commit to a state-contingent rule and, thus, central bank's behavior is characterized as optimization under discretion without being able to systematically influence expectations.[2] Hence, the central bank minimizes the loss function (3.1) subject to the Phillips-curve (3.5) for given, rational expectations. Thus, following Clarida et al. (1999), possible reputational (sunspot) equilibria are ignored and attention is restricted to Markov perfect equilibria, thereby circumventing the possible indeterminacy problem. The resulting optimization problem is identical to the optimal monetary policy under discretion in Clarida et al. (1999) for a closed economy and is solved accordingly. As there are no endogenous state variables, the minimization problem simplifies to a sequence of static optimization problems. The central bank chooses inflation and output each period such as to minimize

$$\pi_t^2 + \alpha x_t^2 + F_t$$

subject to

$$\pi_t = \lambda x_t + H_t$$

where $F_t \equiv E_t \left\{ \sum_{n=1}^{\infty} \beta^n \left[\pi_{t+n}^2 + \alpha x_{t+n}^2 \right] \right\}$ and $H_t \equiv \beta E_t \pi_{t+1} + u_t$ are taken as given. This implies both that the central bank cannot manipulate expectations and that future output and inflation are independent of present policy actions. The resulting optimality condition is:

$$x_t = -\frac{\lambda}{\alpha} \pi_t \tag{3.13}$$

To represent inflation and output as functions of the state variable u_t, iterate (3.5) forward using the first order condition (3.13) and the assumption of rational expectations for private agents, see Clarida et al. (1999):

$$\pi_t = \frac{\alpha}{\alpha(1 - \beta\gamma) + \lambda^2} u_t \tag{3.14}$$

[2] For developing and emerging market economies who have just adopted inflation targeting and lack both the experience of independent monetary policy and the credibility for low inflation policy, a discretionary solution does not seem unreasonable. For a discussion see also Svensson (2007).

$$x_t = -\frac{\lambda}{\alpha(1-\beta\gamma)+\lambda^2}u_t \tag{3.15}$$

Interest rate reaction function

The interest rate reaction function to implement the monetary policy is derived inserting the optimality condition (3.13) into aggregate demand (3.2') and solving for the nominal interest rate:

$$i_t = \frac{\alpha\gamma\varphi+\lambda(1-\gamma)}{\varphi\{\alpha(1-\beta\gamma)+\lambda^2\}}u_t + \frac{1}{\varphi}g_t \tag{3.16}$$

Flexible inflation targeting implies that excess-demand shocks are perfectly offset by monetary policy while cost-push shocks affect both inflation and output. Excess-demand shocks increase output and thus inflation, and an increase in the nominal interest rate can reverse both effects completely. However, the increase in inflation following a cost-push shock can only be counteracted when output is reduced below its natural level, thus forcing a trade-off between inflation and output. To minimize the loss function, an increase in inflation and a reduction in output are optimal such that the loss from a marginal increase in inflation equals the loss from a marginal decrease in output. The strength of the trade-off depends on the direct effect of output on inflation, λ, and the relative importance of the stabilization objective, α.

The assumption of uncovered interest rate parity is not necessary to derive the interest rate reaction function as long as purchasing power parity holds and is only relevant for the determination of the nominal exchange rate. Hence, allowing for deviations from uncovered interest rate parity while purchasing power parity holds does not affect the interest rate reaction function and is therefore not analyzed explicitly.

The optimality condition (3.13) is independent of the assumptions of purchasing power parity and uncovered interest rate parity as they do not affect the loss function (3.1) or the Phillips-curve (3.5). Therefore, only the implications on the interest rate reaction functions resulting from these assumptions are analyzed in the next sections.

3.4.2 Relaxing purchasing power parity

The basic model is very stylized and not qualitatively different from a closed economy model due to the strong assumption of purchasing power parity. However, purchasing power parity has been shown to hold empirically only in the long-run, e.g. Obstfeld and Rogoff (2000). As the Phillips-curve is a predominantly short-term concept, purchasing

power parity is unlikely to hold simultaneously. Therefore, the implications of relaxing purchasing power parity are analyzed by deriving the modified interest rate reaction function.

When purchasing power parity does not hold, changes in the real exchange rate affect aggregate demand. Therefore, the interest rate reaction function, obtained by inserting the reduced form representations of inflation (3.14) and output (3.15) derived from the optimality condition (3.13) into the aggregate demand equation (3.2), now depends on the nominal exchange rate:

$$i_t = \frac{(1-\gamma)\lambda + \alpha\gamma\varphi - \nu\alpha}{\varphi[\alpha(1-\beta\gamma)+\lambda^2]} u_t + \frac{\nu}{\varphi}(e_t + p_t^* - p_{t-1}) + \frac{1}{\varphi} g_t \tag{3.17}$$

The interest rate and exchange rate are simultaneously determined and the interest rate reaction function (3.17) and uncovered interest rate parity (3.8) describe their relation. The simultaneous equation system is solved using the Minimal State Variable criterion proposed by McCallum (1983) based on the method of undetermined coefficients. Accordingly, the solutions for the interest rate and the exchange rate are guessed to be linear functions of the state variables $(u_t, g_t, \rho_t, p_t^*, p_{t-1}^*, \epsilon_t^*, y_t^*, p_{t-1})$. The guessed solutions are inserted into the interest rate reaction function (3.17) and into uncovered interest rate parity (3.8) taking into account the foreign monetary policy rule (3.12). By matching the coefficients of all state variables, the unknown coefficients can be solved for. When the obtained coefficients are plugged into the guessed solutions, the following interest rate reaction function is obtained (for a detailed analysis see appendix 3.A):

$$\begin{aligned} i_t &= \frac{\alpha\gamma[\nu+\varphi(1-\gamma)] + (1-\gamma)^2\lambda}{[\nu+\varphi(1-\gamma)][\alpha(1-\beta\gamma)+\lambda^2]} u_t + \frac{1-\mu}{\nu+(1-\mu)\varphi} g_t \\ &+ \frac{\nu}{\nu+(1-\eta)\varphi}\rho_t + \frac{\nu f_y^*}{\nu+\varphi(1-\rho_y^*)} y_t^* + \frac{\nu(f_\pi^*-\rho_\pi^*)}{\nu+\varphi(1-\rho_\pi^*)}\pi_t^* + \frac{\nu}{\nu+\varphi}\epsilon_t^* \end{aligned} \tag{3.18}$$

Thus, optimal monetary policy reacts not only to domestic but also to foreign shocks. More specifically, shocks to the risk premium ρ, foreign output y^*, foreign inflation π^*, and shocks to the foreign monetary policy rule ϵ^* are perfectly offset.

3.4.3 Relaxing purchasing power parity and uncovered interest rate parity

The assumption of uncovered interest rate parity has no implications for the interest rate reaction function as long as purchasing power parity holds; the corresponding combination is therefore not analyzed explicitly. However, when purchasing power parity is relaxed, uncovered interest rate parity becomes important. While uncovered interest rate parity has some empirical justification, it suffers from considerable shortcomings (forward premium puzzle, etc.). Therefore, a more generic approach to describe the relation between interest rates and exchange rates may be useful. Ball (1999) proposes and applies a very simple approach that just describes the real exchange rate as being proportional to the real interest rate and a random term $\tilde{\rho}_t$:

$$q_t = -\theta(i_t - E_t\pi_{t+1}) + \tilde{\rho}_t \tag{3.19}$$

The idea is that an interest rate increase makes domestic assets more attractive leading to an appreciation of the exchange rate. Furthermore, the term $\tilde{\rho}_t$ captures everything else affecting the real exchange rate like expectations, foreign interest rates, etc. There is a broad literature describing behavior on international financial markets and the determination of exchange rates which may be used as alternatives to uncovered interest rate parity. However, due to its simplicity, Ball's (1999) approach is an attractive alternative and by describing a purely contemporaneous relation between exchange rate and interest rate, the *forward premium puzzle* is avoided.[3] For comparability, the random term is described by

$$\tilde{\rho}_t = \tilde{\eta}\tilde{\rho}_{t-1} + \tilde{\epsilon}_t \tag{3.20}$$

with $0 \leq \tilde{\eta} < 1$ and $\tilde{\epsilon}_t$ being an i.i.d. random term with mean zero and variance $\sigma^2_{\tilde{\rho}}$.

In order to facilitate the comparison, uncovered interest rate parity (3.8) can be rewritten in terms of the real exchange rate:

$$q_t = -(i_t - E_t\pi_{t+1}) + E_t q_{t+1} + i^*_t - E_t\pi^*_{t+1} + \rho_t \tag{3.8'}$$

The comparison with equation (3.19) reveals that the two conditions are the same if

[3] This feature is at the same time also an obvious flaw of the condition (3.19). As all variables affecting the real exchange rate other than the real domestic interest rate are collected in the random term $\tilde{\rho}$, no further insights into the factors moving the random term can be gained.

$\theta = 1$ and $\tilde{\rho}_t = E_t q_{t+1} + i_t^* - E_t \pi_{t+1}^* + \rho_t$.

The interest rate reaction function is obtained by inserting the optimality condition (3.13) into the aggregate demand equation (3.2) and again depends on the nominal exchange rate, see equation (3.17). Now, the interest rate and exchange rate are simultaneously determined by (3.17) and (3.19). However, due to the absence of the expected future exchange rate in the interest rate condition of Ball (3.19), the interest rate reaction function can be derived easily by plugging equation (3.19) into equation (3.2) taking into account (3.13) and solving for the nominal interest rate:

$$i_t = \frac{(1-\gamma)\lambda + \alpha\gamma(\varphi + \nu\theta)}{[\alpha(1-\beta\gamma) + \lambda^2][\varphi + \nu\theta]} u_t + \frac{1}{\varphi + \nu\theta} g_t + \frac{\nu}{\varphi + \nu\theta} \tilde{\rho}_t \tag{3.21}$$

In combination with the reduced form equations for inflation and output, (3.14) and (3.15), this interest rate reaction function shows that monetary policy fully offsets excess-demand shocks and the shocks captured in $\tilde{\rho}$ while cost-push shocks are only partially offset and affect both inflation and output.

3.5 Comparison of the results

The main insight is that the interest rate reaction function is affected when purchasing power parity and uncovered interest rate parity are relaxed. As long as purchasing power parity holds, optimal monetary policy reacts only to cost-push shocks and excess-demand shocks. If, however, purchasing power parity does not hold, optimal monetary policy also fully offsets the effects of foreign shocks. Furthermore, not the direction but the strength of the interest rate response to cost-push shocks and excess-demand shocks is affected. Table 3.1 summarizes the alternative interest rate reaction functions.

Cost-push shocks

As emphasized in the literature, e.g., Clarida et al. (1999), cost-push shocks (u_t) create a trade-off between inflation and output variability. A cost-push shock increases inflation, and inflation can only be decreased at the expense of a reduction in output below potential. The optimal policy reaction is to increase the interest rate such as to balance the effect on output and inflation with the adjustment costs shared according to the optimality condition (3.13). Whether purchasing power parity and/or uncovered

Table 3.1: Interest rate reaction functions.

Basic model (with PPP & UIP)	$i_t = \frac{\alpha\gamma\varphi + \lambda(1-\gamma)}{\varphi\left[\alpha(1-\beta\gamma)+\lambda^2\right]}u_t + \frac{1}{\varphi}g_t$
With PPP & relaxing UIP	$i_t = \frac{\alpha\gamma\varphi + \lambda(1-\gamma)}{\varphi\left[\alpha(1-\beta\gamma)+\lambda^2\right]}u_t + \frac{1}{\varphi}g_t$
Relaxing PPP & with UIP	$i_t = \frac{\alpha\gamma\varphi + \lambda(1-\gamma)\frac{\varphi}{\varphi+\frac{\nu}{1-\gamma}}}{\varphi[\alpha(1-\beta\gamma)+\lambda^2]}u_t + \frac{1}{\varphi+\frac{\nu}{1-\mu}}g_t + \frac{\nu}{(1-\eta)\varphi+\nu}\rho_t + \frac{\nu f_y^*}{\nu+\varphi(1-\rho_y^*)}y_t^* + \frac{\nu(f_\pi^*-\rho_\pi^*)}{\nu+\varphi(1-\rho_\pi^*)}\pi_t^* + \frac{\nu}{\nu+\varphi}\epsilon_t^*$
Relaxing PPP & UIP	$i_t = \frac{\alpha\gamma\varphi + \lambda(1-\gamma)\frac{\varphi}{\varphi+\nu\theta}}{\varphi\left[\alpha(1-\beta\gamma)+\lambda^2\right]}u_t + \frac{1}{\varphi+\nu\theta}g_t + \frac{\nu}{\varphi+\nu\theta}\tilde{\rho}_t$

Note: PPP = purchasing power parity; UIP = uncovered interest rate parity

interest parity hold or not, does not affect the direction but the strength of the optimal interest rate response. When purchasing power parity does not hold, a smaller interest rate increase is sufficient to achieve a given reduction in the output gap. The reason is that due to the exchange rate channel, a given interest rate increase has a bigger effect on output as the additional appreciation of the domestic currency reduces aggregate demand further.

The optimal interest rate increase is always smaller under uncovered interest rate parity as compared to the interest rate condition by Ball (1999), if $\theta < \frac{1}{1-\gamma}$. This is fulfilled, for example, if $\theta = 1$ and $\gamma > 0$. Then, the expected future real exchange rate has an additional contractionary effect on aggregate demand under uncovered interest rate parity, allowing for a lower interest rate increase. If, however, the exchange rate appreciation following an interest rate increase under the condition of Ball is high enough, $\theta > \frac{1}{1-\gamma}$, a lower interest rate increase is required than under uncovered interest rate parity to achieve a given output gap. The interest rate condition of Ball implies that interest rate changes only have a contemporaneous effect on the real exchange rate while

under uncovered interest rate parity also expected future exchange rates are affected.

Excess-demand shocks

The optimal policy response to an excess-demand shock, $g_t > 0$, is to fully offset it by raising the interest rate. The required increase in the interest rate is lower when an exchange rate channel is added, i.e., purchasing power parity does not hold. As the induced appreciation of the domestic currency has an additional contractionary effect, a lower increase in the nominal interest rate is sufficient to perfectly offset the demand shock.

The required interest rate increase is smaller under uncovered interest rate parity than under the interest rate condition of Ball (1999), if $\theta < \frac{1}{1-\gamma}$. The basic intuition is the same as for the cost-push shock.

Foreign shocks

When monetary policy is implemented optimally according to (3.13), inflation and output depend only on cost-push shocks. The interest rate is set to partially offset cost-push shocks and to perfectly offset all other shocks.

When purchasing power parity holds, the interest rate is set independently of foreign shocks to which only the nominal exchange rate reacts. If deviations from purchasing power parity are allowed for while uncovered interest rate parity holds, the interest rate is optimally increased following risk premium shocks, positive deviations of foreign interest rates from the Taylor-type rule ($\epsilon_t^* > 0$), and increases in foreign output. These shocks would otherwise lead to a depreciation of the exchange rate, increasing output above potential and, thus, increasing inflation above target. An increase in foreign inflation is offset by an increase in the domestic interest rate if the induced increase in the foreign interest rate, according to the Taylor-type monetary policy rule, is higher than the persistence in foreign inflation, i.e., $f_\pi^* > \rho_\pi^*$. If deviations from both purchasing power parity and uncovered interest rate parity are allowed for, monetary policy perfectly offsets the shock $\tilde{\rho}_t$ which captures a variety of shocks, changes in expectations, etc.

The result that monetary policy reacts only to foreign shocks when purchasing power parity does not hold is due to the underlying assumption of foreign shocks affecting only world interest rates. A possible extension is to include foreign output in aggregate demand: when foreign output increases, exports to the rest of the world increase and, thus, aggregate demand.

Further aspects

When cost-push shocks are not persistent, i.e., $\gamma = 0$, the interest rate increase following a given shock is lower than for $\gamma > 0$ if the condition $\varphi\alpha > \lambda$ is fulfilled (sufficient but not necessary condition). Hence, the stronger the present output reacts to the real interest rate, i.e., the higher φ, the more important the stabilization objective relative to the inflation objectives, i.e., the higher α, and the lower the direct effect of output on inflation, i.e., the lower λ, the more likely it is, that interest rate increases are higher when cost-push shocks are persistent.

The interest rate response to excess-demand shocks is lower if the shock is persistent, i.e., $\mu > 0$, while it is higher for all other shocks if they are persistent as opposed to being white noise. The interest rate increase following an increase in foreign inflation is higher under persistence of the shock, i.e., $\rho_\pi^* > 0$, if the foreign interest rate response is strong enough, i.e., $f_\pi^* > 1 + \frac{\nu}{\varphi}$.

If a country implements strict inflation targeting, i.e., $\alpha = 0$, the interest rate is set to keep inflation at the target rate while increasing output volatility. As to the interest rate reaction functions, only the reaction to cost-push shocks creating a trade-off between inflation and output is adjusted.

3.6 Conclusion

Two central concepts in international macroeconomics, purchasing power parity and uncovered interest rate parity, are frequently used to describe open economy aspects in monetary policy models even though their empirical relevance is controversial. As developing and emerging market economies increasingly pursue independent monetary policy, in particular flexible inflation targeting, open economy aspects become increasingly important for monetary policy analysis. Therefore, it is important to know if the relatively standard and simple assumptions of purchasing power parity and uncovered interest rate parity yield different policy recommendations than alternative conditions describing the relation between prices, interest rates, and exchange rates.

The present analysis finds that the interest rate reaction function to implement flexible inflation targeting is affected when deviations from purchasing power parity and uncovered interest rate parity are allowed for. As long as purchasing power parity holds, monetary policy reacts only to cost-push shocks and excess-demand shocks. If, however, purchasing power parity does not hold, monetary policy also fully offsets the effects of

foreign shocks. Furthermore, not the direction but the strength of the interest rate response to cost-push shocks and excess-demand shocks is affected. Whether the relation between interest rates and exchange rates is described by uncovered interest rate parity or in the more generic way proposed by Ball (1999) does affect both to which type of shocks monetary policy responds and how strong the response is.

However, the effects are mostly quantitative and the empirical relevance of the alternatives used for purchasing power parity and uncovered interest rate parity is also not warranted. To find alternative concepts that describe the relation between prices, interest rates, and exchange rates in an empirically relevant way while being simple, may be the subject for future research.

The present model abstracts from a number of other important issues for small open economies. Foreign shocks, for example, do not only affect world interest rates but also more directly domestic output through the demand for exports. Additionally, foreign shocks affect inflation rates in small open economies through both imported intermediate and final goods and, thus, affect both aggregate demand and potentially aggregate supply. An extension of the present analysis to include further features of small open economies is planned for future research.

3.A Derivation of the interest rate reaction function

To derive the interest rate reaction function when the assumption of purchasing power parity is relaxed, the reduced form representations of inflation (3.14) and output (3.15) derived from the optimality condition (3.13) are inserted into the aggregate demand equation (3.2). The resulting interest rate function depends on the nominal exchange rate:

$$i_t = \frac{(1-\gamma)\lambda + \alpha\gamma\varphi - \nu\alpha}{\varphi[\alpha(1-\beta\gamma)+\lambda^2]}u_t + \frac{\nu}{\varphi}(e_t + p_t^* - p_{t-1}) + \frac{1}{\varphi}g_t \tag{3.17}$$

Simultaneously, the interest rate and the exchange rate are determined by uncovered interest rate parity (3.8) with i_t^* determined by (3.12):

$$i_t = f_\pi^*\pi_t^* + f_y^* y_t^* + \epsilon_t^* + E_t e_{t+1} - e_t + \rho_t \tag{3.8'}$$

The solutions for the interest and exchange rate are guessed to be linear functions of the state variables $(u_t, g_t, \rho_t, p_t^*, p_{t-1}^*, \epsilon_t^*, y_t^*, p_{t-1})$:

$$e_t = \phi_1 u_t + \phi_2 g_t + \phi_3\rho_t + \phi_4 p_t^* + \phi_5 p_{t-1}^* + \phi_6\epsilon_t^* + \phi_7 y_t^* + \phi_8 p_{t-1} \tag{3.22}$$

$$i_t = \gamma_1 u_t + \gamma_2 g_t + \gamma_3\rho_t + \gamma_4 p_t^* + \gamma_5 p_{t-1}^* + \gamma_6\epsilon_t^* + \gamma_7 y_t^* + \gamma_8 p_{t-1} \tag{3.23}$$

The guessed solutions are then inserted into the interest rate reaction function (3.17):

$$\begin{aligned}
&\gamma_1 u_t + \gamma_2 g_t + \gamma_3\rho_t + \gamma_4 p_t^* + \gamma_5 p_{t-1}^* + \gamma_6\epsilon_t^* + \gamma_7 y_t^* + \gamma_8 p_{t-1} \\
&= \frac{\nu}{\varphi}[\phi_1 u_t + \phi_2 g_t + \phi_3\rho_t + \phi_4 p_t^* + \phi_5 p_{t-1}^* + \phi_6\epsilon_t^* + \phi_7 y_t^* + \phi_8 p_{t-1}] \\
&+\frac{(1-\gamma)\lambda + \alpha\gamma\varphi - \nu\alpha}{\varphi[\alpha(1-\beta\gamma)+\lambda^2]}u_t + \frac{\nu}{\varphi}(p_t^* - p_{t-1}) + \frac{1}{\varphi}g_t
\end{aligned} \tag{3.24}$$

and into uncovered interest rate parity (3.8'):

$$\begin{aligned}
&\gamma_1 u_t + \gamma_2 g_t + \gamma_3\rho_t + \gamma_4 p_t^* + \gamma_5 p_{t-1}^* + \gamma_6\epsilon_t^* + \gamma_7 y_t^* + \gamma_8 p_{t-1} \\
&= f_\pi^*(p_t^* - p_{t-1}^*) + f_y^* y_t^* + \epsilon_t^* + \phi_1\gamma u_t + \phi_2\mu g_t + \phi_3\eta\rho_t \\
&+\phi_4[(1+\rho_\pi^*)p_t^* - \rho_\pi^* p_{t-1}^*] + \phi_5 p_t^* + \phi_7\rho_y^* y_t^* \\
&+\phi_8[\frac{\alpha}{\alpha(1-\beta\gamma)+\lambda^2}u_t + p_{t-1}] - \phi_1 u_t - \phi_2 g_t - \phi_3\rho_t - \phi_4 p_t^* \\
&-\phi_5 p_{t-1}^* - \phi_6\epsilon_t^* - \phi_7 y_t^* - \phi_8 p_{t-1} + \rho_t
\end{aligned} \tag{3.25}$$

These two equations have to hold for all values of the state variables. Matching the coefficients of all state variables yields:

From equation (3.24):	From equation (3.25):
$\gamma_1 = \frac{(1-\gamma)\lambda + \alpha\varphi\gamma - \alpha\nu}{\varphi[\alpha(1-\beta\gamma)+\lambda^2]} + \frac{\nu}{\varphi}\phi_1$	$\gamma_1 = \phi_1\gamma + \phi_8\frac{\alpha}{\alpha(1-\beta\gamma)+\lambda^2} - \phi_1$
$\gamma_2 = \phi_2\frac{\nu}{\varphi} + \frac{1}{\varphi}$	$\gamma_2 = \phi_2\mu - \phi_2$
$\gamma_3 = \phi_3\frac{\nu}{\varphi}$	$\gamma_3 = \phi_3\eta - \phi_3 + 1$
$\gamma_4 = \frac{\nu}{\varphi}(\phi_4 + 1)$	$\gamma_4 = f_\pi^* + \phi_4(1+\rho_\pi^*) + \phi_5 - \phi_4$
$\gamma_5 = \frac{\nu}{\varphi}\phi_5$	$\gamma_5 = -f_\pi^* - \phi_4\rho_\pi^* - \phi_5$
$\gamma_6 = \frac{\nu}{\varphi}\phi_6$	$\gamma_6 = 1 - \phi_6$
$\gamma_7 = \frac{\nu}{\varphi}\phi_7$	$\gamma_7 = f_y^* + \phi_7\rho_y^* - \phi_7$
$\gamma_8 = \frac{\nu}{\varphi}(\phi_8 - 1)$	$\gamma_8 = \phi_8 - \phi_8$

Then, the unknown coefficients can be solved for:

$\gamma_1 = \frac{\alpha\gamma[\nu+\varphi(1-\gamma)] + (1-\gamma)^2\lambda}{[\nu+\varphi(1-\gamma)][\alpha(1-\beta\gamma)+\lambda^2]}$	$\phi_1 = -\frac{(1-\gamma)(\lambda-\alpha\varphi) - \nu\alpha}{[\varphi(1-\gamma)+\nu][\alpha(1-\beta\gamma)+\lambda^2]}$
$\gamma_2 = \frac{1-\mu}{\nu+(1-\mu)\varphi}$	$\phi_2 = -\frac{1}{(1-\mu)\varphi+\nu}$
$\gamma_3 = \frac{\nu}{\nu+(1-\eta)\varphi}$	$\phi_3 = \frac{\varphi}{(1-\eta)\varphi+\nu}$
$\gamma_4 = \frac{\nu(f_\pi^* - \rho_\pi^*)}{\nu+\varphi(1-\rho_\pi^*)}$	$\phi_4 = -\frac{\varphi(1-f_\pi^*)+\nu}{\nu+\varphi(1-\rho_\pi^*)}$
$\gamma_5 = -\frac{\nu(f_\pi^* - \rho_\pi^*)}{\nu+\varphi(1-\rho_\pi^*)}$	$\phi_5 = \frac{\varphi(\rho_\pi^* - f_\pi^*)}{\nu+\varphi(1-\rho_\pi^*)}$
$\gamma_6 = \frac{\nu}{\nu+\varphi}$	$\phi_6 = \frac{\varphi}{\nu+\varphi}$
$\gamma_7 = \frac{\nu f_y^*}{\nu+\varphi(1-\rho_y^*)}$	$\phi_7 = \frac{\varphi f_y^*}{\nu+\varphi(1-\rho_y^*)}$
$\gamma_8 = 0$	$\phi_8 = 1$

By plugging these solutions for the unknown coefficients into the guessed solution for the interest rate (3.23), the interest rate reaction function (3.18) is obtained:

$$\begin{aligned} i_t &= \frac{\alpha\gamma[\nu+\varphi(1-\gamma)]+(1-\gamma)^2\lambda}{[\nu+\varphi(1-\gamma)][\alpha(1-\beta\gamma)+\lambda^2]}u_t + \frac{1-\mu}{\nu+(1-\mu)\varphi}g_t \\ &+ \frac{\nu}{\nu+(1-\eta)\varphi}\rho_t + \frac{\nu f_y^*}{\nu+\varphi(1-\rho_y^*)}y_t^* + \frac{\nu(f_\pi^*-\rho_\pi^*)}{\nu+\varphi(1-\rho_\pi^*)}\pi_t^* + \frac{\nu}{\nu+\varphi}\epsilon_t^* \end{aligned}$$

Chapter 4

Financial globalization in the 19th century: Germany as a financial center[1]

4.1 Introduction

Financial globalization is not a new phenomenon of the late 20th century. An important era of financial globalization and integration took already place in the 19th century. In the 19th century, Europe was the *world's banker*, lending capital to countries around the world (Feis, 1930). The main capital exporter was Great Britain, followed by France and Germany, and their capital cities were the main financial centers intermediating credit through their stock exchanges and bankers. London emerged as an important financial center following the Napoleonic Wars and became the undisputed international financial center in the 1870s. Another important financial center in the 19th century was Paris, second only to London, and contributed significantly to the financing of foreign governments and railroads since the 1820s.[2] At the beginning of the 19th century, Frankfurt was the financial center of Germany and also of importance on an international level. Following the political and economic restructurings in Germany during the mid 1860s, Berlin developed as Germany's financial center.[3] In the early 20th century, New York emerged as another important financial center challenging London's primacy (Burk, 1992).

The capital exports of a country are one way to quantify its importance as an international financial center. However, the collection of data on historical capital flows are a challenging and time-consuming task. For Great Britain, Stone (1999) compiled an

[1] This chapter is based on joint work with Graciela Kaminsky.

[2] Detailed descriptions of the developments of London and Paris as financial centers are provided, e.g., in Cassis and Bussière (2005).

[3] Kindleberger (1974) describes the characteristics of financial centers and the development processes leading to the formation of national and international financial centers.

extensive data set building on previous work. The characteristics of British capital flows have been studied extensively but surely not conclusively. The characteristics of France and Germany as smaller capital exporters have been investigated to a lesser degree and to our knowledge no extensive data sets are available. However, figure 4.1 provides a glance at the relative importance of the three financial centers in terms of capital exports.

Germany established as an important financial center after the *Deutsche Reich* was founded in 1871 following the German-French war. The territory then defined persisted until 1914. In addition to the political unification of Germany, most areas of economic life were harmonized afterwards. In 1873 the gold standard was introduced and in 1875 a central bank, the *Reichsbank*, was created. The era from 1870 until 1914 was characterized by a great expansion of economic activity in nearly all sectors, a further shift from an agricultural to an industrial economy and a concentration of powers, enterprises, and capital. The rapid economic expansion was primarily the consequence but also the cause of a fast growing population and with the transition to an industrial economy urbanization rates increased. While Germany experienced net migration outflows until the mid 1890s, it turned into inflows until 1908. During most of the years, Germany had a negative balance in the trade of goods but a positive current account balance. The main imports were raw materials, intermediate goods, and food while exports were dominated by industrial products, especially chemicals and textiles. National income and savings were steadily growing and made Germany a net creditor. (Hoffmann, 1965; Riesser, 1912)

Before World War I, Germany was an important capital exporter; however, the amount of foreign securities issued in German capital markets did not growth but varied significantly over time. Between 1883 and 1913, Germany invested roughly 680 million British pounds in foreign securities (630 million capital called) corresponding to an average of 22 million pounds per year.[4] The capital was predominantly invested into European countries but also other regions obtained considerable amounts of capital. In the first half of the 19th century, private banks were the main financial intermediaries for foreign securities, but they were increasingly displaced by the joint-stock banks.

The goal of the present study is to analyze the role of Germany as a financial center by characterizing aggregate issuances and in particular foreign issuances in German stock exchanges. The floatation of domestic securities clearly dominated aggregate issuances, quantitatively and qualitatively, and was closely linked to German economic activity. Foreign issuances were less clearly related to German economic growth than to external

[4]The amounts originally reported in mark are converted at the exchange rate of 20.4 marks per British pound.

conditions. The large majority of foreign securities were bonds and the main issuers were governments and railroad companies. The main beneficiaries of the foreign investment were Germany's neighboring countries. Furthermore, more developed and less distant countries were more likely to additionally float equity in Germany. Thus, informational frictions and the pecking order relevant for trade in financial assets in the late 20th century seem to have been important already in the late 19th century. As most of the large international bonds were issued simultaneously in the main financial centers, the conditions in German capital markets relative to Great Britain and France were likely important determinants of foreign issuances in Germany. Therefore, we provide insights into the degree of financial integration between the three main financial centers. We find that shocks affecting the interest rate differential between Germany and France had a significant impact on foreign issuances in Germany. Furthermore, the low interest rate differentials between the three financial centers suggest a high degree of financial integration.

Previous work on German capital exports focuses mainly on the seeming contradiction between the capital exports and the apparent capital shortage in German capital markets. This discussion embraces also the determinants of German capital flows, in particular, whether political or economic considerations were the main drivers of foreign investment in the 19th century, see, e.g., Lenz (1922), Feis (1930), and Esteves (2008). Several studies have significantly contributed to the literature by qualifying and quantifying the nature of German capital exports further, e.g., Pohl (1977), Schaefer (1993), and Esteves (2008). However, these studies focus either on the determinants of German capital exports from the perspective of the issuing countries and, thereby, on the pull effects on capital flows, e.g., Esteves (2008), or on the conditions in German capital markets as determinants for the investment in foreign securities, e.g., Tilly (1992). We add another aspect to the analysis and study the characteristics of Germany as a financial center.

The remainder of this study is organized as follows. Section 4.2 describes the development of German capital markets, the main players involved in foreign issuances, stock exchange regulations, and the process of issuance. Section 4.3 presents our data sources and characterizes both aggregate domestic and foreign securities issued in Germany; then, it analyzes the structure of German capital exports through the individual foreign securities sold in Germany. The role of external shocks on foreign issuances in Germany and the role of Germany as a financial center are studied in section 4.4. Section 4.5

concludes and provides an outlook to future research.

4.2 Capital markets, main players, and regulations in stock exchanges

Germany was the third most important capital exporter during the 19th century lending to countries around the world. At the beginning, when government credit was the primary application, capital was mainly intermediated by private banks. Starting in the 1830s, the financing of the railroad construction and of the advancing industries exceeded the funding capacity of private banks and, therefore, financial intermediation shifted towards the stock exchanges and to the newly created joint-stock banks. Until the 1860s, Frankfurt was the financial center of Germany but lost its status to Berlin following the political and economic reorganization of Germany.[5] Next, the developments of the German stock exchanges and the main intermediaries of foreign credit are examined. Afterwards, the regulation of the stock exchanges and the process of issuance are described.

4.2.1 Development of the German stock exchanges

The onset of modern trading at the stock exchange in Frankfurt a.M. is placed around the turn of the 19th century. The rise of Frankfurt a.M. as a financial center was paralleled by the decline of Amsterdam which was the most important market for government bonds until the end of the 18th century. From the beginning, Frankfurt was an important financial center on an international level and intermediated credits to foreign governments. At that time, the banking house Gebr. Bethmann was one of the most important private banking houses and intermediated the majority of German government credit and made bond financing an important area of business from the middle of the 18th century onwards. Frankfurt's importance as financial center rested also on the presence of the M.A. Rothschild & Söhne whose German headquarters were located in Frankfurt. The Rothschilds increasingly displaced the Gebr. Bethmann and dominated the intermediation of international credits. The Frankfurt stock exchange was the most important one in Germany until the 1860s when Germany was politically reorganized

[5] Kindleberger (1974) describes the transition from Frankfurt as the financial center to Berlin and back to Frankfurt after World War II.

and Berlin became the capital of the newly founded *Deutsche Reich*. As a consequence, the Frankfurt stock exchange lost importance relative to Berlin although in absolute terms it was still growing.[6]

The foundation of the stock exchange in Berlin was based on a decree from 1796 and it had its first formal regulation in 1825. The railroad construction period in the middle of the 19th century and the induced trading in railroad equity are considered the cornerstone for Berlin's importance as a financial center.[7] Frankfurt was mainly a stock exchange for bonds, in particular government bonds, and the private bankers in Frankfurt refused to introduce equity for a long time. In contrast, the Berlin stock exchange was open to equity and introduced numerous railroad shares. This contributed to a substantial shift in financial intermediation from Frankfurt to Berlin and, thereby, to the relocation of the financial center. The stock exchange in Hamburg was the third in importance in Germany after Berlin and Frankfurt. When Amsterdam lost its position as premier financial center, Hamburg was a major beneficiary of the reallocation of foreign trade and, thus, of trade financing. At the onset of World War I, Hamburg had achieved a comparable position as Frankfurt as financial center (Gömmel, 1992).

In addition to their specialization in market segments, the lending of the three main German stock exchanges was regionally specialized as illustrated in table 4.1. According to the tax statistics reported by the Börsen-Enquete-Kommission (1893), the majority of foreign securities, 81 per cent, was taxed at the stock exchange in Berlin. Although the location where the taxes were paid did not necessarily coincide with the place of issuance, it gives an idea of the relative importance of the three stock exchanges. The countries outside Europe drew nearly exclusively on the Berlin stock exchange while North & Central Europe relied mostly on the Hamburg stock exchange. The Frankfurt stock exchange was an important alternative to Berlin for South and East European borrowers. The stock exchanges were important market places for investors and intermediating banks. However, international loans and investments were also made outside the stock exchanges, mainly by the banks.

[6] Wormser (1919) describes the developments of the stock exchange in Frankfurt in detail.

[7] The development of the Berlin stock exchange is analyzed at length by Spangenthal (1903) and Gebhard (1928).

4.2.2 Main players

The investment in international securities and the intermediation of international loans were made both by private banks and joint-stock banks. However, while financial intermediation was dominated by private banks until the middle of the 19th century, the increase in loan volumes to finance the construction of railroads and the heavy industry led to the formation of joint-stock banks. Following the concentration process in the banking sector in the late 19th century, the so-called Great Banks dominated the financial intermediation.[8] The universal banks, pursuing all kinds of banking activities, were characteristic of the German banking system in contrast to the specialized British banks. The German banks engaged in the underwriting, formation, and reorganization of companies while they refrained from creating pure deposit banks. During all times, they were also involved in the intermediation and underwriting of foreign securities. (Riesser, 1912)

Until the middle of the 19th century, foreign loans in Germany were mainly intermediated by private banks who lent their own capital. However, as the demand for financing increased beyond what banks could handle by themselves, the banking house Bethmann, founded 1748 in Frankfurt, and other private banks created the *Partialobligation* and, thereby, started the intermediation of securities. Through the *Partialobligation* banks acquired external funds while explicitly acknowledging the actual borrower and, thus, excluding any liability.[9] The trading of these securities was then a next step. In Frankfurt, the Bethmanns and the banking house B. Metzler seel. Sohn & Co. (founded 1674) were the main bankers around 1800. Later on, the Rothschilds became the main private bankers in Frankfurt were Meyer Amschel Rothschild founded M. A. Rothschild & Söhne with his sons in 1810. The presence of the Rothschild brothers in all important financial centers was pivotal for their outstanding international financial role since private contacts and relations as well as local knowledge were crucial in overcoming information asymmetries.[10] Other important private banks in Frankfurt were Jacob S.

[8] Riesser (1912) provides a detailed account of the German banking system, its activities, and the concentration process.

[9] With the *Partialobligation*, the private banks created a new financial instrument to acquire external funds which could then be lend. The novelty was that the banking house borrowed funds from numerous private persons, bundled them, and lent the amount as one loan. The bankers wrote partial certificates of debt to the lenders but were not anymore liable in case of bankruptcy of the borrower. It thereby represented a new form of financial intermediation between small investors and big borrowers without the private bankers being personally liable. (Wormser, 1919)

[10] The Rothschild office in London was established in 1804 and in Paris in 1812/15. The agencies in Vienna and Naples, established in 1816 and 1820, respectively, were branches of the Rothschild office

H. Stern (1805), Lazard Speyer-Ellissen (1846), and Erlanger & Söhne (1859). Frankfurt was the most important banking center until around 1860, followed by Cologne. The most important private banks in Cologne were Sal. Oppenheim & Cie. (1789)[11] and A. Schaaffhausen (1790). Until the financing of the railroad construction and the heavy industry started in the 1830s, the main banking business was government loans. With the railroad construction, Berlin gained importance and with it the main private banks Gebr. Schickler (1796), S. Bleichröder (1803), Mendelssohn & Co. (1805), and R. Warschauer & Co. (1849). Hamburg played a special role in foreign trade financing and the most important private banks were L. Behrens & Söhne (1780) and M. M. Warburg & Co. (1798). (Wormser, 1919; Gebhard, 1928; Born, 1977)

As the financial needs and transaction volumes of both industries and issuance business increased further, it became more and more difficult for private banks to manage these by themselves even with external funds. Especially the financing of the railroad construction posed a big challenge to private bankers. As a consequence, private banks cooperated both informally through syndicates and formally through the foundation of new banks. As a matter of fact, most joint-stock banks were created by private bankers or were the result of reorganizing an existing private bank. In the first foundation wave between 1848 and 1870, four of the Great Banks were established. The *A. Schaaffhausen'scher Bankverein* was founded 1848 in Cologne through the reconstruction of the bank house A. Schaaffhausen. In 1851 the *Disconto-Gesellschaft* was founded in Berlin and became an actual joint-stock bank in 1856 through a change in legal status. Also the *Bank für Handel und Industrie*, founded 1853 in Darmstadt by the private bankers Gustav Mevissen and Abraham Oppenheim, was a major player in the intermediation of international loans. Due to its location in Darmstadt, the bank is generally known as *Darmstädter Bank*. (Riesser, 1912) The *Berliner Handelsgesellschaft* was founded in 1856 under the participation of Mendelssohn & Co., S. Bleichröder, Robert Warschauer & Co., and Gebr. Schickler. In the second wave of joint-stock bank foundations starting in 1870, the *Deutsche Bank* and *Dresdner Bank* were established. In 1870 Gebr. Schickler, A. Schaaffhausen'scher Bankverein, Gebr. Sulzbach, and others founded the Deutsche Bank in Berlin. The Dresdner Bank was built in 1872 on the basis of the private bank house Michael Kaskel in Dresden in cooperation with the Berliner Handelsgesellschaft and relocated to Berlin in 1881. (Gebhard, 1928) From the late 19th

in Frankfurt until 1844, when they become independent offices. Born (1977) discusses the role of personal networks in overcoming information asymmetries further.

[11] Salomon Oppenheim was founded 1789 in Bonn and relocated to Cologne in 1801. (Born, 1977)

century onwards, a strong concentration process took place in the banking sector and until the beginning of the 20th century, most private banks were taken over by the Great Banks. For example, the business of the Rothschilds in Frankfurt was taken over by the Disconto-Gesellschaft in 1901 and the Frankfurt bank house Erlanger & Söhne by the Dresdner Bank in 1904. (Born, 1977)

While most private banks in Germany had their origins in the trade and shipping business or were the private financiers of German sovereigns, in the last quarter of the 19th century the German joint-stock banks emerged as universal banks, involved in all types of banking activities. They engaged in the financing of industries, trade, and governments through underwriting, foundation, and reorganization activities and through the foundation of appropriate institutions, both domestically and internationally. The Great Banks improved and extended their international business first by creating affiliates abroad, later by founding new banks overseas and delegated part of the international issuance business.[12] However, the private banks and the Great Banks continued to carry out the biggest international transactions by themselves. The underwriting and issuance of foreign securities was in general directed by syndicates, mostly international ones, formed for a limited number of transactions or even individual deals. Only very few syndicates or banking groups dominated the business with a specific country over prolonged time periods. (Born, 1977) When syndicates issued securities, the underwriting syndicate was often different from the introducing syndicate and it was common that the underwriters themselves gave sub-participations to other banks to reduce their economic responsibilities. In general, the leader of the syndicate then actually sold the securities at the stock exchanges or entrusted another company or bank to do so. Mostly, the securities were issued piecewise trying to influence the price. (Lotz, 1890)

4.2.3 Regulation of the stock exchanges

In the first half of the 19th century, the German stock exchanges were subject only to self-determined regulations and not to government regulation, except for the ban on forward trading in Berlin. Due to widespread speculation first in Spanish, then in other foreign securities, and finally in railroad equity, consecutive regulations were established that prohibited forward trading in these securities between 1836 and 1844 in Berlin and were abolished only in 1860. (Spangenthal, 1903) The Stock Exchange Act of 1896

[12] Otto (1910) and Steinmetz (1913) elaborate on the activities of the Great Banks overseas including their foundation activities.

was the first one to regulate the stock exchanges on a national level. The regulation followed closely the recommendations of the *Börsen-Enquete-Kommission* (Committee of the Stock Exchange Inquiry) who conducted a detailed analysis of the stock exchanges in Germany. The new regulation restricted forward trading in securities significantly, required the publication of a prospectus for securities applying for admission to trade, and made the underwriting banks accountable for the content of these prospectuses.[13] As the individual stock exchanges had their own rules governing the admission of securities for trade already prior to the Stock Exchange Act, the consequences of the regulation for capital markets and the intermediaries are not trivial. The restrictions in forward trading are often mentioned as having contributed to the concentration in the banking system, e.g., Fohlin (2002). The induced increase in spot transactions severely reduced the flexibility of capital markets and favored bigger banks over private banks. The prospectus requirements are unlikely to have significantly affected foreign issuances as also the UK and France had similar requirements for the floatation of foreign securities. Wetzel (1996) does not find any statistically significant impact of the Stock Exchange Act on domestic and foreign issuances and Fohlin (2002) finds only a small effect on the concentration in the banking system.

Furthermore, starting in 1881, the government imposed two types of taxes on trading in securities, an issuance tax (*Effektenstempel*) and a turnover tax (*Umsatzstempel*). The issuance tax was levied on all securities sold at an initial public offering in Germany with the exception of German government bonds; the turnover tax was levied on all security transactions. For both taxes, different rates applied to different types of securities and to domestic and foreign borrowers. The tax rates were successively increased in 1885, 1894, 1900, and 1909. Starting in 1894, the issuance tax was also due on foreign assets bought outside of Germany if the investor resided in Germany and the securities were not held in an account abroad.[14] The tax increases on foreign securities significantly reduced the attractiveness of the German stock exchanges for both foreign issuers and domestic investors. The displacement of German capital to foreign stock exchanges might have been significant. According to Fritzsche (1913), German investors increasingly bought foreign securities outside the German capital markets; the amount of foreign securities held in deposits outside the country, and, thus, not subject to the taxes, increased nearly threefold between 1893 and 1902, from 7.5 million pounds to 22 million pounds.

[13] Wetzel (1996) discusses the Stock Exchange Act and its implications in detail.

[14] Details on the tax regulation and the successive amendments are described, e.g., in Meyer (1902), Kleiner (1914), the *Frankfurter Zeitung*, and the *Deutsche Oekonomist*.

While German central government bonds were automatically admitted for trade at the stock exchanges, all other securities had to apply for admission which had to be formally filed for by a German bank. The admission of foreign securities was required for the whole amount issued and not only the share offered for subscription in Germany, thereby facilitating the international trade in these securities. (Kleiner, 1914) Even though the admission to official trading had the advantage of facilitating the issuance and placement of a security, numerous securities were sold exclusively on the *free* market. A very rough estimate of the relative importance of the free market, i.e., the trading outside the stock exchanges, is provided by the Börsen-Enquete-Kommission (1893) for the stock exchange in Hamburg. While only 129 foreign securities with a face value of 17 million pounds were officially introduced to the Hamburg stock exchange between 1880 and 1892, 678 securities with a nominal amount of 27 million pounds were taxed.[15] This leaves 10 million pounds to 549 not officially admitted securities, corresponding to 37 per cent of the value of the foreign securities bought by German investors. However, it also points at the fact that the big international issuances were traded through the stock exchanges while it were mainly smaller securities bypassing the stock exchanges.[16]

4.2.4 The process of issuance

Zickert (1911) describes the most common ways foreign securities were sold in Germany. The main ways of introducing new foreign securities to the investing public were the advertisement through newspapers and circulars and the recommendation by banks and bankers to their clients. Foreign securities were sold either through the introduction at a German stock exchange or directly by the banks to their customers. Through their deposit banks and affiliates the Great Banks had direct access to private investors and could sell foreign securities without requiring the admission to a stock exchange to make the information available. Especially foreign securities underwritten by syndicates were often not placed on stock exchanges but directly sold to the banks' customers. The quantity of foreign securities publicly offered for subscription while bypassing the stock exchange administration office was also non-negligible. Zickert (1911) estimates that in 1909 and 1910 approximately 11 per cent of all foreign securities were offered for subscription without being admitted to a stock exchange. To introduce a foreign secu-

[15]The tax applied to all foreign securities bought by German investors, independent on whether they were bought through a stock exchange or not.

[16]The average amount of the officially admitted securities was 132 thousand pounds, while the not admitted securities only amounted to 18 thousand pounds on average.

rity to the stock exchange, the underwriters had to apply for admission; afterwards, in general, an invitation for subscription followed. However, it had become common practice among underwriting banks at the turn of the century to carry out the subscription prior to the successful admission to a stock exchange as pointed out by the *Deutsche Oekonomist* (August 5, 1899; July 9, 1904). The banks justified this procedure with the time-consuming admission process in Germany which left them with a disadvantage over their fellow underwriters in international syndicates and would require them to refrain from such activities. (Zickert, 1911)

Marx (1913) distinguishes two ways in which new securities were distributed to the public: direct and indirect issuance. In case of a direct issuance, the person or company raising capital offered its securities directly to the public though public subscription or over the counter. Direct issuance was only common practice for German government bonds until the middle of the 19th century, afterwards they were mediated mainly through the Prussia-Syndicate. The more common form was the indirect issuance where a banker or bank syndicate intermediated between the public and the capital searcher. In general, the banks underwrote the whole security, i.e., they bought it for a fixed transfer price and distributed it at their own expenses to the public. For foreign issuances only the indirect method was relevant. The security was then sold to the public either by public issuance, i.e., through subscription invitations or introduction to a stock exchange, or by sale over the counter, advertised through letters to customers and non-customers. Securities issued and sold over the counter were very hard to capture statistically as the process took place off the public without announcements, prospectuses or suchlike in the public press or in other public form. Usually, more than one issuance method was used at a time.[17]

4.3 International issuances

The time period under scrutiny starts in 1883, the year in which the *Deutsche Oekonomist* started publishing data on securities issued on the German stock exchanges and when the turbulences following the *Gründerkrise* (Founding Crisis) of 1873 most likely already faded. As the capital markets basically shut down when World War I started, our sample period ends in 1913. The data sources are described next. Then, the aggregate amounts of capital floated on the German stock exchanges between 1883 and 1913

[17]Lotz (1890) provides a very detailed description of the issuance process in Germany.

are analyzed and the similarities and differences between domestic and foreign issuances are studied. Finally, we look at foreign investments made between 1883 and 1897 by using disaggregated data of foreign securities issued on the German stock exchanges.

4.3.1 Data sources

To quantify the amount of domestic and foreign securities issued on the German stock exchanges, the most widely used and valued statistics are provided by the *Deutsche Oekonomist* located in Berlin and the *Frankfurter Zeitung* located in Frankfurt. The purpose of the issuance statistic of the *Deutsche Oekonomist* was to provide "the most precise possible answer to the question to which extent the capital and money markets have been drawn on by issuances of securities during a specific time period" (January 14, 1911). Thus, only officially admitted securities, based on prospectuses were included. In general, the overall amount admitted based on the subscription price or the introductory rate was reported even though only a fraction may have been introduced during the admission year or allocated following the subscription. It was especially common for real estate and agricultural mortgage bonds that the issuance was extended over prolonged time periods.[18] Conversions, restructurings, and mergers were excluded; only increases in capital were included. (*Deutsche Oekonomist*, January 14, 1911) A peculiarity of foreign securities was that the application to German stock exchanges had to be made for the whole amount issued and not only the share offered for subscription or sold in Germany. As has been pointed out also elsewhere in the literature, e.g., Bankenquete (1910) and Marx (1913), it is extremely hard if not impossible to accurately know the shares of foreign securities actually placed in Germany. The *Deutsche Oekonomist* states that "the issuing house only knows the exact amount actually placed in Germany during the here considered limited time period after the issuance; but it will reveal this amount only possibly if it was sold out, an information not identical to the information that there was an over-subscription" (September 11, 1909). Nevertheless, the *Deutsche Oekonomist* reported tentative estimates of the amount of international securities sold in Germany based on information of the issuing houses if available. However, this detailed information is only available until 1897 as the *Deutsche Oekonomist* stopped publishing detailed lists with the securities sold in Germany. The reason provided by the *Deutsche Oekonomist* was that the number of securities had increased too much to report them

[18] The *Deutsche Oekonomist* reported rounded estimates of the German mortgage bonds for the current year and revised them when the bank statistics were made. (July 13, 1895)

individually (January 14, 1899). However, at the same time the *Kaiserliche Statistische Amt* (Government Statistical Office) started publishing the amounts of securities admitted for trade. As the amounts of foreign securities admitted for trade exceeded the amounts sold in Germany by wide margins, this information is only of limited use for the analysis of capital exports intermediated by the stock exchanges.

The issuance statistic of the *Deutsche Oekonomist* is available starting in 1883, while the statistic of the *Frankfurter Zeitung* is available only for a much smaller time period, starting in 1896. We therefore follow Esteves (2008) and other related literature in using the data provided by the *Deutsche Oekonomist*. The amounts originally stated in marks are converted into British pounds at the exchange rate of 20.4 marks per pound.

4.3.2 Aggregate issuances

The aggregate amount of securities issued in the German stock exchanges during a specific year is a measure of new capital investments, both in domestic and foreign applications. The aggregate issuances in Germany increased over the sample period and fluctuated with four local peaks broadly corresponding to peaks in the German business cycle[19]: in 1888 (98 million pounds), 1899 (110 million pounds), 1905 (148 million pounds), and 1908 (164 million pounds), see figure 4.2. Capital was invested both in German and foreign securities. While the amount invested in domestic securities increased over time, foreign securities fluctuated without trend, see figure 4.3. The fluctuations in aggregate issuances were mainly driven by domestic issuances exhibiting a very similar time pattern[20], with the exception of the peak in 1905 due to an outstanding amount of 60 million pounds in foreign securities. Foreign securities quantitatively dominated total issuances only until 1886; afterwards their share declined with the exception of two peaks around 1897 and 1905.

The variations in foreign issuances were dominated by the floatation of government and railroad bonds, see figure 4.4. The exceptional amount of foreign issues in 1905 is related to the Russian-Japanese war. The war led to the floatation of a Russian government bond of 12 million pounds and three Japanese government bonds summing up to 16 million pounds, thereby accounting for half of all foreign securities floated that year. Government bonds were also an important determinant of fluctuations in

[19]These peaks correspond both to periods of high economic growth and to peaks in the detrended German GDP series using the Hodrick-Prescott filter.

[20]The correlation between the two series is 0.94.

domestic securities, see figure 4.5. Furthermore, investments in mortgage and industrial securities were quantitatively significant while railroad securities played nearly no role among domestic securities. The railroad boom in Germany took place earlier in the 19th century and most railroad companies were nationalized starting in the late 1870s. (Riesser, 1912; Tilly, 1992) Hence, railroads were mainly financed through government securities afterwards. While government bonds exhibited a similar pattern as overall economic activity, industrial securities increasingly displaced mortgage securities.

In the aggregate, 82 per cent of capital was invested in bonds and only 18 per cent in equity. The preference for bonds was even stronger for foreign securities: only 8 per cent of the foreign securities floated in Germany were equity. However, the relative importance of bond versus equity financing varied significantly over time, both for domestic and foreign securities and across sectors, see figure 4.6. Bonds were mainly issued by domestic and foreign governments, followed by domestic mortgage institutions and foreign railroad companies. The industrial sector in Germany was the main receiver of equity financing. Furthermore, German banks issued substantial equity. Investment in foreign equity, however, was mostly directed towards railroad financing and, at the beginning of the 20th century, increasingly towards the banking sector. As bondholders are senior lenders relative to equity holders, investing into bonds involves a lower risk than into equity. Accordingly, the issuance of equity was particularly volatile. Furthermore, information asymmetries between lenders and borrowers may be exacerbated by geographical distance and, thus, be higher for foreign than domestic investments.[21]

Different types of financial instruments involve diverging degrees of risk and so do different types of borrowers. Even though governments can, and sometimes do, default on their debt, government bonds may be considered safer investments than bonds of other issuers. Due to their taxing power, insolvency is a lesser concern for governments than for private enterprises. Furthermore, less information is needed to evaluate a government's financial situation than a private company's one.[22] In the 19th century, most railroad companies enjoyed some form of government guarantees, either explicitly or implicitly, and, therefore, the investment risk was reduced as compared to industrial companies. Private industrial companies may be considered the riskiest borrowers as the available

[21] German investors' knowledge of foreign countries was probably very limited and, therefore, the risks involved when investing in these countries substantial. By lending through bonds the risk could be reduced. The role of informational frictions for trade in financial assets is discussed in the next section.

[22] In the 19th century, information asymmetries were most likely substantial as the transmission of information was costly, see, e.g., Flores (2007).

information relative to the necessary one was probably the least and the solvency risk substantially higher than for governments and government guaranteed railroad companies.

Germany invested in securities of countries around the world and countries were different and involved diverging degrees of actual and perceived risk. The disaggregation of foreign securities to the country or at least regional level helps in identifying patterns in the foreign investment and is pursued in the next section.

4.3.3 Individual foreign securities

German capital was financing governments, railroads, and industrial companies around the world. Using disaggregated data on the foreign securities floated in Germany reveals the countries and regions that were the main beneficiaries of the capital flows and contributes to our understanding of foreign investment decisions. However, the *Deutsche Oekonomist* provided disaggregated data only until 1897. The collection of the disaggregated data for the remaining period until 1913 is the subject of ongoing research. Still, the reduced sample from 1883 until 1897 offers interesting insights into the characteristics of German capital exports and is therefore analyzed in detail.

Table 4.2 illustrates the main regional pattern in foreign investment made through the German stock exchanges between 1883 and 1897.[23] The majority of foreign securities, i.e., 80 per cent, was issued by European countries, more specifically Austria-Hungary and Russia who received 21 and 22 per cent, respectively, followed by South Europe, i.e., mainly Italy, with 16 per cent. The second most important continent were the Americas whose securities floated in Germany accounted for 16 per cent of all international issuances, with only a slightly higher share in North America than Latin America. However, the relative importance of the regions varied over time, see figure 4.7. During the late 1880s, the Americas gained considerable weight in international issuances, especially through increased floatations of Latin American securities. However, between 1891 and 1894, no Latin American securities were floated in Germany, probably as a reaction to the Baring crisis in 1890.[24] The composition of the European securities also varied substantially. The South European countries increased the floatation of securities in the late 1880s and early 1890s when Austria-Hungaria had a low participation and

[23] We focus on the country of location of a railroad, bank, or company, and, thereby, concentrate on the characteristics and risks of the country where the business was carried out as compared to the nationality of the owner.

[24] For a discussion of the Baring crisis, see, e.g., Flores (2007).

Russia did not contribute at all to the foreign issuances in German stock exchanges.

Figure 4.8 provides a more detailed picture of the countries floating securities on the German stock exchanges between 1883 and 1897. Austria-Hungary was the main issuing country with 89 securities floated, followed with a considerable gap by the United States (43 issues), Italy (42 issues), and Russia (35 issues). However, the size of issues varied considerably across countries. The average size of securities floated was highest for Russia and Mexico, both with 2.2 million pounds, followed by Argentina with 1.8 million pounds. Accordingly, the relative importance of countries in terms of funds obtained from German capital markets is a different one. Russia and Austria-Hungary clearly dominated with 78 and 76 million pounds, respectively, followed by Italy (46 million pounds), and the United States (30 million pounds).

The types of investment between regions also differed substantially, see table 4.2. Investment in Africa, North America, and South Europe was mainly related to railroad financing, securities issued by Latin American and South-East European countries were mostly government bonds while Asian, i.e., Chinese, securities were exclusively issued by the government. Investment directed towards the banking, industrial, and mortgage sectors played a non-neglegible role only in Austria-Hungary, North and Central Europe. As previously pointed out, bonds were the dominant type of securities sold on German stock exchanges. However, equity financing played also a role for applications in North America, North & Central Europe, South Europe, and Africa, especially for railroad projects. Industrial equity was highest in Austria-Hungary and North & Central Europe with roughly 2 million pounds each and bank equity in Austria-Hungary with 2 million pounds. These findings are consistent with some stylized facts in the literature on trade in financial assets. Germany invested predominantly in neighboring countries confirming a common pattern. Portes and Rey (2005) find that a gravity model performs very well in explaining international trade in financial assets. They explain the strong negative correlation between geographical distance and asset trade by informational frictions proxied by distance. The knowledge of neighboring countries is generally higher. However, Portes, Rey and Oh (2001) do not find that equity investments react stronger to informational frictions than bond investments.

In our sample period North America issued equity in Germany while Latin America did not. Likewise, North and Central Europe as well as South Europe issued equity but it played nearly no role for South-East Europe. Thus, we find a tendency that close and more developed countries received more equity investment. This may be due to

informational asymmetries being lower for neighboring countries and more developed countries being perceived as less risky. The equity investment into African railroads was nearly exclusively into the Dutch-South African railroad company. The company was founded in the Netherlands but was actually a German company. (Baltzer, 1916) Due to the railroad's location in South Africa it is considered foreign investment in Africa, even though the nationality risk was European. Thus, the investment may have been perceived as less risky thereby strengthening our findings. Daude and Fratzscher (2008) find an actual pecking order in foreign investment determined by informational frictions and institutional quality in the host country. Portfolio investment is much more sensitive to both determinants than direct investments or bank loans. Therefore, FDI and loans dominate investment in less developed countries while portfolio investment is more prevalent in developed countries. However, in our dataset we currently cannot distinguish between portfolio investment and FDI and, therefore, we cannot draw inference in this regard.[25]

The decision to invest into a foreign security depends also on the asset's riskiness. One risk measure is market liquidity: if assets can be easily sold, the risk is lower. The issuance frequency of a borrower in German stock exchanges is a possible proxy for market liquidity. The more often a borrower issues securities in Germany, the higher the circulation of the borrower's securities and, thus, the more likely significant trade is taking place. Furthermore, investors may have better information on borrowers already present in German financial markets. We next look at the frequency in which countries issued securities in Germany. Thereby, we learn which countries had permanent or only temporary access to German capital markets and get some insights about investors' knowledge of specific countries. Figure 4.9 accordingly depicts borrowing behavior on German stock exchanges on a yearly basis. The incidence of new issuances varied significantly across countries. While some of the main recipient countries like Austria-Hungary, Italy, and the United States floated securities nearly every year, Russia as one of the main borrowers did not float securities between 1889 and 1893. This, however, was due to political considerations. Between November 1887 and October 1894, the *Reichsbank* was not allowed to accept Russian bonds as collateral for loans, thereby, Russia was

[25]The distinction between portfolio investment and foreign direct investment is not clear-cut. The related literature characterizes the securities intermediated through the stock exchanges as portfolio investment. In contrast, Lane and Milesi-Ferretti (2007) define an equity participation above 10 per cent as FDI. However, this information is not available for our sample. In any case, equity that may be considered FDI or portfolio investment accounts only for 8 per cent of the foreign securities in our sample and the remainder is portfolio investment.

indirectly denied access to the German capital market.[26] Countries like Switzerland and Sweden floated securities nearly every year even though in absolute terms they were not among the main recipient countries, while other countries like Argentina, China, and Mexico floated securities only during a couple of years but received noteworthy amounts of capital. Yet other countries only floated securities in Germany only once like Algeria, Canada, and Cuba. As we do not have information on denied issuances and amounts issued through other financial centers, we do not know the underlying reasons, i.e., whether a country issued only seldom securities in Germany because of denied access or because no access was requested. Not surprisingly, the majority of securities issued in Germany were rather small in size, both bonds and equity, see figure 4.10. The large international bonds were in general issued by international syndicates and placed not only in Germany but also in London, Paris and smaller financial centers.

4.4 The role of external shocks

The foreign securities floated in Germany were mostly issued simultaneously in other countries, especially in the two main financial centers, London and Paris. Hence, the quantity of foreign securities floated in Germany was not only determined by the conditions in the borrowing countries and on German capital markets but also by the conditions in other financial centers, most importantly London and Paris. In this section, we examine if shocks to these other financial centers affected the floatation of foreign securities in Germany.

4.4.1 The model

Consider a simple partial equilibrium model of the German capital market. There are n countries including Germany, the UK, and France. All countries need funds that are supplied only by the UK, France, and Germany as financial centers. Hence, all the other countries are just borrowers. The German capital market is in equilibrium when the funds demanded equal the funds supplied.

$$\sum_{i=1}^{n-1} D^i(R^G, R^G - R^{UK}, R^G - R^{Fr}, Y^i) + D^G(R^G, R^G - R^{UK}, R^G - R^{Fr}, Y^G) = S^G(R^G, r^G, rp^G)$$

[26] A more detailed description of the *Lombardverbot* and its implications for financial transactions is provided by, e.g., Feis (1930) and Born (1977).

The demand for German funds, D^i, depends on the interest rate R^G at which countries can borrow from Germany and on the interest rate differential between Germany and the UK, $R^G - R^{UK}$, and between Germany and France, $R^G - R^{Fr}$, as countries can alternatively borrow from the UK or France. When the interest rate in Germany is higher than in the UK, for example, the demand shifts towards the British capital market. Therefore, the demand for German funds depends negatively both on the level of the German interest rate and the differentials against the other financial centers. Furthermore, the demand increases with economic activity in the borrower country, Y^i.

Investors in Germany have the alternative between lending to risky domestic or foreign countries/firms at an interest rate R^G and investing at the risk free rate r^G. Hence, the supply of funds in Germany, S^G, depends positively on the risky interest rate and negatively on the risk free interest rate. The risk aversion of German investors and the overall risk of investments are captured in the term rp^G that determines the degree of substitutability of the risky and the safe asset. We take R^{UK} and R^{Fr} as exogenous. Aggregating the demand for funds of non-German countries, D^F, we obtain the supply of funds to non-German borrowers as follows:

$$D^F(R^G, R^G - R^{UK}, R^G - R^{Fr}, Y^F) = S^G(R^G, r^G, rp^G) - D^G(R^G, R^G - R^{UK}, R^G - R^{Fr}, Y^G)$$

Then, solving for R^G, we obtain a reduced form equation for foreign issuances in Germany:

$$I^G(r^G, rp^G, R^G - R^{UK}, R^G - R^{Fr}, Y^G, Y^F) \tag{4.1}$$

Hence, foreign issuances depend negatively on the risk free interest rate and the risk term rp^G. When the opportunity cost of the risky investment, the riskiness of the investments themselves, or the risk adversion of German investors increase, foreign issuances are lower. The effect of a change in the interest rate differentials on foreign issuances is ambiguous. An increase in the differential reduces the demand for German funds but increases the supply of funds to non-German borrowers. The relative interest elasticities of demand and supply determine whether the overall effect is positive or negative. An increase in economic activity in the borrower countries increases the demand and, hence, has a positive effect on foreign issuances. An increase in German economic activity, however, reduces the supply of funds to non-German borrowers.

4.4.2 Estimation

The reduced form equation for foreign issuances in Germany (4.1) is estimated by regressing the log of the nominal amount of foreign securities issued in Germany each year on the following explanatory variables. We use the private discount rate in Germany as the risk free interest rate.[27] The term rp^G capturing both the risk aversion of German investors and the riskiness of investments can be proxied using a variety of indicators. The share of countries defaulting on sovereign debt in a given year measures the aggregate default risk, a higher share implying higher risk. The differential between a long- and a short-term interest rate provides a measure of the term premium, assuming that an increase in the term differential reflects higher risk. The term premium is measured as the difference between the long-term government bond yield and the private discount rate in Germany. A third indicator is the amount of foreign securities issued in Great Britain, the premier financial center, as a proxy of liquidity in financial markets: higher issuances are a sign of higher liquidity and, thus, lower risk. We transform foreign issuances in Great Britain by using the negative value. Then, an increase in each of the three indicators reflects an increase in risk. All indicators have their relative merits and caveats and are correlated. Therefore, instead of choosing one indicator, we derive the principal components of the three risk indicators and use the first principal component as explanatory variable. The first principal component explains 69 per cent of the total variability of the risk indicators and the second principal component an additional 23 per cent. The first principal component is a roughly equal linear combination of the three risk indicators and can be interpreted as overall investment risk. The first two principal components are illustrated in figure 4.11. The interest rate differentials between the financial centers are measured with long-term real interest rates obtained by substracting the inflation rate from the long-term nominal government bond yields. Economic activity in Germany is measured by the GDP growth rate while economic activity in the rest of the world is proxied by the GDP growth rate in the UK. The reason is that the UK was the premier financial center and we assume that when the UK entered a recession, so did the rest of the world. An alternative measure is the growth rate of world exports and is used as a robustness check. The data sources are described in table 4.3. Figure 4.12 illustrates the fluctuations in the real interest rate differentials and the

[27] The private discount rates were the interest rates negotiated in the transactions between credit institutes (Deutsche Bundesbank, 1976). The original interest rates are in nominal terms and are converted into real interest rates by substracting the inflation rate.

private discount rate in Germany, while figure 4.13a depicts the GDP growth rates in Germany and the UK.

Equation (4.1) is estimated using Ordinary Least Square (OLS) techniques. Foreign issuances are truncated at zero, however, the log of foreign issuances is not. The advantage of OLS is that the estimated coefficients can be directly interpreted as compared to Tobit estimations. As a robustness check we perform our estimations also for foreign issuances in levels using Tobit techniques. The results of the estimations are reported in table 4.4 and figure 4.14 shows the actual series of the log of foreign issuances as well as the fitted values and residuals for specification (1). While column (1) in table 4.4 is the baseline regression including all the above described variables, the regression in column (2) excludes economic activity in Germany and the UK.

The main insight is that the conditions in financial markets both in Germany and relative to the other financial centers as well as aggregate risk mattered for the amount of foreign securities floated in German stock exchanges. As expected, higher private discount rates in Germany and higher risk discouraged foreign lending in Germany. While an increase in the long-term interest rate in Germany relative to France affected foreign issuances in Germany negatively, the differential between Germany and the UK does not have a statistically significant effect. This can be interpreted as follows. The interest rate semi-elasticity of the demand for funds of non-German borrowers is higher than the interest rate semi-elasticity of supply. Hence, Germany and France seem to be substitutes as financial centers for borrowers. The effect is quite substantial: a one percentage point increase in the interest rate differential decreased foreign issuances by roughly 80 per cent. As the interest differential between Germany and France ranged between -0.2 and 0.8 per cent, the changes in the differential were commonly much smaller than one percentage point, see figure 4.12. The semi-elasticity of foreign issuances with respect to changes in the interest rate differentials is higher than with respect to changes in the domestic short-term interest rate. This may suggest that foreign shocks mattered more for international issuances than domestic shocks. However, an increase in the differential may be due to both an increase in German long-term interest rates and a reduction in long-term interest rates in the respective other financial center. Therefore, these estimations do not provide clear guidance in this respect. Furthermore, the small interest rate differentials and their low volatility in figure 4.12 suggest that the financial centers were highly integrated. Economic activity in Germany and world economic activity, however, are not statistically significant in explaining foreign issuances

in Germany.

Thus, only financial conditions seem to matter for the amount of foreign securities floated in Germany and not economic activity, neither in Germany nor in the rest of the world. Together, they explain roughly 45 per cent of the variation in foreign issuances.

4.4.3 Robustness checks

To check the robustness of our findings, we repeat the estimations for the level of foreign issuances in Germany as dependent variable and use Tobit estimation techniques. The results are reported in table 4.5. Additionally, instead of using the log of nominal foreign issuances in Germany, we state foreign issuances in real terms and in terms of capital called, respectively. Thereby, we can check if forces related to the overall price level in Germany or to the discount on foreign securities are driving our results. As bonds and equity are fundamentally different types of foreign investment, e.g., with respect to the seniority of lenders and, thus, their riskiness, we run separate regressions for the two types. The estimation results are reported in table 4.6. Furthermore, we alternatively use the Hodrick-Prescott (HP) filtered deviations from GDP trend to measure economic activity in Germany and proxy world economic activity accordingly by the HP filtered deviations from GDP trend in the UK. Graph 4.13b illustrates the fluctuations of these variables over the sample period. The detrended data series are smoother than the growth rates; the estimation results, however, are not affected. Another proxy for world economic activity is the growth rate of world exports. The regression results are reported in column (3) in table 4.4.

In all cases, our results are not affected substantially. Only the estimation for foreign equity performs badly and the variables are neither individually nor jointly significant. This suggests that for the investment in equity other forces than the here mentioned ones are in place. The literature on trade in financial assets finds that distance as a proxy for informational frictions can explain cross-border flows in equity. The inclusion of variables related to distance in the estimations is planned for future research. Furthermore, we are working on including an index describing the taxation of issuances as control variable. As discussed previously, taxes on foreign issuances seem to have been important determinants for the amount of foreign securities floated in Germany and have displaced part of foreign investment to other financial centers.

4.5 Conclusion

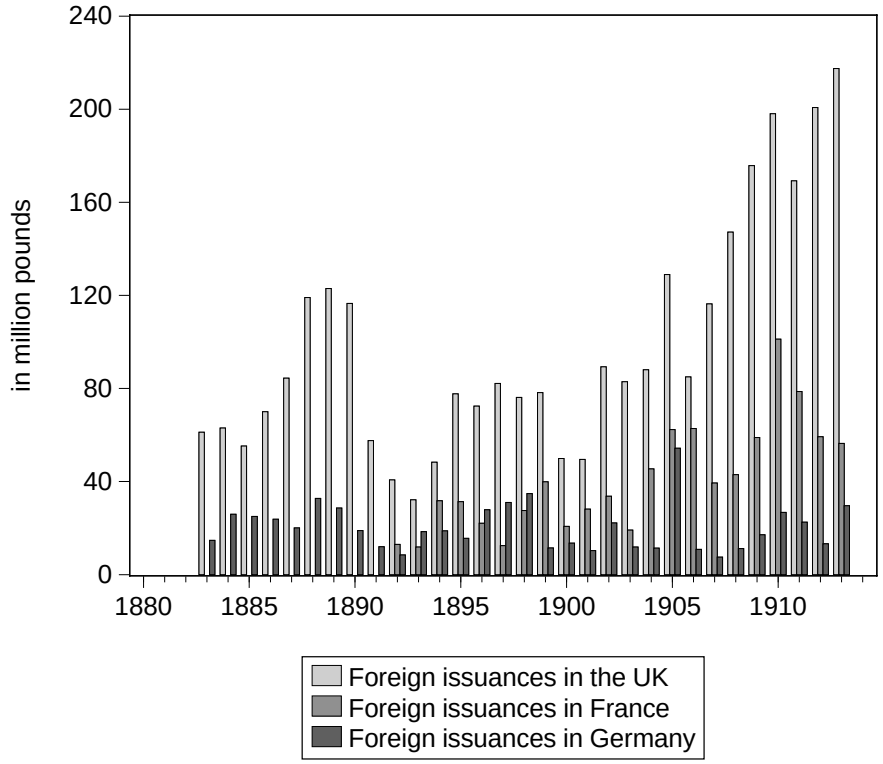
After the political unification in 1871 Germany was an important financial center and the third largest capital exporter at the turn of the 20th century. German foreign lending was predominantly directed towards European countries, however, also other regions received substantial funds. While private banks dominated the intermediation of foreign credit in the first half of the 19th century, they were successively displaced by the joint-stock banks. The broad picture emerging from the present analysis of German foreign investment in the late 19th century is the following. German lending was mainly bond financing and directed towards its neighboring countries. Furthermore, more advanced economies (either perceived or actual) and less distant countries were more likely to additionally float equity in Germany. Thus, informational frictions and the pecking order relevant for trade in financial assets in the late 20th century, seem to have been important already in the 19th century.

Furthermore, we stress the role of Germany as one financial center besides Great Britain and France. Borrowers could choose in which financial center to float their securities and often they issued securities simultaneously in the main financial centers. In the econometric analysis we find that German foreign investment did not only react to conditions in German capital markets but also to interest rate differentials relative to France. When interest rates in Germany increased relative to France, less foreign securities were issued in Germany. Aggregate risk was also an important determinant of foreign investment. However, the present analysis abstracts from investors' choice between financial markets to invest their funds. This may be the subject for future research.

To further spur our understanding of financial globalization at the turn of the 20th century, we are working on extending the present analysis. This includes the extension of the disaggregated data series on foreign securities to span a longer time period and to include a broader set of financial assets. This data will then allow us a more in-depth analysis of the drivers of German foreign investment and the relative importance of Germany as a financial center.

4.A Appendix: Figures and tables

Figure 4.1: Foreign issuances floated in the main financial centers.



Note: Issuance data for France is only available starting in 1892.
Sources: Stone (1999), Saul (2005), and Deutsche Oekonomist.

Table 4.1: Regional specialization in lending by the German stock exchanges, 1882-1892.

	Berlin		**Frankfurt**		**Hamburg**	
	million pounds	share	million pounds	share	million pounds	share
Africa	**7.64**	**95.6%**	**0.35**	**4.4%**	**0.00**	**0.0%**
Asia & Pacific	**0.25**	**100.0%**	**0.00**	**0.0%**	**0.00**	**0.0%**
The Americas	**34.62**	**90.82%**	**2.55**	**6.7%**	**0.98**	**2.6%**
North America	16.71	93.4%	1.12	6.3%	0.06	0.3%
Latin America	17.91	88.4%	1.43	7.0%	0.92	4.6%
Europe	**171.45**	**79.2%**	**28.93**	**13.4%**	**16.15**	**7.5%**
Austria-Hungary	26.20	80.9%	5.58	17.2%	0.60	1.9%
North & Central Europe	10.21	39.5%	3.25	12.6%	12.40	47.9%
Russia	47.35	96.2%	1.41	2.9%	0.44	0.9%
South Europe	53.23	77.7%	12.55	18.3%	2.70	3.9%
South-East Europe	34.47	84.9%	6.13	15.1%	0.00	0.0%
Total	**213.96**	**81.4%**	**31.82**	**12.1%**	**17.13**	**6.5%**

Source: Börsen-Enquete-Kommission (1893) and authors' calculations.

These amounts were taxed at the respective stock exchanges and most likely were also issued there. The shares are relative to the overall amount of securities of a specific region taxed in Germany, i.e. either in Berlin, Frankfurt, or Hamburg. The regions are defined as follows. Africa: Egypt and South Africa; Asia & Pacific: China; North America: Canada and USA; Latin America: Argentina, Brazil, Chile, Dominican Republic, and Mexico; North & Central Europe: Denmark, Finland, Luxemburg, Netherlands, Norway, Sweden, Switzerland, United Kingdom; South Europe: Italy, Portugal, and Spain; South-East Europe: Greece, Rumania, Serbia, and Turkey. The choice of the regional groupings is based on purely geographical considerations.

Figure 4.2: Aggregate issuances floated in Germany.

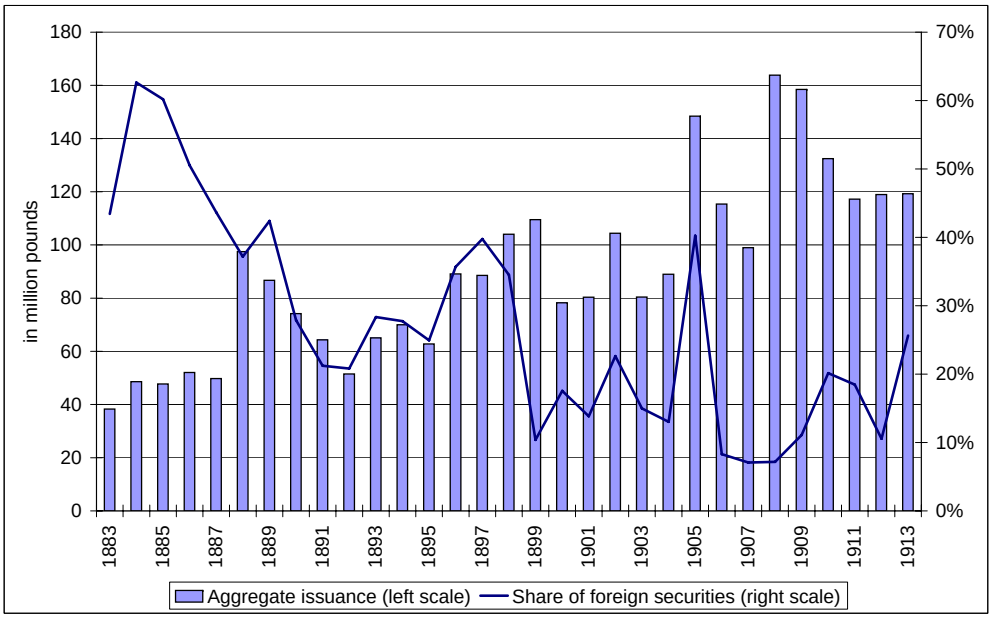


Figure 4.3: Domestic and foreign issuances floated in Germany.

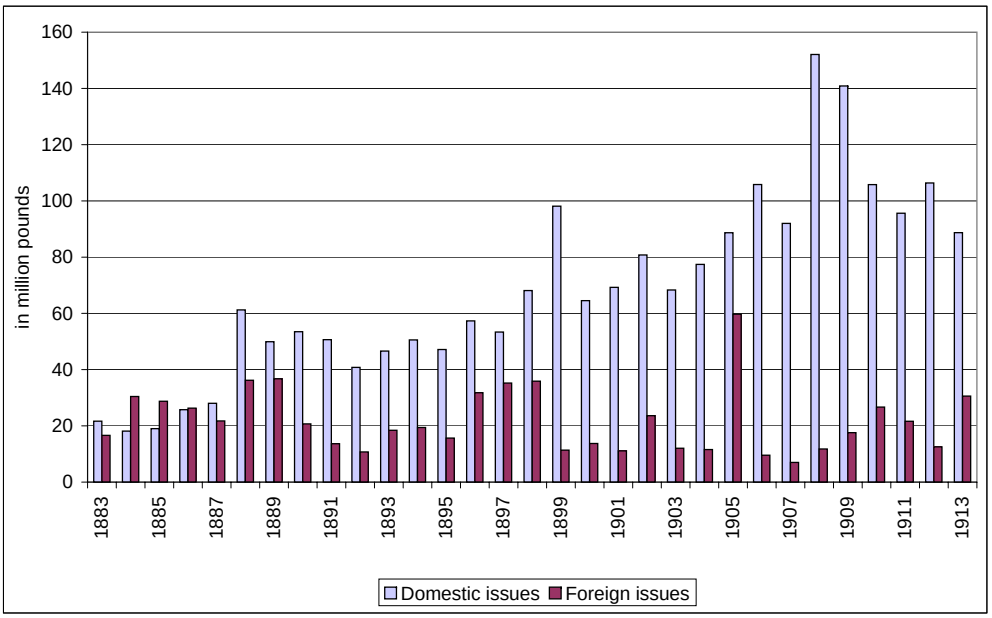


Figure 4.4: Foreign issues floated in Germany by sector.

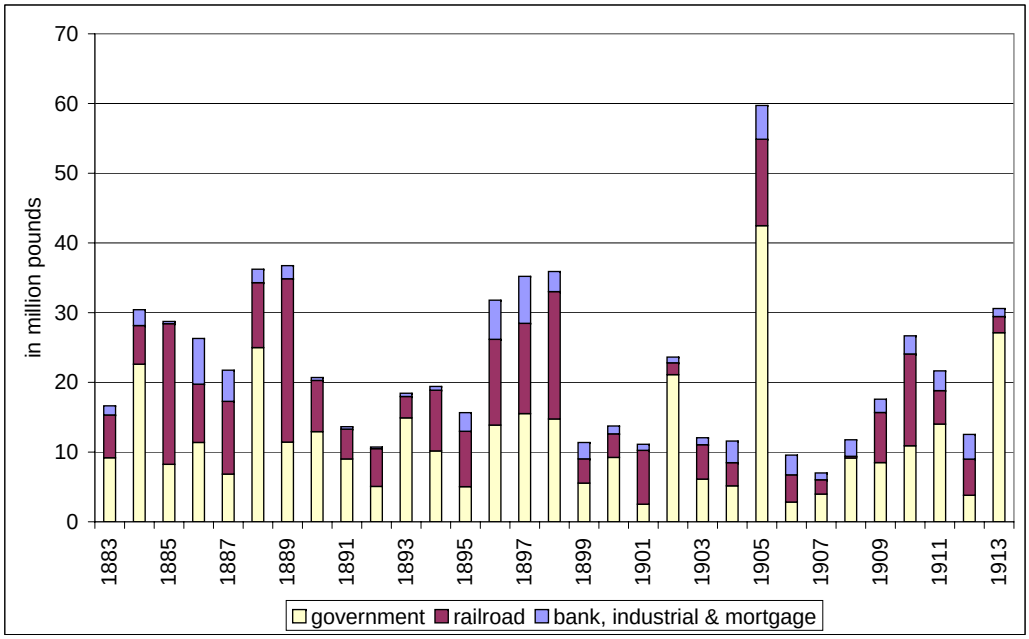
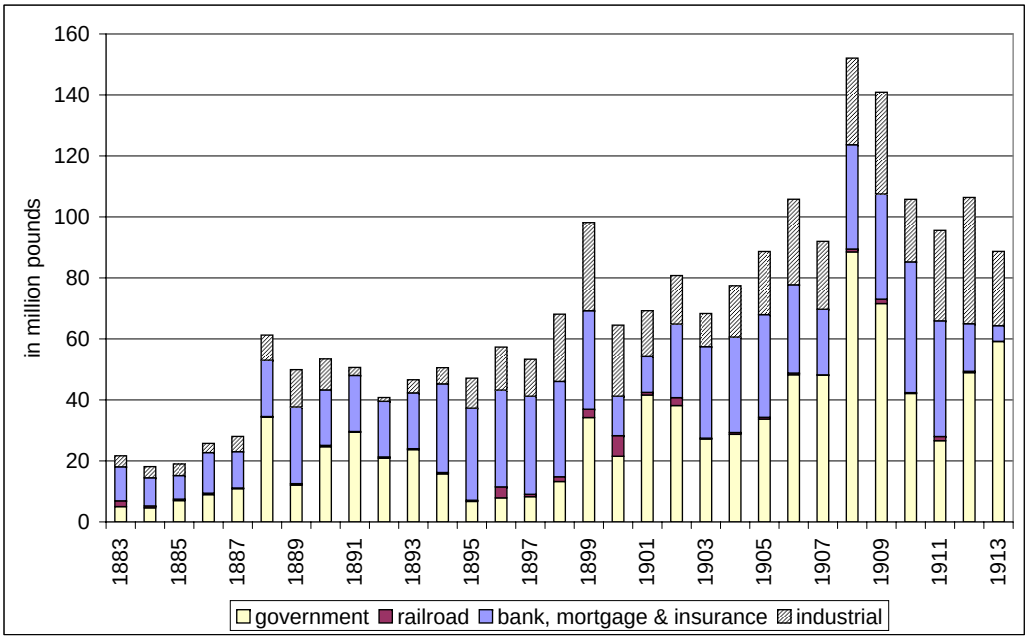


Figure 4.5: Domestic issues floated in Germany by sector.



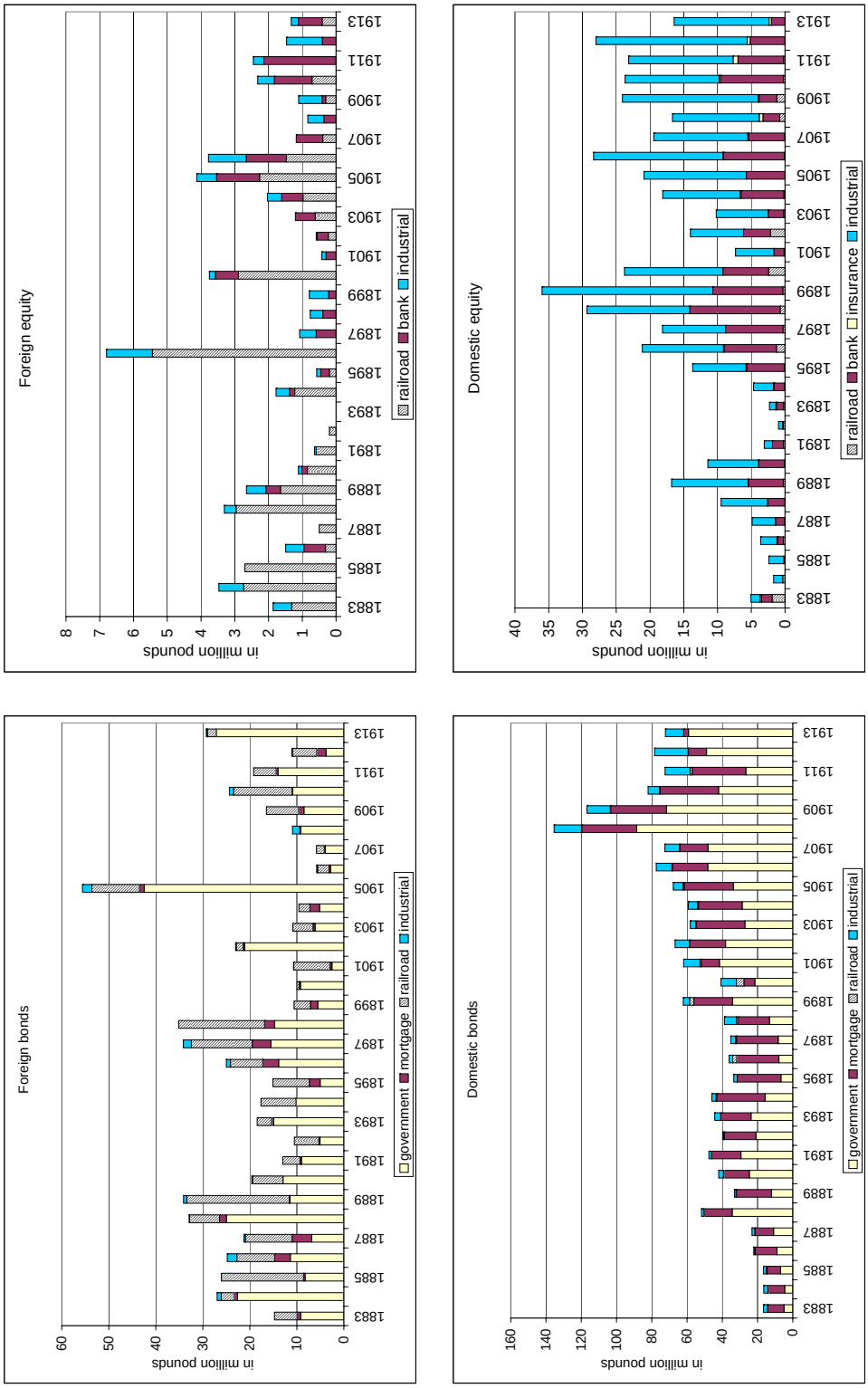


Figure 4.6: Foreign and domestic issuances: bonds and equity by sectors.

Table 4.2: Pattern of foreign investment, 1883-1897.

Region	govern-ment	railroad	bank, industry & mortgage	bond	equity	as share of total issuances
Africa	**25.5%**	**72.4%**	**2.1%**	**86.5%**	**13.5%**	**2.2%**
Asia & Pacific	**100.0%**	**0.0%**	**0.0%**	**100.0%**	**0.0%**	**2.6%**
The Americas	**40.8%**	**57.0%**	**2.3%**	**90.6%**	**9.4%**	**15.5%**
North America	1.4%	95.9%	2.8%	83.0%	17.0%	8.5%
Latin America	89.1%	9.1%	1.7%	100.0%	0.0%	7.0%
Europe	**49.6%**	**37.4%**	**13.0%**	**91.6%**	**8.4%**	**79.7%**
Austria-Hungary	49.7%	30.3%	20.0%	91.2%	8.8%	21.3%
North & Central Europe	46.7%	17.1%	36.2%	84.8%	15.2%	9.5%
Russia	49.4%	46.8%	3.8%	94.4%	5.6%	21.8%
South Europe	33.1%	57.2%	9.6%	87.4%	12.6%	15.6%
South-East Europe	74.7%	22.9%	2.4%	98.5%	1.5%	11.5%

Source: Deutsche Oekonomist and authors' calculations.

The regions are defined as follows. Africa: Algeria, Congo, Egypt, and South Africa; Asia & Pacific: China; North America: Canada and USA; Latin America: Argentina, Brazil, Chile, Cuba, Dominican Republic, and Mexico; South Europe: Italy and Portugal; South-East Europe: Bosnia & Herzegovina, Bulgaria, Greece, Rumania, Serbia, Turkey; North & Central Europe: Belgium, Denmark, Finland, Luxemburg, Netherlands, Norway, Sweden, Switzerland, and United Kingdom. The choice of the regional groupings is based on purely geographical considerations.

Figure 4.7: Foreign securities by regions.

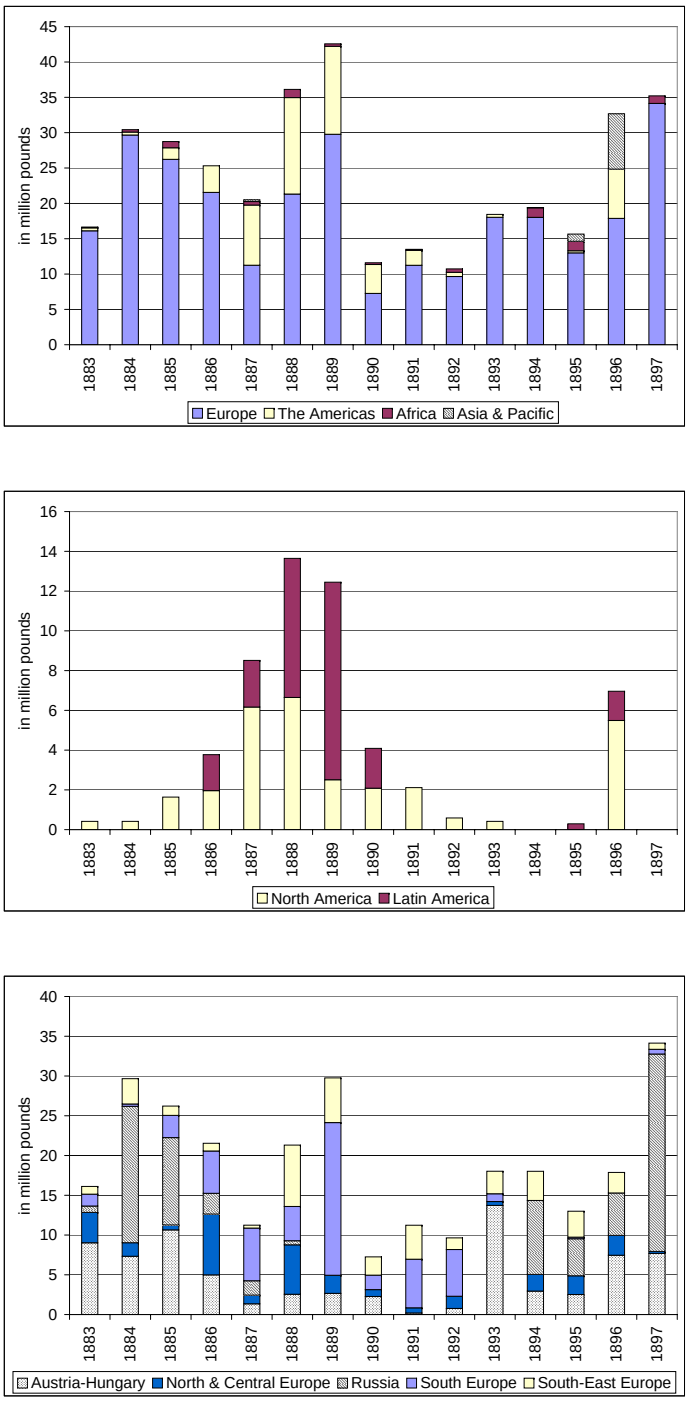


Figure 4.8: International lending: country composition, 1883-1897.

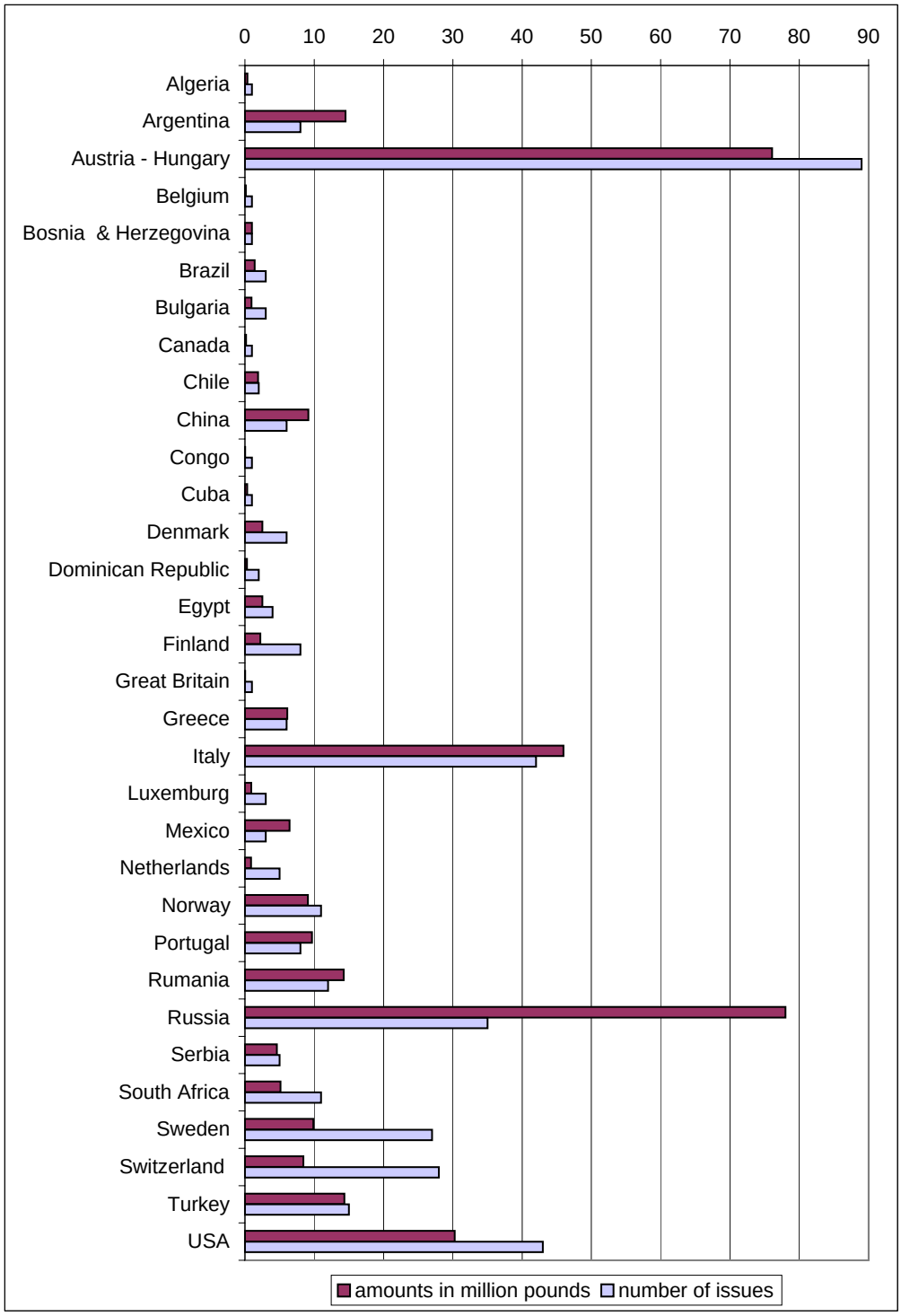
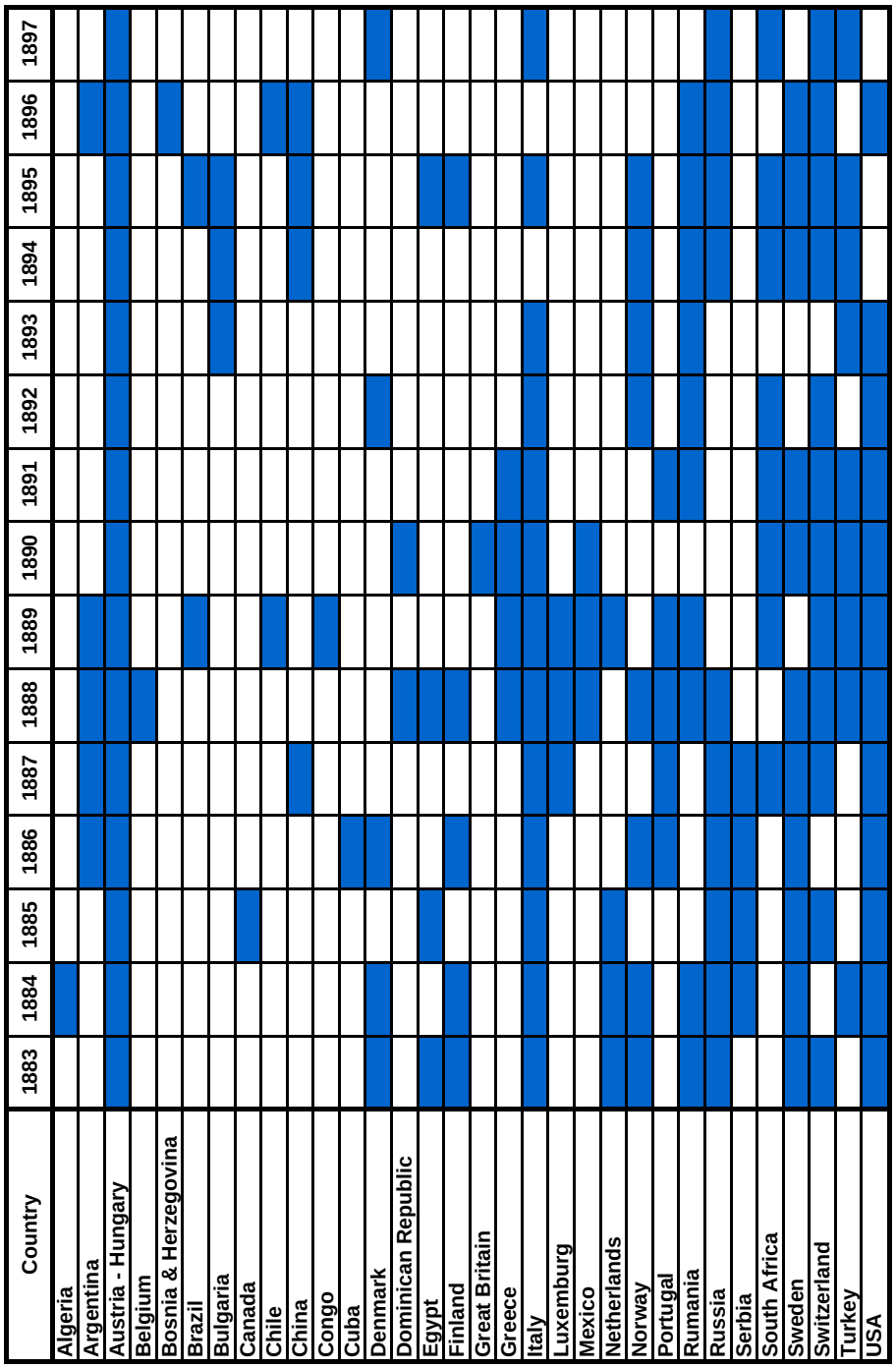
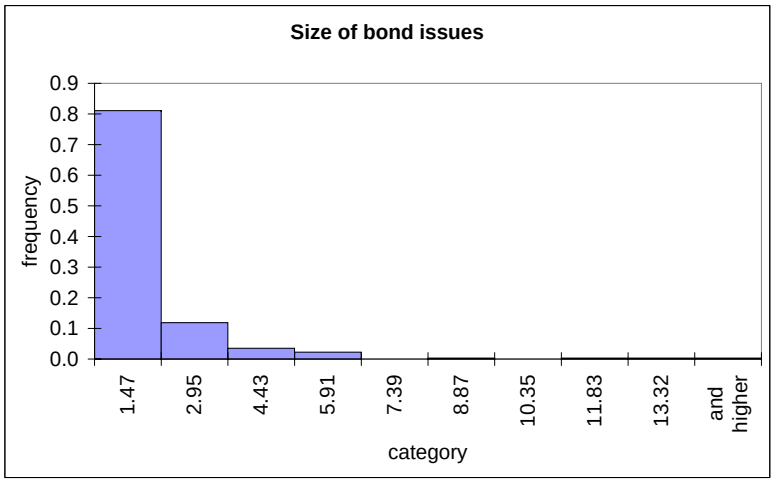


Figure 4.9: Evolution of lending, 1883-1897.



Note: If the cell is filled out, the country successfully floated issues in Germany that year; if instead it is blank, the country did not float issues in Germany that year.

Figure 4.10: Size of issues (in million British pounds).



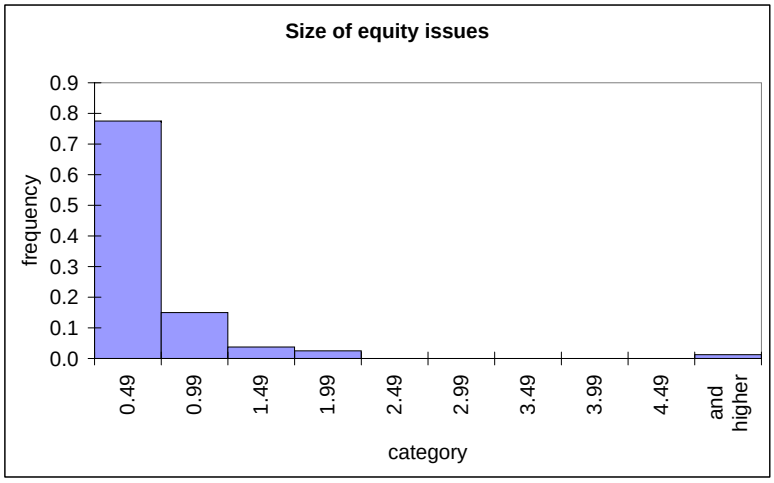


Table 4.3: Data sources.

Variable	**Source**
Foreign issuances in Germany	Deutsche Oekonomist, various issues
GDP	Spliced series, Jones and Obstfeld (2001)
World exports	Global Financial Data and authors' calculations
Long-term nominal interest rates	Yield on government gold bonds, Flandreau and Zumer (2004)
Private discount rates	Deutsche Bundesbank (1976)
Inflation rates	General prices, Flandreau and Zumer (2004), and authors' calculations
Foreign issuances in the UK	Stone (1999)
Default risk	Standard & Poor's (1999), and authors' calculations

Figure 4.11: Principal components of the risk indicators.

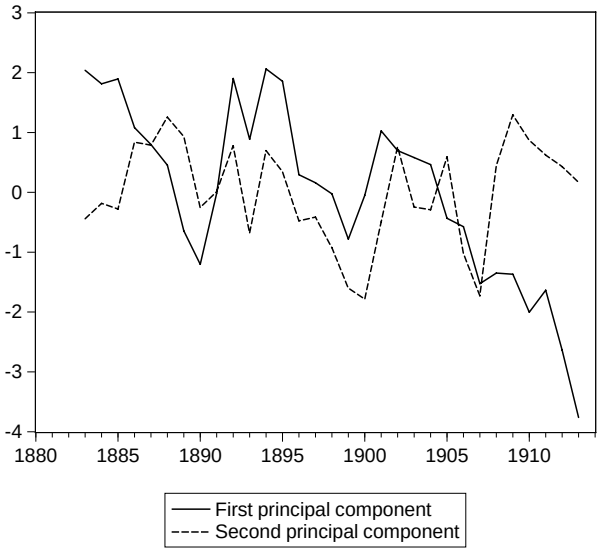


Figure 4.12: Interest rate differentials and private discount rate.

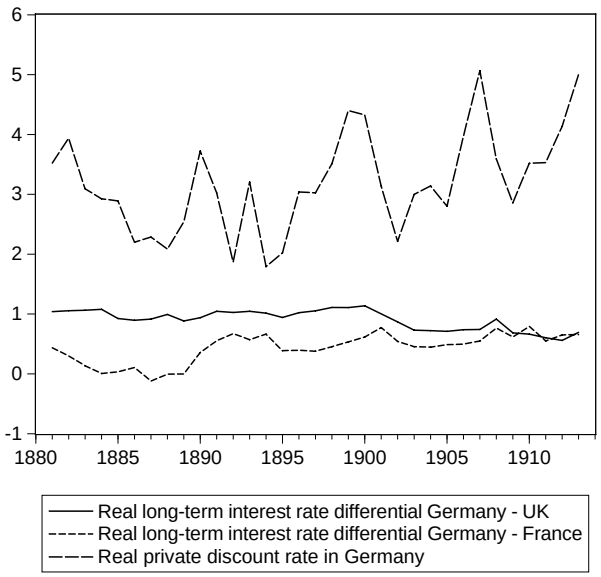
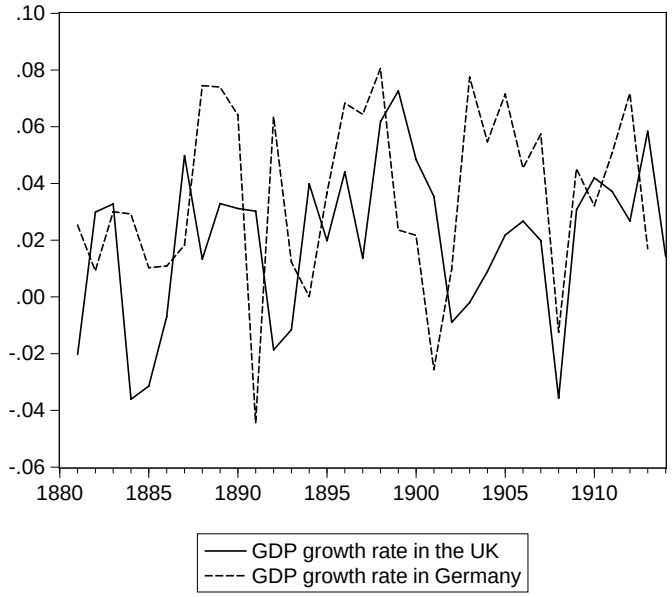


Figure 4.13: Economic activity in Germany and the UK.

(a) GDP growth rates



(b) HP filtered deviations of GDP from trend

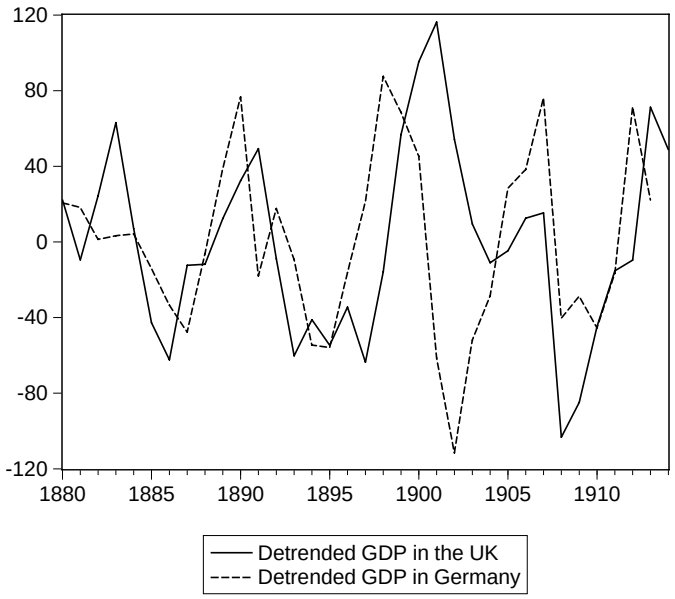


Table 4.4: OLS regressions.

Dependent variable: log of foreign issuances in Germany	**(1)**	**(2)**	**(3)**
Constant	3.5728***	3.7778***	3.7135***
	(0.6508)	(0.6106)	(0.5997)
Growth rate GDP in the UK	0.4053		
	(2.9896)		
Growth rate GDP in Germany	2.1372		3.3366
	(2.8659)		(3.3896)
Growth rate of world exports			-1.7847
			(2.1284)
Real long term interest rate differential between Germany and the UK	1.0480	0.9716	0.9224
	(0.6375)	(0.6173)	(0.6105)
Real long term interest rate differential between Germany and France	-0.8092**	-0.9008***	-0.8199**
	(0.3797)	(0.2876)	(0.3888)
Real private discount rate in Germany	-0.4065***	-0.4097***	-0.4055**
	(0.1361)	(0.1240)	(0.1491)
First principal component of risk indicators	-0.2845***	-0.2991***	-0.3031***
	(0.0879)	(0.0829)	(0.1055)
R-squared	0.447	0.431	0.456
Adjusted R-squared	0.309	0.343	0.315
Observations	31	31	31
F-statistic	3.2388	4.9210	3.2197
(p-value)	(0.0178)	(0.0043)	(0.0191)
Durbin-Watson statistic	1.915	1.856	1.793

Note: White robust standard errors reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 4.14: Actual, fitted, and residual series, OLS (1).

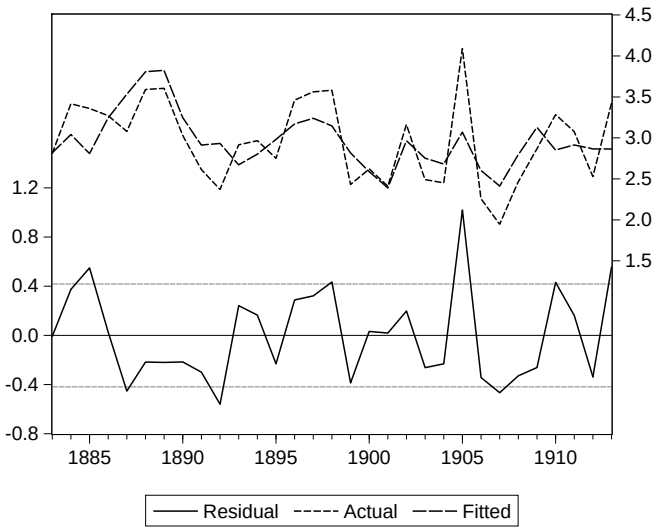


Table 4.5: Robustness check: Tobit regressions.

Dependent variable: foreign issuances in Germany	**(1)**	**(2)**	**(3)**
Constant	31.709**	40.334**	33.881***
	(13.686)	(15.650)	(12.494)
Growth rate GDP in the UK	-0.705		
	(51.431)		
Growth rate GDP in Germany	83.846		100.691
	(57.158)		(65.022)
Growth rate of world exports			-26.441
			(38.0157)
Real long term interest rate differential between Germany and the UK	20.138	16.109	17.612
	(12.900)	(13.778)	(11.881)
Real long term interest rate differential between Germany and France	-15.219**	-18.809***	-15.683**
	(7.068)	(5.361)	(7.218)
Real private discount rate in Germany	-7.696***	-7.821***	-7.489***
	(2.296)	(2.145)	(2.499)
First principal component of risk indicators	-5.618***	-5.987***	-5.671***
	(1.534)	(1.429)	(1.815)
Log likelihood	-111.7529	-112.8588	-108.5033
Observations	31	31	31
Likelihood ratio	14.5596	12.3477	14.1429
(p-value)	(0.024)	(0.015)	(0.028)

Note: Huber/White robust standard errors reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.6: Further robustness checks.

Dependent variable: log of foreign issuances in Germany	**in real terms**	**capital called**	**only bonds**	**only equity**
Constant	3.777***	3.552***	3.566***	0.636
	(0.659)	(0.648)	(0.669)	(1.526)
Growth rate GDP in the UK	0.699	1.165	-0.037	1.002
	(2.992)	(2.945)	(3.105)	(6.537)
Growth rate GDP in Germany	2.282	1.976	1.689	4.294
	(3.045)	(2.983)	(2.982)	(5.597)
Real long term interest rate differential between Germany and the UK	1.221*	0.733	1.292*	-1.075
	(0.655)	(0.631)	(0.711)	(1.191)
Real long term interest rate differential between Germany and France	-0.891**	-0.724*	-0.800**	-1.143
	(0.397)	(0.399)	(0.376)	(0.930)
Real private discount rate in Germany	-0.453***	-0.344**	-0.499***	0.311
	(0.140)	(0.135)	(0.144)	(0.257)
First principal component of risk indicators	-0.262***	-0.250***	-0.338***	0.073
	(0.091)	(0.083)	(0.102)	(0.127)
Adjusted R-squared	0.375	0.239	0.334	0.033
Observations	31	31	31	31
F-statistic	4.0003	2.5686	3.5121	1.1657
(p-value)	(0.0065)	(0.0458)	(0.0123)	(0.3582)
Durbin-Watson statistic	1.870	1.915	1.945	2.243

Note: Huber/White robust standard errors reported in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

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