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Bilateral Foreign Direct Investments: Differential Effects of Tariffs in Source and Destination Countries *

By

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Abstract

We examine some of the important determinants of bilateral foreign direct investments (FDI) using Gravity analysis. We have bilateral FDI and bilateral average tariff data for 47 countries during the period 2001-2012. The main focus of the paper is bilateral tariffs in FDI-receiving (destination) and FDI-sending (source) countries. Theory suggests that while the former would encourage tariff-jumping inward FDI, the latter would discourage off-shoring and export-oriented outward FDI. Our empirically study — which uses pairwise, destination-time and origin-time fixed effects — confirms this theoretical expectations. The results hold under several robustness checks. We also find that the 2008 Financial Crisis have had a significant impact on the magnitude of the effects of bilateral tariffs.

Keywords: Tariff-Jumping FDI, Off-shoring, Export-Oriented FDI, Bilateral Tariffs, Gravity Model.
JEL Classifications: F14, F21.

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1 Introduction

There are many reasons why multinational corporations (MNCs) undertake cross-border investments or foreign direct investments (FDI).[1] Sometimes, instead of exporting from the home country to a foreign country, an MNC decides to relocate or open a plant in the foreign country to serve the market there. This can happen, *inter alia*, when the foreign country imposes barriers to imports there. In the literature this type of FDI is called *tariff-jumping FDI*. There is now a substantial theoretical and empirical literature which analyzes tariff-jumping FDI (see, for example, Bhagwati et al., 1992; Motta, 1992; Blonigen and Ohno, 1998; Blonigen, 2002; Barry et al., 2016). Here FDI is in response to tariffs in the destination or FDI-receiving country. The higher the tariffs are, *ceteris paribus*, the more would be such tariff-jumping inward FDI in the host country.

In some other instances, an MNC relocates in a foreign country not to serve the market there, but to export its outputs back to its home country. This type of off-shoring is often called *export-oriented or export-platform FDI* (see, for example, Lahiri and Ono, 2003; Kneller and Pisu, 2004; Ekholm et al., 2007; Ito, 2013). Home-country governments often try to discourage such off-shoring or outward, export-oriented FDI by imposing tariffs on imports. There is now a large theoretical and empirical literature to examine the role of trade policies in the source or FDI-sending country on the extent of export-oriented outward FDI (see, for example, Gao, 2007;

[1] Dunning (1977) was one of the early researchers to provide an eclectic framework in term of ownership, location and internalization – the so-called OLI approach to the analysis of foreign direct investments.

Ornelas and Turner, 2008; Diez, 2014; Hashimoto, 2015). Here, tariffs in the source or FDI-sending country attempt to discourage export-oriented outward FDI. The higher the tariffs are, *ceteris paribus*, the less would be such export-oriented outward FDI from the host country.

From the above discussions, it should be clear that while tariffs in the source country will have negative effect on export-oriented outward FDI, tariffs in the destination country will have the opposite effect on tariff-jumping inward FDI in the destination country. In this paper, we test these hypotheses simultaneously in a unified framework.

Since the dependent variable in our gravity model is bilateral FDI, each observation is an outward FDI for the source country and an inward FDI for the destination country, at the same time. Therefore, a gravity model is ideally suited to analyze the problem at hand, i.e., to test the two hypotheses simultaneously, and that is precisely what we do. To be specific, we include tariffs at the source country on imports from the destination country, and tariffs in the destination country on imports from the source country as two separate explanatory variables and expect the two coefficients to have opposite signs: negative and positive respectively. Note that these two tariff variables are time-dependent dyadic variables.

Our data on bilateral FDI are from the United Nations Conference on Trade and Development (UNCTAD), details of which will be provided later on in the paper. We include bilateral FDI between 47 countries for 12 years (2001-2012). Data on bilateral tariffs are from the World Bank, but we use UNCTAD data on bilateral

trade to disaggregate tariff data for the EU as a whole into average bilateral tariff rates for individual member countries.

The literature on gravity model for FDI is very limited. Anderson et al. (2016) has derived the theoretical underpinning for a gravity model of FDI and estimated such a model. They use common membership of trading block as a time-variant dyadic determinant of FDI, and, as we mentioned above, our focus is to examine the asymmetric effect of tariffs in source and destination countries on outward and inward FDI respectively. Diez (2014) carries out a similar analysis as ours, albeit not in a gravity framework. Moreover, he uses intra-firm import data of the U.S.A. from six of its trading countries and finds that US tariffs have the opposite effect on such imports than tariffs in its trading partners. In contrast, our analysis is more direct and uses a very different methodology.

2 Methodology and Data

2.1 Model Specification

We follow the recent literature on gravity analysis to estimate our model (see, for example, Anderson, 2011; Anderson and Van Wincoop, 2003; Anderson and Yotov, 2010; Anderson et al., 2016; Bergstrand et al., 2015; Yotov et al., 2016). These authors developed the econometric specification of these models from rigorous theoretical considerations, and these include the considerations of multilateral resistances and bilateral transaction costs.

Since our dependable variable – bilateral foreign direct capital – has many zero observations, it is known that the Poisson Pseudo-Maximum Likelihood (PPML) estimates give more robust results than traditional OLS estimates, and it also generates consistent estimates in the presence of heteroskedasticity (see, for example, Santos Silvia and Tenreyro, 2006).

The specification of our benchmark model is

$$\text{FDK}_{ij,t} = exp\big(\beta_0 + \beta_1\ \tau_{ij,t} + \beta_2\ \tau_{ji,t} + \beta_3\ \text{FDK}_{ij,t-1} + \eta_{i,t} + \theta_{j,t} + \phi_{ij} + \zeta_{ij,t}\big), \quad (1)$$

where $\text{FDK}_{ij,t}$ is the ratio of the stock of foreign capital from the source country i to the destination country j at time t, to the source country's GDP at time t. For many pairs and many time periods, the figures for the flow of FDI take negative values. By considering the stock of FDI, we avoid this problem of negative values of the dependent variable. It is to be noted that Anderson et al. (2016) also use FDI stock as their dependent variable. The error term is $\zeta_{ij,t}$, and $\eta_{i,t}$, $\theta_{j,t}$ and ϕ_{ij} are respectively the source-time, destination-time, and time-invariant pairwise fixed effects.

As we know, the source-time and destination-time fixed effects will take care of all country-specific, time-dependent variables, and the pairwise fixed effects will capture all time-independent, bilateral variables, like common language and distance (see, for example, Head and Mayer, 2014; Yotov et al., 2016). Therefore, spurious correlation arising from omitted variables is unlikely to occur (Baier and Bergstrand, 2007).

The two main variables of interest are $\tau_{ij,t}$ and $\tau_{ji,t}$ which are respective tariff

duty imposed by the destination country j at time t on imports from the source country i, and tariff duty imposed by the source country i at time t on imports from the destination country j. We also include the lagged dependent variable $\text{FDK}_{ij,t-1}$ since our dependent variable is a stock variable,

The coefficient β_1 captures the tariff-jumping effect on FDI and is expected to be positive, as explained in the introduction. Similarly, the coefficient β_2 represents the discouraging effect on export-oriented FDI and is expected to be negative. The coefficient of the lagged dependent variable is expected to be positive and less than one. The presence of lagged dependent variable implies that we shall need to distinguish between short-run and long-run effect of tariffs.

Since the year of a major financial crisis – 2008 – is a part of our sample, we shall also extend the benchmark model (1) to include interactions of the tariff variables with a variable we call CRISIS which takes the value 1 when t is equal to either 2008 or 2009, and 0 otherwise.

$$\begin{aligned} \text{FDK}_{ij,t} &= exp\big(\beta_0 + \beta_1\ \tau_{ij,t} + \beta_2\ \tau_{ji,t} + \beta_3\ \text{FDK}_{ij,t-1} + \beta_4\ \text{CRISIS}_t * \tau_{ij,t} \\ &\quad + \beta_5\ \text{CRISIS}_t * \tau_{ji,t} + \eta_{i,t} + \theta_{j,t} + \phi_{ij} + \zeta_{ij,t}\big). \end{aligned} \tag{2}$$

We do not include the variable CRISIS on its own as it will be absorbed by the fixed effects. We might expect a dampening of the effects of the crisis on the impact of tariffs on FDI. Therefore, we shall expect β_4 to be negative and β_5 to be positive.

2.2 Data Sources

We obtain data on our dependent variable, bilateral foreign capital stock from the United Nations Conference on Trade and Development (UNCTAD) Bilateral FDI Statistics database,[2] In particular, to ensure consistency and maximum coverage, we use FDI inward stock (positions) data. We specifically excluded some countries or territories from our sample due to our concerns about the quality of their data, the motivation behind those FDI activities, and more importantly, due to many missing observations during the sample period. At the end, there are 47 countries,[3] 2162 (47×46) different country pairs,[4] and 12 years (2001-2012) data in our study. That is, we have 25,944 (2162×12) observations in our data set. Data on national annual GDP are from the Centre d'tudes Prospectives et d'Informations Internationales (CEPII) Gravity Model database.[5]

We assemble data on bilateral weighted average tariff rates from four different sources. The main source of it is the World Bank WITS database. The WITS database contains bilateral aggregated trade and tariff data. However, the WITS database only includes the weighted average tariff rates data for non-European Union (EU) member nations and treats the EU as one nation. Although the EU has a common external tariff (CET) policy, the CETs vary across goods, and the member countries of the EU have very different trading patters with the rest of the world.

[2]http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx (last accessed on 7 November, 2020)

[3]The list of countries is given in Table A1 in the Appendix.

[4]Excluding domestic investments ($i = j$).

[5]http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp (last accessed on 8 November, 2020).

Therefore, each member state faces different average tariff rates with countries outside the EU. To get the weighted average bilateral tariff rates separately for all EU member nations, we calculate it by matching the European Union member nations annual bilateral trade data from the UNCTAD Commodity Trade Statistics Database with the EU tariff line duties from the World Trade Organization Tariff Analysis Online (TAO) database, based on Harmonized System six-digit code system (HS6 system).[6] We first calculate the tariff paid by each pair of nations based on the HS6 system for each year, then sum them up and divided it by the total trade value of the trading pair in the same year in order to get the weighted average tariff rate. We repeat the process for all the European Union member nations in our dataset.

2.3 Data Description

We have summarized the key variables in three separate tables. Table 1 is the summary values of bilateral FDI stock data from 2001 to 2012. We see that during 2001-2012 period, the average value increased almost three times, from $1.859 billion US dollars in 2001 to $5.419 billion US dollars in 2012. However, there is a slight decrease in 2008. This must be caused by the 2008 Financial Crisis. Since this is a stock variable, the drop is only modest. Another interesting point to note is that, with time, the standard deviation has gone up, but the value of the coefficient of variation (standard deviation over mean) has gone down.

Inset Table 1 here

[6] https://tao.wto.org/ (last accessed on 8 November, 2020).

Table 2 presents the average figures of our dependent variable – FDI stock to GDP ratio —from 2001 to 2012. We note that although FDI stock has gone up almost three-fold during this period, the FDI stock to GDP ratio has more or less remained stable at 0.01 which is 1% in percentage terms.

Inset Table 2 here

Table 3 shows data description of bilateral weighted average tariff rates from 2001 to 2012. The data show that during the sample period, the average bilateral weighted average tariff rate steadily decreased from 5.9% in 2001 to 3.56% in 2012.

Inset Table 3 here

3 Results

3.1 The Benchmark model

We first estimate equations (1) and (2) by using PPML method. Table 4 presents the results. Columns 1 and 2 give the results for equation (1), and column (3) that for equation (2). In column 1, we use the full sample of observations, but in column 2, we use two-year interval data, i.e., data for every other year.[7] As can be seen,

[7]Given that the adjustment of FDI stock in response to changes in other covariates takes time, Cheng and Hall (2005) suggested using intervals data instead of continuous panel data. In gravity analysis, it is very common to work with interval data (see, for example, Anderson et al., 2016; Baier and Bergstrand, 2007).

the coefficients are of the expected signs. Tariff in the destination country has a positive effect on tariff-jumping FDI, and that in the source country has a negative discouraging effect on off-shoring or export-oriented of FDI. The magnitude of these effects were dampened during the financial crisis years of 2008 and 2009. The results are robust when we use a two-year interval data (column 2).

Inset Table 4 here

In terms of the magnitude of the coefficients, since we have a lagged endogenous variable as a regression, we need to distinguish between short-run and long-run effects. Also, since we are estimating a non-linear regression, we first of all need to calculated the marginal coefficients. For column 1 in Table 4, the marginal coefficients of $\tau_{ij,t}$ and $\tau_{ji,t}$ are calculated to be 0.0000177 and -0.0000104 respectively. Therefore, if we have 1% increase in tariffs, it will increase tariff-jumping FDI stock to GDP ratio from 1% to 1.00177% in the short run. Similarly, a 1% increase in tariffs will reduce off-shoring by 0.00104 percentage points in the short run. The long-run marginal effects will be marginally higher at 0.0000178 and -0.00001045 respectively.[8]

3.2 Robustness Check

We shall now carry out a few robustness checks. We have already seen from column 2 of Table 4 that our results are robust to two-year interval data. However, one

[8] From (1), we find $d\text{FDK}/d\tau_{ij,t} = e^{\{\cdot\}}\beta_1 = \text{FDK}\ \beta_1$ and $d\text{FDK}/d\tau_{ji,t} = e^{\{\cdot\}}\beta_2 = \text{FDK}\ \beta_2$, in the short run. In the long run, $d\text{FDK}/d\tau_{ij,t} = \text{FDK}\ \beta_1/(1 - \text{FDK}\beta_3)$ and $d\text{FDK}/d\tau_{ji,t} = \text{FDK}\ \beta_2/(1 - \text{FDK}\beta_3)$.

can claim that tariffs are endogenous and they can be responsive to changes to FDI. For example, FDI can take place to preempt imposition of tariffs, the so-called *quid pro quo* FDI (see, for example, Bhagwati et al., 1992). Endogeneity can also occur because the weights in calculating average tariff rates are imports shares, and these can be affected by FDI.

We use one-year lag of the tariffs, $\tau_{ij,t-1}$ and $\tau_{ji,t-1}$,to deal with this issue. Also note that endogeneity coming from unobserved heterogeneity, for example, in the form of omitted variables, is unlikely as we have included origin-time, destination-time and pairwise fixed effects. The results are presented in Table 5, and they are qualitatively the same as those in Table 4.

Inset Table 5 here

Our next robustness check is on the heterogeneity of the effects of the tariffs. In particular, we want to see if the magnitude of the tariff-jumping effect depends on the size of the destination country. We do so by introducing the interaction term Size$\times\tau_{ij,t}$, and define Size as a dummy variable which takes the value 1 if the destination country is large in terms of the level of GDP, and 0 otherwise. In particular, we take the top twenty countries in terms the size of their GDP as large countries. These countries are listed Table A2 in the appendix. Note that the coefficient of Size on its own cannot be identified because of the presence of pairwise fixed effects.

The results are presented in Table 6. Interestingly, we find that the tariff-jumping effect is significant for the big destination countries, but not in the small ones. Per-

haps, the existence of increasing returns (fixed costs) in FDI explain this result. The other results are qualitatively the same as in Table 4.

Inset Table 6 here

Our final robustness check is about possible outliers. Although most observations – 23782 of them — for our dependent variables have values less than 2, there are 23 observation that are more than 2 and the highest one being 4.54. We rerun the regressions in Table 4 after omitting these 23 observations. The results are presented in Table 7. Once again, the results are qualitatively similar to those in Table 4.

4 Conclusion

In this paper, we analyzed a unique and rich data set which has not been explored much in the literature. This is the United National Conference on Trade and Development (UNCTAD) dataset on *bilateral* Foreign Direct Investments (FDI). The nice property of bilateral data on FDI is that one get data on both inward and outward FDI simultaneously.

We use this dataset to examine two properties of FDI – one of inward FDI and one of outward FDI – in one unified framework of analysis. We use up-to-date developments in gravity analysis which is normally used to explain bilateral trade in goods, to analyze bilateral FDI.

Many governments try policies aimed at encouraging inward FDI and at discour-

aging off-shoring which can be export-oriented FDI in other countries. A tariff in the destination country is supposed to encourage tariff-jumping inward FDI, and that in the source country is supposed to discourage off-shoring or export-oriented FDI.

Our dataset on bilateral FDI and the adopted method of analysis, viz., gravity analysis, is ideally suited to test both the above hypothesis. Our empirical analysis finds robust support for both hypotheses. We also find the existence of some heterogeneity in the tariff-jumping results: it hold more for countries with high GDP than for the ones with low GDP.

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Table 1: FDI Stock (Millions of US $)

Year	Min	Max	Mean	Std. Dev.	Obs.
2001	0	198656.9	1859.69	11439.48	2162
2002	0	211699	2103.18	11766.12	2162
2003	0	232924.9	2602.35	13498.59	2162
2004	0	267209	3041.76	15255.87	2162
2005	0	371350	3132.82	16529.75	2162
2006	0	414629	3775.12	19397.70	2162
2007	0	405543	4626.59	21544.12	2162
2008	0	447529	4351.20	20434.09	2162
2009	0	414590	4823.60	21409.36	2162
2010	0	387163	5062.23	22380.14	2162
2011	0	461701	5194.06	23761.54	2162
2012	0	486833	5419.80	25544.52	2162

Table 2: FDI Stock to GDP Ratio

Year	Min	Max	Mean	Std. Dev.	Obs.
2001	0	4.54	0.007	0.111	2162
2002	0	4.18	0.007	0.100	2162
2003	0	3.75	0.008	0.098	2162
2004	0	3.40	0.009	0.098	2162
2005	0	2.15	0.009	0.084	2162
2006	0	2.13	0.010	0.091	2162
2007	0	2.51	0.012	0.109	2162
2008	0	2.37	0.011	0.104	2162
2009	0	2.77	0.014	0.129	2162
2010	0	3.23	0.014	0.137	2162
2011	0	3.27	0.013	0.127	2162
2012	0	3.59	0.013	0.132	2162

Table 3: Bilateral Tariff (in %)

Year	Min	Max	Mean	Std. Dev.	Obs.
2001	0	158.74	5.90	9.04	2162
2002	0	113.12	5.36	7.24	2162
2003	0	82.05	5.31	6.71	2162
2004	0	197.27	4.97	8.37	2162
2005	0	192.09	4.45	7.12	2162
2006	0	226.48	4.29	8.73	2162
2007	0	202.59	4.17	7.88	2162
2008	0	202.57	3.78	7.06	2162
2009	0	209.30	3.90	7.25	2162
2010	0	123.07	3.80	5.96	2162
2011	0	188.08	3.64	6.46	2162
2012	0	236.52	3.56	7.35	2162

Table 4: Benchmark PPML Regressions

$FDK_{ij,t}$	(1)	(2)	(3)
$\tau_{ij,t}$	0.00177*	0.00185**	0.00211*
	(0.08)	(0.05)	(0.07)
$\tau_{ji,t}$	-0.00104*	-0.00124*	-0.00124**
	(0.08)	(0.08)	(0.02)
$FDK_{ij,t-1}$	0.46219***	0.39818***	0.46221***
	(0.00)	(0.00)	(0.00)
$CRISIS * \tau_{ij,t}$			-0.00161**
			(0.05)
$CRISIS * \tau_{ji,t}$			0.00103**
			(0.02)
Observations	23,782	10,810	23,782
R-squared	0.98950	0.99043	0.98951
Origin-Time FE	YES	YES	YES
Destination-Time FE	YES	YES	YES
Pairwise FE	YES	YES	YES

p-value in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: PPML Regressions with Lagged Tariffs

	(1)
$FDK_{ij,t}$	
$\tau_{ij,t-1}$	0.00152*
	(0.10)
$\tau_{ji,t-1}$	-0.00104*
	(0.08)
$FDK_{ij,t-1}$	0.46235***
	(0.00)
$CRISIS * \tau_{ij,t-1}$	-0.00164**
	(0.04)
$CRISIS * \tau_{ji,t-1}$	0.00096***
	(0.01)
Observations	23,782
R-squared	0.98951
Origin-Time FE	YES
Destination-Time FE	YES
Pairwise FE	YES

p-value in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Heterogeneity in Tariff-Jumping Effect

$FDK_{ij,t}$	(1)	(2)
$\tau_{ij,t}$	0.00043	0.00076
	(0.39)	(0.24)
$\tau_{ji,t}$	-0.00103*	-0.00123**
	(0.08)	(0.02)
$FDK_{ij,t-1}$	0.46159***	0.46161***
	(0.00)	(0.00)
$SIZE * \tau_{ij,t}$	0.00360**	0.00361*
	(0.05)	(0.07)
$CRISIS * \tau_{ij,t}$		-0.00163*
		(0.07)
$CRISIS * \tau_{ji,t}$		0.00103**
		(0.02)
Observations	23,782	23,782
R-squared	0.98951	0.98952
Origin-Time FE	YES	YES
Destination-Time FE	YES	YES
Pairwise FE	YES	YES

p-value in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Regression without Outliers (FDK>2)

$FDK_{ij,t}$	(1)	(2)
$\tau_{ij,t}$	0.00169*	0.00195*
	(0.09)	(0.09)
$\tau_{ji,t}$	-0.00101*	-0.00120**
	(0.08)	(0.03)
$FDK_{ij,t-1}$	0.63668***	0.63653***
	(0.00)	(0.00)
$CRISIS * \tau_{ij,t}$		-0.00124*
		(0.07)
$CRISIS * \tau_{ji,t}$		0.00100***
		(0.01)
Observations	23,759	23,759
R-squared	0.9784	0.9784
Origin-Time FE	YES	YES
Destination-Time FE	YES	YES
Pairwise FE	YES	YES

p-value in parentheses

*** p<0.01, ** p<0.05, * p<0.1

APPENDIX

Table A1: List of FDI Source and Destination Countries

Argentina	Luxembourg
Australia	Malaysia
Austria	Mexico
Belgium	Netherlands
Brazil	New Zealand
Canada	Norway
Chile	Philippines
China	Poland
Colombia	Portugal
Denmark	Qatar
Egypt	Romania
Finland	Saudi Arabia
France	Singapore
Germany	Slovenia
Greece	South Africa
Hungary	Spain
Iceland	Sweden
India	Switzerland
Indonesia	Thailand
Ireland	Turkey
Israel	UK
Italy	USA
Japan	Vietnam
Korea	

APPENDIX

Table A2: List of World Bank Top 20 GDP Ranking Nations

Ranking	Economy
1	United States
2	China
3	Japan
4	Germany
5	United Kingdom
6	France
7	India
8	Italy
9	Brazil
10	Canada
11	Russian Federation
12	Korea
13	Australia
14	Spain
15	Mexico
16	Indonesia
17	Netherlands
18	Saudi Arabia
19	Turkey
20	Switzerland