

Crossing borders: exploring the relationships between different modes of international provision of services

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Abstract

Services are at the heart of world economic integration. The different modes through which they cross national borders play an active role in this course of action. However the knowledge on how these different modes act, and interact, is far from complete. Empirical evidence shows that international trade and service FDI seem to play on different levels within the internationalisation process. This could be explained by the complementarity or substitution effects occurring between these two internationalisation ways. The present paper focus on possible relations between Mode 1 and Mode 3 of cross boarder supply of services, by drawing a research line based on different estimation techniques of simultaneous equations models built on the basis of the gravity equation. Bilateral services relations between 65 countries during the period 2000-2007 are therefore studied. Results reinforce the complementary hypothesis between the two modes beyond the existence of substitution effects.

Key words

Services, internationalisation, modes of international supply, international trade, FDI, complementarity, substitution

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1. Introduction

The process of globalisation has been one of the most important economic issues of the last 20 years. Within this framework, the tertiary sector played, and is still playing, a major role. Service activities head toward increasing internationalisation patterns: services, providers and clients are increasingly crossing national frontiers while business and consumption habits evolve at a fast rate. Services passed from being considered mainly local activities provided by local suppliers to global products created and sold all over the world. The export of services grew at the yearly average rate of 9 per cent since 1990. Even the composition of the exported services experimented important changes. At the beginning of the nineties, travel and transport services represented two thirds of the total world export of services. Nowadays they sum only one third of the total while activities such computer services consulting or distributive trade are gaining importance in the world market.

At the same time, the speed at which capitals cross national borders to face the challenge of new markets quickly increased. Sectors that until recently seemed to be an exclusive field of national company, and in many cases state-owned ones, are now open to the entrance of foreign capital and corporations. The evolution of the telecommunication sector is a good example of this kind of transformation. The large majority of foreign direct investments (FDI) are related with service activities. For example, according to Eurostat, in 2006 services accounted for more than 77 per cent of the total direct investment of the European Union.

Furthermore it has to be taken into account that services represent more than 70 per cent of GDP and employment in developed countries. Therefore it results clear how important and crucial is the process of globalisation experimented by the sector when attempting to understand the possible development of world economy and employment. Unquestionably, the comprehension of mechanism behind this process represents a central challenge for stakeholders and policymakers. The recent growth of service offshoring has created a new hot topic in policy agendas leading to discussion on the limits and challenges of international trade and investment in services.

The 70% of service economy contrast with the around 20% of service in total international trade. This paradox is explained by many reasons: strong wrights and growth of goods trade (while similar growth rates were experienced by both manufacturing and services trade in the past), natural barriers for services trade (due to the more physical proximity requirements) and artificial barriers (e.g differences in regulations in services markets). However, an additional reason can be formulated: internationalisation of service may circulate through the role of FDI, which importance if extremely relevant (more that 70% of FDI is in services). If this is the case, substitution between different modes of international service supply may apply. For example, previous international trade theories for services have established the natural way of internationalising services when they start crossing frontiers is the traditional cross-border way and, once the physical requirement is requested, the setup-u of a subsidiary is produced. However, this type of example should not reject the importance of complementary effects between different modes of supply. Potential complementarity and substitution effects influencing the flows are investigated at macro level in order to understand if the commercial relations foster the presence of national companies in a foreign country and if the presence of national companies installed in a country promotes international trade.

The internationalisation process of the sector passes through various channels or modes of provision. Although service internationalisation is produced through many different ways (Rubalcaba and Cuadrado, 2002), at international level the WTO summaries major modalities, which have been classified under four modes. The literature developed on the relations

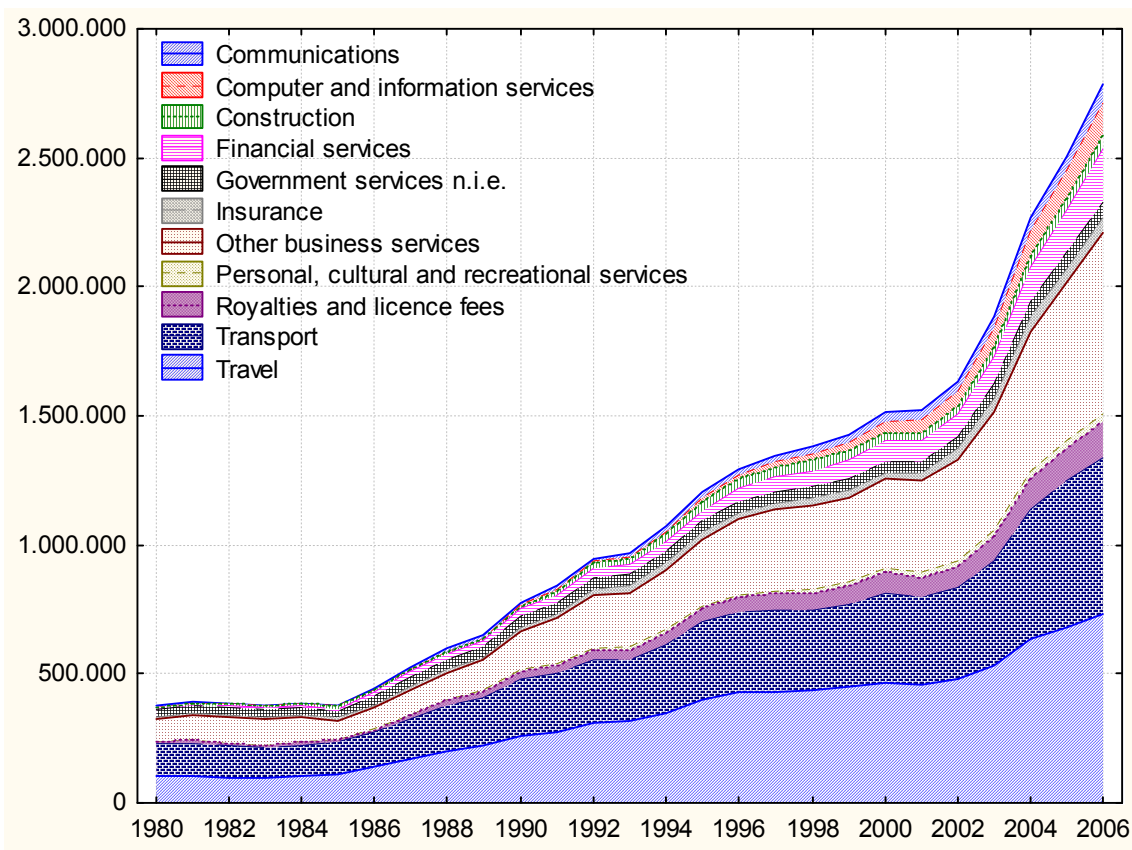
between the different modes of international supply is still scarce. This article draws a research strategy designed to investigate possible relationships between two modes of supply (Mode 1 and Mode 3 which can be roughly approximated by trade and investment) in the service sector at world level.

The rest of the article is developed as follows: Section 2 introduces the main concepts regarding the internationalisation of the tertiary sector, drivers of the process and some figures are briefly presented; Section 3 is a survey of the literature on the relations between trade and investments; the aim of section 4 is to present a methodology, based on a system of simultaneous equations developed on the basis of the gravitational relation, able to investigate possible relations between the different modes of supply of services; the methodology is applied to a database where the information of bilateral relations between more than 60 countries is collected; the results of this analysis are exposed in Section 5; Section 6 resumes the main findings and concludes the article.

2. Internationalisation: stylized facts and factors

Services are moving quickly towards internationalisation. A fast look at some figures shows the extent of the process. During the first five years of the eighties the world trade of services followed a stable pattern of around 360 000 millions dollars of internationally traded services per year. That moment, the mid eighties, can be considered the turning point when services started to be global. As can be appreciated in Figure 1, the average growth rate of the export of commercial services between 1985 and the year 2000 was almost 10 per cent per year. Later on, service globalisation become even faster. From the beginnings of the century until the start of the current crisis, the latest data available, it showed a growth rate of almost 12 per cent per year on average. This escalation was led by different facts. From one side, several activities, which relevance international markets was low until the nineties, started to be international: *Royalties and licence fees* or *Financial services* for example. These activities show a growing relevance on international scene during that period. Nevertheless the fast growth was led by the expansion of the most traded activities: *Transport, Travel* and *Other business services*. The latter category, which shows the fastest growth patterns, is composed by all those business-to-business activities used as inputs by services and manufacturing companies such as the various types of consulting, marketing and advertising or architectural and engineering activities, for example.

Figure 1 – The evolution of world trade 1980 – 2008, millions of dollars



Source: UNCTAD

Another typology of data capable to give a helicopter view of the process of internationalisation is the stock of foreign investments in the sector. As it will be more extendedly explained in the following sections, the stock of FDI of a country represents the value of the capital that national companies have invested in other markets. Roughly speaking, all investments that are necessary to open new international branches and divisions or to acquire already existing entities in foreign countries are recorded here. In this brief presentation we can consider it as a sort of barometer of the internationalisation not realized *via* trade. In the following paragraphs the concept will be deepened. Unfortunately, available data on FDI in service is not as complete as data on trade and long time series are not accessible. Table 1 presents an outlook of what FDI in services looks like for most OECD countries. Services represent the majority of the international investments realised. As it can be seen in the second column, most investments are realised in this sector. The magnitude of these investments is relevant even when compared with countries' GDPs, in the majority of the countries observed it represent more than 20 per cent of national gross product. In any case, the relevance of the sector is not only a matter of dimensions, the growth patterns during the first years of the century is a double digit figure in almost all countries surveyed.

Table 1. Outward FDI stock in services, 2006

<i>country</i>	<i>service FDI</i>	<i>% of total FDI</i>	<i>% of GDP</i>	<i>agr 02-06</i>
United States	1.841.080	75	14	12
Japan	158.682	35	4	
Germany	767.052	80	26	11
United Kingdom	697.142	48	29	4
France	890.859	78	40	17
Italy	225.609	60	12	20*
Spain	352.344	85	29	
Korea	20.512	38	2	
Netherlands	427.502	56	65	17
Turkey	4.164	47	1	7
Sweden	179.822	68	47	
Switzerland	341.127	61	90	14
Poland	2.822	20	1	29*
Austria	74.890	71	23	18*
Greece	19.302	86	6	21*
Denmark	62.894	42	23	
Finland	20.071	21	10	7
Portugal	47.930	89	25	24

Source: OECD-Stat

*= annual growth rate 03-06

Two factors can be individuated as the main drivers of this extensive internationalisation process. From one side it has to be considered that during the period observed the world went through a tertiarisation process. The natural growth of some activities and the externalisation of others made services employ around 70 per cent of the labour force and produce approximately the same amount of GDP in developed countries. Since services became the dominating sector in employment and production, its international relevance is not surprising at all. From the other side it is interesting observing how service internationalisation was, at the same time, a main actor and a recipient of the world globalisation process. Thanks to great diffusion of the communications technologies, market liberalisations and to the efforts directed to the creation and implementation of international treaties, services became a leading character of the globalisation process. These activities took part in the process inactively, taking advantage from the international opening to get to new markets, as well as actively, directly supporting the internationalisation (Rubalcaba et al., 2002). A good example of these two sides of the coin is the financial sector. Higher levels of international integrations, due to new common rule for example, opened the doors to several entities to reach new markets; at the same time the presence of national financial companies in a market represented a support for business heading toward international expansion. The joint effect of the growing importance of the sector and the globalisation process contributed to the figures previously exposed.

The internationalisation of the tertiary sector is more complex matter when compared to the internationalisation of the goods sector. Manufacturing companies fabricate their goods where the production plants are situated. At that moment, if they intend to sell them in others markets than the national, they have to transport the goods crossing one or various borders until the final consumer. Sometimes the strategy to get to international customers is different. Often companies decide to establish the production plant directly in the markets where the final consumers are settled. This explication of the internationalisation of the goods sector is defiantly naïve, nevertheless it is a useful benchmark to understand the complexity behind the process of internationalisation of the tertiary activities. When they decide to go international, service firms face different ways of achieving their new clients. Services can be sold without any need of movements, neither of the supplier neither of the client. A good example of this case is the translation service provided online by several companies, neither the clients nor the providers have to move from their desk. Sometimes the supplier needs to actually reach the client in order to create and provide its service. In other cases, it is the client who crosses the border to take advantage of a service produced abroad; tourism is an example of this way of internationalising a service. The description of the possibilities of international provision of

services does not run out here. Many service companies decide to open a division or acquire an already existing entity abroad in order to be able to achieve other's countries customers. Large restaurant chains or financial entities are used to this kind of internationalisation.

In order to analyse this complex situation a conceptual framework was created. The classification created within the General Agreement on Trade in Services (GATS) is nowadays considered the main reference in this sense. This taxonomy organises service internationalisation in four ways or *modes*. The first mode (Mode 1) includes all the international transaction made without any need for movement, both the client and the provider act from their location. Mode 2 refers to the consumption made in a foreign country when the consumer has to move to a foreign country in order to buy the service. Under Mode 3 are classified all that transaction realised by a corporation in a foreign country through its divisions, daughter companies or subsidiaries settled there. These branches could be the result of a direct expansion or of the acquisition of already existing companies and structures. Finally, Mode 4 gathers the transactions that require the physical presence of the supplier, but without any need for local infrastructure, in order to provide the service.

This classification is not only the reference on which international agreements are set up, it also represents the benchmark for the academic research and it is the conceptual framework used in the collection of data by the various statistical institutions and research organisations. In spite of that, such a complex system of internationalisation makes the collection of data particularly tough. For this reason, and due to the newness of the framework, most of the data available so far relates to international trade and FDI (stocks and flows). Only recently, some major statistic institution started releasing data on the income produced in foreign countries. It is the case of Eurostat, which published data on the income perceived by national companies from the direct investment realised. According to WTO (2006), international trade figures, usually collected from data of the balance of payments, represent transactions realised under Modes 1, 2 and 4. However, the main services traded under Mode 2 are travel and tourism services. It is therefore relatively trouble-free to isolate these transactions from the ones produced under Mode 1 and 4 when sectoral break-down is available. On the other hand it is not possible to make any distinction in order to understand which figures relate to Mode 1 and which to Mode 4. Since data on FDI stocks and flows represents the investment realised by companies with the aim of future gains, they could be interpreted as indexes of the commercial presence or Mode 3 transactions. The volume of stock of FDI is a proxy for Mode 3 commonly applied in empirical studies (Nordas and Kox 2009). Nonetheless, the data which would best represent Mode 3 operations should describe the volume of business of foreign affiliates of national companies. Due to the scarce availability, few previous works are based on this kind of data. Lennon, 2008 and Benassy-Quere et al. (2006), for example, consider data on the sale of foreign affiliates of USA companies to study Mode 3 of provision of services.

Notwithstanding all limitations, nowadays these three kinds of data, Trade, FDI and income from foreign affiliates, represent the field upon which stands most of the empirical analysis on the internationalisation of the service sector and the relations between its different modes. It is actually interesting to investigate what kind of relations these modes maintain. There is an ample literature on the relations between trade and investment in economics. Nevertheless, most of it regards trade and investment in the manufacturing sector. The complementarity and substitution relations maintained by these two ways of internationalisation are the main focus in literature since most companies face this doubt when attempting to attain foreign markets. One decision definitely influences the other. This discussion can be easily brought from micro to macro level. It is actually reasonable to think that international trade volumes have an influence on the flows of investment and vice versa. A commercial expansion, made through trade, of a sector in a foreign country represents the first "bridge" between the two economies, the commercial relations created can be the bases for possible future investments. At the same time, when several companies are set in a foreign country via FDI, their commercial relations with home headquarters and others national companies increase the levels of trade. Furthermore, it can be observed that if most of the corporations of a sector choose a particular way of internationalisation, this choice will definitely influences the actions of the rest of the

sector. Improving knowledge on the behaviour and relations between the different modes of internationalisation in the service sector is the aim of this paper.

The path followed by the service sector on its way to internationalisation is not clear so far. Only a limited number of works focused on the functioning of the recently produced framework exposed above. In particular there is no consensus on the existence and the direction of the mutual influence the different modes can have on each others. The role of the different modes is not clear. The next sections propose a research line capable of spreading some light on the possible interaction between Mode 1 and Mode 3 of provision of services.

3. A survey of the literature on internationalisation and relationships between modes of provision

This section of the paper briefly presents theoretical and empirical developments on the relations between the different ways of internationalisation, paying particular attention to works focusing on the service sector. The presentation starts with an overlook on the theory on international trade and investment. The process of internationalisation intended as a combination of different ways finds its first theoretical foundations within the so called *new theories of international trade* shaped during the eighties. The well known works of Helpman (1984), Markusen (1984) and Helpman and Krugman (1985) among others, beyond explaining international trade, allow the presence of multinational companies which localisation is based on factors endowments. These are the first models leaving behind the limitations of the identity internationalisation-trade and approach the argument in a more complex way. They justify the presence of vertical FDI, this means investment realised to produce goods and services for the national market in foreign countries, taking advantage of the difference in production costs.

During the nineties, the developments that followed were able to create a more complete theoretical framework where horizontal FDI as well as vertical were allowed. This kind of investment is realised with the firm's aim to be fully present in a new market: produce in the new country goods and services to be sold locally. Horstman and Markusen (1992), Brainard (1993) and Markusen and Venables (1998) reached this point, principally including transport costs, scale economies at company and plant level in their models. Trade and production overseas is seen in these models as two substitutive ways to reach the foreign customer.

What can be considered the current theoretical framework of the internationalisation processes finds its roots at the end of the past decade and is based on the so called *Knowledge-Capital models* (kk models). The idea that supports this thinking is the essential role played by companies' headquarters. These are actually considered in charge of a phase of the production, employing mainly high qualified labour force and presenting their particular scale economies. The role of the headquarters is to provide services to several production plants. It is the presence of the headquarters in the kk models that permits FDI to be horizontal as well as vertical while previous models only allowed one type of investment at a time. The decision of the company between the two kinds of investments is taken considering transport costs, fixed cost related with the creation of a branch and factors endowments. Among the main contributors to this framework it is worth to mention Markusen et al. (1996) Markusen and Maskus (1999a and 1999b) and Carr et al (2001). During the last ten years, the necessity to develop theories going beyond the relations between FDI and trade inspired new lines of thought. These new developments take into consideration different ways or modes of internationalisation. A complete survey on this argument can be found in Helpman (2006). Also in this case the theory predicts substitution between the different ways of internationalisation.

Theoretical developments prepared the field for the progress of empirical literature. Actually the aim of most of it is testing the strength of the theoretical concepts elaborated through the exploitation of available data. Therefore a consistent part of this literature is focused on the relationship between the different ways of internationalisation. In this sense, due to data

availability, several works focused on the links between trade flows and FDI. It is interesting to note how, despite the fact that the theory mainly sustains the substitution between trade and foreign investment, most empirical literature argues for a complementary relationship between the two ways. In Forte (2004) a comprehensive survey of the empirical work focused on the relation between trade and FDI can be found. In the following paragraphs we will highlight some key examples of pertinent contributions to this debate.

These works can be classified into two groups distinguishing on the level of the analysis. In the first group might be included all the articles which aim is to study the flows among countries or regions (macro level). The second group is composed by the works that consider the dichotomy between trade and investment as a decision to be taken at company level; therefore they study companies' behaviour (micro level). Evidently, the different approaches require different kind of data.

Studies of the first group generally relate data on trade and FDI flows with other macroeconomic data. The first work going in this direction is the article of Lipsey and Weiss (1981) showing how the activity of North American daughter companies in a foreign countries contribute the export to the same countries. This complementary performance is confirmed by the work of Grubert and Mutti (1991) on trade and proxies of FDI data. Nevertheless, trade and FDI tend to follow the same growth patters as a consequence of the influence of other factors simultaneously affecting both variables. It is the case of the globalisation process or the country income, for example. The analysis of trade flows and business volumes of multinational firms carried on by Clausing (2000), controls for these variables. The outcome evidences the complementary relationship between these forms of internationalisation.

Contributions belonging to the second group make use of data describing companies' actions. Having as benchmark their already cited article of 1981, Lipsey and Weiss (1984) tested their results using firm level data. They verified that if a company has a branch in a foreign country, its exports to this country are proportional to the volume of activity of the local branch. A complementary relationship between trade and investments is supported by the results of Head and Ries (2001) as well in their study on the internationalisation of Japanese manufacturing firms. The article of Bloningen (2001) represents an essential work approaching the differences between theory and empirical results. The author argues that analysis on firm-aggregate data presents bias. Therefore he develops an analysis looking for substitution or complementarity based on product-level data. The analysis implemented on Japanese automobile parts for the U.S. market finds strong evidence of substitution. The decision between export and foreign production seems not to be taken at firm level but at product level.

The service sector only recently appears in the debate on the international provision. This delay is due to the late recognition of the sector as one of the main economic actors and to the difficulty in the collection of consistent data on international transactions. Nevertheless the last ten years saw the rise of the attention on the argument. The implementation of models created to study the internationalisation of the manufacturing sector had been one of the first steps undertaken to investigate the particularities of the internationalisation of the tertiary. It is the case of works such as the one of Deardorff et al. (2000), Ansari and Ojemakinde (2003) and Mann (2004) among others. Van Welsum (2003) presents a detailed survey on this kind of studies. Furthermore, it is worth to mention the work of Grunfeld and Moxnes (2003) and Mirza and Nicoletti (2004) among the most important contribution to the study of the service sector and its internationalisation patterns. Kimura and Hyun-Hoon (2004), Kox and Lejour (2005, 2007) and Walsh (2006) are valuable recent empirical contribution to the argument².

The different modes of provision and their complementarity and substitution effects is the argument investigated in a limited group of works. The quoted contribution of Grunfeld and Moxnes (2003) was a pioneer in this direction. After analysing the behaviour of trade and FDI through a gravitational approach, they perform an analysis of the residuals which outcome confirms the complementarity effects thesis. Nicoletti et al. (2003) estimate a negative relation

² In addition to the works treating the aggregate sector there is a vast sector specific literature dedicated to the internationalisation processes.

between an FDI restriction index and trade flows in the sector. This conclusion supports the complementarity hypothesis. Taking the latter work as benchmark, Lennon (2008) studies the relationship between Mode 1 and Mode 3 of USA services. The results achieved by the author support the thesis of a mutual positive influence between the two modes of provision. Pain and van Welsum (2004) implement an analysis breaking down the service aggregate into several tertiary activities. Using panel data on six different service activities in the United States they investigate the relation between foreign investment/ foreign production and trade. These authors find out that trade in certain activity go along with investment (complementarily) in some particular sector but not in all of them.

The advances in the literature exposed above give a clear idea on how open is the debate. It is still not clear if crossing borders through a particular mode endorses or deters the use of other modes of provision. The relationships between different modes represent still an open field of research with no abundance of empirical contribution. The recent availability of data is eventually making possible the applications of various kind of technique to the subject and its growing importance is attracting the attention of stakeholders and policymakers. Our paper takes advantage from this recent availability at world level and contributes to the debate on the complementarity or substitution effects between different modes of international provision of services.

4. Methodology

The aim of this section is to present a methodological approach able to empirically investigate the relationship between different modes of international provision of services. In particular the article focuses on Mode 1 and Mode 3, according to the GATS definition. The main purpose of the analysis is to establish whether there is a complementary or substitutive relationship between these two modes. A system of simultaneous equations created in a gravitational framework will be the tool implemented to this aim. Since clearing up all the dilemmas on the relationships goes beyond the extent of this paper, this analysis can be considered as a benchmark to be developed in future investigations.

In the previous section different works on the relationships between internationalisation ways were presented. In this article we decided to follow the line draw by those articles assuming a macro approach. There two main reasons behind this choice. As it will be explained later, the analysis will be founded on the principles that the different ways by which services cross the borders influence each others. It is to say that we assume the quantities exported from country A to country B are not independent from the volumes of business maintained by the branches of firms from country A set in country B. Considering this mutual influence that affects macro variables, we maintain the so called autonomy requirement (Wooldrige, 2002, chapter 9), which is a necessary condition in order to implement a simultaneous approach. According to this requirement, the equations that will compose our model represent an underlying conditional expectation that has a causal structure. If we choose to move the analysis at the micro level we would fail this requirement and could not implement a simultaneous analysis. Indeed the endogenous variables in the system would be all choice variables of the same economic unit. From the firm's decision between exporting and investing we cannot infer any causality because none of the two quantities is influenced by the other, since they are part of the same economic choice. In this case we could only estimate a variable trade off against the other. On the other hand, considering macro quantities we are able to construct structural equations from which infer causality. The investments realised in a country by national companies affect the export there, but are not part of the same economic decision. The investments made by a bank in a particular country, for example, have some bearing on the decisions whether to export or not of others banks or of different kind of firms in that particular country. Another reason to choose the macroeconomic approach is the recent availability of data that opened the door to this kind of analysis at world level. The available

micro data on firms' behaviour are seldom specific enough to implement this sort of analysis and are hardly comparable at international level.

Mode 1 and Mode 3 of provision of services abroad and their mutual influence will be at the centre of this study. For the empirical analysis we make use of data on three variables: international bilateral trade (IT), FDI and income produced in foreign countries (INC) in the service sector³. It is widely recognised that data on IT can be used as proxy for Mode 1 of provision and we will proceed in this line. Nevertheless some remark needs to be made. As already highlighted in the previous paragraphs, the data on trade cover those transactions made through Mode 1, 2 and partially Mode 4. Data on Mode 2 are given by the values of tourism services traded. Identifying and separating these values from the IT service aggregate would mean losing a large amount of information. Furthermore, there are no realistic estimates for Mode 4 of supply (Magdeleine and Maurer, 2008)⁴. From now on we will refer uniquely to Mode 1, but it has to be taken into account that within this definition we include Mode 2 and, partially, Mode 4 of provision.

At the moment, there is not any available precise measure of Mode 3 of provision of services⁵. In some works (Lennon, 2008, for example), it was represented by the volumes of business of foreign firms in a country. Unfortunately this data is available only for few cases like USA firms, which is a strong limitation when the aim is to analyse the global process of internationalisation. In order to proceed with an empirical analysis founded on data on a large range of countries, we decided to split Mode 3 of provision into two different dimensions. In our perspective, the first one can be considered as the "causal" dimension, since it is useful to measures the extent by which Mode 3 influences Mode 1 of supply. This dimension is represented by the data on the stock of FDI. The second dimension can be called "consequence" dimension and it is implied in the determination of the impact of Mode 1 on Mode 3. This dimension is embodied by the data on the INC. In fact, for each country, the data on the income produced in foreign countries is representative of the volume of business effectively realised there by national companies. It is a proxy of the services provided by a branch or daughter companies, or by acquired firms.

The basic idea behind the model is that the three quantities considered influence each other. Therefore, studying this mutual influence we will be able to infer awareness about the relation between Mode 1 and Mode 3 of international provision of services. Creating a system of equations that takes advantage from the information on IT, INC and FDI means using the best information available in order to give a complete picture of the internationalisation process of the sector and understand if there is mutual influence between Mode 1 and Mode 3.

Empirical studies of international economics found in the gravitational equation an important tool, capable of spreading some light on the relations between countries or regions. Since their first formulation by Tinbergen (1962), the models based on this equation (gravity models) had been widely employed to describe trade, as well as FDI behaviour. Their name derives from the fact that they relate flows (mainly trade and FDI) with different economic variables similarly to the gravitational equation. The analysed flows are supposed to be positively related with the product of the economic masses of the countries (GDPs are used as proxy in this sense) and negatively related with the distance between them. Their high explicative power impelled the research on their theoretical foundations. Their existence is justified in the theoretical models developed by Anderson (1979), Helpman and Krugman (1985) and Helpman et al. (2007), among others. It is not in the intention of this paper to reply here their neoclassical mathematical underpinning, since it can be found in several works. It is anyway worth to mention that most of the derivations are centred on demand functions where the consumer

³ The definition of the aggregate service sector adopted by the main statistical institution is here applied: from NACE *F* to NACE *U*.

⁴ An estimation of Australian supply of services in 2002-03 reported in this article shows that 63 per cent are provided via mode 3; 19 per cent through mode 2 and the remaining 18 per cent is trade via mode 1 and mode 4.

⁵ In a previous work (Visintin, 2009) data on FDI are used as proxies for mode 3 of provision of services. The 5 years moving average of FDI flows was considered as a proxy of the expected returns on investments, and therefore of the volume of business carried on by national companies in foreign countries.

maximises his utility function facing his budget constraint and choosing between national and imported products on the bases of international prices. For what concerns their estimation, there is an intense debate on the different techniques that can be applied to gravity models. Gómez and Milgram (2009), for example, is a recent paper presenting an overview of this debate.

The model had been widely used to empirically estimate trade in services, and its capacity was also demonstrated when modelling investments flows and stock. Grunfeld and Moxnes (2003), Kox and Lejour (2005) and Walsh (2006) are some examples of the application of these models to the internationalisation of the tertiary sector. In some cases gravity models have been included in simultaneous equation systems. A system of simultaneous gravity equation was elaborated to study the reciprocal influence between bilateral trade in goods and asset holdings by Aviat and Coeurdacier (2006).

In this empirical analysis three equations are used to describe the analysed variables: bilateral service trade, bilateral FDI stock and bilateral INC in the sector. In the gravity equation describing the behaviour of IT, FDI is considered as a factor. The way by which IT is influenced by FDI can be interpreted as the effect of Mode 3 on Mode 1 of provision. Simultaneously, in the gravity equation describing FDI, IT acts as a factor. The mutual influence between trade and FDI represents only partially the relationship between the different modes of provision of services. A third equation closes the circle describing the behaviour of INC. Both IT and FDI are considered variables having an effect on INC.

This allows us to study the influence each variable has on the other, controlling for the effect of factors contemporary affecting the considered quantities. A priori, their relationship is ambiguous. As it has been previously explained, it is reasonable to assume that the actual value of the investment realised in the past in country B from country A's firms (the stock of FDI) has a direct influence on the present export from A to B. If these investment were horizontal this influence is negative, since there could exist a substitution effect. From the other side, the relationships established could have "opened the door" to further commercial relations and, therefore, has a positive influence on trade. From the other side, it can be noted how international trade can have a positive impact on FDI, due to the "opening the door" factor, as well as negative, since trade can be a substitute for investment. Thirdly, we expect a positive effect of FDI on INC, since the volume of business carried on is proportional to the investment realised in the past. At the same time we have no expectations and therefore aim at inferring information about the impact that export has on the income generated in foreign countries, once the effect of other variables is controlled.

Therefore we can assume that the three variables observed exert a simultaneous reciprocal influence. In this framework we have to elaborate a system capable to capture all these effects at the same time. Considering each effect singularly would lead to misleading results. A system of three simultaneous equations based on the gravity framework was elaborated. The identification strategy that covers all the relations at the centre of the study is as follows:

$$\ln IT_{ijt} = \alpha_1 + \beta_1 \ln GRAV_{ijt} + \gamma_1 \ln Z_{ijt}^{IT} + \delta_1 \ln FDI_{ijt} + \nu_{ijt} \quad [1]$$

$$\ln INC_{ijt} = \alpha_3 + \varphi \ln IT_{ijt} + \lambda \ln FDI_{ijt} + \varepsilon_{ijt} \quad [2]$$

$$\ln FDI_{ijt} = \alpha_2 + \beta_2 \ln GRAV_{ijt} + \gamma_2 \ln Z_{ijt}^{FDI} + \delta_2 \ln IT_{ijt} + \nu_{ijt} \quad [3]$$

IT_{ijt} represents the flow of export of services from country i to country j in year t (OECD data). FDI_{ijt} is the stock of foreign direct investment of companies of country i maintained in country j in the year t (EUROSTAT data). INC_{ijt} is the variable corresponding to the income produced during the year t in country j by firms which headquarter is located in country i (EUROSTAT data). Due to data availability the list of countries i and j is not symmetric. In Appendix A can be found the full lists of the 36 countries considered as *exporters/owner of the commercial presence* and of the 65 states considered as *importers/consumers of the foreign commercial presence*. The range of countries considered covers the whole world. Although the availability of data gives more weight to the European and OECD countries, it has to be noted that all the main emerging economies⁶ several South American countries and some African economies are considered, at least within the second group. The fact that the OECD and, more in general, the so called developed countries present an higher weight within the database is not misleading, since they represent the vast majority of the international exchanges in the service sector. We used data from the period 2000 – 2007. Unfortunately not all the variables presented data for the whole period and in some cases shorter time intervals are studied.

$GRAV_{ijt}$ is a vector of gravity variables included in all the equations. Under the definition of gravity variable we include the usual variables comprised in this kind of models, the GDP of country i and j , and the distance between the two countries. The distance is approximated by the physical distance (*dist*) between the two capitals of the two countries and represents the costs to provide the service. We also augmented the model with some additional variable that have been demonstrated to influence the flows considered. Consequently we introduced a dummy variable which is equal to one when the two countries share the same language (*lang*), a dummy variable showing when the two country have a common boarder (*adj*), a dummy variable indicating if the couple of countries are both part of the European Union (*eu*) and two variables indicating the productivity of the considered economies (*prod*). The latter measure, provided by OECD, is composed by data on the productivity of the labour force in the commercial service sector, all the tertiary activities not provided by public institutions. In this model the index of the productivity does not account exclusively for the extent at which the country is capable to take advantage from its human resources, it can be also considered as a measure of the technology development and of the income levels in different countries⁷.

$$GRAV_{ij} = \begin{pmatrix} GDP_i \\ GDP_j \\ dist_{ij} \\ lang_{ij} \\ adj_{ij} \\ eu_{ij} \\ prod_i \\ prod_j \end{pmatrix}$$

Finally, Z^{IT} and Z^{FDI} are vectors composed by several variables that affect uniquely IT and FDI respectively. For what concerns Z^{IT} , an index of corruption of the importer country is included (*corr*)⁸. Most services are activities often regulated by national and local laws and rules. The financial system, health or transport services are few examples of activities where

⁶ We refer here to the BRIC economies (Brazil, Russia, India and China) as well as to the Asian emerging economies (South Korea, Singapore or Taiwan, for example). See Appendix A for details.

⁷ Actually multicollinearity problems arise when introducing measures of the income levels, such as the GDP per capita.

⁸ The Corruption Perception Index employed in this analysis had been elaborated by the organisation Transparency International. It is an indicator between 0 (maximum corruption) and 10 (minimum corruption).

the private operator has to deal with national and local red tape. The clearer is this institutional framework the easier is for an operator to work in a foreign country. Vice versa, the more difficult is the ensemble of regulations to understand the harder will be for foreign operators penetrate the market. In this line, it is reasonable to think that the higher is the level of corruption in a country the tougher is the work for international companies to be present in that market.

$$Z_{ij}^{IT} = \begin{pmatrix} corr_j \\ RER_{ij}^{ULC} \\ RERHET_{ij}^{ULC} \\ prodHET_{ij} \end{pmatrix}$$

The RER_{ij}^{ULC} variable is the real exchange rate based on unit labour cost. It is an index of the labour competitiveness of the service sector of a country. Among the various competitiveness index proposed in the literature, there is a general tendency to consider the real exchange rates (RER) as range of indicators that better fits the concept of cost related competitiveness. In their benchmark paper, Turner and Van't dack (1993) conclude that the real exchange rate based on unit labour costs seems to be the most useful proxy for competitiveness since it assesses developments in profitability of production when labour is the main input required. These results were confirmed in following works, among which Carlin et al. (2001) deserve to be mentioned. The significance of this index in the internationalisation of the service sector was confirmed by Maroto et al. (2008) when analysing the commercial performance of European countries, and by Visintin et al. (2008) for the Spanish case. This real exchange rate between country i and j is calculated as the nominal exchange rate e times the ratio of the countries' unit labour cost (ULC). The latter is a widely used measure of the competitiveness of countries and/or sectors and it represents the relation between the cost of the labour factor and its productivity. In the following equations LPH represents the labour compensation per hour of the labour force; VA is the value added; Emp stays for the employment and H is the number of hour worked per person by the labour force.

$$RER_{ij}^{ULC} = e * \frac{ULC_i}{ULC_j} \qquad ULC = \frac{LPH}{\left(\frac{VA}{Emp * H} \right)}$$

Beyond the RER index, we decided to include another index based on this indicator. We created a heterogeneity index measuring the difference in the real exchange rate based on unit labour cost between the two different countries ($RERHET$). Furthermore a productivity heterogeneity index was elaborated and applied ($prodHET$). The idea at the base of the inclusion of the latter variables is that countries trade more with other countries with similar characteristics.

Z^{FDI} is composed by eight indexes of regulation regarding the j country, the country that received the investment (from $reg1_j$ to $reg8_j$). The idea behind this inclusion is that setting up in a foreign country means facing unknown legal frameworks, the highest is the level of regulation the more costly should be the process. The measures are obtained by the well known *Doing Business* report by the World Bank. Among the several indexes elaborated within this report we selected a group directly affecting the establishment and implementation of a daughter company in a foreign country. It is the case of several indexes affecting the organisation and start-up of a business (such as the *days to start a business* index or the *difficulty of hiring index*), and several measures of the level of regulation in fields related to the implementation of a business (e.g. *rigidity of employment index* or *credit information index*). The complete list of the regulation indexes employed can be found in Appendix B of the present

paper. The level of these regulations is assumed to affect directly the provision of services through Mode 3, but not the provision via international trade.

$$Z_{ij}^{FDI} = \begin{pmatrix} reg1_j \\ reg2_j \\ \dots \\ reg8_j \end{pmatrix}$$

The presence of the variables composing the vectors Z^{IT} and Z^{FDI} fulfils theoretical justifications. Beyond this reason, they had been selected because their high correlation with the endogenous variable of the equation where they appear, IT and FDI respectively, and their low correlation with the others exogenous variables. This orthogonality is of great importance when considering estimation techniques.

Equations (1) (2) (3) are considered as a system of simultaneous equations since they represent the simultaneous effects the variables have on each others. Accordingly to what previously exposed, none of the three dependent variables acts independently from the others and independently from the variables simultaneously affecting the three quantities. A system of simultaneous equations can therefore be considered the best way to infer information from the available data since it takes into consideration the mutual interactions while estimating each equation separately would lead to biased estimators due to endogeneity problems.

There are several estimations techniques that take into account this simultaneity and correct, therefore, endogeneity. To proceed with the estimation, first of all we have to notice how the system of equations (1) (2) (3) satisfies rank, as well as order condition. Once we checked these conditions the system can be estimated. A closer look at the system shows how equation (2) is independent. It means that while FDI and IT has an effect on INC while the vice versa does not apply. This drives to no endogeneity problems while using panel estimations techniques. Consequently this equation can be estimated separately. Equations (1) and (3) compose a system with potential endogeneity problems that can be solved since it satisfies rank and order conditions.

Equation (2) relates the income produced by the foreign affiliates of national companies with the past behaviour of these companies, represented by FDI . We expect to find out a significant and positive relation, since it is reasonable to think that the more is the actual value of the investment, the greater is the expected flows of income. The significance and the sign of the coefficient of the IT will describe the relation between Mode 1 and Mode 3 of provision of services. As it was specified at the beginning of this section, this paper can be considered as a first step in the acquisition of knowledge on the subject. The specification of equation (2) represents a first attempt to model INC and should be developed and theoretically supported in further investigations.

In order to achieve the aim of this paper, investigating the mutual relationship between Mode 1 and Mode 3, we are interested in estimating equation (1) and equation (2). The elasticity of IT with respect to FDI will show what kind of influence Mode 3 has on Mode 1, while the coefficient of IT in the third equation will be an indicator of the effect that trade has on the commercial presence. Equation (3) can be considered as structural, therefore the results of its estimation can be considered of minor importance and are reported in the Appendix C.

Simultaneous equations estimations techniques rely on instrumental variables. Actually, these techniques correct endogeneity problems substituting endogenous variable with instrument variables. A good instrument is characterised by the fact that it is strongly correlated with the instrumented variable and weakly correlated with the rest of endogenous variable included in the system. We would need instruments for the variable FDI in equation (1) and

instruments for the variable IT in equation (3). We decided to use vector Z^{FDI} ⁹ as a vector of instruments for the former and the variables included within Z^{IT} as instruments for the latter, since they presented the aspired characteristics. When instrumental variable are used, the results strongly depends on the choice of the instruments. In order to show that the selected instruments are suitable instruments we present the result of the underidentification, weak identification, overidentification and endogeneity test are presented. The regressions of the instruments on the instrumented variables are also presented in Appendix D. The results of the F-tests validate the suitability of the instruments.

There exist different estimations techniques that deal with simultaneous equations systems. In this work we make use of three of them which belong to the group of so called *limited information techniques*. This name was given after the fact that the equations of the system are not estimated at the same time, but one after the other. Several works in literatures rely on this kind of techniques. The *two stages least square* method (2SLS) is among the most popular technique of simultaneous equations estimation. The purpose of this methodology is to obtain a predicted value of the endogenous regressor (FDI and IT in this case) from the instruments (first stage), and then apply the obtained values to estimate the coefficients in the equation.

Nevertheless this technique presents relevant limitations when applied to a system of gravitational equations with the intention of estimating panel data. Two different kinds of problems arise. First, it does not take into account the relations deriving from the panel structure of the data. Not accounting for individual (pairs of countries) and time differences could lead to endogeneity problems and, therefore, biased estimators. Secondly, it is widely acknowledged that gravity models present heteroskedasticity. These estimations are not consistent in this case.

The limited information maximum likelihood (LIML) is an estimator capable of dealing with clusters. It takes into consideration individual effects and has the same asymptotic properties of 2SLS. There exist another estimator capable to control for the endogeneity derived from the repetition of the same individual and that allows for heteroskedasticity and autocorrelation. It can be found under different names in the literature, Green (2005), for example, calls it heteroscedastic two-stage least square (H2SLS). It is basically a general method of moment estimator in two stages. It is consistent in presence of cluster and heteroskedasticity.

As it was stated, although it is part of the system, equation (2) is autonomous and is therefore estimated separately. Due to the nature of the data, panel data techniques were chosen as the most suitable in the present work. Since our model cases are composed by country pairs, we can expect that a series of fixed effects case-specific applies. For this reason the fixed effects estimators should be chosen as the most reliable. Nevertheless the results of the estimation using the fixed effects and the random effects estimators are presented. The results of the Hausman-Taylor test are also presented in order to verify which should be the most suitable estimator.

5. Results

This section presents the results of the estimations described in above. As anticipated, the outcome of different estimations techniques applied to equations (1) and (2) are displayed here, while the results corresponding to the estimation of the equation (3) can be found in the Appendix C. The aim is to focus on the two effects investigated: the influence of Mode 1 on Mode 3 of provision of services and vice versa.

⁹ The relevant influence of regulation on FDI stock is highlighted in Nordas and Kox (2009).

Table 2 shows the results of different estimations of equation (1). The gravity framework allows controlling for the influence of other variables affecting the export of services and for the variables simultaneously affecting exports and investments realised abroad. The three methods applied are consistent with each others on the effect that the stock of foreign direct investment realised overseas have on the export of services to the same countries: there is a significative and positive influence. The elasticity of the log of the export of services with respect to the log of the stock of FDI is around 0.16. This means that, at aggregate levels, the more the companies of the service sector of one country are set in a second country, the more they export there, *ceteris paribus*. In other words, the more Mode 3 is used to provide services from one country to another, the more increases the supply via Mode 1. It has to be noted that we can not infer a causality relation from this kind of analysis, nevertheless it is a valuable result demonstrate the existence of a positive relation between the two modes of international supply.

Table 2. Instrumental variable estimation of a gravity model for the stock of international trade (exports) in the service sector; equation (1).

dep:IT	2SLS	LIML	H2SLS
<i>FDI</i>	.169***	.176***	.152***
<i>gdp i</i>	.488***	.480***	.501***
<i>gdp j</i>	.689***	.684***	.705***
<i>dist</i>	-.609***	-.603***	-.650***
<i>lang</i>	.760***	.746**	.739**
<i>adj</i>	.218*	.215	.154
<i>eu</i>	-.213*	-.215	-.271
<i>prod i</i>	-.017	-.032	-.009
<i>prod j</i>	.218*	.226	.214
<i>rer</i>	.003	.003	.014
<i>corr</i>	.493***	.483**	.501**
<i>prophet</i>	-.016	-.014	-.025
<i>rerhet</i>	-.001	-.001	-.011
<i>underidentification (p-value)</i>	.000	.001	.001
<i>weak identification (F stat)</i>	8.066	5.380	5.380
<i>overidentification (p-value)</i>	.089	.339	.337
<i>number of observations</i>	412	412	412

2SLS, two-stages least squares; LIML, Limited information maximum likelihood; H2SLS, heteroscedastic two-stage least square.

* significant at 10%; ** significant at 5%; *** significant at 1%

The tests presented support the outcome of the analysis. The *underidentification* test is a LM test of whether the equation is identified. The null hypothesis is that the excluded instruments are not correlated with the endogenous regressor (*FDI* in this case). We can reject this null hypothesis at 1 per cent significance level. The *weak identification* test is useful to detect problems that can arise when instruments are "weak". This happens when the instruments are correlated with the endogenous regressor, but only weakly. In the worst of these cases the regressor could be as biased as the OLS regressor. There is general accordance to accept a "rule of thumb" of 10 in the Cragg-Donald Wals statistic. The reported values do not reach that benchmark, nevertheless the critical values elaborated by Stock and Yogo (2005) permit to understand that the regressor presents always (at least) less than 20 per cent of the OLS bias. Finally the *overidentification* test is reported in order to demonstrate that the excluded instruments are distributed independently of the error process. The results of the p-value of the Sargan and Hansen J. statistics do not permit to reject the null hypothesis that the instruments are valid instruments.

Table 3 Estimation of the model describing the behaviour of Incomes produced in foreign countries in the service sector; equation (2)

dep: <i>INC</i>	<i>FE</i>	<i>RE</i>
<i>IT</i>	.323***	.355***
<i>FDI</i>	.539***	.583***
hausman test	chi2(2)= 2.10 ; prob .350	
number of observations	882	882

* significant at 10%; ** significant at 5%; *** significant at 1%

The estimations presented in Table 3 show how the income produced by foreign affiliates of national companies clearly depends on the investment realised in the past and on the present value of the exports realised in the same country. The former result was reasonably expected. The higher is the value of the investment realised, the higher should be its return. From the perspective analysed in the present paper, the most important result is the coefficient of the (logarithm) of the *IT* variable. It is clearly positive and highly significant. According to econometric theory, the fixed effect estimators should be the most appropriate. The cases analysed are country pairs and it is reasonable to assume that several pair characteristics are taken into account by this estimator. Actually the Hausman test confirms this hypothesis. Nevertheless it has to be noted that the estimated coefficients are similar in both cases. We can therefore affirm that the income produced by foreign affiliates in a particular country is positively affected by the volumes of exports realised in that country, in the service sector. In other words we can affirm that there is a positive relation between Mode 1 of international provision of services and Mode 3.

As it was stated in the previous session, the equation modelling the behaviour of the income generated by foreign affiliates applied here represents a first approximation to the subject and will need further theoretical developments backing it up. It is naïve and lacks of theoretical fundamentals. For this reason it is not helpful to interpret the magnitude of the coefficient obtained. Nonetheless its consistency and sign are useful indicators of the underlying relation. Finally, although from these analyses we are not allowed to infer causality relations, it results clear that Mode 1 and Mode 3 of international provision of services are positively related. The present empirical study affirms that there are evidences of complementarity between these two modes of supply.

6. Discussion and concluding remarks

Services cross borders more and more. Their internationalisation process presents different patterns when compared with the good one. In particular, the relation between the modes seems to be different¹⁰. Their intangibility and the strong relation that arise between supplier and client give to service firms different internationalisation possibilities. This article presented the situation of the aggregate sector facing the internationalisation challenge. Furthermore it draws a research strategy in order to, at least partially, figure out the functioning of this process.

In particular, we aimed at creating an empirical approach capable to study the relations between Mode 1 and Mode 3 of the world international provision of services at macro level. We implemented a system of simultaneous equations built up in a gravity framework in order to analyse the relations between three different variables capable to describe the behaviour of these modes of supply. The analysis was carried on a set of 65 countries and the largest period of time studied goes from the year 2000 till the year 2007.

¹⁰ Services represent 20 per cent of international trade, but around 70 per cent of foreign direct investments

At macro level, what we were able to explore was if, once the effect of other variables is controlled, the presence of national companies installed in a country promotes international trade (influence of Mode 3 on Mode 1 of provision) and, from the other side, if trade relations foster the volume of business maintained by national companies in a foreign country through affiliates and foreign branches (influence of Mode 1 on Mode 3 of provision). It resulted clear that Mode 1 and Mode 3 of international provision of services are positively related. We can affirm that there are evidences of complementarity between these two modes of supply from both sides at aggregate level. This result is in line with the empirical researches cited in section 3 that approached the argument with different datasets and econometric techniques. A substitution effect can not be observed at this level of aggregation. However, this underlying relation can be considered one of the factors that affected the increase in the internationalisation patters shown in section two.

The macro approach implemented in this paper presents several limitations. The main constraint is due to the fact that the available data, at the moment the study is implemented, allow aggregated analysis only. The whole service sector, composed by more than 51 activities¹¹, is considered as a single sector. Evidently, this aggregate approach hides important information. Some service activities are likely playing a catalyst role within the process of internationalization. The function of national financial entities abroad could be an example of the deepness of the level of the relations we have not been able to reach in our analysis. The presence of national entities in third countries could be a factor promoting the trade relationships since it provides a recognised framework in which national operators are keener to develop their business. This means that probably there could be sectors acting as auxiliaries for others activities to expand internationally. The same process probably occurs the other way round. We suspect that some exporters break boundaries and create the needs for national infrastructures to implement and improve their business relations. When data on bilateral flows in specific sectors will be available, the task of the analysis will be to identify which activities investment act as vehicle for others' trade and vice versa and account for these effects. So far this level of analysis cannot be achieved.

We helped in understanding that, even though part of the theory states that at micro level there should be a substitution effect between trade and production abroad, the service sector at aggregate level shows complementarity. We have demonstrated that, *ceteris paribus*, the different relations maintained by countries strengthen each others: the more intense are trade relations the more intense is the connection in terms of national companies installed abroad and vice versa. This means that if operators, no matter their area/sector, sell their services to clients of another country, other entities, from the same or different business area, are keener to reach that market starting a division there. It also means that when service firms from one country are set abroad, it is more likely that firms from the first country export to the second. In general, we analytically demonstrated that the involvement of some operators in international operations promotes the development of more businesses relations in the country where the experience takes place.

These conclusions can be useful from the political economy perspective. Policy makers have to be aware of the indirect effects that each internationalisation mode can have. Mode 1 and Mode 3 of internationalisation promotes each others. This means that the effect of policies encouraging, for example, the development of commercial relationships do not run out in international trade, but extends its outcomes to the investments/capital relations between the two countries. At the same it has to be taken into account that the opening of the frontiers to foreign capitals will be a support for commercial deals. Policy actions regarding trade liberalisation or regulations should analyse more in deep and take care of the existing interrelations among the two main modes of service internationalisation.

¹¹ Considering the two digit NACE classification.

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Appendix A

List of the 36 countries considered as Exporters /owners of the commercial presence:

Austria, Australia, Belgium, Bulgaria, Canada, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Honk Kong, Croatia, Hungary, Ireland, Italy, Japan, South Korea, Lithuania, Luxemburg, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Sweden, Slovenia, Slovakia, United Kingdom and United States.

List of the 65 countries considered as Importers / consumers of the foreign commercial presence:

Albania, Argentina, Austria, Australia, Belgium, Bulgaria, Brazil, Byelorussia, Canada, Switzerland, Chile, China, Colombia, Serbia and Montenegro, Cyprus, Czech Republic, Germany, Denmark, Estonia, Egypt, Spain, Finland, France, Greece, Honk Kong, Croatia, Hungary, Indonesia, Ireland, Israel, India, Iran, Iceland, Italy, Japan, South Korea, Lithuania, Luxemburg, Latvia, Morocco, Malta, Mexico, Malaysia, Nigeria, Netherlands, Norway, New Zealand, Philippines, Poland, Portugal, Romania, Russian Federation, Sweden, Singapore, Slovenia, Slovakia, Thailand, Turkey, Taiwan, Ukraine, United Kingdom, United States, Uruguay, Venezuela and South Africa.

Appendix B

List of the regulation indexes employed.

reg1 = starting a business (days)

reg2 = difficulty of hiring index

reg3 = rigidity of hours index

reg4 = difficulty of firing index

reg5 = rigidity of employment index

reg6 = registering property (days)

reg7 = credit information index

reg8 = closing a business (cost in percentage)

Appendix C

The results of the estimations of equations (2) are here presented.

Table A1. Instrumental variable estimation of a gravity model for the stock of Foreign direct investments (outward) in the service sector; equation (2)

dep:FDI	2SLS	LIML	H2SLS
<i>IT</i>	2.953***	3.230***	2.891***
<i>gdp i</i>	-.880*	-1068	-.855
<i>gdp j</i>	-1.616**	-1.840**	-1.576**
<i>dist</i>	1.190*	1411	1175
<i>lang</i>	-.985	-1260	-.964
<i>adj</i>	-.462	-.576	-.414
<i>eu</i>	.510	.527	.544
<i>prod i</i>	1.181***	1.087*	1.237**
<i>prod j</i>	-1.713***	-1.802***	-1.673***
<i>reg1</i>	-.122	-.149	-.110
<i>reg2</i>	-.749	-.637	-.823
<i>reg3</i>	-1743	-1515	-1908
<i>reg4</i>	.296	.387	.169
<i>reg5</i>	2324	1963	2644
<i>reg6</i>	-.126	-.109	-.157
<i>reg7</i>	.147	.174	.144
<i>reg8</i>	-.301	-.343	-.244
<i>underidentification (p-value)</i>	.002	.027	.027
<i>weak identification (F stat)</i>	4018	2885	2885
<i>overidentification (p-value)</i>	.549	.74	.708
<i>number of observations</i>	412	412	412

2SLS, two-stages least squares; LIML, Limited information maximum likelihood; H2SLS, heteroscedastic two-stage least square.

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix D

The results of the regression of the instruments on the instrumented variables are here presented. Fixed and random effects panel techniques are applied.

Table A2. Instruments of IT (natural logarithms)

	FE	RE
<i>Prob F-test / Wald (p-value)</i>	.000	.000
<i>corr</i>	2.458***	2.472***
<i>prodhet</i>	0.024	.011
<i>rer</i>	0.033	.102***
<i>rerhet</i>	-.094***	-.142***
<i>hausman test</i>	chi2(4)= 19.63 ; prob .001	
<i>number of observations</i>	3754	3754

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A3. Instruments of FDI (natural logarithms)

<i>instruments of FDI</i>	<i>FE</i>	<i>RE</i>
<i>Prob F-test / Wald (p-value)</i>	.000	.000
<i>reg1</i>	-.277***	-.283***
<i>reg2</i>	-1.406*	-.399
<i>reg3</i>	-7.671***	-1.690*
<i>reg4</i>	-.2615	-.042
<i>reg5</i>	7.046**	1775
<i>reg6</i>	-.050	-.098
<i>reg7</i>	-.786*	-.007
<i>reg8</i>	.674***	.743***
<i>hausman test</i>	chi2(8)= 31.12 ; prob .001	
<i>number of observations</i>	898	898

* significant at 10%; ** significant at 5%; *** significant at 1%