FOREIGN DIRECT INVESTMENT AND PSYCHIC DISTANCE: 
A GRAVITY MODEL APPROACH

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1. Introduction

In last decades the internationalization and globalization process has been studied from different perspectives. Different analyses, at both macroeconomic and microeconomic levels, allowed to highlight the interconnection between economic areas or to understand the mechanism that drives trade flows, foreign direct investments, technology transfer and so on. Economists, econometricians and statisticians have proposed theories and models in order to interpret these phenomena, among these the gravity model is an interesting one.

In empirical studies, the gravity model has been widely used in the analysis of trade flows between countries. This model takes into account macroeconomic variables and the distance between countries.

Initially the distance had only a geographical connotation as a proxy for transport costs. Afterwards, the meaning of “distance” has been extended considering also psychological and cultural factors, which could be an obstacle to the information flows between markets. Such dimension is called “psychic distance”.

In most of the studies the psychic distance has been measured through a composite index (Kogut and Singh, 1988), that combines the Hofstede's cultural indicators (Hofstede, 1980). Taking into account only the cultural dimension, this approach seems to be limited (Dow, 2000). Recently the psychic distance has been broadened by other dimensions.

In this work we analyse FDI flows through a gravity equation, considering the effect of some variables that influence psychic distance.

After an introduction on the application of the gravity model in economics in section 2, we provide a brief description of the concept of the psychic distance and its role in a gravity equation in section 3. In section 4 we present the research questions and the variables considered in our application. In the last section we present results and discussion.
2. The gravity model

A domestic firm that plans to open a business in a foreign country has to take into account both opportunities and risks arising from this venture. In other words, the decision that firm makes can be viewed as the result of attraction and repulsion forces. The dimension of the economy of a foreign country, for instance, might be viewed as an attraction force as it represents the opportunity, for the firm, of a new end market, while the distance from the foreign market might be viewed as a force in opposite direction because it entails growing transport costs.

Broadening the perspective from a micro to a macroeconomic level, it has been empirically observed that the volume of trade between two countries is proportional to the size of their economies and inversely proportional to their distance (Krugman and Obstfeld, 2009). Generally, the higher is the Gross Domestic Product (GDP), the higher are the trade flows; contrariwise, the higher is the distance and thus the transport costs, the smaller are the trade flows. So, distance seems to have a negative impact on trade flows. These empirical observations have been translated into a formal model by mimicking an astronomical law: the Newton's law of universal gravitation which states that two bodies in the universe attract each other with a force following the relation:

\[ F_{1,2} = G \frac{M_1 M_2}{D_{1,2}^2} \]  

where \( F_{1,2} \) is the attraction force between two astronomical bodies, \( M_1 \) and \( M_2 \) are their masses, \( D_{1,2} \) is the distance between the centre of masses and \( G \) is the gravitational constant.

In this paper we study foreign direct investments considering a model derived from (1). More specifically we consider the following gravity model:

\[ Y_{i,j} = \beta_0 X_i^{\beta_1} X_j^{\beta_2} D_{ij}^{-\beta_3} \]

where \( Y_{i,j} \) is the volume of FDI from origin country \( i \) to the destination country \( j \), \( X_i \) and \( X_j \) are the size of the economy of the two countries and \( D_{ij} \) is the distance between the two countries. Applying a logarithmic transformation, the model assumes the following additive form

\[ \log Y_{ij} = \log \beta_0 + \beta_1 \log X_i + \beta_2 \log X_j + \beta_3 \log D_{ij} \]
This transformation enables us to estimate easily the parameters of the linear model using for instance OLS estimators.

The gravity model has been introduced by Tinbergen (1962) at the beginning of the sixties, but only at the end of the seventies, with the contribution of Anderson (1979), it reached a first theoretical formalization. For a long time, indeed, the gravity model has been considered able to capture the empirical regularities, but without a consolidated theoretical basis.

The model (3) is the simplest one and we have to define more specifically the independent variables, in particular the distance that might be considered not only in a geometrical strictly sense (think to a geographical distance between two countries) but we might enrich this idea by considering several other dimensions such as psychological and cultural ones, each of which need an adequate operationalization.

3. The Psychic distance

In the previous section we have pointed out that the gravity models, at the beginning, have been used to model trade flows. For this reason the distance variable initially was essentially the geographical distance between the two countries involved in the bilateral trade, viewed as a proxy of the transport costs. Afterwards the meaning of the distance has become a multidimensional construct of which the geographical is only one of its dimensions.

By analogy in the decision to invest in a foreign country an investor takes into account some costs: the transport cost is as much important as the information related transaction costs for which the psychic distance is an interesting proxy. So cultural and psychological variables could drive the firm to select the end market (Beckerman, 1956, Johanson and Vahlne, 1977).

The concept of psychic distance, introduced by Beckerman (1956), has been afterwards developed by scholars at the University of Uppsala in the seventies (Johanson and Wiedersheim-Paul, 1975, Johanson and Vahlne 1977, Vahlne and Wiedersheim-Paul, 1977). In particular, Johanson (1977) defined it as: “... the sum of factors preventing the flow of information from and to the market. Examples are differences in language, education, business practices, culture, and industrial development.”

Among all, we remind the use of the Hofstede's cultural dimensions (Hofstede, 1980) or the Sethi's market similarity factors (Sethi, 1971). Nevertheless according to Dow (2000), these approaches do not measure the entire construct of psychic distance because they lack some of its components.
Another empirical approach has faced the problem of the measure of the psychic distance by asking key informants to estimate it using a Likert Scale (Nordstrom, 1991, Vahlne and Nordstrom, 1992).

4. Method

4.1. Hypotheses

Taking cue from Dow and Karunaratna (2006) and Dow and Ferencikova (2010), that embed what they called “psychic distance stimuli” into a gravity model, we consider this framework to modelize the FDI flows between couples of countries. The psychic distance perceived by a decision-maker is influenced by several stimuli that should influence the individual and collective perception of it and that are measured using several macro-level variables representatives of differences in language, education, religion, industrial development and political system, as well as the difference in the Hofstede's cultural dimensions and in time zones. For convenience, hereafter we will use “psychic distance” or “psychic distance stimuli” indifferently.

Unlike Dow and Ferencikova (2010) which tested psychic distance influence on market selection prediction, entry mode choice and performance, we consider the gravity model to identify the variables that impact on the level of FDI between couples of countries.

In this work we want to verify the following hypothesis:

H1. The greater the GDPs of the countries between which there is an investment the greater the FDI;
H2. The greater the geographical distance the lower the FDI;
H3. The greater the psychic distance the lower the FDI.

4.2. Variables and sample

To verify the hypotheses H1-H3 we considered the model (2) in which the dependent variable is the average of the yearly investment of the country \(i\) in the country \(j\) in the period 2007-2011. We denote this variable by \(FDI_{ij}\).

As far as the independent variables are concerned, in addition to the base-gravity model variables we embed those representing additional barriers or facilitations to the information flows.

To be more precise the economic size of each country is captured by the average GDP from 2007 to 2011 and the psychic distance is captured following Dow and Karunaratna (2006), although some indicators have been recalculated or
replaced by new ones. Specifically, the indicators concerning language (Lang) and religion (Relig) are the same made available by Dow and Karunaratna (2006) (see Dow and Karunaratna (2006) and details therein).

Other indicators considered by Dow and Karunaratna (2006), for the operationalization of the psychic distance, may change over time, especially in developing countries\(^1\). For this reason we updated the variables differences in political system (Pol) and in ideology (Soc), while we replaced the variable that measures the difference in industrialization with the difference in *Competitive Industrial Performance Index*\(^2\) (CIP).

As Hofstede's cultural dimension (Hof) are expected to change over time (Taras *et al.*, 2012) so we used its latest version (Hofstede *et al.*, 2010). A composite index was calculated through an improved version of Kogut and Singh's measure proposed by Kandogan (2012) that takes into account the correlations between the cultural dimensions.

As in Dow and Karunaratna (2006), the difference in time zones (DTZ) is measured by the residuals of a linear regression between differences in time zones and geographical distances, in order to remove the dependence of the first variable upon the second.

In our analysis we consider 54 countries\(^3\) overall, half of which are OECD members. The empirical analysis has been restricted to this subset of countries due to data availability on psychic distance stimuli from Dow and Karunaratna (2006). Furthermore, the dependent variable of the model has been extracted from the OECD database, which includes only outward FDI relative to member countries towards partners, whether OECD members or not. Thus, it is not possible to use symmetrically all the feasible country pairs.

The final sample size is 670 observations as we have had to remove some records with null or negative values to avoid undefined logarithms.

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\(^1\) For instance, approximately 25 years ago the literacy rate of Turkey was 75.97% and 90.82% in 2009 http://www.quandl.com/society/adult-literacy-rate-all-countries

\(^2\) CIP is provided by UNIDO (http://www.unido.org).

\(^3\) Australia, Bangladesh, Austria, Brasile, Belgio, Cina, Svizzera, Costa Rica, Cile, Ecuador, Spagna, Guatemala, Estonia, Croazia, Finlandia, Indonesia, Francia, India, Grecia, Iran, Ungheria, Lituania, Irlanda, Lettonia, Israele, Marocco, Italia, Malesia, Giappone, Pakistan, Lussemburgo, Panama, Messico, Filippine, Norvegia, Singapore, Nuova Zelanda, El Salvador, Polonia, Suriname, Portogallo, Thailandia, Slovacchia, Vietnam, Slovenia, Russia, Svezia, Venezuela, Turchia, Colombia, Stati Uniti, Perù, Trinidad and Tobago.
5. Results and discussion

The gravity model we use is the multiple linear regression in equation (4)

\[
\log FDI_{i,j} = \log \beta_0 + \beta_1 \log GDP_i + \beta_2 \log GDP_j + \beta_3 \log D_{i,j} + \beta_4 \text{Lang}_{i,j} + \beta_5 \text{Relig}_{i,j} + \beta_6 \text{Edu}_{i,j} + \beta_7 \text{Pol}_{i,j} + \beta_8 \text{Soc}_{i,j} + \beta_9 \text{Hof}_{i,j} + \beta_{10} \text{DTZ}_{i,j} + \epsilon_{i,j},
\]

(4)

The \( \beta \) coefficients are estimated through the weighted least squares method (WLS) in order to overcome heteroskedasticity. Table (1) summarize the results.

Table 1 – Gravity model summary.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>Std. Error</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnGDPi</td>
<td>0.813</td>
<td>0.063</td>
<td>***</td>
</tr>
<tr>
<td>lnGDPj</td>
<td>0.979</td>
<td>0.059</td>
<td>***</td>
</tr>
<tr>
<td>lnDist</td>
<td>-0.708</td>
<td>0.061</td>
<td>***</td>
</tr>
<tr>
<td>Lang</td>
<td>-0.531</td>
<td>0.061</td>
<td>***</td>
</tr>
<tr>
<td>Relig</td>
<td>-0.249</td>
<td>0.076</td>
<td>**</td>
</tr>
<tr>
<td>Edu</td>
<td>-0.030</td>
<td>0.008</td>
<td>***</td>
</tr>
<tr>
<td>CIP</td>
<td>2.106</td>
<td>0.537</td>
<td>***</td>
</tr>
<tr>
<td>Pol</td>
<td>-0.071</td>
<td>0.117</td>
<td>***</td>
</tr>
<tr>
<td>Soc</td>
<td>-0.009</td>
<td>0.047</td>
<td>***</td>
</tr>
<tr>
<td>Hof</td>
<td>-0.001</td>
<td>0.097</td>
<td>***</td>
</tr>
<tr>
<td>DTZ</td>
<td>0.001</td>
<td>0.045</td>
<td>***</td>
</tr>
<tr>
<td>Constant</td>
<td>-38.084</td>
<td>2.010</td>
<td>***</td>
</tr>
</tbody>
</table>

Observations 757  R2 0.546  Adj. R2 0.539  Resid. Std. Error 181.3 (df=745)  F Statistic 81.463 (df=11; 745) ***

Signif.codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '..' 0.1 ' ' 1

Note: WLS estimators

The coefficients related to the variables Pol and Soc result not statistically significant. This means that differences in political system and ideological leanings doesn’t seem to have an influence on FDI in our sample. Similarly, differences in Hofstede’s cultural index (Hof) and in time zones (DTZ) are not statistically significant.

The adjusted \( R^2 \) is 0.539. A D’agostino \( K^2 \) normality test leads to accept the hypothesis of gaussianity of the residuals distribution (p-value 0.95). Collinearity between regressors seems to be absent (variance inflation factors <5).

Hypothesis H.1 is confirmed. Thus, the size of the economy of both countries has a positive effect on the volume of FDI, as expected in a gravity model.
With respect to the hypothesis H.2, as it happens for trade flows, a negative linear effect is present.

Differences in language (Lang), religion (Relig) and education (Edu) have a negative coefficient as expected. The effect of differences in political system and ideology is not statistically significant, as well as the effect of time zones (DTZ). The non-significance of the cultural differences (Hof) is relevant, since the Hofstede's index is widely used in literature on internationalization. Note that the same results was obtained by Dow and Ferencikova (2010) for the inward FDI market selection prediction, entry mode choice and performance into Slovakia and in Dow and Karunaratna (2006) in a gravity model for trade flows.

In conclusion, the FDI flows between countries are adequately explained by the model here presented, however, further investigation is needed to take into account the different strategies followed by the FDI (horizontal, vertical or conglomerate), and how they are shared among the different countries.

Riferimenti bibliografici


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SUMMARY

Foreign Direct Investment and Psychic Distance: a Gravity Model Approach

The study of the foreign direct investments (FDI) has, in last decades, captured the interest of several scholars that study, on one hand which variables are crucial in the FDI choices, on the other hand the impact of some variables on the level of FDI between two countries. In this paper we present an empirical analysis, by means of the gravity model, to test the relationship between FDI, GDP, geographical and psychic distance. This distance may be interpreted as an obstacle to the knowledge of foreign markets. In literature, yet few works have explored the effect of psychic distance on FDI, focusing mostly on market selection, entry mode and performance prediction. Furthermore, the use of the Hofstede's index, often used as proxy of psychic distance, it has been shown to be inadequate. To overcome this limit we consider in our application the multidimensionality of the psychic distance by using several variables.

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