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The effect of the great recession on foreign direct investment: global empirical evidence with a gravity approach

Salvador Gil-Pareja^a, Rafael-Llorca Vivero^a and
Jordi Paniagua^{b,*}

^a*Universidad de Valencia, Departamento de Estructura Economica,
Valencia 46022, Spain*

^b*Universidad Católica de Valencia 'San Vicente Mártir', Facultad de Ciencias
Económicas y Empresariales, C/. Jorge Juan 18, Valencia 46004, Spain*

This article estimates the effect of the present global systemic banking crisis on foreign direct investment (FDI) using the gravity equation on a sample of 161 countries over the period 2003 to 2010. Systemic banking crises, through demand shocks and credit constraints, may impact FDI in two ways: aggregate monetary flows and individual projects count. Since gravity equations account for output variations, our research relies on the financial constraints channel. We find that the great recession, through credit constraints on home supply markets, has reduced the number of FDI projects, but not their size, forcing investors to become more selective on their international endeavours.

Keywords: foreign direct investment; great recession; systemic banking crises; gravity equation

JEL Classification: F20; F21; F23

I. Introduction

One of the first visible consequences of the great recession has been the deterioration of the surge of foreign direct investment (FDI) observed in past decades. Following data from the United Nations Conference on Trade and Development (UNCTAD, 2012), FDI inflows reached an unprecedented sudden stop in 2008 with a plunge of more than 13%. The annual FDI growth rate in the following years has not matched the double digit growths during the pre-crisis period. These facts have led economists to be interested on the

effect on FDI of the systemic banking crises after 2007 as well as the channels through which these effects are generated.

The aim of this article is to estimate the impact of the most recent banking crisis on FDI using a large sample of 161 countries over the period 2003 to 2010. We use the gravity equation as a natural way to control for variations on FDI as a result of gross domestic product (GDP) changes. In particular, we use dichotomist variables to capture the overall financial constraints faced by foreign investors. We find that the unprecedented number of systemic banking crises

*Corresponding author. E-mail: jordi.paniagua@ucv.es

since 2007 known as the great recession, through credit constraints on supply markets, has a significant negative impact on the investment decision, but not on the quantities invested.

The effect of financial and banking constraints on FDI¹ has caught the attention of a number of academic papers. For instance, Ma and Cheng (2005) conclude that foreign investment drops as a result of banking crises. More recent research by Milesi-Ferretti and Tille (2011) stresses the importance of domestic macroeconomic conditions and the connection between capital flows and world trade flows. Contessi and De Pace (2011) analyse the effects of the subprime crises in the inward FDI into the USA. In their research involving emerging markets, Cetorelli and Goldberg (2010) conclude that global banks catalysed the subprime crisis to less developed countries. Similar channels of financial constraints on FDI have been identified in western economies, such as Belgium and Germany (Düwel *et al.*, 2011; De Maeseeneire and Claeys, 2012).

Theoretically speaking, systemic banking crises may impact FDI through two channels. First, banking crises are commonly accompanied by demands shocks, such as the downturn of world's GDP, which is known to be highly correlated with FDI. Second, credit supply is an evident constraint on FDI. Firms aimed to prospect foreign markets face entry costs barriers in the form of fixed and information costs. Financing these sunk costs related to FDI is an arduous task for a number of reasons such as the lag between initial investments and production and sales or the complexity to forecast foreign revenues. Additionally, financial constraints may affect new endeavours of transnational companies as well as established subsidiaries.

Furthermore, banking crises may affect both the number of investments across borders and the amount invested. As a response to the credit or demand shortening, firms' responses can be either through the FDI's extensive margin, reducing the number of investments abroad, or through FDI's intensive margin, reducing the financial scale of the projects undertaken. For German companies, Buch *et al.* (2009) find that financial constraints appear to be decisive for the decision to engage in FDI, but less so for the aggregate magnitude of sales of foreign affiliates.

II. Data and Empirical Methodology

We are interested in estimating the effect of banking crises on bilateral FDI flows and project counts. To

this end, we estimate a conventional gravity model of FDI, which is widely used in empirical research on international economics. In particular, we estimate a nonlinear variant of the gravity equation in line with that proposed by Silva and Tenreyro (2006):

$$FDI_{ijt} = e^{\left(\begin{array}{l} \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln(D_{ij}) + \beta_4 lang_{ij} \\ + \beta_5 rel_{ij} + \beta_6 smctry_{ij} + \beta_7 locked_j + \beta_8 BIT_{ijt} + \beta_9 FTA_{ijt} + \beta_{10} CC_{ijt} \\ + \beta_{11} GR_{ijt} + \beta_{12} GR_{it} + \beta_{13} GR_{jt} + \lambda_i + \lambda_j + \gamma_t \end{array} \right)} + \varepsilon_{ijt} \quad (1)$$

where i and j denote FDI partners, t is time, and the variables are defined as follows: FDI_{ijt} is the aggregate investment between home country i and host j in year t ; GDP_{it} and GDP_{jt} are the GDPs of home and host countries, respectively; D_{ij} is the distance in kilometres between country capitals; col_{ij} (Colony) is set to one if the two countries have ever had a colonial link; $lang_{ij}$ (Common language) takes positive value if both countries share the same official language; rel_{ij} (Religion) is a composite index which measures the religious affinity between country pairs with values from zero to one; $smctry_{ij}$ (Same country) indicates if both countries were part of the same country in the past; $locked_j$ (Landlocked) is one if the host is a landlocked country and zero otherwise; BIT_{ijt} (Bilateral investment treaty) is a dummy that takes a value of one if the country pair has a bilateral investment treaty in force; FTA_{ijt} (Free trade agreement) is a dummy that indicates if both countries have a free trade agreement in force; CC_{ijt} (Common currency) is set to one if countries share a common currency or have a fixed exchange rate; and GR_t are dummy variables for systemic banking crises; additionally, we add fixed home and host country dummies (λ_i and λ_j); and fixed year dummies γ_t , lastly ε_{ijt} represent an stochastic error term.

Since the gravity equation is a natural way to control for the evolution of incomes in countries, the GR dummy variables will capture the impact of financial constraints on FDI. We use GR_{it} , for home country involved in the great recession and GR_{jt} for host countries. Additionally, we use GR_{ijt} when both home and host countries belong to the recession club. GR_{ijt} captures the effect of global banking crises on FDI among countries involved in a contemporaneous banking crisis whereas GR_{it} gives the impact of a crisis in home countries in host countries. With GR_{jt} we disentangle the effect of local credit constraints on international investment. The countries involved in the great recession can be found in Table 1.

¹ For a review on banking crises literature see Laeven (2011).

Table 1. Systemic banking crises

Country	Year	Country	Year	Country	Year
Austria	2008	Latvia	2008	UK	2007–2008
Belgium–Luxembourg	2008	Mongolia	2008–2009	USA	2007–2008
Denmark	2008–2009	Netherlands	2008	Kazakhstan	2008–2010
Germany	2008–2009	Nigeria	2009–2010	Ukraine	2008–2009
Greece	2008	Spain	2008–2010		

Source: Laeven and Valencia (2012)

Several control variables which capture bilateral investment costs have been taken from the CEPII (2011) database: distance, landlocked, common language, colony, same country and border. BIT has been manually constructed from the UNCTAD website. The source of FTA and common currency is Head *et al.* (2010). GDP in constant 2000 US dollars have been taken from the World Bank. Religion is calculated with data from CIA World Factbook according to the following formula for each country pair: $\%Christian_i * \%Christian_j + \%Muslim_i * \%Muslim_j + \%Buddhist_i * \%Buddhist_j + \%Hindu_i * \%Hindu_j + \%Jewish_i * \%Jewish_j$.

The FDI data set has been taken from the Financial Times Ltd. cross-border investment monitor (FDI Markets, 2011). Investment flows are measured in constant 2000 US dollars. The data set covers greenfield firm-level investments from 2003 to 2010, which are split into FDI flows between 161 host and 120 home countries. Overall, the database is heavily unbalanced with 8671 nonzero observations.

To hedge estimation bias due to zeros in the database, we follow Silva and Tenreyro (2006) and estimate FDI counts and flows with the poisson pseudo maximum likelihood (PPML) method. We run a robustness check using both poisson maximum likelihood country-pair (PML-CP) panel estimations and ordinary least squares (OLS). Additionally, we perform a robustness check using the two-stage estimation method proposed by Helpman *et al.* (2008, HMR hereafter) for the invested quantities. In order to capture the differences between FDI's margins, we follow Felbermayr and Kohler (2006) and estimate a second equation where we substitute the regressand for the individual investment project count between countries, N_{ijt} .

Furthermore, we perform a sensitivity analysis by using a different FDI data set. In particular, we also estimate the effect of the current recession on foreign direct re-investments. This data set consists of 1811 observations between 140 host and 56 home countries taken from Financial Times Ltd. cross-

border investment monitor (FDI Markets, 2011) during 2003–2010.

III. Results and Discussion

As shown in Table 2, the gravity equation performs well explaining around two-thirds of initial bilateral investment flows and project counts and half of the re-investments. The coefficients show, in general, the expected sign and are statistically significant. Focusing on the variables of interest in column 1, we realize that financial constraints concentrate on the decision to engage on new FDI, expressed through FDI's extensive margin. In particular when both countries are immersed in systemic banking crises, new projects are reduced by 30%, on average.² When only home countries suffer recession, this impact is reduced to 13%. We observe no significant effect of banking constraints in host countries. These results are robust using a fixed effects poisson panel, as shown in third column.³ The negative effect on third host countries is also significant with the lin-log OLS regression in column 2.

Our results in column 5 show that financial constraints have no significant effect on the monetary quantities invested. This result remains unchanged under the OLS regression in column 6, the fixed effects poisson panel in column 7 and HMR in column 8.

Re-investments of settled foreign firms in the last two columns of Table 2. show a similar pattern as greenfield. Re-investments are reduced by 31% on average when source countries encounter banking difficulties, while quantities remain unaffected. However, settled firms hedge financial difficulties when the host country suffers the great recession.

IV. Concluding Remarks

Banking crises may affect FDI through their impact on country incomes or through international financial

² This impact is calculated in the form $\exp(-0.310) - 1$

³ According to the Hasuman test, we can strongly reject a random effects panel model.

Table 2. Results

Regressand variable	[1] N_{ijt}	[2] N_{ijt}	[3] N_{ijt}	[4] N_{ijt}	[5] FDI_{ijt}	[6] $\ln(FDI_{ijt})$	[7] FDI_{ijt}	[8] $\ln(FDI_{ijt})$	[9] N_{ijt}	[10] FDI_{ijt}
GDP $\ln(Y_{it} \cdot Y_{jt})$	0.534** (0.21)	0.416** (0.14)	0.526*** {0.09}	0.380*** {0.01}	0.260 (0.07)	-0.001 (0.21)	0.167 (0.24)	0.270 (0.31)	-0.031 (0.05)	-0.121 (0.05)
Distance $\ln(D_{ij})$	-0.444*** (0.02)	-0.283*** (0.05)		-0.428*** {0.03}	-0.460*** (0.04)	-0.264*** (0.04)		-0.217* (0.15)	-0.390*** (0.04)	-0.376*** (0.07)
Common language $lang_{ij}$	0.464*** (0.05)	0.299*** (0.07)		0.313*** {0.01}	0.514*** (0.06)	0.362*** (0.06)		0.329** (0.14)	0.489*** (0.09)	0.325*** (0.14)
Colony col_{ij}	0.543*** (0.06)	0.477*** (0.11)		0.325*** {0.07}	0.488*** (0.06)	0.417*** (0.07)		0.827*** (0.27)	0.460*** (0.12)	0.5483*** (0.18)
Same country $smctry_{ij}$	0.003 (0.10)	0.039 (0.05)		0.190 {0.14}	0.118 (0.10)	0.347** (0.14)		0.396*** (0.13)	0.494** (0.21)	0.965*** (0.41)
Religion rel_{ij}	0.174 (0.09)	0.266*** (0.10)		-0.163** {0.07}	0.243* (0.14)	0.123 (0.10)		0.067 (0.13)	0.090 (0.14)	0.485** (0.20)
Host landlocked $locked_j$	-1.707*** (0.31)	0.437 (0.35)		0.104 {0.07}	1.991*** (0.33)	1.326*** (0.27)		1.148 (0.99)	2.987*** (0.96)	5.354*** (0.77)
Bilateral investment treaty BIT_{ijt}	-0.125*** (0.04)	-0.245*** (0.04)		0.031 {0.04}	-0.094 (0.05)	-0.141*** (0.05)		-0.052 (0.05)	-0.098* (0.06)	-0.114 (0.12)
Free trade agreement FTA_{ijt}	0.074** (0.07)	-0.030 (0.03)		0.103** {0.05}	-0.001 (0.06)	0.045 (0.06)		0.102 (0.07)	-0.004 (0.08)	-0.031 (0.14)
Common currency CC_{ijt}	-0.035 (0.04)	-0.320 (0.04)		-0.039 {0.04}	0.015 (0.04)	-0.020 (0.04)		-0.018 (0.04)	-0.605 (0.48)	-1.452*** (0.51)
GR in both GR_{ijt}	-0.310*** (0.16)	-0.13 (0.22)		-0.436*** {0.09}	0.088 (0.13)	0.165 (0.17)		0.048 (0.15)	-0.085 (0.41)	-0.191 (0.23)
GR in home GR_{it}	-0.138** (0.06)	-0.320*** (0.09)		-0.047 {0.04}	-0.049 (0.07)	-0.051 (0.08)		-0.094 (0.08)	-0.377*** (0.10)	0.145 (0.15)
GR in host GR_{jt}	-0.100 (0.07)	-0.120** (0.05)		-0.118** {0.05}	-0.073 (0.08)	0.044 (0.10)		0.077 (0.10)	-0.078 (0.28)	-0.028 (0.22)
Hausman test $\chi^2(14)$				63.96***						
Observations	33 520	32 033	20 121	32 033	30 577	8671	21 167	8671	7654	8126
R ²	0.64	0.13			0.63	0.36			0.45	0.56
Estimation	PPML	OLS	PML-CPFE	PML-CPRE	PPML	OLS	PML-CPFE	HMR	PPML	PPML
Fixed dummies	Country, year	Country, year	Year	Year	Country, year	Country, year	Year	Country, year	Country, year	Country, year
FDI type	Greenfield	Greenfield	Greenfield	Greenfield	Greenfield	Greenfield	Greenfield	Greenfield	Re-investment	Re-investment

Notes: Robust SEs in parentheses, and SEs in brackets. Only the second stage of HMR is shown. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

constraints. Our results show that the number of international investment projects are reduced through the financial constraint channel. Since systemic banking crisis have no significant impact on the amount invested by foreign firms, the observed reduction in the world's FDI quantities could be largely explained through the deterioration of the world's GDP.

Our empirical findings suggest that firms involved in international investments across borders become more selective on their endeavours during financial turmoil. We observe less greenfield FDI and re-investment projects with unchanged magnitudes. Additionally, we find that FDI hedges banking constraints of recipient countries. Therefore, policies aimed to restore FDI volumes on host markets should concentrate mainly on alleviating financial restraints on supply markets.

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