Courant Research Centre

'Poverty, Equity and Growth in Developing and Transition Countries: Statistical Methods and Empirical Analysis'

Georg-August-Universität Göttingen
(founded in 1737)

Discussion Papers

No. 124

The Role of Risk and Information for International Capital Flows: New Evidence from the SDDS

Yuko Hashimoto, Konstantin M. Wacker

September 2012

Wilhelm-Weber-Str. 2 · 37073 Goettingen · Germany
Phone: +49-(0)551-3914066 · Fax: +49-(0)551-3914059

Email: crc-peg@uni-goettingen.de Web: http://www.uni-goettingen.de/crc-peg

The Role of Risk and Information for International Capital Flows: New Evidence from the SDDS

Yuko Hashimoto[a], Konstantin M. Wacker[b]

[a] *International Monetary Fund; yhashimoto@imf.org*
[b] *University of Göttingen; kwacker@gwdg.de*

Abstract

In this paper, we investigate whether better information about the macroeconomic environment of an economy has a positive impact on its capital inflows, namely portfolio and foreign direct investment (FDI). The purpose of our study is to explicitly quantify information asymmetries by compliance with the IMF's Special Data Dissemination Standard (SDDS). For FDI, we find statistically significant and robust support for this hypothesis: SDDS subscription increased inflows by an economically relevant magnitude of about 60 percent. We also find evidence of aversion against political and macroeconomic risk as determinants of portfolio and FDI flows and use a non-parametric test for spatial correlation in the residuals of capital flows.

Keywords: determinants of capital flows, information, panel data, risk, SDDS, IMF, FDI, portfolio investment, spatial econometrics

JEL classification: C33, F21, G14

Highlights:

- We use compliance with an international data standard (SDDS) for identification of informational frictions in international capital flows.
- We find that macroeconomic data provisioning has a substantial impact on a country's FDI inflows.
- No aggregate effect is found for portfolio inflows.
- Using a novel approach, we find no spatial correlations in international capital flows.

Disclaimer: The views expressed in this Discussion Paper are those of the authors and do not necessarily represent those of the IMF, of any other affiliation of the authors, or IMF policy.

1. Introduction

Economic theory attributes positive welfare effects to capital flowing from capital-abundant countries to those which have potentially productive assets but where the capital necessary to employ them is scarce. This implicitly assumes that (foreign) investors are aware of these assets, i.e. they have the information necessary to make an optimal decision. Some investors, especially foreign direct investors, however, are not specialized in acquiring information and those who are, especially larger portfolio funds and credit rating agencies, have to deal with non-excludable information they acquired, due to herd behavior in financial markets (cf. inter alia Banerjee, 1992; Bikhchandani et al., 1992, and Avery and Zemsky, 1998). On the demand side, countries with productive assets but lack of capital may find it difficult to signal their productivity while less productive countries may whitewash their signaled information, and the international asset market may turn out to be a market for lemons (cf. Akerlof, 1970).[1] The price mechanism may also fail in this context because countries with the highest interest rate and hence the most productive investment opportunities may be perceived as especially unstable so that risk averse investors may rather prefer to invest into safe havens (cf. Stiglitz and Weiss, 1981).

Previous research has already investigated the role of information for capital flows, both empirically and theoretically. However, most of the early empirical studies could not convincingly identify a parameter for the quantitative impact of information on capital flows. Similar to the 'Solow residual' (cf. Vaizey, 1964, p. 5), they attributed patterns in capital flows that models could not explain to informational frictions. Are these unexplained patterns really a measure of the impact of information asymmetries or are they simply a 'measure of our ignorance' about the determinants of international capital flows? Probably the most convincing identification strategies have been provided by studies such as Gelos and Wei (2005), Daude and Fratzscher (2008), and Harding and Javorcik (2011). All these studies have a somewhat different focus and methodology from each other and from our investigation, which is probably the most related to the study of Daude and Fratzscher (2008).

More precisely, we look at the impact that compliance with the IMF's Special Data Dissemination Standard (SDDS) had on international capital flows, specifically portfolio and foreign direct investments (FDI). The SDDS, established in 1996 with the aim of enhancing member countries' access to the international capital market, is about macroeconomic data provision to the public. Institutional investors' decision on investments are based on macroeconomic and financial data, but not all the investors have time and money to collect information they need. Accordingly, we find statistically significant and robust evidence of an economically relevant impact of providing more (accurate) information about the macroeconomic and financial environment under the umbrella of the SDDS on FDI inflows, but fail to find the same evidence for portfolio flows. Furthermore, we find evidence for macroeconomic risk-aversion for portfolio and for FDI flows and more robust evidence of political-risk

[1] Bond and Samuelson (1986) and Gordon and Bovenberg (1996) provide models where productive countries can use tax-holidays to identify themselves to foreign investors.

aversion for portfolio flows.

Our contribution further adds to the literature by looking at systematic differences between FDI and portfolio flows and by proposing new measures for productivity that may be especially relevant for the FDI literature. Finally, we also consider spatial interdependencies in our investigation. Contrary to previous studies on spatial interdependences in FDI flows, such as Coughlin and Segev (2000), Blonigen et al. (2007), or Baltagi et al. (2007), our approach relies on less stringent assumptions about the potentially underlying spatial process. In line with the results implied by Baltagi et al. (2008), we do not find evidence for significant spatial patterns in our empirical models.

We review the previous literature on information and international investment in section 2. The empirical model and variables used in this paper are introduced together with the data in section 3. A variable list with summary statistics of the data can be found in Appendix B. We present our results in section 4, showing that better data dissemination through SDDS increases FDI inflows by about 60 percent, but has no significant aggregate effect on portfolio flows. In section 5, we show robustness checks that provide strong supplementary support for the impact of information on FDI. In section 6, we discuss the implications of our findings for macroeconomic stability and growth as well as potential lines of future research.

2. Information and Investment: A Literature Review

Previous (macro-)economic studies have already highlighted the role of information in international capital markets, but have mostly failed to provide a convincing empirical identification methodology for the impact of information. French and Poterba (1991), for example, note that even when being risk-averse, few investors diversify their portfolio internationally despite potential nontrivial risk-reduction by cross-border holdings. Their results suggest that investors expect domestic returns to be systematically higher than those of a diversified portfolio by imputing an "extra risk to foreign investments because they know less about foreign markets, institutions, and firms" (p. 225). Tesar and Werner (1995) found that foreign equity portfolios were turned over much faster than domestic equity portfolios. They argue that transactions costs associated with trading foreign securities hence cannot be the reason for the observed reluctance of investors to diversify their portfolios internationally.[2] They conclude that informational constraints may play a role, but also argue that the observed lack of international diversification may have less to do with 'international' investment choices or transaction costs, but simply reflect the tendency of individuals to hold

[2]Because variable transaction costs would not explain the high turnover and because it seems generally improbable that the cumulated return on a well-diversified portfolio does not exceed the fixed barriers to entry in most markets.

ill-diversified portfolios.[3] Mody and Taylor (2003) find high probabilities of capital crunches for certain episodes in emerging economies and argue that this is not only influenced by default risk but also by asymmetric information; however, the paper fails to convincingly identify this channel. Brennan and Cao (1997) have argued that positive correlations of international equity flows with the returns on the markets of the destination countries can be due to information asymmetry between foreign and domestic investors and provide micro-level evidence for this hypothesis in follow-up work (Brennan et al., 2005). Ahearne et al. (2004) find that countries with higher stock market listing in the US play a larger role in the US portfolios whereas Pagano et al. (2002) find that foreign-listed European companies perform better in the US, but without significant leveraging effects. The role of information is also emphasized by the empirical evidence of Hau (2001a,b), using German stock markets data and showing that foreign traders perform worse on German stock markets because of the information disadvantage compared to the trading environment in headquarters in Germany. Finally, Byard et al. (2011) provide some evidence that the adoption and strong enforcement of the European Union's International Financial Reporting Standards (IFRS) reduced financial analysts' absolute forecast errors when domestic accounting standards differ significantly from the IFRS.

On the macro level, Portes et al. (2001) find that distance matters in gravity models using two different data sets of gross bilateral equity transactions. Contrary to what one would expect from portfolio diversification, the impact is negative.[4] They attribute this finding to the hypothesis that "distance is seen as a proxy for informational frictions" (p. 784). While distance has often been used for this purpose thereafter, it is questionable to what extent this proxy is appropriate. Savastano (2000, p. 157), for example, already noted "that distance (and hence gravity-type equations) is probably not among the factors that will help us understand the geography of capital flows".

Daude and Fratzscher (2008) use a pseudo-fixed effects model of the Anderson and van Wincoop (2003) class for bilateral capital stocks to address the "pecking order" of different types of capital with emphasis on information and the quality of host country institutions. As information friction measurements, they use distance, the volume of bilateral telephone calls, bilateral newspapers' and periodicals' trade, and the stock of immigrants from the source country in the host country.[5] They find that all investigated forms of capital respond significantly to information, but that the elasticity is higher for FDI than for other forms of capital which is evidence against the models of Razin et al. (1998) and Goldstein and

[3] Warnock (2002) argues that an underestimation of foreign-equity holdings drove some results of Tesar and Werner (1995), but also concludes that variable investment costs cannot explain the home-bias puzzle.

[4] Economies being geographically close tend to have higher correlations, portfolio diversification would thus suggest investing in distant economies.

[5] It should be noted that Portes et al. (2001) also look at the impact of of bilateral telephone call traffic to account 'explicitly' for information so that their contribution takes more effort to identify the impact of information than other studies of that time. However, we find the empirical strategy of Daude and Fratzscher (2008) more convincing so that we focus on their results.

Razin (2006) that suggests that portfolio should be more elastic to informational frictions.[6] However, the information proxies of Daude and Fratzscher (2008) cover a whole range of potential transaction costs that may include but are not limited to information. This may cause an omitted variable bias. For example, newspaper circulation and telephone traffic will be correlated with immigrant stocks and if immigrants have a 'home bias' in consumption, using these measures is likely to provide biased and inconsistent estimates in the presence of horizontal FDI. The same applies to the study of Milesi-Ferretti and Lane (2004) who use a similar model and try to capture information by a number of cultural and physical proximity variables.

In their study on the effect of information frictions on portfolio holdings of emerging market funds (relative to the host country's share in the world market portfolio, proxied by Morgan Stanley's Emerging Markets Free Index), Gelos and Wei (2005) construct a measure for macroeconomic data opacity that is based on Agça and Allum (2001) and comes closest to our SDDS variable. Their ovall results indicate that portfolio funds prefer to hold more assets in more transparent emerging markets. Furthermore, the authors (p. 3003ff) conduct a quasi-event study, where a dummy variable takes on the value 1 once a country either voluntarily publishes its IMF Article IV reports, publishes the IMF's "Reports on Standards and Codes", or adopts SDDS, and find a statistically significant, albeit moderate increase of the respective country's portfolio weighting.

Considering FDI, Wheeler and Mody (1992) find support for agglomeration economies as a driving factor for US manufacturing multinational corporations (MNCs). Head et al. (1995, p. 226) attribute the agglomeration behavior of 751 Japanese multinationals in the USA to lowering the cost of acquiring information about the local market. Blonigen et al. (2005) find empirical results that information exchange in "Presidential Council" meetings of Japanese MNCs may lower information costs and thus implies positive impacts on FDI and find empirical support for agglomeration. In a similar vein, Kinoshita and Mody (2001) find Japanese investment in Asian emerging markets to be positively correlated with its own previous investment and the current investment by competitors and argue that this cannot be explained by industrial agglomeration, but by the value of private information. Bobonis and Shatz (2007) find FDI agglomeration within the US and conclude that it would be desirable in future research to disentangle different economic motives for this behavior such as technological spillovers, information sharing or other externalities. The FDI-agglomeration literature hence shows that the role of information is also important for the assessment of foreign market potential in the multinationals' FDI decision,[7] although Davies and Kristjánsdóttir (2010), for example, do not find similar agglomerative type ef-

[6] Mody et al. (2003) also develop a model where FDI has an advantage over other forms of foreign investment in case of information asymmetries.

[7] Furthermore, more accurate information may even increase GDP and thus market potential in an economy because it allows efficient flexible inflation targeting by the central bank, whereas the readily observed interest rate may only bear loose connection to the true interest rate in an economy with information gaps (cf. Berg et al., 2010, on the issue).

fects for FDI flows to power-intensive industries in Iceland for the period 1989 - 2001.[8,9] Other potential evidence for the importance of information for FDI can be derived from the results of Davies et al. (2009). Their finding that tax treaties only increase the extensive margin of FDI may in part be driven by the fact that information asymmetries decrease with tax treaties so that entry into the potential host market becomes easier. In fact, they conclude that their "results suggest that the impact of treaties might be greatest due to their impact on issues of uncertainty, not by adjusting the effective tax rates firms face" (p. 108). Finally, in a recent contribution Harding and Javorcik (2011) find that investment promotion agencies (IPAs) have a positive impact on FDI flows[10] from the US to developing (but not to industrialized) countries. While they do not generally take a stand on whether IPAs play an informative or persuasive role (cf. footnote 29 on p. 1469), they also provide some evidence that IPAs may alleviate information asymmetries. However, they use the common measures for information such as language, cultural and power distance and newspaper circulation which are likely to also capture other impacts, as discussed above.[11]

In summary, previous macro-studies on capital flow determinants have highlighted the potential role of information. But we find our contribution going way beyond these preliminary efforts since (with the exception of Gelos and Wei, 2005, in their specific application to emerging markets in the late 1990s) they have mainly drawn this conclusion indirectly by the residuals of capital flows that cannot be explained through other conventional determinants of capital flows or by identification strategies that seem worrisome at least.

Our contribution is also related to the literature investigating other aspects of SDDS subscription. For example, Cady (2005) finds statistically significant evidence that SDDS subscription decreased borrowing costs for emerging market economies on primary markets by a considerable amount,[12] thereby confirming previous studies mentioned in his paper that

[8]However, they find that fixed market entry costs play an important role and can lead to a bias in simple OLS estimation (instead of a Heckit procedure) when bilateral flows are used, especially for the parameter estimate of distance, which makes a strong statement for investigating the effect that information may play in this context.

[9]Note that there is also a potential channel how information could negatively affect FDI: Models of vertical FDI motivate such investments, inter alia, by the problem of contract enforcement in vertical market relationships. IMF (1991, p. 24) thus argues that asymmetrical information provides a clue why FDI has been such an important component of capital flows. Hence, more accurate information might also lower incentives for FDI. This is also the rationale of the models of Goldstein and Razin (2006) and Mody et al. (2003). However, we find this argument - while potentially adequate in some special circumstances - not very important on the macro level, especially considering the fact that most FDI is driven horizontally.

[10]More precisely, they use the first difference of BEA stock data.

[11]In an older study using data from the early 1980s, Coughlin et al. (1991) also find that US state government spending to attract FDI had a positive, statistically significant effect on FDI attraction.

[12]The parameter estimate is around 0.2, translating into a decrease in borrowing costs of about 22 percent. See also Cady and Pellechio (2006) for an extension including the General Data Dissemination Standard. Glennerster and Shin (2008) find a somewhat smaller decline in borrowing cost spreads using a different sample and methodology.

found similar effects on secondary markets.[13] Cady and Gonzalez-Garcia (2007) find that the adoption of the reserves data dissemination standard under the umbrella of SDDS was associated with a decrease in exchange rate volatility of about 20 percent, but finds that SDDS itself has had no particular effect on nominal exchange rate volatility.

3. Investment: Model and Data

In our empirical strategy, we focus on the investors' motives (i.e. the supply side) toward host country effects. This is not to say that home country effects do not matter,[14] but our aim is to focus on a given country's policy options to attract investment.[15] This means that source country fundamentals have to be taken as externally given[16] and we can focus on overall inflows instead of bilateral flows. In line with the study of Harding and Javorcik (2011), we use flow data instead of stock data. This has the advantage of being plagued less intensively with autocorrelation and potential spurious regression problems (cf. Wacker, 2012). Furthermore, the use of flow data allows us to rule out reversed causality as discussed in subsection 5.1 below and we expect to see more responsive changes in the flow data than in the stock data.[17]

3.1. Portfolio and foreign direct investment

In our study, we use both FDI and portfolio investment flows. In the balance of payments, which is the source for international capital flow data, the distinction between FDI and portfolio investment is a rather pragmatic one: a host-country enterprise in which a foreign investor owns 10 percent or more of the voting power is classified (or: should be classified) as a *direct* investment enterprise. FDI thus usually implies a long-term relationship between investor and the direct investment enterprise in the host country.[18] The residual category of cross-border transactions involving debt or equity securities is then classified

[13]See Diamond and Verrecchia (1991) for a model how providing information can reduce the cost of capital from the firm-perspective.

[14]In fact, studies such as Calvo et al. (1993), Fernandez-Arias (1996), di Giovanni (2005) or Dabla-Norris et al. (2010) show that external push factors are highly relevant, although the literature also suggests that the importance of push vs. pull factors depends on the time period and countries analyzed. See, e.g., Chuhan et al. (1998); Hernández et al. (2001); Albuquerque et al. (2005); Dabla-Norris et al. (2010).

[15]Hence, it is implicitly assumed that attraction of foreign capital is a policy motive. Potential gains from higher capital inflows generally include positive growth effects, higher resources for temporary fiscal stimulus in case of a domestic recession under constrained tax revenues and low saving of private households, or for inter-temporary utility maximization when future consumption is less valued than actual one.

[16]We econometrically control for these 'global' effects by using year dummies.

[17]Note that in equilibrium flows will equal the depreciation of existing stock. Flows will hence (also) depend on *levels* of economic activity in the host country. Furthermore, the adjustment from one equilibrium to another will occur via flows which is exactly our research focus in the context of a policy change in informational asymmetries. See Wacker (2012) for details.

[18]Graham and Krugman (1989: 10) showed that raising the classification criterion to 20 or even 50 percent would only have a minor impact on the measurement of US firms classified as being under foreign control.

as portfolio investment which covers (but is not limited to) securities traded on financial markets.[19]

Economically, portfolio and FDI hence refer to different concepts of investment and they could therefore respond differently to changes in the explanatory variables. In our context, for example, it might be the case that it is part of the job of portfolio investors to acquire information about potential markets and this leads to considerable economies of scale because of large externalities. MNCs, on the other hand, can barely benefit from such externalities of information and they would hence respond stronger to public provisioning of macroeconomic data.

Our data on capital flows come from the International Financial Statistics (IFS) balance of payments data. Since IFS data for most countries do not start before 1993, we use data from the IMF's World Economic Outlook (WEO) where the IFS data are not available but WEO data are.[20] In order to correct for potential errors from this procedure, we use a dummy variable that equals 1 if WEO data are used and equals 0 if IFS data are used. We use data in constant USD and take the natural logarithm thereof.

3.2. Econometric model

We estimate a log-linear[21] static model with real capital flows on the left hand side and account for potential autocorrelation in inference using a heteroscedasticity and autocorrelation consistent (HAC) variance estimator based on Huber (1967) and White (1980), commonly referred to as 'cluster-robust' standard errors. We thus model the investment of type j in country i at year t as given by

$$y_{it}^{j} = \Psi_{it}\theta^{j} + SDDS_{it}\lambda_{SDDS}^{j} + \eta_{t}^{j} + \alpha_{i}^{j} + \varepsilon_{it}^{j}, \tag{1}$$

where y_{it}^{j} is the logarithm of capital flow of type $j = 1, 2$ (either FDI or portfolio) to country $i = 1, ..., N$ in year $t = 1, ..., T$ and Ψ is a matrix of (up to) $K - N - T - 1$ control variables which are discussed in the next subsections. Our main variable of interest is a dummy variable of SDDS compliance which is equal to 1 in country i in year t if the country met the

However, this does not necessarily tell us much how the picture would look like for, say, applying a 5 percent rule instead, especially for non-US firms in more recent years. We find this to be another reason worth addressing the question whether FDI and portfolio flows differ in their determinants.

[19] Precise definitions of FDI and portfolio investment can be found in the IMF's "Balance of Payments and International Investment Position Manual", 6th edition (2009).

[20] WEO data are compiled by IMF staff based on the information gathered by the IMF country desk officers in the context of their missions to IMF member countries and through their ongoing analysis of the evolving situation in each country. Historical data are updated on a continual basis, as more information becomes available, and structural breaks in data are often adjusted to produce smooth series with the use of splicing and other techniques. See Pellechio and Cady (2006) on the general differences between IFS and other data sets.

[21] Note that logs are taken for GDP so it can be interpreted as an elasticity.

SDDS specifications by then. η_t and α_i are time and country fixed effects, respectively. The country-fixed effect α_i can be interpreted as the average inflow of capital to country i over time. The time-fixed effect η_t controls for the overall volume of global cross-boarder capital flows in year t and hence for source-country effects as well as for global factors such as the oil price or the general trend that capital flows increased over time. This two-way fixed effect specification with controlling for main variables that change over time and country, allows us to interpret the corresponding parameter estimate of SDDS subscription (after the transformation discussed in footnote 41 on page 17) as a difference-in-difference effect of compliance with the SDDS (under the assumption that the model is well-specified). Our sample generally covers $N = 55$ countries between 1989 and 2008, but is unbalanced so that our actual number of observations is lower than 55×20. In summary, our identification strategy uses the data variation within countries over time, accounting for global shocks at every point in time and requires that there are no omitted variables that influence both, capital inflows and the decision to comply with SDDS, and that causality does not run from capital inflows to SDDS compliance. We will address these potential issues in section 5 below.

3.3. Determinants of international investment flows

A basic textbook (domestic) investment equation (e.g. Blanchard, 2010) describes investment through demand Y and interest rate i:

$$I = I(\underset{+}{Y}, \underset{-}{i}) \tag{2}$$

The rationale of equation (2) is to capture the (expected) returns of investment and its (expected) cost as the determinants positively or negatively influencing the investment decision. In what follows, we discuss those aspects of international investment costs and returns that have shown to be very robust in the literature and we also present the data we use to control for them.

Like for domestic investment, current and future market potential are a main driving force for international investment. It is well documented in the literature that capital flows thus positively react to the size of the market, usually measured by GDP, market capitalization and/or its growth rate (cf., inter alia, Blonigen et al., 2003; Portes and Rey, 2005), to the investment rate and savings rate in the economy (cf. Hernández et al., 2001), and to the overall competitiveness of the economy (Stehrer and Woerz, 2009).

In our regressions, we use *GDP* data from WEO and take the natural logarithm of its real value in USD to account for current market size. We proxy future market potential by short and long run factors influencing GDP growth. Short-run *growth* is measured as the percentage change of real GDP per capita in national currency, taken from WEO. The *investment rate*, measured as gross capital formation at current national prices to GDP at current national prices (both taken from WEO) proxies for long-run growth.

It is standard in FDI models to account for education as a measure for the overall competitiveness of the economy by using data on educational achievements as provided by Barro and Lee (2010). Obviously, human capital is a robust and important factor for long-run growth, but the rationale in the FDI literature is mainly to understand the relationship between vertical and horizontal motivations for firm's FDI decision (see especially Carr, 2001, and Blonigen et al., 2003). In our view, overall education measures may be an inaccurate proxy for the exercise of examining the determinants of FDI flows. In many aggregated models, the Barro-Lee dataset does not enter the equation statistically significant. Investors may be more concerned about the competitiveness in sectors where host countries have overall comparative advantages - their export sector. We hence look at *high-tech exports* as provided by World Bank's World Development Indicators (WDI) as a measure for competitiveness in the export-related sector. From this data set, we calculate a country's share of global high-tech exports in a certain year. Furthermore, we look at *export unit values*, provided by WEO.[22] Finally, we also include the OECD-provided total number of *patents* in a country to account for R & D seeking investment motivations.[23] We compare the performance of these proposed measures to the average years of schooling from the Barro and Lee (2010) data set.

We also account for the *trade share* in our model, which is measured as the sum of imports (including c.i.f.) and export from and to the rest of the world in current USD (from IFS) relative to GDP in current USD (from WEO). One reason is that as economies become more open, they might have larger markets. Furthermore, there might be important interdependencies between FDI and trade. In fact, one main argument in the FDI literature is that foreign affiliates of multinational firms can overcome trade costs and trade restrictions such as tariffs and non-tariff barriers to trade (cf. Blonigen, 2002 , although the empirical evidence is somewhat mixed). For our purpose as a control variable, our measure of trade share should largely account for trade openness.[24]

The role of international trade in the context of investment decisions also gives rise to look at impacts of the exchange rate, as done by Froot and Stein (1991) who developed a model of informational imperfections where a depreciation leads to FDI inflows and provide evidence for this phenomenon. Blonigen (1997) shows that a real depreciation of the host country's real exchange rate may increase profits of multinational firms that would (also) sell affiliate's products in the home market (or process them there). The depreciation also allows foreign firms to make higher bids for host country's assets than domestic firms because the multinational can realize profits of the acquisition in its home currency. Since most FDI comes in the form of M & A, real exchange rate depreciations will thus have a positive effect on FDI. The relationship has also been addressed by other studies such as Chakrabarti (2001) and Pain and van Welsum (2003). We also control for these effects by

[22]An extensive discussion of unit values in international trade is provided by Silver (2010).

[23]An advantage of patent data over the Barro and Lee (2010) dataset is also that the former is available on an annual basis while there are only data at a five-year basis for the latter.

[24]Also note that we are using fixed effect estimation, so the fact that larger countries will generally have a lower trade share than smaller economies will not pose a problem.

taking the implied *PPP exchange rate*, measured in national currency per USD from WEO.[25]

Although the above equation (2) highlights the role of the interest rate, it is remarkable that the interest rate has not made it into the standard set of control variables for FDI models.[26] As Lehmann and Kang (2004) argue, local leveraging in the host economy is of high relevance for MNCs' affiliates and hence a low interest rate will be preferable because it provides them easier access to credit or capital. The situation is completely different when the only focus is the capital flow component: in the Mundell-Fleming model, capital responds positively to the spread of the domestic to the foreign interest rate. This highlights an important potential difference between portfolio and foreign direct investment (cf. Wacker, 2012).[27] We hence include the spread of the *money market rate* (MMR)[28] over LIBOR in percent p.a. (both taken from IFS) to proxy for the interest rate.

Finally, it is important for our exercise to account for *financial openness* of the host country. Governments that attribute more positive growth effects to open financial markets may be more likely to open their capital account on one hand. But they may also be more likely to join SDDS on the other hand. Since both, capital account openness and SDDS will potentially increase capital flows, omission of controling for capital openness could cause an omitted variable bias. We hence control for financial openness using the index of Chinn and Ito (2006, 2008, 2011), which measures a country's degree of capital account openness and is available up to 2009. It is based on binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. It is hence a *de jure* measure. A higher index value indicates a higher openness to cross-border capital transactions.[29,30]

[25] As for many other variables, we lag the PPP exchange rate by one year to avoid the problem of reversed causality since a capital inflow will automatically lead to an increase in the exchange rate if the latter is allowed to float freely, although it is ultimately the *net* inflow of *all* forms of capital that is relevant.

[26] For example, it is not among the determinants discussed by Blonigen (2005) or Blonigen and Piger (2011).

[27] Furthermore, previous studies on the impact of political instability that failed to control for the interest rate are likely to suffer from an omitted variable bias: instable countries are more likely to have higher interest rates. The relationship between stability and FDI hence also captures the cost of financing, not only an "instability tax".

[28] The MMR is the rate at which banks lend to each other for short term.

[29] Since the index also takes into account restrictions on the current account, one may argue that it is too broad for our purpose. However, according to Jeanne (2011), import restrictions can have exactly the same effect as controls on capital inflows and reserve accumulation.

[30] We do not include measures for other investment costs such as wages or taxes because both theoretical models and empirical evidence are ample for these variables. Despite cost-minimization playing an important role (cf. Badinger and Egger, 2010), MNCs do not necessarily shy away from paying high wages (Lipsey, 2002) and Haufler and Mittermaier (2011) even argue that governments in countries with high unionization rates (and thus probably higher wages) will have more incentives to attract FDI, e.g. by tax incentives. Scholes and Wolfson (1990) provide a framework where FDI flows grow as a result of a tax increase. The results of Davies et al. (2009) highlight that MNCs' response to taxation is very complex. Since tax systems are usually highly persistent, our fixed effect should absorb most of their impact. An omitted variable

3.4. Risk

In our analysis, we look at two broad categories of risk: political and macroeconomic risks in international capital markets. *Political risk* (or instability) is an obvious cost to investors already outlined by Lucas Jr. (1990) and has both direct and indirect effects. Political risk may increase the direct cost of doing business. According to the theoretical model and empirical results of Kesternich and Schnitzer (2010), for example, ownership shares in multinational firms decrease as political risk increases. Thus, while the number of MNCs may not necessarily decline, the amount of FDI will.[31] Indirect negative effects of political instability may arise in situations where governments set spending priorities to short-term projects that politically pay off immediately, instead of undertaking necessary long-run infrastructure or education spendings.

Empirical studies addressing the role of political instability include Wei (2000a,b); Papaioannou (2009) and Daude and Fratzscher (2008).[32] All of these studies find negative impacts of political risk on FDI inflows. Daude and Fratzscher (2008) furthermore show that portfolio investment is much more sensitive to institutional indicators and market openness than FDI and that investor protection has a large effect on portfolio investment but not on FDI. This is in line with the predictions of the model of Albuquerque (2003) that FDI is harder to expropriate because of inalienability of its proprietary asset.[33,34]

Our data set includes the political risk ratings provided by the International Country Risk Guide (ICRG). It takes into account factors of government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability, and bureaucracy quality. Data are provided on monthly basis and averages over one year were taken. Risk ratings range from a high of 100 (least risk) to a low of 0 (highest risk), though the lowest de facto rating in the sample is 56.

As our measure for *macroeconomic risk*, we look at *exchange rate volatility*. Exchange rate volatility can have a negative indirect effect on productivity, at least when financial markets are poorly developed, as recently pointed out by Aghion et al. (2009). Furthermore, exchange rate volatility usually does not come on its own and might thus be a good

bias for SDDS stemming from omitting wage data is economically less likely. Furthermore, wages should be highly correlated with GDP which is among our control variables so that we control for this potential problem at least partially.

[31] Similarly, Javorcik and Wei (2009) find that corruption reduces FDI and shifts the ownership structure towards joint ventures (because the local partner has an advantage in cutting through the red tape).

[32] Blonigen (2005, p. 390) points out that there are problems with the estimation of institutional quality.

[33] We discuss the study of Daude and Fratzscher (2008) in more detail in the subsequent subsection 3.5 and in the concluding section 6.

[34] Contrary to most of these studies, we explicitly control for the interest rate in our model because otherwise parameter estimates are likely to be biased (cf. footnote 27 on page 11)

indicator that something else is going on in the economy. Finally, risk-averse MNCs will directly be affected by changes in the exchange rate when affiliates are not operating independently of each other, but are part of complex vertical production networks and export platforms (cf., for example, Cushman, 1985; Schmidt and Broll, 2009; Campa, 1993; Kiyota and Urata, 2004 on the issue).

Our calculation of exchange rate volatility is based on monthly data from the IFS and uses data on the national currency per Special Drawing Right (SDR) instead of per USD, in order to avoid variation that arises from volatility in one single reference currency. We take the squared deviations from the expected exchange rate for each month, divide it by last month's exchange rate and sum these deviations over the first 6 months of year t and of the last 6 months of year $t-1$. As Engel and West (2005) show, even if exchange rates respond to economic fundamentals, their fluctuations should be nearly unpredictable, especially in the short run, so that today's exchange rate is a reasonable predictor for tomorrow's exchange rate. Hence, our measure for volatility of the exchange rate e is

$$\text{Exrtvol}_{it} = \sum_{m=t-1_{(7/12)}}^{t_{(6/12)}} \frac{(e_m - e_{m-1})^2}{e_{m-1}}, \tag{3}$$

where $t_{(1/12)}$ denotes the first month of year t.[35] The intuition of our measure is that investors will make their investment decision based on previous volatility in exchange rates that serve as an estimate of future exchange rate volatility.

3.5. Information

As explained in section 1, the International Monetary Fund has launched the Special Data Dissemination Standard (SDDS), as one of two data transparency standards, in March, 1996. Compliance with this data standard is voluntary for member states that are interested in getting or expanding access to international capital markets by signaling data of a certain quality in 18 macroeconomic and financial categories outlined in Appendix A. On February 19, 1999 Canada and the United States were the first SDDS subscribers that met the requested data standard specifications. To date (2012), SDDS has 71 member countries listed in Appendix A with their exact timing of subscription, metadata posting and SDDS compliance.

Although improvements in data provisioning may have taken place prior to official compliance with SDDS, we assign a dummy variable equal 1 to an observation if the country i has met the SDDS specification[36] in year t and a 0 otherwise:

[35] Note that results remain similar if we sum the deviation over the first three monts of year t and the last nine months of year $t-1$.

[36] We perform a robustness check by looking at the impact of (lagged) SDDS subscription and investigating the dynamics of the process, see section 5.

$$SDDS_{it} = \begin{cases} 1, & \text{if country } i \text{ meets SDDS specification in year } t \\ 0, & \text{else.} \end{cases} \tag{4}$$

Accordingly, 1999 is the first year where 1-values are observed for at least some of the countries in the sample.

3.6. Spatial interdependencies

Our discussion so far has referred to distance as an exclusive measure for informational frictions for capital flows. However, distance may measure many other factors and cause spatial correlations of economic relevance and with adverse impacts on statistical inference.

For example, capital inflows to a certain country might allow this country to run larger current account deficits. Since trade depends negatively on distance, especially nearby economies may benefit from these flows. This, in turn, might foster investment in neighboring economies, suggesting a positive spatial correlation. Vice versa, a negative shock in one economy might cause contagion to neighboring economies, also suggesting positive spatial correlation in investment patterns (see footnote 4 on page 4). However, to the extent that investors will anticipate this contagion effect, they may spread their risk among several regions, leading to negative spatial correlation. Accordingly, it may not be determined a priori which effect is larger, although the results of Portes et al. (2001) and Daude and Fratzscher (2008) for portfolio investment and the agglomeration literature for FDI suggest that the diversification effect is not very strong.[37]

There may also be a close relation between spatial interdependence and information: In case investors lack other information about potential host countries, they may assume that countries that are geographically close may also be similar economically and base their investment decision on these grounds. On the other hand, the more information becomes available to investors, the more we would expect the spatial correlation in a geographic sense to decline (in absolute terms) and the spatial correlation in an economic sense to rise.

Spatial correlation in investment has been investigated in studies such as Coughlin and Segev (2000), Hernández et al. (2001) and, later on, by Blonigen et al. (2007), and Baltagi et al. (2007). All but the last of these studies, as well as a number of other contributions, use spatial autoregressions (SARs) but only cover a sample of countries and thereby implicitly

[37] When considering the production aspect of MNCs for the case of FDI, the picture gets even less clear (see Yeaple, 2003, for a model where complex integration strategies create complementarities between potential host countries): Export platform FDI may give rise to negative spatial correlation with positive third-country effects (see Blonigen et al., 2007) but potential FDI spillovers to neighboring economies might encourage other foreign investors to run businesses in these economies generating positive spatial correlations. In the case of complex vertical FDI, positive spatial correlations may also be present since multinationals will then ceteris paribus look for close production facilities in order to save trade costs.

impose the restriction of zero-interaction of capital-market shocks between countries in the sample and out of the sample. Furthermore, their use of a t-statistic for the significance of the spatial lag (instead of a Moran statistic) implicitly assumes that the data generating process does not change as the number/composition of sampled countries grows. We find these assumptions to be somewhat strict but since even misspecified SARs may increase the forecasting performance of a structural model of determinants of investment and improve the inference of other regression coefficients (cf. Wall, 2004, p. 311) these investigations have at least shown that the potential omitted variable bias of not including spatial autocorrelation terms or other spatial interdependence measures, if any, is negligible when country fixed effects are used.

In summary, the use of distance in such different contexts as measuring information and using SARs further adds to the argument that distance can measure many other aspects than informational frictions, hence making the interpretation of a related parameter estimate economically doubtful. Second, it points out that one should take into account potential spatial interdependencies in the econometric framework since untreated spatial correlation may bias the estimated covariance matrix (cf. Conley, 1999) similar to the time-series case of autocorrelation that most applied economists are familiar with.

To deal with this issue, we apply an approach based on Conley (1999) and Conley and Ligon (2002) toward the spatial process which makes less stringent assumptions about its data generating nature, hence avoiding potential misspecification (cf. Kelejian and Prucha, 1999, p. 511). To the best of our knowledge, the only contribution in the literature on international capital flows that comes close to our approach is Baltagi et al. (2008) who use the spatial heteroscedasticity and autocorrelation consistent estimator proposed by Kelejian and Prucha (2007). Correcting for such spatial heteroscedasticity, however, is only necessary if spatial correlation is present in the first place. Our approach therefore is to non-parametrically estimate the correlation of error terms depending on their distance in space and bootstrap a 90 percent confidence region for the null hypothesis of no spatial correlation. Our results indicate that there is no need to correct inference for spatial interdependencies.

More precisely, we first take the residuals ε_{it} from equation (1) and perform a Pearson transformation, i.e. we form

$$\eta_{it} = \frac{\varepsilon_{it} - \overline{\varepsilon}}{\sigma_{\varepsilon}}. \tag{5}$$

While the transformation in the numerator is trivial (the mean of the residuals should be 0), the division by the standard error should make our results more comparable between different residual series and especially to potential future work in the field. In what follows, we denote the $N \times \overline{T}$ observations about the η_{it} simply as the (column) vector $\eta \in \mathbb{R}^n$. We then compose the correlation matrix $C = \eta\eta',\ C \in \mathbb{R}^{n \times n}$. Similarly, we compose a distance matrix D of the same dimension, where element d_{jl} measures the distance of the country in line j to the country in column l. By (geographic) distance we mean the Euclidean distance between the longitude and latitude of the countries' main city as reported on *www.cepii.fr*:

$$d_{jl} = 110.57 \times \sqrt{(\text{lat}_j - \text{lat}_l)^2 + (\text{long}_j - \text{long}_l)^2}, \tag{6}$$

where 110.57 is the conversion factor to translate distance into kilometers. Accordingly, all diagonal elements d_{ii} of D will be equal to 0 and it is trivial that both, D and C are symmetric: $D = D', C = C'$. To eliminate this redundant information, we create vectors $s = \{d_{jl} : j < l\}$ and $\rho = \{c_{jl} : j < l\}$. Note that this simply creates vectors that contain information about the correlation between two residuals (in ρ) and the corresponding distance between the two countries from which these residuals come (in s) and that we eliminate correlations between residuals that both come from the same country because their correlation will be driven by persistence patterns that we do not want to disturb the spatial structure we are interested in. We can then plot ρ against s, as done in figure 6 on page 30 and investigate the relation between the correlation of the standardized residuals and the (geographical) distance between them.

In order to address the relationship between residual correlation and distance, few assumptions can be made so that a nonparametric method suggests itself. Conley (1999), for example, studies the case of nonparametric VCV estimation using a local average estimator. This has the advantage of being a flexible approach. However, it can also be too flexible: In some local environment on the distance dimension, correlations between the j and l countries will be characterized by the fact that all countries in j will be fairly similar in some respect while the same holds for the countries in l. For example: Suppose we have European, Sub-Sahara African and Latin American countries in our sample and we assess the standardized residual correlation in the three local environments a, b, c with $a < b < c$, representing the distances within these regions itself (a), the correlation of countries from Sub-Saharan Africa with countries from Europe and Latin America (b) and between Latin American and European countries (c). The correlation structure in environment b will then probably differ in the data generating process from the one in c or a because of institutional issues not being accounted for by the model that produces the residuals. If we are really interested in the impact of geographical distance and assume that we measure it correctly, we would then not want the relationship to depend on such local characteristics but would like it to be more smooth, meaning that relatively more emphasis should be given to a low variance of the estimator.

We hence use a smoothing spline that is the solution to the minimization problem

$$\hat{f}_p(s) = \underset{f(s) \in S_m(\Delta_K)}{\text{argmin}} \left[\sum_{i=1}^{n} \{\rho_i - f(s_i)\}^2 \; \lambda J(f) \right], \; \lambda > 0, \tag{7}$$

where $J(f) := \int_a^b \{f^{(m+1)}(s)\}^2 ds$ is a penalty function and $S_m(\Delta_K)$ is the spline space of degree m based on the partition Δ_K. It can be shown that among all functions with $m+1$ continuous derivatives, there is a unique function that minimizes (7), which is called a 'smoothing spline'. The optimal λ is estimated using leave-one-out cross-validation.

This approach raises the question: What is a (statistically) significant spatial correlation? The problem is that the undogmatic approach toward the spatial relationship makes it difficult to asymptotically derive a null hypothesis against a reasonable alternative. To overcome this problem we use a bootstrap approach. I.e., we assign the estimated (standardized) residuals randomly (with replacement) to the locations (which are kept fixed) and calculate the spatial correlation pattern of these (standardized) residuals. With this procedure, spatial correlation patterns will be purely random. We hence repeat the procedure B times and order the estimated correlations at each location in ascending order. Then, the $0.05 \times B$th and the $0.95 \times B$th observation approximate a 90 percent pointwise confidence interval where we would not reject the null hypothesis of no spatial correlation.

4. Main Empirical Results

The estimation results[38] of equation (1) for FDI and portfolio investment are depicted in tables 1 and 2, respectively. The first columns show baseline results not including the SDDS variable which enters the model in the second column. The difference between the third column and the first two columns is that the latter use the standard Barro and Lee (2010) years of schooling while our proposed measures for skill intensity in the sector(s) of comparative advantage can be found in the third column which is our preferred specification. The last column provides the results using random effects instead of fixed effects regression specification. Note that the Hausman test does by no means suggest that random effects would provide consistent estimates, however, we think it is interesting to see what happens to the model if cross-section variation is taken into account.[39]

For the *FDI* models (2a) - (4a) the SDDS dummy enters the model highly significant.[40] The increase in the explanatory power when moving from model (1a) without SDDS to (2a) with SDDS is relatively small but it is important to stress that the impact of information is nevertheless economically highly relevant: Conditional on other factors, providing high-quality information about the macroeconomic and financial environment under the umbrella of SDDS increases FDI inflows by 56.2 to 61 percent.[41] Furthermore one should note that the change in the estimated parameters for the control variables is of minor importance

[38]Our results are calculated using STATA 11. The estimators for the spatial correlation patterns in section 5.4 are implemented using the R-PROJECT.

[39]Note that random effects is a matrix-weighted average of fixed and between effects estimation (cf. Maddala, 1971).

[40]Unless noted otherwise we refer to "significance" as statistical significance at the 95 percent level. Furthermore, we use "highly significant" and "weakly significant" for the 99 percent and the 90 percent level of statistical significance, respectively.

[41]This is the straightforward calculation of the marginal effect in the log-linear models (2a) and (3a),

Dependent Variable: ln(FDI flow)

model	(1a)	(2a)	(3a)	(4a)
SDDS		0.4462***	0.4760***	0.4590***
		(0.1522)	(0.1355)	(0.1310)
ln(GDP)	0.7724***	0.7732***	0.7116***	0.8287***
(-1)	(0.0995)	(0.0952)	(0.0795)	(0.0550)
GDP growth	4.1104***	4.4241***	2.9280***	3.8167***
	(0.9197)	(0.8887)	(0.9967)	(1.2328)
investment rate	3.1872***	3.4468***	2.1197*	2.0197**
(-1)	(0.9126)	(0.8909)	(1.1974)	(1.0252)
capital account open	0.1445**	0.1299**	0.1399**	0.1377**
	(0.0646)	(0.0625)	(0.0677)	(0.0554)
political risk	0.1143**	0.1140**	0.0207	0.0021
	(0.0458)	(0.0473)	(0.0380)	(0.0240)
exchange rate volatility	-2.9418***	-2.8234***	-3.3692***	-3.4416***
	(0.7488)	(0.7428)	(0.8635)	(1.0731)
exchange rate volatility	-0.7471	-0.7105	-1.4820**	-1.1573
(-1)	(0.7864)	(0.7611)	(0.5685)	(0.7046)
interest rate	0.0000	0.0000	-0.0002***	-0.0003***
(-1)	(0.0000)	(0.0000)	(0.0001)	(0.0001)
real exchange rate	-0.0001	-0.0001	-0.0003*	-0.0003***
(-1)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
trade share	0.1873	0.0990	-0.1835	0.4382***
	(0.2047)	(0.1899)	(0.2890)	(0.1227)
yrs. of schooling	-0.1155	-0.0926		
	(0.1383)	(0.1322)		
high-tech exports			-0.0000	-0.0000
(-1)			(0.0000)	(0.0000)
export unit value			-0.0098**	-0.0043
(-1)			(0.0042)	(0.0036)
# of patents			0.0000	-0.0000
(-1)			(0.0000)	(0.0000)
WEO data dummy	0.8398*	0.8663*	-0.2562	-0.6221
	(0.4916)	(0.5097)	(0.4287)	(0.4193)
constant	-6.1518	-6.3316	2.4603	0.0000
	(3.8131)	(3.8362)	(3.2122)	(.)
estimation	FE	FE	FE	RE
time dummies	yes	yes	yes	yes
observations	1,084	1,084	634	634
(N × avg. T)	(70 × 15.5)	(70 × 15.5)	(55 × 11.5)	(55 × 11.5)
within R-sq	0.38	0.40	0.44	0.43
Hausman (p-value)			0.000	

Cluster-robust standard errors in parentheses; see text for further details. ***, **, and * denotes statistical significance at the 1 percent, 5 percent and 10 percent level, respectively.

Table 1: FDI determinants

when SDDS enters the model. This suggests that omitted variable biases in previous investigations that failed to account for informational asymmetries were negligible.

Considering the control variables, we first look at the performance of our proposed measures for human capital and technology in the export-relevant sector in model (3a) relative to the standard education variable of Barro and Lee (2010) in model (2a). As one can see, years of schooling do not turn out to be significant and the estimated sign is contrary to the expected effect, supporting our claim that overall education averages on the macro level may not be as relevant for a multinational firm's investment decision. On the other hand, the number of patents is at the borderline of weak statistical significance (t-statistic 1.46) and shows both the expected sign and an economically relevant impact.[42] The impact of the world market share of high-tech exports is far from being statistically significant, maybe reflecting offsetting positive effects from high knowledge in the sector with comparative advantage and negative impacts from too competitive markets.

The considerable negative (and statistically significant) effect of (lagged) export unit values may be surprising on a first view if one thinks of commodity prices that are reflected in the export unit values. However, our sample mainly consists of advanced economies for which the large country assumption is reliable at least in their sectors of comparative advantage. Lower export unit values could then simply reflect high total factor productivity and hence high international competitiveness in this sector which would attract FDI.[43]

As expected, FDI responds positive to current and potential future market size measured by GDP, the growth of GDP p.c. and the investment rate, where the latter is only weakly significant in model (3a). Also, the positive impact of de jure capital account openness is statistically significant and very robust, capturing the incentives to transfer capital.[44] On the other hand, the effect of local leveraging as measured by the spread of the interest rate is only statistically significant in models (3a) and (4a). There, however, it is highly significant but of minor economic relevance: An increase in the spread of one percentage point increases FDI inflows by about 0.02 percent. Nevertheless, we find it important to control for the host country interest rate in FDI models, especially since data availability should

---

$ln(y) = X\beta$:

$$\frac{\mathbb{E}(y|x=1) - \mathbb{E}(y|x=0)}{\mathbb{E}(y|x=0)} = \frac{\exp(\beta) - \exp(0)}{\exp(0)} = \exp(\beta) - 1.$$

An unbiased estimator for the marginal impact is discussed in Giles (1982).

[42]The parameter may look small on a first sight: Another patent increases FDI inflows by 0.004 percent. Considering that the annual average number of registered patents was above 10,000 for the United States and more than 9,000 in Japan (standard error about 3,000 in both cases), however, the relevance should not be neglected.

[43]Alternatively, the results could indicate that FDI shies away from monopolistic markets: High export unit values may indicate pricing power of domestic exporters.

[44]Note that the bias of omitting capital account openness on the SDDS variable is relatively small: Without controling for capital account openness, the impact is about 65 percent.

not pose a problem in most applications. The insignificant effect of the interest spread in model (2a) may be driven by sample effects: The larger sample includes more less developed economies where multinationals have advantages over local competitors by having larger access to capital markets in their source countries. In the sample of more advanced (and more homogeneous) countries, access to local leverage might influence the multinationals' location decision more clearly.

A similar effect may influence the results for political risk: It is unlikely that it has a relevant impact in the subsample of more advanced economies but when a larger and more heterogeneous sample is investigated, FDI shies away from political risk.[45]

Considering exchange rate volatility, FDI clearly resiles from macroeconomic risk: The appropriate test statistic is an F-test for joint insignificance of both lags of exchange rate volatility and we can reject this null hypothesis both in model (2a) and (3a) at the 1 percent level of statistical significance.[46]

Contrary to Blonigen (1997), we find a negative impact of a real exchange rate devaluation on FDI inflows. This might be driven by the fact that he disaggregates the effect down to the industry level while we look at the aggregate effect in the whole economy. Furthermore, his rationale is only one of many potential channels between the real exchange rate and FDI. For example, under Dixit-Stiglitz preferences, a real exchange rate appreciation will ceteris paribus increase the relative demand for imported varieties (because they become relatively cheaper). This increased demand can then either be served by imports or by horizontal FDI, so both of them will increase.[47]

The results for *portfolio* investment are generally not as appealing as the ones obtained for FDI flows. We do not find a significant impact of SDDS compliance on inflows, neither is the size of the estimated parameter very relevant in economic terms. This contrasts with previous macro studies that held asymmetric information responsible for "too low" international portfolio capital flows (but could not empirically justify this assumption). We will discuss this issue in the concluding section 6. However, portfolio flows too respond positive to current and potential future market size, although the growth rate of GDP p.c. or the investment rate are not statistically different from 0 in models (1+2b) or (3b), respectively.

[45]Remember: Higher values imply higher political stability. Also note that the within-variation (which is the relevant signal for fixed effects estimation) of political risk will be larger for developing countries than for industrialized countries.

[46]The same result holds if we exclude observations where countries of the Euro area share the same currency.

[47]The relative increase in trade will generally be stronger since the acquisition price for domestic assets will also increase. Note, however, that one of the main production factors of multinationals, its proprietary asset, is not located in the host economy, and hence its acquisition price will not be affected by the increase in the real exchange rate.

Dependent Variable: ln(portfolio flow)

model	(1b)	(2b)	(3b)	(4b)
SDDS		-0.2079	-0.0545	0.0713
		(0.2185)	(0.2425)	(0.2022)
ln(GDP)	1.0519***	1.0516***	1.2999***	1.1935***
(-1)	(0.1024)	(0.1064)	(0.2473)	(0.0924)
GDP growth	3.2752	3.2010	6.1644***	4.4890*
	(2.3892)	(2.4053)	(2.1640)	(2.3619)
investment rate	2.9249**	2.7624**	2.3474	-0.0970
(-1)	(1.3292)	(1.3441)	(2.2172)	(1.4085)
capital account open	0.0198	0.0298	-0.0552	0.1462***
	(0.0799)	(0.0809)	(0.0853)	(0.0559)
political risk	0.1107***	0.1221***	0.1121**	-0.1451***
	(0.0413)	(0.0398)	(0.0512)	(0.0381)
exchange rate volatility	-0.6470	-0.6689	-1.3807	-2.5401**
	(1.6459)	(1.6538)	(1.4529)	(1.0597)
exchange rate volatility	-5.4158	-5.2558	-22.1873**	-22.5561**
(-1)	(5.5546)	(5.6120)	(10.7241)	(8.9123)
interest rate	0.0000	0.0000	0.0007**	0.0007**
(-1)	(0.0000)	(0.0000)	(0.0003)	(0.0003)
real exchange rate	-0.0000	-0.0000	0.0002	-0.0001
(-1)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
trade share	0.0586	0.0851	-0.7122	0.0382
	(0.4282)	(0.4244)	(0.7054)	(0.1856)
yrs. of schooling	0.0893	0.0869		
	(0.1803)	(0.1794)		
high-tech exports			0.0000	0.0000
(-1)			(0.0000)	(0.0000)
export unit value			-0.0055	0.0010
(-1)			(0.0071)	(0.0045)
# of patents			-0.0000	-0.0001**
(-1)			(0.0000)	(0.0000)
WEO data dummy	0.4811*	0.4806*	0.4611	1.0629
	(0.2723)	(0.2759)	(0.5525)	(0.7039)
constant	-14.7047***	-15.3078***	-19.1741**	0.0000
	(3.0642)	(3.1258)	(7.3630)	(.)
estimation	FE	FE	FE	RE
time dummies	yes	yes	yes	yes
observations	805	805	520	520
(N × avg. T)	(66 × 12.2)	66 × 12.2)	(53 × 9.8)	(53 × 9.8)
within R-sqared	0.27	0.27	0.31	0.28
Hausman (p-value)			0.067	

Cluster-robust standard errors in parentheses; see text for further details. ***, **, and * denotes statistical significance at the 1 percent, 5 percent and 10 percent level, respectively.

Table 2: Portfolio determinants

We can reject the null hypothesis that both lags of exchange rate volatility have no impact on portfolio flows at the 10 percent level in model (3b) but not in model (2a). As expected, portfolio investment responds positive to spreads in the interest rate in model (3b). Somewhat surprising, we do not find a statistically significant impact of de jure financial liberalization on portfolio inflows. We find very robust evidence of portfolio investment shying away from political risk in the fixed effects models. The positive significant correlation with political risk in the random effects model (4b) may be due to an omitted variable bias.

Finally, we find it interesting to notice that portfolio investment reacts more elastic to changes in the (current) market size than FDI. This corresponds to the theoretical assumption that for FDI more firm-internal considerations play a role in the investment decision while portfolio investment tends to view the potential host markets more isolated. The evidence is more mixed when looking at potential future market size development but this is not too surprising: Since portfolio investment should be more flexible than FDI, its location decision is not as binding as for the latter.

5. Robustness and Further Results

In section 4 we have estimated a highly significant effect of SDDS subscription on FDI inflows, obtaining a parameter estimate around 0.45. The aim of this section is to investigate how appropriate the overall model specification and its identifying assumptions are and to investigate the robustness of the parameter estimate and its statistical inference. More precisely, we will investigate if there is an underlying time-dependent process in an omitted variable that drives (or influences) the results, we will look how robust the parameter is to different specifications and subsamples, if the impact is persistent and how its dynamics work and whether there is spatial correlation in the residuals that might plague inference. Overall, neither the QQ and PP plot in figure 1 nor the kernel density estimate in figure 2 do show any specific pattern in the residuals from our preferred model (3a), lending support to the overall model specification.

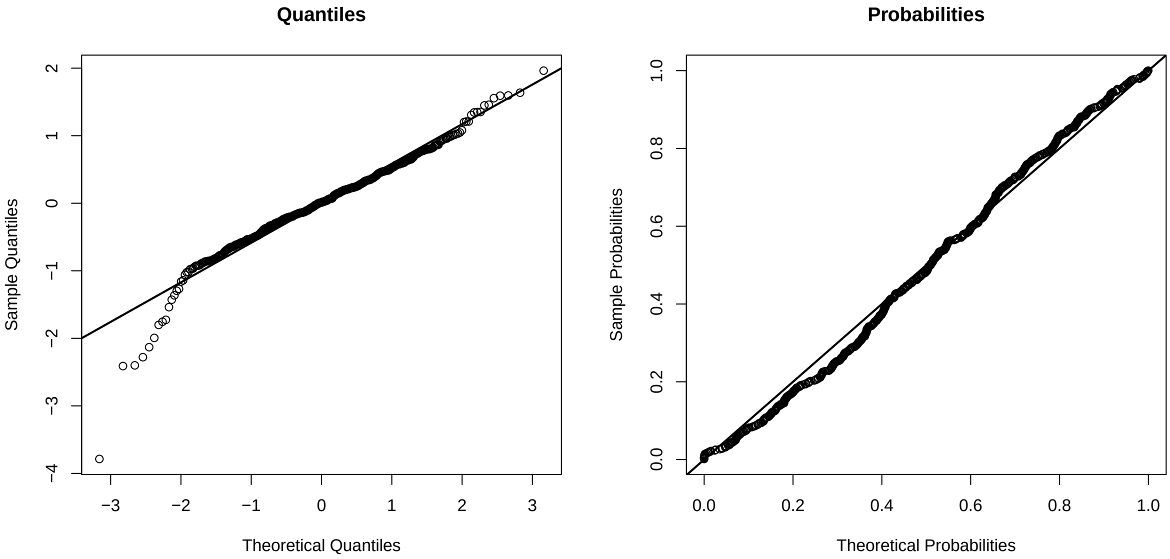
5.1. Identifying assumptions and potential time-dependent omitted variable bias

For further discussion of the statistical properties of our estimators, we define a $N \cdot T \times K$ matrix X that consists of Ψ, the (time and country) fixed effect dummy variables and the $SDDS$ dummy variable. Furthermore, let the parameter vector β consist of the $K-1$ parameters for θ, η, α and the parameter λ^j_{SDDS} and let $X^{\neg\alpha}$ denote the columns of the X matrix that do not include the country dummies α_i. Then, assuming that

$$\mathbb{E}(X^{\neg\alpha}_{it}\alpha_i) \neq 0 \ \forall \ i, t, \tag{8}$$

i.e. there is unobserved heterogeneity across countries correlated with the other variables in X, meaning that fixed effects is the operating model in equation (1), the main condition for

Figure 1: Plots for normality of residuals from model (3a)



obtaining an unbiased OLS estimator for β, $\hat{\beta} = (X'X)^{-1}X'y$, is

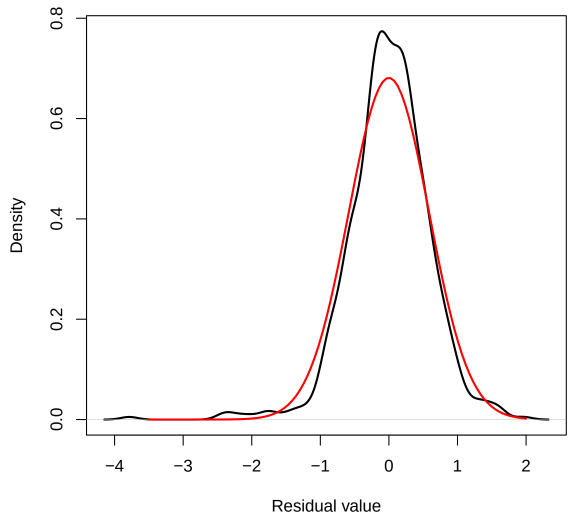
$$\mathbb{E}(X_{it}\varepsilon_{it}) = 0 \ \forall \ i, t \tag{9}$$

because only then the same expression in $\mathbb{E}((X'X)^{-1}X'y) = \beta + \mathbb{E}((X'X)^{-1}X'\varepsilon)$ cancels out and leads to $\mathbb{E}(\hat{\beta}) = \beta + (X'X)^{-1} \cdot 0 = \beta$. In our case this means that there are no omitted variables that influence both, capital inflows and the decision to comply with SDDS and that causality does not run from capital inflows to SDDS compliance. One may think the latter is present: More investors in a country might push the government to provide more accurate data. However, the exclusion of this channel is pretty trivial: On one hand, SDDS is a multilateral initiative and most countries joined at a single point in time (1996), so exogeneity can be assumed. The concern that international investors grew very strong over time and pushed both FDI flows and the implication of SDDS in 1996 is controlled for by the time fixed effect.[48] Furthermore, we look at the date when SDDS specifications are met by subscribers, which usually takes place three to four years *after* countries' subscription to SDDS so that our main explanatory variable is predetermined. One may still argue that there is a certain level of serial correlation in capital flow data (cf. Wacker, 2012) but the country-fixed effect should take care of most of this negligible problem.

The problem of omitted variables influencing both, capital inflows and SDDS subscription, is less trivial. This would lead to a self-selection bias because a country's decision to

[48] Also, this controls for cyclical push factors as discussed in footnote 14 on page 7.

Figure 2: Kernel density estimate for residuals from model (3a) with corresponding normal distribution



comply with SDDS is non-random. However, we should highlight that such omitted variables have to be country-specific and to vary over time. Moreover, they will increase the probability of joining SDDS in later points of time (since once a country complies, the time dummy is set equal to 1 for all remaining observations) so they have to be variables that generally follow a time pattern. For example, assume we omitted to control for GDP and GDP would positively influence both FDI inflows and SDDS compliance. Then, we would have no problem with the fact that there are rich and poor countries in the sample because the fixed effects transformation takes care of this unobserved heterogeneity. Also, cyclical fluctuations in the world economy should not play a role (at least as long as they affect poor and rich countries similarly) since they are controlled for by the time dummy variables. However, if rich and poor countries have structurally different *developments* of GDP over time and GDP was omitted, its impact would go into the error term, ε which will then be trended differently for subscriber and non-subscriber countries and since the SDDS dummy also follows a 'quasi-trend' (by changing to 1 in later periods in time), $\mathbb{E}(SDDS_{it}'\varepsilon_{it}) > 0$ and $\hat{\lambda}_{SDDS}$ will hence be upward biased. Following this line of reasoning, a trend in the unexplained part of the model that differs between subscriber and non-subscriber countries would be evidence of an omitted variable bias. To investigate this possibility we estimate the model

$$y_{it} = \alpha_i + \Psi_{it}\theta + \delta_{SDDS}\, t + \gamma_{non-SDDS}\, t + \varepsilon_{it}, \tag{10}$$

for FDI flows up until certain points in time[49] and perform a Wald test to check equality of parameters, $H_0 : \delta_{SDDS} = \gamma_{non-SDDS}$. The estimates for the different parameters and the p-values of the F-statistic are displayed in table 3. The results do not provide any evidence whatsoever that there would be an underlying time-dependent process that was omitted from equation (1) and influenced the probability of joining SDDS, i.e. there is no evidence for an omitted variable bias.[50]

before year...	1996	1997	1998	1999
SDDS trend ($\hat{\delta}$)	-0.0764	-0.0898	-0.1173	0.0534
non-SDDS trend ($\hat{\gamma}$)	-0.0468	-0.0890	-0.1295	-0.0046
difference significant (p-val)?	0.563	0.989	0.822	0.377
observations	150	190	234	278

Table 3: Different time trends between SDDS subscribers and non-subscribers?

5.2. Parameter robustness

Another way to look at the problem of selection bias is to check what would happen to model (3a) if we excluded the early subscribers from our sample. Countries that experience developments in potentially omitted variables influencing both SDDS subscription and FDI inflows should be those that are more likely to join early. The parameter estimate obtained when excluding the bulk of countries that subscribed to SDDS in 1996 is presented in the first column of table 4 and equals 0.50. Still being statistically significant, this is very strong evidence for our findings that SDDS has a strong positive impact on FDI inflows since the number of observations decreases considerably.[51]

Since subscribers will generally improve their data quality already after (or even slightly before) subscription to SDDS and it may take a while before official specifications are met, we also look at the impact when the dummy variable starts equaling 1 after countries subscribe to SDDS. As we can see from column 2 of table 4, most of the action seems to take place after subscription already. We will have a closer look at these dynamics in the following subsection 5.3.

Finally, we allow the parameter estimate to vary between different country income categories based on the World Bank classification 1987. We find that the impact of SDDS was

[49]If SDDS has a positive impact on FDI flows, there will obviously arise a differing trend once the effect takes place.

[50]Note that the power of this test will not necessarily be high and generally increase in T. However, if we exclude all control variables in Ψ from equation (10) we obtain p-values of 0.0135 (1996), 0.0076 (1997), 0.0057 (1998), and 0.0052 (1999), indicating that the test has at least some power in finding an omitted variable bias.

[51]Only 19 countries remain in this sample. When 1998 subscribers are excluded (in 1997, Portugal was the only subscribing country), the parameter estimate becomes 0.45, being highly statistically significant.

stronger for high income countries (0.69) than for upper medium (0.20) and lower medium (0.22) countries and that the fit of this extended model is "better" in terms of standard model selection criteria (AIC/BIC) and a likelihood ratio (LR) test statistic (13.24 with 2 degrees of freedom). Since the parameter estimate for upper medium and lower medium countries is fairly similar, we perform the same exercise comparing this extended model to one that has one parameter estimate for high income countries and another one for all other countries. We find the latter to outperform the extended model along all three lines (LR statistic 0.01 with 1 degree of freedom), so we report the corresponding coefficients of the latter in the last column of table 4. We find that the impact of SDDS on FDI inflows is in fact driven by high-income countries. This, however, should not be too surprising: Economically, the better the overall performance of the economy, the better capital markets will respond to the provision of data. Statistically, most SDDS subscribers are high-income countries so that parameter identification is easier for these countries. This result does not imply that countries with a lower income level could not benefit from SDDS or from the signaling of macroeconomic data. In fact, the estimated parameter for other countries is still positive and economically relevant (+23 percent) and the estimated standard error is of reasonable size (t-statistic 1.33). The result, however, highlights that data-provision on its own will not be sufficient to acquire FDI inflows but should be based on sound macroeconomic fundamentals.[52]

SDDS (general)	0.5016**	0.4935**	0.2056
	(0.1907)	(0.2362)	(0.1550)
SDDS (high inc)			0.6905***
			(0.2340)
Note	w/o 1996 subscribers	subscr. instead of compl.	parameter heterogeneity
observations	160	634	587

Table 4: Parameter robustness

5.3. Dynamics

As found in the preceding subsection 5.2, the impact of SDDS seems to start happening once countries subscribe to SDSS. We investigate the dynamics of the effect by first introducing dummy variables that that are specific to SDDS subscribers and measure the impact on FDI flows at each year before and after subscription. More precisely the model

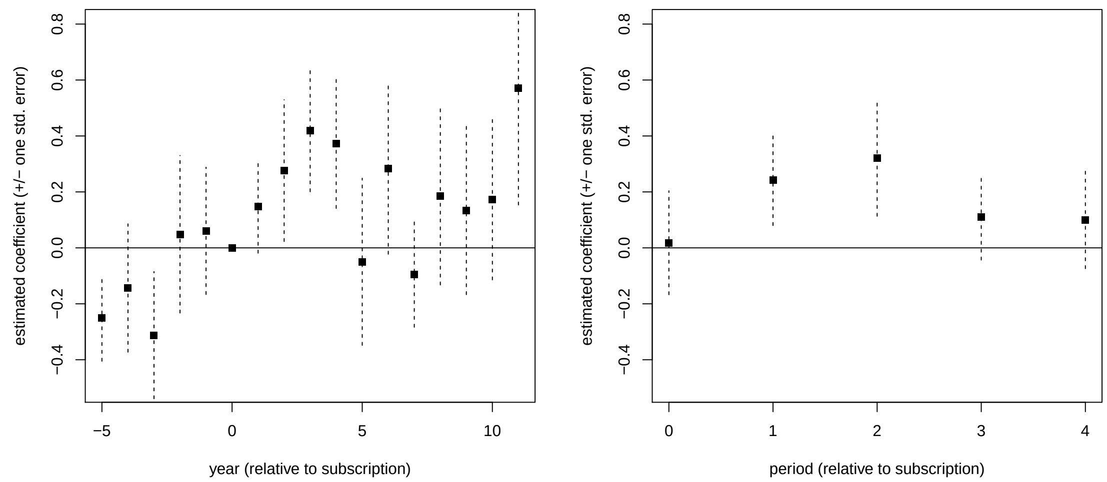
$$y_{it}^j = \Psi_{it}\theta^j + \eta_t^j + \zeta_t^j + \alpha_i^j + \varepsilon_{it}^j, \tag{11}$$

[52]Since SDDS compliance for most countries took place within a relatively narrow time frame, one could also argue that capital was not abundant enough to raise the capital stock in all countries to the new, higher, equilibrium level simultaneously. Under this restriction it seems reasonable that risk averse investors focus on the supposedly save havens in high income countries.

with the same control variables as in model (3a) is estimated, where ζ_t is a SDDS subscriber-specific time dummy. The interpretation of this variable is the effect of subscription, conditional on other factors, at time period t. The results are depicted in the left panel of figure 3, where the subscription year is taken as reference year 0. As can be seen, in the first four years after subscription, capital inflows considerably increase but the impact does not remain as robust thereafter with negative estimates for the years 5 and 7 and an overall picture that suggests somehow increased inflows.

Since year-specific effects are probably too volatile because they might be influenced by various other noise steaming from 'global' effects in the specific years or different countries having somewhat differing dynamics, we also construct period-specific dummies, that is a dummy that is equal to 1 at the year of subscription and two years thereafter (period 1), 3 to 5 years (period 2), 6 to 8 years (period 3), and 8 to 10 years (period 4) after subscription, respectively. Furthermore, we control for effects in the three years prior to subscription (period 0). The overall picture in the right panel of figure 3 is less volatile but shows the same general pattern as before: Most of the increased inflows occur in the first years after subscription, the effect decays afterwards but suggests slightly higher FDI inflows also at later periods in time.

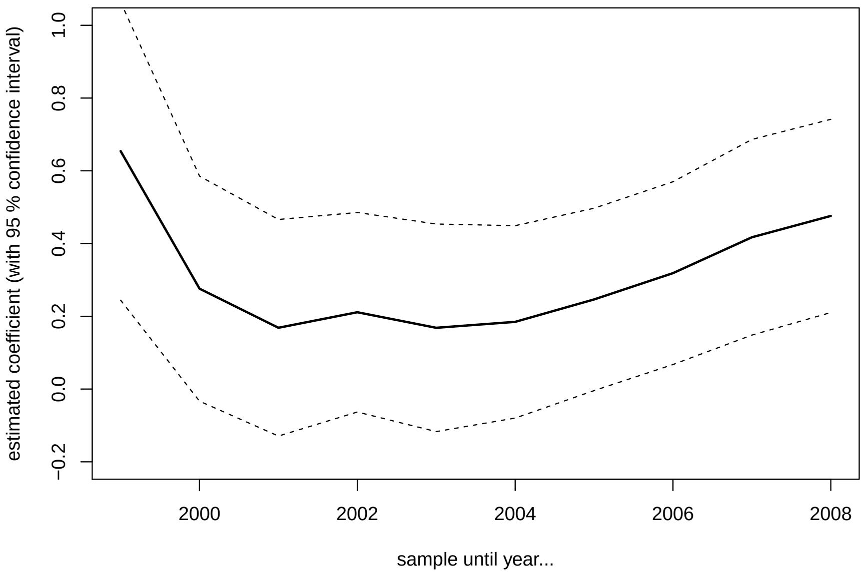
Figure 3: Dynamic effects of SDDS subscription



In fact, this is also the dynamic we would expect from a theoretical perspective: Increased information should result in a permanently higher capital stock and to reach this higher stock level, an adjustment process has to take place once, which operates through increased inflows. After the new equilibrium level is reached, inflows should only be slightly higher in subscriber countries since replacement of the (now increased) capital stock will be higher than otherwise (cf. Wacker, 2012, on the issue).[53]

Finally, we also perform a recursive regression to investigate the stability of our estimated parameter (about 0.45) but also with the objective to gain more insights into the dynamic process taking place. The idea originates from the time-series context and progressively enlarges a subsample of the sample to look if the estimated parameter changes dramatically. The results are depicted in figure 4. For example, the solid line depicts the estimated coefficient of 0.45 to the very right, when the sample includes all years up to 2008, because this is the last year in the overall sample. As one can see, the effect is particularly strong when the sample is limited until 1999 which was the first year some subscribers met the SDDS specifications. After this, the impact decreased to about 0.25 and recovered when years after 2004 were included. Note that the line does *not* depict the impact of SDDS at specific years but when the sample is truncated at those years.

Figure 4: Recursive regression



Since recursive regressions are derived under time-series assumptions while we have asymptotics where N goes to infinity first, the results of this exercise should not be overrated with respect to inference. However, we think the figure tells an important story: Countries

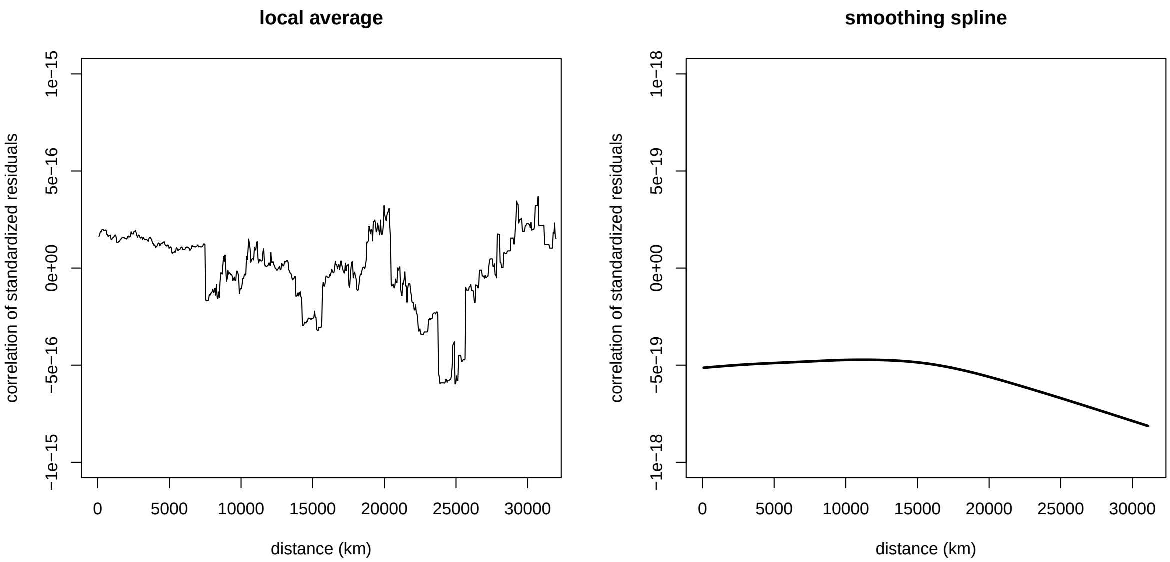
[53]Harding and Javorcik (2011, footnote 25 on p. 1460) find that the positive effect of investment promotion agencies in developing countries increases over time. However, in their case support with bureaucracy and not with informational frictions is likely to be the driving factor.

that were eager to quickly signal their data to markets will most likely have had strong fundamentals; the impact of meeting the SDDS specifications will since be stronger. After them (i.e. after 1999), countries that met the specification might have also signaled less promising data so that the impact was not so strong (or even inexistent) for them, the overall parameter being a mixture of these types of countries. However, compliance with SDDS and increased screening by financial markets might have increased the pressure on these countries to bring their economic fundamentals in order, so that the impact would also turn (more) positive for these countries after several years. This can be seen from the increase in the parameter estimate when the sample reaches beyond 2004: It provides strong evidence that the impact converges to the economically relevant parameter of 0.45 over the years also for countries that might have had weaker macroeconomic fundamentals in the first place and confirms that the positive impact of SDDS was statistically significant.

5.4. Spatial correlation patterns

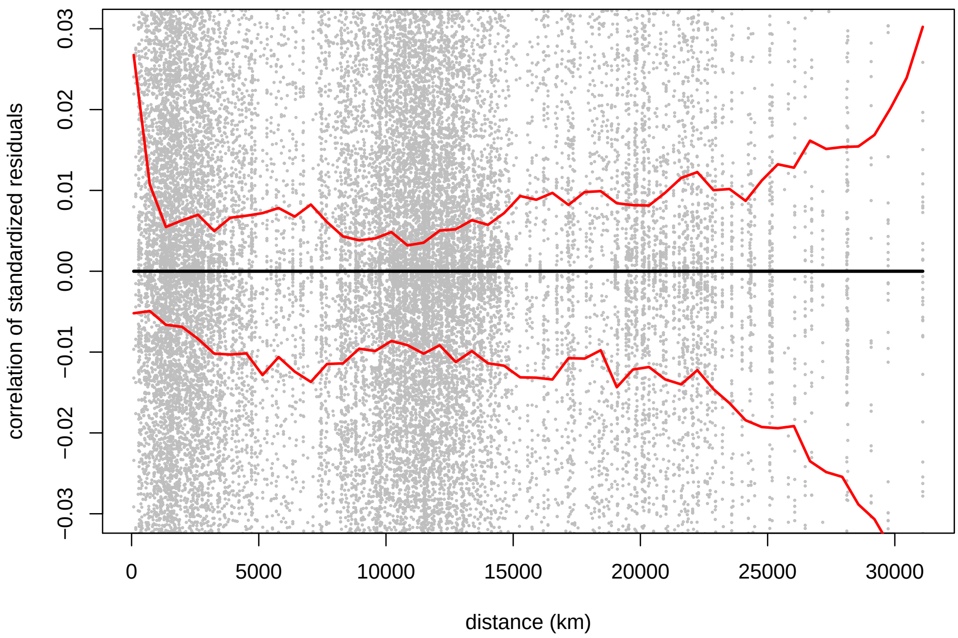
Finally, we estimate the spatial correlation pattern as outlined at the end of section 3.6. Figure 5 depicts the relationship between the correlation of (standardized) residuals from equation (1) and distance using a local average estimator with a window of $7,500$ km (left panel) and a smoothing spline (right panel), respectively. As one can see, the spline function is much more smooth and hence gives a picture that is easier to interpret overall: There seems to be negative spatial correlation in the residuals that tends to increase if distance gets large.

Figure 5: Spatial correlation of FDI residuals



However, as one can see from the scale of both figures, the correlation is fairly small and we hence test if it is in fact statistically significant using $B = 1,000$ bootstrap replications. Figure 6 puts the estimated correlation into perspective: On this scale, the smoothing spline does not show any significant pattern or deviation from 0 and it does by no means reach a level that is beyond randomness so that one could not reject the null hypothesis of no spatial correlation in the residuals. Accordingly, the inference in our models is not plagued by spatial correlation in the residuals.

Figure 6: Smoothing spline estimate of spatial correlation in FDI flow residuals with 90 percent pointwise confidence bands based on 1,000 bootstrap replications



6. Discussion and Conclusion

6.1. Main findings

Our analysis has shown that countries which committed themselves to provide macroeconomic data with a certain accuracy and timeliness, as requested by the IMF's Special Data Dissemination Standard, received more foreign direct investment inflows than other countries. The impact that accounts for a set of standard control variables, time- and country-specific effects, is both statistically significant and economically relevant: Compliance with the SDDS increases FDI inflows by about 60 percent.[54]

The most important impact occurs in the first years after subscription to (or compliance with) the SDDS, especially for those countries that are able to submit data which is solid not only with respect to technical accuracy, but also considering the underlying economic fundamentals. Most industrialized countries hence experience an even larger impact of 100 percent as reported in table 4, while the comparable impact for other countries that do not possess such strong fundamentals may be somewhat above 20 percent. However, our results also indicate that in the longer run these countries can also catch up to the overall parameter of 60 percent, probably driven by the fact that once financial markets are monitoring macroeconomic and financial data, there is a stronger incentive for countries to get these fundamentals straight.

Portfolio and FDI flows both shy away from political and macroeconomic risk, though political risk does not seem to matter much for FDI in the most advanced countries and the aversion against macroeconomic risk in the form of exchange rate volatility is less robust for portfolio investment.

6.2. Relation to other findings in the literature

Our main finding is generally in line with the result of Daude and Fratzscher (2008) that FDI is more responsive to information than other forms of capital flows. We should also highlight that information about the macro environment is probably more important for FDI because the firm-specific asset is brought by MNCs, whereas portfolio investment is likely to be more connected with firm-level information in the host economy.[55] In line with this argument, acquiring information privately is costly for these multinational firms because they cannot benefit from the positive externalities of informational investment.[56] On the other hand, portfolio investors are supposed to acquire information and this is essentially what portfolio funds are paid for - as the model of van Nieuwerburgh and Veldkamp (2009) points out, investors profit more from information others do not know. Especially, large institutional investors might have an incentive to acquire information about potential host countries on their own. They may therefore lose short-run arbitrage gains from informational asymmetries once information becomes public. Accordingly, smaller investors with

[54] This may seem large on a first view. But the impact of information is found to be large also by other studies: Gelos and Wei (2005, p. 2997) exemplify that a country like Venezuela could more than triple their weight in portfolio holdings by increasing its transparency to Singapore's level. Harding and Javorcik (2011) find that sectors targeted by IPAs in developing countries receive 155 percent more FDI inflows. Also note that our result does *not* imply an increase in *stocks* by 60 percent as discussed in subsection 5.3.

[55] This assumption that can neither be supported nor dismissed by the findings of Gelos and Wei (2005, p. 3000f).

[56] Harding and Javorcik (2011, p. 1450f.) describe the FDI decision process in more detail: A list of potential host countries is usually restricted to 8-20 countries which is still narrowed down to up to five potential host countries, which is usually done without visiting the potential host. This highlights the importance of public information to come up with potential host countries in the first place.

more long-run perspective may rely on this public information.[57] These two opposing effects might simply offset each other resulting in an overall impact that is small and statistically not significantly different from zero. Hence, our findings do not necessarily contradict the results of Gelos and Wei (2005) that emerging market portfolio funds respond positively to information because their sample may only capture one third of the total portfolio flows to the relevant countries (p. 2989) and their specific measure for macrodata opacity, which is most comparable to our SDDS measure, loses statistical significance when including fixed region effects (p. 3002).

6.3. Further results

Our study empirically supports the distinction of portfolio flows from FDI flows in the balance of payments. We find empirical evidence that the elasticity of portfolio investment toward current market size is significantly higher than for foreign direct investment. We also find evidence of other differences between portfolio and FDI flows, most notably their contrary response toward the interest rate, highlighting that FDI is not simply a capital flow but also that MNCs' finance strategy for investments should play a more important role in the (micro-)economic attempt to understand the behavior of the multinational firm. Our study also suggests that the empirical modeling of (firm demand for) education should probably focus more specific on know-how in sectors with comparative advantages and shows that spatial correlations do not play a significant role when FDI flows are estimated at an aggregate level using fixed effects.[58]

6.4. Perspectives on further research and policy issues

Our results highlight the need for further, more disaggregated research about the role of information for portfolio (and potentially other forms of) investment. As mentioned above, the finding that there is no significant overall effect of information does not imply that the structure of portfolio investment stays unaffected. Informational asymmetries may attract market makers and hence more short-term oriented portfolio flows, which would generally result in more volatility in capital markets (cf. e.g. Diamond and Verrecchia, 1991; Du and Wei, 2004) and can cause adverse externalities (cf. Bianchi, 2011). Public dissemination of more accurate and timely economic and financial data is hence a potentially important macroeconomic tool to manage capital inflows since it may attract more long-term oriented portfolio flows. As our evidence strongly suggests that more FDI will be attracted by stronger macro fundamentals and by the macroeconomic information, public dissemination of accurate economic data will initiate more stable and one of the most advantageous forms of capital inflows to countries. This should result in a more sustainable and healthy international investment position, may help to lessen the degree of international balance of

[57] Ausubel (1990) suggests that if outsiders can assume that - due to increased macroeconomic information - insiders cannot take as much advantage of them, they may increase their investment.

[58] We also did not find a significant spatial pattern in the residuals of the random effects specification.

payments imbalances, and would develop the productive resources of capital-scarce countries. Accordingly, we also think that informational frictions may account to a certain extent for the fact that growth effects of financial openness have turned out to be somewhat disappointing and are generally far from being robust (cf. Jeanne et al., 2012, ch. 3 and 4 for a recent survey and investigation), although this channel still has to be investigated in more detail.

Acknowledgments

We would like to thank Emma Angulo, John Cady, Natasha Che, Ron Davies, Philipp Grosskurth, Stephan Klasen, Silvia Matei, Anna Orthofer, reviewers from the IMF's Research Department and seminar participants at the IMF's Statistics Department and at the University of Göttingen for helpful comments, inputs and ideas. K.M. Wacker acknowledges financial support by the China Scholarship Council. All remaining errors are ours.

Appendix A. Information on SDDS

Country	subsc	meta	spec	Country	subsc	meta	spec
Argentina	1996	1996	1999	Korea	1996	1998	1999
Armenia	2003	2003	2003	Kyrgyz Republic	2004	2004	2004
Australia	1996	1998	2001	Latvia	1996	1997	1999
Austria	1996	1997	2001	Lithuania	1996	1997	1999
Belarus	2004	2004	2004	Luxembourg	2006	2006	2006
Belgium	1996	1997	2001	Macedonia	2011	2011	2011
Brazil	2001	2001	2001	Malaysia	1996	1996	2000
Bulgaria	2003	2003	2003	Malta	2009	2009	2009
Canada	1996	1996	1999	Mauritius	2012	2012	2012
Chile	1996	1997	2000	Mexico	1996	1996	2000
Colombia	1996	1997	2000	Moldova	2006	2006	2006
Costa Rica	2001	2001	2001	Morocco	2005	2005	2005
Croatia	1996	1996	2001	Netherlands	1996	1996	2000
Cyprus	2009	2009	2009	Norway	1996	1996	2000
Czech Republic	1998	1998	1999	Peru	1996	1996	1999
Denmark	1996	1996	2000	Philippines	1996	1996	2001
Ecuador	1998	1998	2000	Poland	1996	1996	2000
Egypt	2005	2005	2005	Portugal	1997	1998	2000
El Salvador	1998	1998	1999	Romania	2005	2005	2005
Estonia	1998	1999	2000	Russia	2005	2005	2005
Finland	1996	1996	2000	Singapore	1996	1996	2001
France	1996	1996	2000	Slovak Republic	1996	1998	1999
Georgia	2010	2010	2010	Slovenia	1996	1996	2000
Germany	1996	1997	2000	South Africa	1996	1996	2000
Greece	2002	2002	2002	Spain	1996	1998	2000
Hong Kong SAR	1996	1997	2000	Sweden	1996	1996	2000
Hungary	1996	1997	2000	Switzerland	1996	1996	2001
Iceland	1996	1998	2004	Thailand	1996	1996	2000
India	1996	1997	2001	Tunisia	2001	2001	2001
Indonesia	1996	1997	2000	Turkey	1996	1996	2001
Ireland	1996	1996	2001	Ukraine	2003	2003	2003
Israel	1996	1996	2000	United Kingdom	1996	1996	1999
Italy	1996	1996	2000	United States	1996	1996	1999
Japan	1996	1996	2000	Uruguay	2004	2004	2004
Jordan	2010	2010	2010	West Bank and Gaza	2012	2012	2012
Kazakhstan	2003	2003	2003				

“subsc” is the date of subscription to SDDS, “meta” is the year where metadata were posted on the Dissemination Standards Bulletin Board, “spec” is the first year where subscribers met SDDS specification.

Table A.5: List of SDDS subscribers

Category	**Component (example)**
Real Sector	
National Accounts	GDP by categories
Production Indices	idustrial / commodity production
Labor market	(un)employment, wages
Price Indices	CPI, producer price index
Fiscal Sector	
General Government Operations	revenue, expenditure, financing
Central Government Operations	revenue, expenditure, financing
Central Government Debt	domestic / foreign (by currency)
Financial Sector	
Analytical Banking Accounts	money, credit
Analytical Central Bank Accounts	reserve money, domestic claims, external position
Interest Rates	government security rates
Stock Market	share price index
External Sector	
Balance of Payments	goods and services
Reserves	reserves
Merchandise Trade	exports and imports
International Investment Position	
Exchange Rates	spot rates, 3- and 6-month forward markets
External Debt	debt of different sectors (government, banking etc.)
Population	

This is just an illustrative list of the SDDS data coverage. For comprehensive information on SDDS data coverage please consult the SDDS website.

Table A.6: SDDS Data Coverage

Appendix B. Sample, variables and descriptive statistics

List of countries in the sample (model 3a):

Algeria, Argentina, Australia, Austria, Brazil, Bulgaria, Canada, Chile, Colombia, Croatia, Czech Republic, Estonia, Finland, France, Germany, Greece, Hong Kong (China), Iceland, Indonesia, Ireland, Italy, Jamaica, Japan, Jordan, Korea, Rep., Kuwait, Latvia, Lithuania, Malaysia, Mexico, Moldova, Morocco, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Poland, Romania, Russian Federation, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Switzerland, Thailand, Turkey, Ukraine, United Kingdom, United States, Uruguay, Venezuela

Variable	Explanation	Mean (Std. Dev.)	Source
ln(FDI)	Logarithm of real foreign direct investment inflows in USD	22.04 (1.70)	IFS (WEO)
ln(portfolio)	Logarithm of real foreign portfolio investment inflows in USD	22.10 (2.40)	IFS (WEO)
SDDS	dummy variable equal 1 if country i met 'Special Data Dissemination Standard' in yeart t, see table A.5	0.40 (0.49)	IMF
ln(GDP)	Logarithm of real GDP in USD	25.95 (1.79)	WEO
GDP growth	percentag change $((y_t - y_{t-1})/y_{t-1})$ of real GDP per capita in national currency	0.031 (0.036)	calc from WEO
investment rate	gross capital formation (at current prices) / GDP (also at current prices)	0.233 (0.058)	calc from WEO
capital account open	Chinn and Ito (2006) index for capital account openness (higher values mean higher openness	1.12 (1.40)	Chinn/ Ito (2011)
political risk	political risk rating of International Country Risk guide (ICRG, yearly average), 0 (high risk) - 100	65.89 (3.49)	ICRG
exchange rate volatility	see equation (3) on page 13	0.0026 (0.024)	calc from IFS
interest rate	spread of money market rate over LIBOR (both in percent p.a.)	19.08 (231.37)	calc from IFS
real exchange rate	implied purchasing power parity exchange rate measured in national currency per USD	85.90 (371.63)	WEO
trade share	sum of imports (including c.i.f.) and export from and to the world in current USD / GDP in current USD	0.696 (0.601)	calc from IFS, WEO
yrs. of schooling	Years of Schooling from Barro and Lee (2010) using a smoother with weights 25, 16, 9, 4, and 1	9.04 1.99	Barro/ Lee (2010)
high-tech exports	country i's share of high-tech exports in global high-tech exports at year t	1.84e+10 (3.47e+10)	calc from WDI
export unit value	export unit value index	87.31 (20.59)	WEO
# of patents	total number of patents	841.73 (2,592.6)	OECD
WEO data dummy	dummy variable equal 1 if WEO data was used for dependent variable (instead of IFS data)	0.121 (0.327)	own calc.

Mean and standard deviation are reported for those observations included in model (3a), except for *ln(portfolio)*, where observations included in model (3b) are taken.

Table B.7: List of Variables

Bibliography

Agça, Mehmet and Peter Allum (2001), "Economic data dissemination: What influences country performance on frequency and timeliness?" IMF Working Papers 01/173, International Monetary Fund.

Aghion, Philippe, Philippe Bacchetta, Romain Rancière, and Kenneth Rogoff (2009), "Exchange rate volatility and productivity growth: The role of financial development." *Journal of Monetary Economics*, 56, 494 – 513.

Ahearne, Alan G., William L. Griever, and Francis E. Warnock (2004), "Information costs and home bias: an analysis of US holdings of foreign equities." *Journal of International Economics*, 62, 313–336.

Akerlof, George A. (1970), "The market for 'lemons': Quality uncertainty and the market mechanism." *Quarterly Journal of Economics*, 84, 488–500.

Albuquerque, Rui (2003), "The composition of international capital flows: risk sharing through foreign direct investment." *Journal of International Economics*, 61, 353–383.

Albuquerque, Rui, Norman Loayza, and Luis Serven (2005), "World market integration through the lens of foreign direct investors." *Journal of International Economics*, 66, 267–295.

Anderson, James E. and Eric van Wincoop (2003), "Gravity with gravitas: A solution to the border puzzle." *American Economic Review*, 93, 170–192.

Ausubel, Lawrence M (1990), "Insider trading in a rational expectations economy." *American Economic Review*, 80, 1022–41.

Avery, Christopher and Peter Zemsky (1998), "Multidimensional uncertainty and herd behavior in financial markets." *American Economic Review*, 88, 724–48.

Badinger, Harald and Peter Egger (2010), "Horizontal vs. vertical interdependence in multinational activity." *Oxford Bulletin of Economics and Statistics*, 72, 744–768.

Baltagi, Badi H., Peter Egger, and Michael Pfaffermayr (2007), "Estimating models of complex FDI: Are there third-country effects?" *Journal of Econometrics*, 140, 260–281.

Baltagi, Badi H., Peter Egger, and Michael Pfaffermayr (2008), "Estimating regional trade agreement effects on FDI in an interdependent world." *Journal of Econometrics*, 145, 194–208.

Banerjee, Abhijit V. (1992), "A simple model of herd behavior." *The Quarterly Journal of Economics*, 107, 797–817.

Barro, Robert and Jong-Wha Lee (2010), "A new data set of educational attainment in the world, 1950-2010." Working Paper No. 15902, National Bureau of Economics Research, Cambridge, MA.

Berg, Andrew, Rafael Portillo, and D. Filiz Unsal (2010), "On the optimal adherence to money targets in a New-Keynesian framework: An application to low-income countries." Working Paper 10/134, International Monetary Fund, URL `http://www.imf.org/`.

Bianchi, Javier (2011), "Overborrowing and systemic externalities in the business cycle." *American Economic Review*, 101, 3400–3426.

Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch (1992), "A theory of fads, fashion, custom, and cultural change as informational cascades." *Journal of Political Economy*, 100, 992–1026.

Blanchard, Olivier (2010), *Macroeconomics*, 5. edition. Prentice Hall, Upper Saddle River, New Jersey.

Blonigen, Bruce A. (1997), "Firm-specific assets and the link between exchange rates and foreign direct investment." *American Economic Review*, 87, 447–65.

Blonigen, Bruce A. (2002), "Tariff-jumping antidumping duties." *Journal of International Economics*, 57, 31 – 49.

Blonigen, Bruce A. (2005), "A review of the empirical literature on FDI determinants." *Atlantic Economic Journal*, 33, 383–403.

Blonigen, Bruce A., Ronald B. Davies, and Keith Head (2003), "Estimating the knowledge-capital model of the multinational enterprise: Comment." *American Economic Review*.

Blonigen, Bruce A., Ronald B. Davies, Glen R. Waddell, and Helen T. Naughton (2007), "FDI in space: Spatial autoregressive relationships in foreign direct investment." *European Economic Review*, 51, 1303 – 1325.

Blonigen, Bruce A., Christopher J. Ellis, and Dietrich Fausten (2005), "Industrial groupings and foreign direct investment." *Journal of International Economics*, 65, 75–91.

Blonigen, Bruce A. and Jeremy Piger (2011), "Determinants of foreign direct investment." NBER Working Papers 16704, National Bureau of Economic Research, Inc.

Bobonis, Gustavo J. and Howard J. Shatz (2007), "Agglomeration, adjustment, and state policies in the location of foreign direct investment in the United States." *The Review of Economics and Statistics*, 89, 30–43.

Bond, Eric W. and Larry Samuelson (1986), "Tax holidays as signals." *American Economic Review*, 76, 820–26.

Brennan, Michael J. and H. Henry Cao (1997), "International portfolio investment flows." *Journal of Finance*, 52, 1851–1880.

Brennan, Michael J., H. Henry Cao, Norman Strong, and Xinzhong Xu (2005), "The dynamics of international equity market expectations." *Journal of Financial Economics*, 77, 257 – 288.

Byard, Donal, Ying Li, and Yong Yu (2011), "The effect of mandatory IFRS adoption on financial analysts' information environment." *Journal of Accounting Research*, 49, 69–96.

Cady, John (2005), "Does SDDS subscription reduce borrowing costs for emerging market economies?" *IMF Staff Papers*, 52, 503–517.

Cady, John and Jesus Gonzalez-Garcia (2007), "Exchange rate volatility and reserves transparency." *IMF Staff Papers*, 54, 741–754.

Cady, John and Anthony J. Pellechio (2006), "Sovereign borrowing cost and the IMF's data standards initiatives." IMF Working Papers 06/78, International Monetary Fund.

Calvo, G., L. Leiderman, and C. Reinhart (1993), "Capital inflows and the real exchange rate appreciation in Latin America: The role of external factors." *IMF Staff Papers*, 40, 108–151.

Campa, Jose Manuel (1993), "Entry by foreign firms in the United States under exchange rate uncertainty." *The Review of Economics and Statistics*, 75, 614–22.

Carr, David L. (2001), "Estimating the knowledge-capital model of the multinational enterprise." *American Economic Review*, 91, 693–708.

Chakrabarti, Avik (2001), "The determinants of foreign direct investment: Sensitivity analyses of cross-country regressions." *Kyklos*, 54, 89–113.

Chinn, Menzie D. and Hiro Ito (2006), "What matters for financial development? Capital controls, institutions, and interactions." *Journal of Development Economics*, 81, 163–192.

Chinn, Menzie D. and Hiro Ito (2008), "A new measure of financial openness." *Journal of Comparative Policy Analysis*, 10, 309–322.

Chinn, Menzie D. and Hiro Ito (2011), "Notes on the Chinn-Ito financial openness index 2009 update." mimeo.

Chuhan, Punam, Stijn Claessens, and Nlandu Mamingi (1998), "Equity and bond flows to Latin America and Asia: the role of global and country factors." *Journal of Development Economics*, 55, 439–463.

Conley, Timothy G. (1999), "GMM estimation with cross sectional dependence." *Journal of Econometrics*, 92, 1–45.

Conley, Timothy G and Ethan Ligon (2002), "Economic distance and cross-country spillovers." *Journal of Economic Growth*, 7, 157–87.

Coughlin, Cletus C. and Eran Segev (2000), "Foreign direct investment in China: A spatial econometric study." *The World Economy*, 23, 1–23.

Coughlin, Cletus C., Joseph V. Terza, and Vachira Arromdee (1991), "State characteristics and the location of foreign direct investment within the United States." *The Review of Economics and Statistics*, 73, 675–683.

Cushman, David O. (1985), "Real exchange rate risk, expectations, and the level of direct investment." *The Review of Economics and Statistics*, 67, 297–308.

Dabla-Norris, Era, Jiro Honda, Amina Lahreche, and Geneviève Verdier (2010), "FDI flows to low-income countries: Global drivers and growth implications." Working Paper 10/132, International Monetary Fund, Washington, DC, URL `http://www.imf.org/`.

Daude, Christian and Marcel Fratzscher (2008), "The pecking order of cross-border investment." *Journal of International Economics*, 74, 94 – 119.

Davies, Ronald B. and Helga Kristjánsdóttir (2010), "Fixed costs, foreign direct investment, and gravity with zeros." *Review of International Economics*, 18, 47–62.

Davies, Ronald B., Pehr-Johan Norbäck, and Ayça Tekin-Koru (2009), "The effect of tax treaties on multinational firms: New evidence from microdata." *World Economy*, 32, 77–110.

di Giovanni, Julian (2005), "What drives capital flows? The case of cross-border M and A activity and financial deepening." *Journal of International Economics*, 65, 127 – 149.

Diamond, Douglas W. and Robert E. Verrecchia (1991), "Disclosure, liquidity, and the cost of capital." *Journal of Finance*, 46, 1325–1359.

Du, Julan and Shang-Jin Wei (2004), "Does insider trading raise market volatility?" *Economic Journal*, 114, 916–942.

Engel, Charles M. and Kenneth D. West (2005), "Exchange rates and fundamentals." *Journal of Political Economy*, 113, 485–517.

Fernandez-Arias, Eduardo (1996), "The new wave of private capital inflows: Push or pull?" *Journal of Development Economics*, 48, 389 – 418.

French, Kenneth R. and James M. Poterba (1991), "Investor diversification and international equity markets." *American Economic Review*, 81, 222–26.

Froot, Kenneth A. and Jeremy C. Stein (1991), "Exchange rates and foreign direct investment: An imperfect capital markets approach." *The Quarterly Journal of Economics*, 106, 1191–1217.

Gelos, R. Gaston and Shang-Jin Wei (2005), "Transparency and international portfolio holdings." *Journal of Finance*, 60, 2987–3020.

Giles, David E. A. (1982), "The interpretation of dummy variables in semilogarithmic equations : Unbiased estimation." *Economics Letters*, 10, 77–79.

Glennerster, Rachel and Yongseok Shin (2008), "Does transparency pay?" *IMF Staff Papers*, 55, 183–209.

Goldstein, Itay and Assaf Razin (2006), "An information-based trade off between foreign direct investment and foreign portfolio investment." *Journal of International Economics*, 70, 271 – 295.

Gordon, Roger H and A Lans Bovenberg (1996), "Why is capital so immobile internationally? Possible explanations and implications for capital income taxation." *American Economic Review*, 86, 1057–75.

Harding, Torfinn and Beata S. Javorcik (2011), "Roll out the red carpet and they will come: Investment promotion and FDI inflows." *Economic Journal*, 121, 1445–1476.

Hau, Harald (2001a), "Geographic patterns of trading profitability in Xetra." *European Economic Review*, 45, 757–769.

Hau, Harald (2001b), "Location matters: An examination of trading profits." *Journal of Finance*, 56, 1959–1983.

Haufler, Andreas and Ferdinand Mittermaier (2011), "Unionisation triggers tax incentives to attract foreign direct investment." *Economic Journal*, 121, 793–818.

Head, Keith, John Ries, and Deborah Swenson (1995), "Agglomeration benefits and location choice: Evidence from Japanese manufacturing investments in the United States." *Journal of International Economics*, 38, 223–247.

Hernández, Leonardo, Pamela Mellado, and Rodrigo Valdés (2001), "Determinants of private capital flows in the 1970s and 1990s: Is there evidence of contagion?" Working Paper 01/64, International Monetary Fund, Washington, DC, URL `http://www.imf.org/`.

Huber, Peter J. (1967), "The behavior of maximum likelihood estimates under nonstandard conditions." in: Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability. Berkeley, CA: University of California Press, Vol. 1: 221233.

IMF (1991), "Determinants and systemic consequences of international capital flows: a study." Occasional Paper no. 77, International Monetary Fund, Research Department, Washington, DC, URL `http://www.imf.org/`.

Javorcik, Beata S. and Shang-Jin Wei (2009), "Corruption and cross-border investment in emerging markets: Firm-level evidence." *Journal of International Money and Finance*, 28, 605–624.

Jeanne, Olivier (2011), "Capital account policies and the real exchange rate." John Hopkins University, mimeo.

Jeanne, Olivier, Arvind Subramanian, and John Williamson (2012), *Who Needs to Open the Capital Account?* Peterson Institute for International Econometrics, Washingon, DC.

Kelejian, Harry H. and Ingmar R. Prucha (1999), "A generalized moments estimator for the autoregressive parameter in a spatial model." *International Economic Review*, 40, 509–33.

Kelejian, Harry H. and Ingmar R. Prucha (2007), "HAC estimation in a spatial framework." *Journal of Econo-*

metrics, 140, 131 – 154.
Kesternich, Iris and Monika Schnitzer (2010), "Who is afraid of political risk? Multinational firms and their choice of capital structure." *Journal of International Economics*, 82, 208 – 218.
Kinoshita, Yuko and Ashoka Mody (2001), "Private information for foreign investment in emerging economies." *Canadian Journal of Economics/Revue canadienne d'économique*, 34, 448–464.
Kiyota, Kozo and Shujiro Urata (2004), "Exchange rate, exchange rate volatility and foreign direct investment." *The World Economy*, 27, 1501–1536.
Lehmann, Alexander and Hyoung G. Kang (2004), "Multinational affiliates and local financial markets." Working Paper 04/107, International Monetary Fund, Washington, DC, URL `http://www.imf.org/`.
Lipsey, Robert E. (2002), "Home and host country effects of FDI." Working Paper No. 9293, National Bureau of Economics Research, Cambridge, MA.
Lucas Jr., Robert E. (1990), "Why doesn't capital flow from rich to poor countries?" *American Economic Review*, 80, 92–96.
Maddala, Gangadharrao Soundalyarao (1971), "The use of variance components models in pooling cross section and time series data." *Econometrica*, 39, 341–358.
Milesi-Ferretti, Gian Maria and Philip R. Lane (2004), "International investment patterns." IMF Working Papers 04/134, International Monetary Fund, URL `http://ideas.repec.org/p/imf/imfwpa/04-134.html`.
Mody, Ashoka, Efraim Sadka, and Assaf Razin (2003), "The role of information in driving FDI flows: Host-country transparency and source-country specialization." IMF Working Papers 03/148, International Monetary Fund.
Mody, Ashoka and Mark P. Taylor (2003), "International capital crunches: The time-varying role of informational asymmetries." Discussion Papers 3757, C.E.P.R. Discussion Papers.
Pagano, Marco, Ailsa A. Röell, and Josef Zechner (2002), "The geography of equity listing: Why do companies list abroad?" *The Journal of Finance*, 57, 2651–2694.
Pain, Nigel and Desirée van Welsum (2003), "Untying the Gordian Knot: The multiple links between exchange rates and foreign direct investment." *Journal of Common Market Studies*, 41, 823–846.
Papaioannou, Elias (2009), "What drives international financial flows? Politics, institutions and other determinants." *Journal of Development Economics*, 88, 269 – 281.
Pellechio, Anthony and John Cady (2006), "Differences in IMF data: Incidence and implications." *IMF Staff Papers*, 53, 326–349.
Portes, Richard and Hélène Rey (2005), "The determinants of cross-border equity flows." *Journal of International Economics*, 65, 269 – 296.
Portes, Richard, Helene Rey, and Yonghyup Oh (2001), "Information and capital flows: The determinants of transactions in financial assets." *European Economic Review*, 45, 783–796.
Razin, Assaf, Efraim Sadka, and Chi-Wa Yuen (1998), "A pecking order of capital inflows and international tax principles." *Journal of International Economics*, 44, 45–68.
Savastano, Miguel (2000), "Comment on Gosh and Wolf." in: Sebastian Edwards (ed.): *Capital Flows and the Emerging Economies: Theory and Evidence, and Controversies*, University of Chicago Press, 156-158.
Schmidt, Christian and Udo Broll (2009), "Real exchange-rate uncertainty and us foreign direct investment: an empirical analysis." *Review of World Economics*, 145, 513–530.
Scholes, Myron and Mark Wolfson (1990), "The effects of changes in tax law on corporate reorganization activity." *Journal of Business*, 63, S141–S164.
Silver, Mick (2010), "The wrongs and rights of unit value indices." *Review of Income and Wealth*, 56, S206–S223.
Stehrer, Robert and Julia Woerz (2009), "'Attract FDI!' - A universal golden rule? Empirical evidence for OECD and selected non-OECD countries." *European Journal of Development Research*, 21, 95–111.
Stiglitz, Joseph E and Andrew Weiss (1981), "Credit rationing in markets with imperfect information." *American Economic Review*, 71, 393–410.
Tesar, Linda L. and Ingrid M. Werner (1995), "Home bias and high turnover." *Journal of International Money and Finance*, 14, 467 – 492.
Vaizey, John (1964), "The residual factor and economic growth." Study Group in the Economics of Education,

Paris: OECD.
van Nieuwerburgh, Stijn and Laura Veldkamp (2009), "Information immobility and the home bias puzzle." *Journal of Finance*, 64(3), 1187–1215.
Wacker, Konstantin M. (2012), "Measurement and Determinants of Activities of Multinational Firms and Foreign Direct Investments." mimeo.
Wall, Melanie M. (2004), "A close look at the spatial structure implied by the CAR and SAR models." *Journal of Statistical Planning and Inference*, 121, 311–324.
Warnock, Francis E. (2002), "Home bias and high turnover reconsidered." *Journal of International Money and Finance*, 21, 795–805.
Wei, Shang-Jin (2000a), "How taxing is corruption on international investors?" *The Review of Economics and Statistics*, 82, 1–11.
Wei, Shang-Jin (2000b), "Local corruption and global capital flows." *Brookings Papers on Economic Activity*, 31, 303–354.
Wheeler, David and Ashoka Mody (1992), "International investment location decisions : The case of U.S. firms." *Journal of International Economics*, 33, 57–76.
White, Halbert (1980), "A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity." *Econometrica*, 48, 817830.
Yeaple, Stephen Ross (2003), "The complex integration strategies of multinationals and cross country dependencies in the structure of foreign direct investment." *Journal of International Economics*, 60, 293–314.