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Opening Services Markets within Europe:

Modelling Foreign Establishments in a CGE Framework

Arjan Lejour, Hugo Rojas-Romagosa, Gerard Verweij

CPB Netherlands Bureau for Economic Policy Analysis
Van Stolkweg 14
P.O. Box 80510
2508 GM The Hague, the Netherlands

Telephone +31 70 338 33 80
Telefax +31 70 338 33 50
Internet www.cpb.nl

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Abstract in English

In services, the activities of foreign affiliates often exceed the value of cross-border trade. A complete analysis of services liberalisation therefore requires the modelling of FDI. This paper presents the treatment of FDI in our CGE model WorldScan based on the ideas of Petri (1997) and Markusen (2002). They assume that firms establishing affiliates abroad also transfer firm-specific knowledge. Consequently, capital and products differ from existing capital and products in the host country. As an illustration, we apply this model to assess the proposals of the European Commission to open up services markets. FDI in services could increase by 20% to 35%. However, the overall economic impact is limited. Our assessment suggests that GDP in the EU25 could increase up to 0.4%. These effects could be up to 0.8% higher if foreign capital also increases the overall productivity of the services sector.

Key words: FDI, CGE models, trade in services, economic integration

JEL code: F23, C68, F15

Abstract in Dutch

In dienstensectoren overstijgen de verkopen van buitenlandse vestigingen vaak de waarde van grensoverschrijdende handel. Een volledige analyse van handelsliberalisatie in diensten is dan alleen mogelijk als ook directe buitenlandse investeringen (DBI) worden meegenomen in de analyse. Dit artikel presenteert de modellering van DBI in CPB's toegepaste algemeen-evenwichtsmodel WorldScan. De modellering is geïnspireerd op de ideeën van Petri (1997) en Markusen (2002). Zij gaan ervan uit dat een bedrijf dat een buitenlandse dochteronderneming opzet, ook bedrijfsspecifieke kennis overdraagt. Daardoor onderscheiden het kapitaal en product zich van het al aanwezige kapitaal en van producten in het gastland. We passen deze modellering toe op de voorstellen van de Europese Commissie om de dienstenmarkten te liberaliseren. DBI in diensten kan met 20% tot 35% toenemen. Echter, de macro-economische effecten zijn bescheiden. Onze analyse suggereert dat het BBP in Europa met maximaal 0,4% kan toenemen. De toename kan 0,8% groter zijn als buitenlands kapitaal ook de productiviteit in diensten verhoogt.

Trefwoorden: Directe buitenlandse investeringen, toegepaste algemeen-evenwichtsmodellen, handel in diensten, economische integratie

Contents

Summary

Foreign direct investment (FDI) in services is often more important to supply foreign markets than cross border trade. In spite of the importance of FDI the general equilibrium effects of FDI flows are not widely examined in computational general equilibrium (CGE) models. This paper overviews the related literature and finds that existing work is often hampered by the modelling complexities involved and by the lack of good data.

In this paper we step over these barriers and model FDI in WorldScan: CPB's computational general equilibrium model for the world economy. In a previous study, we have already created an inward FDI stock data base by home country and by sector. With this data base we can overcome some of the previous data limitations. The modelling work is based on the ideas of Petri (1197) and Markusen (2002) who assume that a firm establishing an affiliate abroad also transfers firm-specific knowledge to that affiliate. This assumption implies that capital is more substitutable between countries within a specific sector than between sectors within a country.

FDI is often hampered by barriers. These restrictions are still prevalent in many developing countries and in network industries in developed economies. In Europe FDI flows between members states is often held back by national requirements and regulations. These barriers are not always discriminatory per se but increase the costs of establishing a foreign affiliate, since the requirements and regulations are different from country to country. An important objective of the European Commission is to reduce these regulatory barriers and the heterogeneity of requirements between member states. To achieve this aim they have launched the Services Directive.

As an application of our modelling of FDI in WorldScan we analyse the economic effects of increased FDI flows induced by the Services Directive in the European Union (EU). In order to conduct this simulation we have estimated FDI barriers. These barriers are modelled as a tax equivalent in the country receiving FDI flows and this tax can differ between countries. In our benchmark scenario we assume that these tax equivalents generate rents for the receiving country, but we also explore the alternative assumption that the tax equivalents do not generate rents and are only cost increasing.

Another important topic is the assessment of the productivity of the foreign affiliates. In particular, empirical research of firm specific data suggests that foreign affiliates are more productive than comparable domestic firms. However, the empirical literature has not yet converged to a commonly accepted estimate of these differences, but the size of these effects is very important for the assessment of increased FDI flows. This paper deals with this lack of information by exploring two alternative assumptions. First, in the benchmark case we assume that foreign affiliates are equally productive than domestic firms. Alternatively, we assume that foreign affiliates have a productivity advantage. This productivity effect is modelled as an increase in total factor productivity associated with a larger share of foreign capital. The size of this effects is based on the empirical estimates of Keller and Yeaple (2003).

What does the Services Directive imply for services and the national economies in the EU25 when FDI flows are increased? In the benchmark scenario, bilateral FDI in the EU25 increases on average by 20% in commercial services. However, the overall economic effects are modest. This is a result of the low net FDI inflows into member states, in combination with a low share of foreign capital ownership in commercial services in the EU25, which is on average less than 5% of the total capital stock. The New Member States (NMS)[1], France, Belgium-Luxembourg and Austria benefit the most, by an order of magnitude of 0.1 to 0.2% of national income. For the other countries the effects are smaller.

However, the benchmark case is characterised by restrictive assumptions on the increase in FDI flows, the revenue-generating effects of the tax equivalents and the lack of extra productivity by foreign capital. When these assumptions are eased, higher gains are reported. When FDI in commercial services increases on average by 35% with the Services Directive and the tax equivalents do not generate rents, then GDP and national income can increase by 0.4% and 0.3% respectively. Although all EU25 members benefit, the NMS, France, Belgium-Luxembourg and Austria experience the largest gains. When foreign affiliates are assumed to be more productive than domestic firms, the benefits are much higher. Compared to the benchmark case, GDP and national income increase by an extra 0.8% on average in the EU25.

[1] The NMS are Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

1 Introduction[2]

Foreign direct investment (FDI) in services is often more important to supply foreign markets than cross border trade. In spite of the importance of FDI[3] , in particular in commercial services sectors, theories and empirics on trade are much further developed than on FDI. Moreover, researchers have developed large-scale computational general equilibrium (CGE) models to analyse trade policies. These models are based on microeconomic theory, equilibrium mechanisms, and the forward and backward linkages between various inputs and output markets.[4] On the other hand, the general equilibrium effects of FDI flows are not widely examined in CGE models.[5]

However, in analysing trade liberalisation policies, the role of foreign direct investment becomes increasingly important. Trade through foreign commercial presence is much more important than cross-border trade in services (Karsenty, 2000). Recently some economists have conducted research on the microeconomic underpinnings of FDI and have tried to incorporate this in general equilibrium models. The work of Markusen (2002) is leading. He has developed theories of the behaviour of multinationals in their decisions to service foreign markets by exports or commercial presence. His microeconomic perspective fits into the origins of CGE models. Some others have incorporated these theories in CGE models. Examples are the FTAP model (Hanslow *et al.*, 2000), Rutherford and his co-authors with several models (Markusen *et al.*, 2005; Rutherford *et al.*, 2005), and a version of the Michigan model (Brown and Stern, 2001).

The main objective of this paper is to present our modelling of FDI in WorldScan: CPB's computational general equilibrium model for the world economy. The modelling work is based on the ideas of Petri (1997) and Markusen (2002) who assume that a firm establishing an affiliate abroad also transfers firm-specific knowledge to that affiliate. This assumption implies that capital is more substitutable between countries within a specific sector than between sectors within a country.

[2] This paper benefited from stimulating and sometimes provocative comments by our CPB colleagues: Stefan Boeters, George Gelauff, Albert van der Horst, Fré Huizinga, Henk Kox, Bas Straathof and Paul Veenendaal; by Theo van der Klundert and by the participants of the 9th GTAP conference in Addis Ababa, 2006, and the workshop on Trade in Services, organised by DG Trade in Brussels, 2006. We thank our colleagues Ali Aouragh and Nico van Leeuwen for research assistance

[3] FDI flows have mounted from 100 billion US$ in 1980 to about 600 billion US$ per year in the period 1998-2003. The increase of FDI flows outpaced that of trade flows: FDI flows have increased by about 25% per year in the eighties and nineties, while trade flows have increased annually by about 10%. Sales of foreign daughter companies have increased by 10% to 15% each year while GDP increased at most by 5% per year. Sources: Markusen (2002) and UNCTAD (2004).

[4] Examples of these so called global CGE models are the GTAP model (Hertel, 1997), the Linkage model (Van der Mensbrugghe, 2001), the Mirage model (Bchir *et al.*, 2003), Michigan model (Brown and Stern, 2001), G-Cubed Model (McKibbin and Wilcoxen, 1999), WorldScan model (Lejour *et al.*, 2006), and the model of Rutherford (1999).

[5] Recently, many empirical papers have been published on FDI flows and the productivity of FDI. See Blonigen (2005) for a review of the empirical literature on the determinants of FDI and Rojas-Romagosa (2006) on the productivity effects and the references included there.

Because FDI flows have different effects on the various sectors in the economy, and affect input and output markets, CGE models are a suitable tool for analysing FDI. The relevance of FDI differs per sector. In some sectors foreign presence is relatively more important to serve foreign markets than in other sectors. An example is business services, where the needed proximity between consumers and producers, requires foreign presence instead of cross border trade. Moreover, policy proposals to facilitate FDI are quite often sector specific and not generic. Examples are the proposed Services Directive by the European Commission, and the GATS proposals to liberalise services trade by the WTO members.

Foreign affiliates also compete with domestic firms at their home market, not only on output markets, but also on input markets. Moreover, foreign affiliates can transfer knowledge and intangible capital to hired employees or providers of intermediate deliveries. The question is whether these so called FDI spillovers affect the productivity of domestic firms. Given the inter-sectoral and within-sectoral linkages, CGE models are appropriate tools to analyze the economic effects of these types of relationships.

As an application of our modelling of FDI in WorldScan, we analyze the economic effects of increased FDI induced by the Services Directive in the EU. This directive is a relevant exercise for analysing FDI policies in WorldScan, since the target sector –other commercial services– represents about 40% of the economy and the policy is multilateral instead of unilateral. The output of this application are four simulations. They deal with the lower and upper bound of the expected FDI increases, analyse possible rent removal associated with FDI barriers and gauge the effects of productivity differences between foreign and domestic capital.

Our application is based on the previous work by Kox *et al.* (2004), who concluded that intra-EU trade in other commercial services can increase by 30% to 60% and FDI by 20% to 35%. In a related study, De Bruijn *et al.* (2006), find that the induced-trade effect of the Services Directive (including the country of origin principle) could increase GDP in the EU by 0.3% to 0.7% and consumption by 0.5% to 1.2%. The analysis of Copenhagen Economics (2005) on the Services Directive estimated that GDP could increase by 0.6% including trade and FDI effects. This paper focuses exclusively on the economic effects of FDI changes caused by the Service Directive and therefore it complements the analysis of de Bruijn *et al.* (2006) on the trade effects. These analyses were not taken together because we had to first model FDI in an CGE model. Thus, the analysis of the FDI-induced effects of the Services Directive is a second purpose of this paper.

Services markets in Europe are fragmented. Not only because the diversity in services is large, but also because it is difficult for service providers to supply foreign markets by exporting or setting up a foreign establishment. The main reason is that every country has its own regulation and regulation acts as a barrier, explicitly or implicitly. A service provider has to comply with the regulation of another country, and these regulations can differ from those regulations he already complies with in his own home-country. Thus, FDI barriers have two

dimensions: the level of regulation in each country and the inter-country heterogeneity in regulation. In this paper, FDI barriers are taken from Kox *et al.* (2004). Service providers have to accept these barriers because countries have their own autonomy, but for EU countries aiming at the free movement of services this is hardly acceptable. Therefore the European Commission (2004) has proposed the Services Directive in order to stimulate bilateral trade and direct investment in commercial services; although it excludes transport and financial services.

Section 2 presents an overview of the literature of CGE models on services liberalization with FDI. Section 3 presents WorldScan. Section 4 discusses the modelling of FDI within WorldScan, which includes the new treatment for the demand and supply of capital, and the inclusion of barriers to investing abroad. Productivity differences between domestic and foreign capital are highlighted in Section 5. This section also presents the modelling of these productivity differences. Section 6 describes the economic results of simulating the FDI induced effects of the Services Directive. Section 7 concludes.

2 Empirical review of FDI in CGE models

Some CGE models have incorporated FDI to assess the impact of FDI flows related to services trade liberalization. Lejour and Rojas-Romagosa (2006) present an overview of these models and simulation outcomes. This section presents their main results.

The FTAP and Michigan models are based on the ideas of Petri (1997). He distinguishes activities of domestic and foreign-owned firms. He models production linkages between the headquarter and the foreign plant. The plant uses factor inputs, intermediate inputs and inputs from the headquarter. Consumer demand is not only differentiated by the place of production (standard Armington), but also by the country of ownership. This allows for the possibility that even foreign varieties in non-tradable sectors are consumed.

FTAP contains four types of trade barriers. It distinguishes barriers to commercial presence (primarily through FDI) from barriers to other modes of service delivery; and additionally, it distinguishes non-discriminatory barriers to market access from discriminatory restrictions on national treatment. Moreover, these services trade barriers create rents that are assigned to different agents. A key result of their simulation is that the rents associated with services barriers are substantial. Finally, it is important to note that in the FTAP model the production structure and productivity levels are equal for domestic and multinational firms.

Dee and Hanslow (2000) use FTAP to assess the relative importance of services trade liberalization with respect to the liberalization of agriculture and manufactures in the (then forthcoming) Doha WTO round of negotiations. They find significant overall world-wide welfare gains, although these are mainly concentrated in non-OECD countries. Moreover, the gains in services liberalization are as big as those related to the combined liberalization of the remaining barriers to trade in agriculture and manufactured goods. The main results, however, are driven by increased FDI flows from OECD countries towards emerging markets.

Brown and Stern (2001) adapt the Michigan Model to incorporate relationships and data for cross-border services trade and FDI. To model services barriers they use a tax on capital and labour. When a reduction in these taxes is simulated, they find both sizable but very variable welfare effects (both positive and negative) between different countries. They conclude that these welfare effects are strongly associated with the capability of a country to attract FDI as a result of services liberalization. In one simulation, they exogenously increase the world capital stock by 3%, and then, the welfare effects are positive for all countries. However, this *ad hoc* increase in the total capital stock is not a result of their CGE model nor based on any empirical assessment. It just follows the intuition that a rising real return to capital is likely, over time, to increase the world's capital stock.

Rutherford *et al.* (2005) develop a small open economy CGE comparative static model of Russia to assess the impact of FDI liberalization as part of its WTO accession. In their model, they use the basic concept of Markusen's knowledge-capital model. However, they do not calibrate the full model, nor do they have the data on specific knowledge-capital input. To a

large extent the foreign headquarter is not modelled. Moreover, they do not model FDI flows explicitly. Because of their one-country model, the reduction of FDI barriers is directly translated into an inward flow of FDI, regardless of other regions' trade policies and FDI stocks. This is the advantage of a one-country model but will be different in global CGE models. They also include Dixit-Stiglitz endogenous productivity effects from FDI flows derived from *business* services liberalization. In the scenarios where they only reduce FDI barriers, welfare increases by approximately 2.4% (equivalent variation as percentage of GDP). Although they directly link these relatively large welfare gains with economies of scale in the services sector, implicitly the result is driven by a large rise in FDI inflows.

Copenhagen Economics (2005) also applies the ideas of Markusen's knowledge-capital model. They use their CGE model: CETM to assess the impact of the removal of the barriers to the internal market for services in the EU. Although they use a different methodology and do not explicitly model changes in FDI flows, their overall results can be a useful reference for our own results. When the overall effect of both the trade-related and FDI-related effects of services liberalization are accounted for, they find significant welfare gains of around 0.6% and a GDP increase of 33 billion euros.

A common feature of all these models is that the welfare gains derived by increased FDI related to services liberalization are strongly associated with the *net* inflow of FDI. Countries that experience a net positive inflow are likely to increase GDP and social welfare. This fact can explain why the GDP gain for EU countries with relatively small net inflows is not significant. Without an increase in the total stock of capital, which can in turn produce a significant net positive FDI inflow for must EU countries, it appears that the GDP effects of increased FDI flows due to services liberalization tend to be small.

In addition, the inclusion of imperfect competition is also a common feature of the CGE models that explicitly account for FDI flows. However, the welfare effects do not seem to be directly related to the economies of scale, nor the positive effects of an increased number of varieties in consumption and production.

Another issue that affects the welfare results is how the FDI barriers are modelled. Generally, there are two approaches. One is to associate the revenue from the foreign capital tax with the domestic rents generated by services barriers. The second option is to assign this tax revenue as an iceberg costs on FDI; consequently, the removal of the tax will not diminish the rents and welfare of domestic agents.

Finally, another mechanism that can introduce significant welfare effects will be to model domestic and multinational firms with different cost structures and productivity levels. This

approach will closely follow the theoretical work of Markusen (2002) and, to the best of our knowledge, has not yet been empirically applied to other CGE models with explicit FDI flows.[6]

[6] The MIRAGE model (Bchir *et al.*, 2002) implements an experiment where FDI creates technological spillovers. In this scenario, the welfare gains associated with increased FDI flows after liberalization are greatly expanded.

3 WorldScan model

Characteristics of the model

WorldScan is a computational general equilibrium model for the world economy, see Lejour *et al.* (2006). The model version used in this paper distinguishes nine goods and services markets, a labour market, and a capital market for each of the 23 countries and regions. All EU countries are modelled separately, except for Belgium and Luxembourg, and the three Baltic States, Cyprus and Malta. Moreover, we distinguish the United States, Rest OECD, and Rest of the World. The 9 sectors are agriculture, energy (primary energy and electricity), four manufacturing sectors (high, high-medium, low-medium and low technology), and three services sectors (transport, other commercial services and other services).

All goods and services are produced by using labour, capital, and intermediate inputs, albeit in different proportions. The relative demand for each of these inputs depends on the characteristics of the sectoral production function. In general, we assume that labour and capital are good substitutes (the elasticity of substitution equals 0.85). We consider the various intermediate inputs as good substitutes, but there are hardly any substitution possibilities between the intermediate inputs, on the one hand, and capital and labour, on the other hand.

Consumers demand the various goods and services, and provide labour and capital to the firms. They consume goods and services in different proportions, depending on their prices and the income elasticities of these goods and services. We assume that the supply of labour is exogenous. Because consumers save part of their income, they are able to supply capital to firms in return for non-wage income. Savings depend on income growth and demographic characteristics. In the OECD countries, demography mainly concerns ageing within the population, which reduces savings.

Consumers own the capital stock, which is used for production by firms. Equilibrium between the supply and demand of capital determines the user price of capital.[7] In contrast to the labour market, regional capital markets are assumed to be linked to each other. So if capital is abundant in one region (and thus is relatively inexpensive), it is invested in another region in which capital is scarce (relatively expensive). However, there are some barriers to investing abroad. Therefore, interregional capital mobility reduces, but does not eliminate, capital price differentials between regions. In the latter case we would have one global capital market.

The regional goods and services markets are linked to each other. Not only the home market, but also foreign markets determine demand for a good. Each region produces a different variety of that good. Because we distinguish 23 regions, there are 23 varieties for each of the 9 sectoral goods. In principle, consumers and producers demand all these different varieties. The demand for each of the varieties depends on its relative price, the substitution possibilities between the varieties, transportation costs, trade barriers and preferences for the variety. If the price of a particular variety goes up, demand will decrease in favour of other varieties. Hence, total demand for each variety depends on the demand at the home and foreign markets.

[7] Specifically, the user price of capital is a function of the investment price times the sum of the real interest rate and depreciation rate.

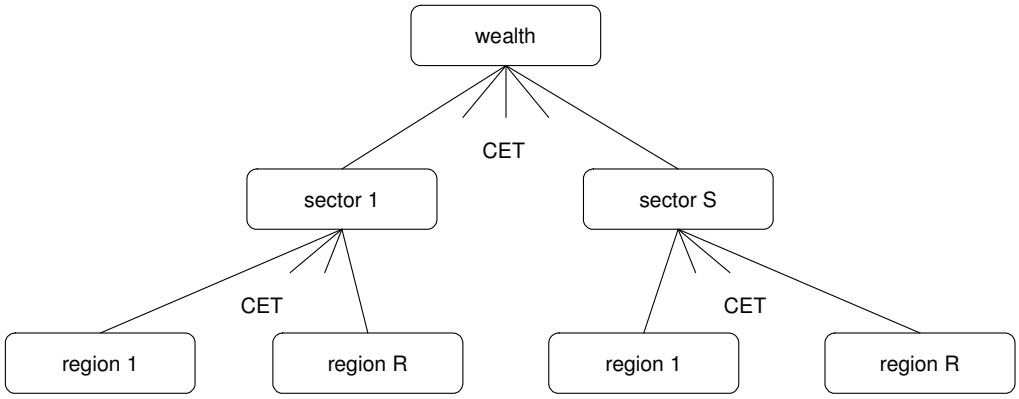
4 Modelling Foreign Direct Investment in WorldScan

4.1 Capital supply[8]

4.1.1 Allocation of capital

The allocation of total wealth in a region over sectors and other regions takes place in two steps.[9] In the first step, the wealth of a region is allocated across sectors as a function of the relative rate of return on capital per sector. In the second step, the region of origin distributes the sectoral capital stocks across the regions of destination. Figure 4.1 depicts this decision tree graphically.

Figure 4.1 Allocation of wealth



The allocation of capital across sectors is located at the upper level of the decision tree, thereby inducing that capital flows are less sensitive to differences in rate of return across sectors than across regions. This decision structure captures the idea that FDI knowledge capital will often be sector specific (Markusen, 2002).

Each allocation step is characterised by a constant elasticity of transformation function (CET). This CET function derives from maximization of the return on the total capital portfolio, R^K , under an aggregation restriction for capital stocks. For the first level the optimization problem reads:

[8] The formation of the regional capital stock and its calibration is treated in Appendix A.

[9] Some CGE models also make a distinction between portfolio capital and FDI. This may be relevant for some issues, but we do not consider this to be of great importance for the subject of this paper: the opening of services markets. In our model, wealth is defined as the value of the capital stock owned.

$$\max: \quad R_o^K = \sum_s r_{s,o}^N \, k_{s,o}$$

$$\text{given}: \quad k_O = \left[\sum_s \alpha_{s,o}^{\frac{-1}{\omega^S}} \, k_{s,o}^{\frac{\omega^S+1}{\omega^S}} \right]^{\frac{\omega^S}{\omega^S+1}}, \quad \text{with } \omega^S > 0,\ \alpha_{s,o} > 0 \text{ and } \sum_s \alpha_{s,o} = 1 \tag{4.1}$$

with k denoting the capital stock volume and r^N the rate of return on capital net of taxes. The subscript o is the region of origin of the capital stock and s the sector. The equations contain two parameters: the preferences in the region of origin for providing capital to a specific sector, $\alpha_{s,o}$, and the elasticity of transformation between sectors, ω^S. This elasticity of transformation must be positive to insure a system of concave isoquants. The system of equations (4.1) can be solved with the Lagrange method, resulting in equations for the allocation of capital across sectors:[10]

$$k_{s,o} = k_o \, \alpha_{s,o} \left(\frac{r_{s,o}^N}{r_o^N} \right)^{\omega^S} \tag{4.2}$$

and the net total rate of return to capital for the region of origin:

$$r_o^N = \left[\sum_s \alpha_{s,o} \left(r_{s,o}^N \right)^{\omega^S+1} \right]^{\frac{1}{\omega^S+1}} \tag{4.3}$$

From equation (4.2) the interpretation of the elasticity of transformation becomes apparent, i.e. the relative change in the volume of the capital stock per sector in response to a relative change in the net rate of return on capital in that sector. Two extreme cases can be distinguished: for ω^S approaching infinity, capital mobility is perfect with an economy-wide uniform rate of return and for ω^S approaching zero, capital mobility is lacking, i.e. sector-specific capital with sector-specific rates of return. By specifying a positive number for the elasticity of transformation, imperfect capital mobility is assumed. Higher values for ω^S imply more capital mobility, i.e. capital allocation will be more sensitive to differences in the net rate of return.

At the second level, the sectoral capital stock of the region of origin is allocated across the regions of destination. The maximization problem of this level is a variation on equations (4.1):

[10] Note that the CET function generally implies a loss in capital stock due to the allocation over sectors, i.e. $k_o \leq \sum_s k_{s,o}$.

$$\max: \quad R^K_{O,s} = \sum_d r^N_{s,od}\, k_{s,od}$$

$$\text{given}: \quad k_{s,o} = \left[\sum_d \alpha_{s,od}^{\frac{-1}{\omega^R}}\, k_{s,od}^{\frac{\omega^R+1}{\omega^R}} \right]^{\frac{\omega^R}{\omega^R+1}}, \quad \text{with } \omega^R > 0, \alpha_{s,od} > 0 \text{ and } \sum_{\mathrm{d}} \alpha_{s,od} = 1 \tag{4.4}$$

with d denoting the region of destination. Again, these equations contain two parameters: the preference in the region of origin for a specific region of destination , $\alpha_{s,od}$ [11], and the elasticity of transformation between regions of destination, ω^R . Solving the maximization problem of equations (4.4) yields the equation for the capital allocation to the regions of destination:

$$k_{s,od} = k_{s,o}\, \alpha_{s,od} \left(\frac{r^N_{s,od}}{r^N_{s,o}} \right)^{\omega^R} \tag{4.5}$$

and the net rate of return to capital for the region of origin per sector:

$$r^N_{s,o} = \left[\sum_d \alpha_{s,od} \left(r^N_{s,od} \right)^{\omega^R+1} \right]^{\frac{1}{\omega^R+1}} \tag{4.6}$$

FDI liberalization in our model is implemented as a reduction of the tax on capital returns (i.e. a rise in the return on capital in the region of destination). Given the specified two-level CET-function, the higher rate of return on capital will result in a higher supply of capital to that region. The magnitude of the response depends on the elasticities of transformation.

The net foreign income of a region r is defined by the net reward for capital services:

$$Y^{NFI}_r = \sum_s \sum_{d \neq r} \tilde{r}^N_{s,rd} k_{s,rd} - \sum_s \sum_{o \neq r} \tilde{r}^N_{s,or} k_{s,or} \tag{4.7}$$

with $\tilde{r}$ denoting the net rate of return on capital corrected for depreciation.

4.1.2 The specification of the parameters

The preference parameters of the CET functions are calibrated on FDI-stock data.[12] Inverting equations (4.2) and (4.5) to the preference parameters and enforcing a unit adding up constraint for parameters, we obtain:

[11] In general, the preference parameter for capital originating from the home region will be close to 1, which reflects the home bias of international capital flows.

[12] Van Leeuwen and Lejour (2006) describe the construction of the bilateral FDI stock data by sector, mainly based on OECD statistics.

$$\alpha_{s,o} = \frac{Rq_{s,o}\ r_{s,o}^{N\ -(\omega^S+1)}}{\sum_s Rq_{s,o}\ r_{s,o}^{N\ -(\omega^S+1)}}, \qquad \text{with} \quad Rq_{s,o} = \frac{R_{s,o}^K}{R_o^K} \tag{4.8}$$

with $Rq_{s,o}$ denoting the share of each sector in the total return to capital in the region of origin, and

$$\alpha_{s,od} = \frac{Rq_{s,od}\ r_{s,od}^{N\ -(\omega^R+1)}}{\sum_d Rq_{s,od}\ r_{s,od}^{N\ -(\omega^R+1)}}, \qquad \text{with} \quad Rq_{s,od} = \frac{R_{s,od}^K}{R_{s,o}^K} \tag{4.9}$$

with $Rq_{s,od}$ denoting the sectoral specific share of the return to capital of each region of destination in the total return to capital in the region of origin. These shares are exogenous and their values are derived from OECD statistics, see Van Leeuwen and Lejour (2006).

No compelling information can be found in the empirical literature on the values of the transformation elasticities. Therefore, WorldScan follows the specification of other CGE-models used for the study of FDI liberalization. Therefore, the results of our study are comparable with the rest of the literature. Table 4.1 gives the elasticities of capital transformation used in the FTAP-model (Hanslow *et al.*, 1999), the DART-model (Springer, 1998) and the model of Lee and van der Mensbrugghe (2001). In line with these values, WorldScan assumes a sectoral elasticity of transformation equal to 3 and a regional elasticity of transformation equal to 5.

Table 4.1 Transformation elasticities from several CGE models

FTAP	
Sectoral	6.0
Domestic versus Foreign	6.5
Regional	7.0
DART	
Domestic versus Foreign	4.0
OECD versus non-OECD	2.0
Intra OECD-regions	8.0
Intra non-OECD regions	4.0
Lee and van der Mensbrugghe	
Sectoral	2.0
Domestic versus Foreign	3.0
Regional	4.0

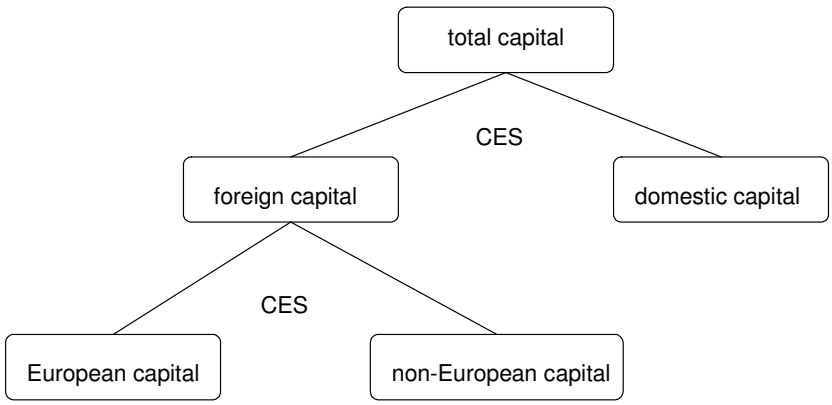
Source: FTAP(1999) assuming a rate of return on capital equal to 0.05, Springer (1998), and Lee and van der Mensbrugghe(2001).

4.2 Demand for capital

Firms demand capital to produce goods and services. The input of capital in production is specified as a two-level CES-function. Figure 4.2 depicts the capital input part of the production function graphically. On the highest level of the production tree, domestic capital is distinguished from foreign capital. In production, both types of capital are aggregated by a CES-function to one input factor capital. For this CES-function the elasticity of substitution is assumed to be 4, in accordance with the DART-model (Springer, 1998).[13] In the case of reducing the user costs of foreign capital (Services Directive), the demand for domestic capital is reduced in favour of foreign capital because capital from other EU countries becomes relatively cheaper.

On the lowest production level, foreign capital from Europe is distinguished from non-European capital. A substitution parameter of 2 is assumed for this particular CES-function.[14]

Figure 4.2 The structure of capital inputs for production



4.3 Clearance of the capital markets

In the previous sections, the supply and demand equations are specified. Based on these equations, the clearance of the capital markets can be formulated. For every region-sector combination three capital markets exist: a market for domestic capital, k^D, a market for foreign capital from Europe, k^E, and a market for foreign capital from non-Europe, k^W. For every market a different clearance rate of return will evolve:

[13] For additional information on the use of CES-functions in the production tree of WorldScan, see Lejour *et al.* (2006).
[14] Empirical evidence on the elasticity of substitution between different types of capital is lacking. Instead, a substantial degree of homogeneity for capital is assumed to be reasonable.

$$
\begin{aligned}
k_{s,d}^{S,D}\left(r_{s,d}^{D}\right) &= k_{s,d}^{D,D}\left(r_{s,d}^{D}\right) \\
k_{s,d}^{S,E}\left(r_{s,d}^{E}\right) &= k_{s,d}^{D,E}\left(r_{s,d}^{E}\right) \\
k_{s,d}^{S,W}\left(r_{s,d}^{W}\right) &= k_{s,d}^{D,W}\left(r_{s,d}^{W}\right)
\end{aligned}
\tag{4.10}
$$

which gives the following gross rate of returns:

$$
\begin{aligned}
r_{s,od} &= r_{s,d}^{D}, \quad \text{for} \quad o = d \\
r_{s,od} &= r_{s,d}^{E}, \quad \text{for} \quad o \neq d \quad \textit{and} \quad o \in \textit{Europe} \\
r_{s,od} &= r_{s,d}^{W}, \quad \text{for} \quad o \neq d \quad \textit{and} \quad o \in \textit{non Europe}
\end{aligned}
\tag{4.11}
$$

with o denoting the region of origin and d the region of destination.

4.4 Tariff equivalent measures

Heterogeneity in regulation between regions is an impediment to FDI flows. The proposed EU-directive lowers intra-EU heterogeneity in product market regulation for services. In the WorldScan model, this heterogeneity in regulation takes the form of an ad valorem tax rate on capital returns, t^R. This tax rate differs by sector, importing country and country of origin, such that:

$$
r_{s,od} = \left(1 + t_{s,od}^{R}\right) r_{s,od}^{N} \tag{4.12}
$$

The revenues of this tax rate are returned in a lump-sum fashion to the households of the region using the capital for production:[15]

$$
T_d^R = \sum_s \sum_d t_{s,od}^{R} \; r_{s,od}^{N} \; k_{s,od} \tag{4.83}
$$

The tariff equivalent measures are calibrated on data for the expected increase in FDI stock due to the Services Directive, as documented in Kox *et al.* (2004). In an empirical analysis they related the size of bilateral FDI stocks to the level of FDI restrictions and heterogeneity in regulations between the home and host country. The statistical significant results are used to assess the effect of the Services Directive, aimed at reducing the level of FDI restriction and heterogeneity in regulations, on the bilateral FDI stocks.

[15] As an alternative to the tariff equivalent measures, an iceberg-type cost can be assumed. This is a cost that does not generate rents nor tax revenues, and is comparable to the iceberg cost specification used in trade theory. In any case, both formulations will be used and their results compared in Section 6.

5 Productivity of foreign capital

Replacing domestic capital with foreign capital can raise production output through two channels.[16] First, assuming the existence of separate domestic and foreign firms, productivity differences between these two types of firms may exist. On average, foreign firms are more productive than domestic firms and a shift to more foreign capital will therefore logically raise total output. Second, the higher level of FDI related knowledge will not only remain within the firm, but will spill over to other firms as well. For instance, competition will force domestic firms to raise their standards and quality as well.

A review of the empirical studies about productivity differences between domestic and foreign firms reveals mixed results: a large bandwidth of productivity differences is found (Rojas-Romagosa, 2006). Often the productivity differences are a composition effect. The foreign firms are on average bigger and more productive than the average domestic firm, but corrected for size the productivity differences are much smaller or negligible. In addition foreign multinationals often acquire the most productive domestic firms (cherry picking).

A straightforward way to incorporate separate domestic and foreign firms in the WorldScan model would be to specify two different production functions, as in other CGE models. The production function of the domestic firm would have domestic capital and labour as inputs and a numeraire for Total Factor Productivity (TFP) levels, while the production function of the foreign firm would have foreign capital and (domestic) labour as inputs and a higher TFP level compared with the numeraire TFP level. The value for this TFP level of the foreign firm should be derived from empirical studies.

However, WorldScan assumes a hybrid firm using both domestic and foreign capital for two reasons. The first is that we do not have meaningful data to discriminate the production functions for domestic and foreign capital. Most other models therefore assume similar production functions. The second is that it expands the dimensions of the model substantially, while this expansion does not give much additional insights in our view. Other models have to restrict the number of sectors to cope with the larger dimension introduced by foreign capital. The only meaningful interpretation of productivity differences in the context of a hybrid firm is the difference in marginal productivity between domestic and foreign capital. However, marginal capital productivity differs too much from the productivity definitions used in the empirical literature, to allow for a meaningful conversion of the estimated parameters.

As a result of all the difficulties mentioned above, we decided to model the productivity effect of additional foreign capital in the form of externalities. Benczúr *et al.* (2003) describe a model for the Hungarian economy, which contains a production function with foreign capital externalities and is closely related to the WorldScan production function:[17]

[16] See Barba Navaretti and Venables (2004).

[17] We neglect sectoral and regional notation in the following equations.

$$y = A\, g\left(k^F, k^D, l\right) \tag{5.1}$$

with y denoting the production output, g a general homogenous production function of degree one, l labour supply, k^F and k^D foreign (the aggregate of European and non-European) and domestically owned capital. A represents total factor productivity (TFP) which includes the external effect of the foreign capital ratio:

$$A_t = A_0 \left(1+\mu^{TFP}\right)^t e^{\gamma \frac{k^F_{t-1}}{k_{t-1}}} \tag{5.2}$$

Equation (5.2) expresses the TFP level A_t as the product of a scaling factor of output A_0, the constant exogenous TFP growth μ^{TFP}, and the output generating externality implied by the ratio of foreign owned capital, k^F, to total capital, k. We only have to add this externality term to the TFP equation in WorldScan to construct equation (5.2). This specification of the production function implies homogeneity of first degree in the input factors. Foreign owned capital is divided by total capital in order to avoid scaling effects (otherwise larger regions would get higher productivity gains). A higher FDI intensity, i.e. foreign owned capital divided by total capital, raises the TFP level.

A direct implication of equations 5.2 is a higher impact of FDI shocks for regions with a higher FDI intensity. Countries like The Netherlands, Belgium, Luxemburg, and Ireland will benefit relatively more from FDI liberalisation, given an identical FDI shock (see Table 6.1).

We have implemented this production function with TFP externalities in WorldScan to assess the productivity effects associated with foreign establishments. Following a review of the empirical literature on the productivity effects of FDI inflows, we take a value of 1.09 for gamma (Keller and Yeaple, 2003).

An important conclusion of this literature is that the productivity impact of FDI inflows in the host country is conditional on the absorptive capacity of domestic firms. The evidence suggests a positive relationship between the development level of the country and the productivity impact of FDI inflows. The study by Keller and Yeaple is based on data for the United States, and to be consistent with the evidence on absorptive capacity, we assume that this gamma value of 1.09 is an upper bound for these productivity effects.[18]

As an illustration, in the study of Benczúr *et al.* (2003) the γ-parameter is calibrated to actual Hungarian GDP growth data in the period 1996-2003. This criterion resulted in a value for gamma of approximately 0.1.[19]

[18] For details see Rojas-Romagosa (2006).

[19] Benczúr *et al.* (2003) define the foreign capital ratio as foreign owned capital divided by production output, while WorldScan uses foreign owned capital divided by total capital. The reason is that in our recursive dynamic model the capital-output ratio is not stable after shocking the size of foreign capital. This affects the size of the external productivity effect differently for every period. This is an undesirable property of the model, which we avoid.

Finally, the gamma parameters are derived from macro production functions. In WorldScan we use these values for sectoral specific externalities, neglecting possible spillovers between sectors.

6 Liberalising commercial services in Europe

The European Commission proposed the Services Directive to open up the national markets for commercial services (except transport and financial services). Kox *et al.* (2004) have estimated that FDI in other commercial services could increase by 20% (lower bound) to 35% (upper bound) within the EU. They use an econometric approach to measure the impact of heterogeneity in regulation between countries on bilateral trade and investment in commercial services. Subsequently they assessed the impact of the Services Directive on differences in regulation and calculated the impact on bilateral FDI and trade in services. Appendix B presents the bilateral increase in foreign capital stocks in commercial services for nearly all EU Member States.[20] The aim of this study is the analysis of the general equilibrium effects of the intra-EU FDI increase stimulated by the Services Directive. Cross border trade in other commercial services will also increase, but this is analysed separately in De Bruijn *et al*. (2006).

Table 6.1 presents some characteristics of the other commercial services sector in Europe in 2001. Other commercial services account for about 45% of the economy. This share is substantially higher in countries like Austria, Germany, and Italy. On the other hand, in Belgium-Luxembourg, Denmark, Finland, Greece, Ireland, and in most of the New Member States (NMS),[21] it is substantially lower. For the EU25 only 5% of services production is exported. In Ireland commercial services are exceptionally internationalized. Belgium-Luxembourg, the Netherlands, Austria, and Denmark export also relatively much services. The share of foreign capital is large in Belgium, Denmark, Netherlands, and Ireland. For the EU as a whole it is on average 5.8% in the sector other commercial services. On average most of the foreign capital stock is owned by other EU citizens. This observation implies that an ex ante increase in intra-EU FDI of 20% to 35% will have a modest effect on the total capital stock in other commercial services in each Member State.

[20] Due to lack of data no results for Slovakia, Slovenia and Rest EU25 are available. We assume that for these countries the FDI increase with their partner countries are the same as for the Czech Republic, Hungary, and Poland respectively.
[21] In WorldScan the NMS region consists of Poland, Czech Republic, Hungary, Slovakia, Slovenia and Rest EU25.

Table 6.1 Other Commercial Services sector in 2001

	Value added[a]	Exports[b]	Imports[b]	Openness[c]	Specialisa-tion[d]	EU capital[e]	Non-EU capital[e]
EU25	45.5	334.3	356.1	5.4	105.9	3.7	2.1
Germany	53.1	54.4	77.7	3.7	73.7	3.4	1.4
France	40.0	40.9	31.2	4.6	101.3	4.8	1.6
United Kingdom	44.5	78.6	58.8	6.4	188.9	2.4	3.6
Italy	51.9	29.0	36.2	3.7	89.2	0.2	0.1
Spain	41.8	13.6	13.4	3.5	82.3	1.4	2.6
Netherlands	45.4	28.9	31.5	9.0	149.1	8.7	3.8
Belgium-Luxembourg	37.0	19.6	23.2	14.4	92.1	33.0	16.5
Denmark	32.2	7.2	5.3	8.2	97.2	13.3	14.7
Sweden	41.8	14.9	14.7	9.5	127.5	6.8	4.9
Finland	31.2	3.0	4.7	4.8	50.6	4.1	0.4
Ireland	33.6	13.6	29.1	24.8	134.1	15.4	12.4
Austria	53.8	13.0	11.6	8.0	137.6	2.4	0.6
Greece	38.5	2.8	3.4	2.9	95.9	2.0	0.7
Portugal	40.5	2.6	2.3	2.5	72.2	10.1	2.1
Poland	39.6	2.7	3.2	2.3	54.9	2.9	0.7
Czech Republic	33.6	2.1	2.5	4.6	45.3	9.1	1.3
Hungary	42.7	2.6	3.3	7.0	64.5	7.4	4.3
Slovakia	32.8	1.0	1.4	6.9	54.0	5.1	0.6
Slovenia	35.2	0.8	0.8	5.8	57.1	1.8	0.2
Rest EU25	40.0	3.1	1.6	11.8	133.7	3.3	2.6
United States	48.2	137.5	108.5	1.7	134.3	1.4	0.5
Rest OECD	40.0	109.1	120.1	2.5	73.2	0.4	0.7
Non OECD	31.3	144.4	140.6	4.3	91.3	3.5	4.3

Source: Dimaranan and McDougall (2004), Van Leeuwen and Lejour (2006) and own calculations.

[a] Value added of other commercial services as share of GDP in the region.

[b] Value of exports and imports in other commercial services expressed billions US$ (includes intra-EU trade).

[c] Share of exports in production in other commercial services.

[d] Specialization is characterised by the Balassa index. The index compares the share of other commercial services in total exports in a country towards that share in the world economy. If the index exceeds 100 , a country is relatively specialized in exporting other commercial services.

[e] Share of the foreign capital stock (owned by other EU member sates or non-EU countries) in the total capital stock in the sector other commercial services.

6.1 Benchmark scenario

The benchmark scenario assumes increases in bilateral intra-EU FDI stocks according to the lower bound increase of Kox *et al.* (2004). The average increase in FDI stocks is thus 20%. The increase in FDI stocks is simulated in WorldScan by lowering the taxes on capital, see equation (4.11). In the benchmark scenario we assume that these taxes generate revenues for the host country. Furthermore, we assume that extra foreign capital does not generate extra

productivity. Section 0 relaxes these last two assumptions and discusses also the results of the upper bound scenario.

This subsection presents first the results of calibrating the tax equivalents and the impact of eliminating these tax equivalents on the user costs of capital. Then we discuss the effects on the demand for domestic and foreign capital and output in other commercial services. Finally, the macroeconomic effects are presented.

The increase in FDI flows due to Services Directive is simulated by lowering the tax equivalent. We have calibrated the values of these tax equivalents in such a way that the elimination of the tax equivalent increases the bilateral FDI stocks by the numbers presented in the appendix *ex ante.* These numbers are derived by Kox *et al.* (2004) in their analysis of the Services Directive on bilateral services trade and FDI flows. The changes in the tax equivalents are presented in the first column of Table 6.2.

Table 6.2 User costs of capital inputs in Commercial Services for the lower bound Services Directive

	Tax shock	User costs of domestic capital	User costs of EU capital	User costs of non-EU capital	User costs of total capital
Germany	– 9.9	0.1	– 4.7	0.9	– 0.1
France	– 9.8	– 0.4	– 4.9	0.7	– 0.7
United Kingdom	– 8.3	0.2	– 4.6	0.5	0.0
Italy	– 10.8	0.0	– 4.8	1.1	0.0
Spain	– 15.7	– 0.2	– 8.7	0.5	– 0.4
Netherlands	– 7.8	0.6	– 3.5	0.7	0.2
Belgium-Luxembourg	– 10.2	0.8	– 5.9	0.4	– 1.4
Denmark	– 11.8	0.9	– 6.3	0.6	– 0.2
Sweden	– 12.4	0.1	– 6.5	0.8	– 0.3
Finland	– 13.5	– 0.4	– 6.9	1.4	– 0.9
Ireland	– 9.3	0.1	– 4.9	0.4	– 0.6
Austria	– 20.6	– 0.4	– 10.6	1.9	– 0.8
Greece	– 13.5	0.0	– 6.3	1.2	– 0.1
Portugal	– 14.4	0.9	– 7.0	1.7	0.4
Poland	– 18.0	– 1.1	– 9.3	1.4	– 1.6
Czech Republic	– 14.6	– 1.0	– 7.6	1.2	– 1.7
Hungary	– 16.7	– 1.1	– 9.4	0.8	– 1.7
Slovakia	– 13.5	– 0.5	– 7.1	1.5	– 0.8
Slovenia	– 13.9	– 0.1	– 7.3	1.7	– 0.3
Rest EU25	– 21.7	– 1.1	– 11.7	0.9	– 1.7

Source: WorldScan simulations. Numbers are percentage differences from the baseline in 2040.

Table 6.2 shows that the tax shock (or elimination of the tax) is absorbed for about 50% in lower prices for EU capital from other member states. The price of domestic capital decreases slightly for most NMS, but increases for most old member states. The relative large increases in the Netherlands and Portugal imply a higher average user cost of capital. For Belgium-Luxembourg, Denmark and Ireland the large price increase in domestic capital does not lead to

higher average user costs of capital, because of the large share of foreign EU capital in these countries and the fact that the user costs of foreign EU capital decline.

The changes in the user costs of capital affect the demand for capital from the various home countries. Table 6.3 shows that capital from other countries increases, but the share of domestic capital decreases. Proportionally the effects on domestic capital are much smaller than on foreign capital, but in absolute size the effects are comparable due to the modest role of foreign capital in total capital in commercial services. For Belgium-Luxembourg, the Netherlands, Denmark, Ireland and Portugal the relative decrease in domestic capital is larger. This reflects their capital outflow. Although on average the share of EU capital increases by 18.5% in the member states (domestic capital excluded), the total capital stock only increases by 0.3%. This is not surprising: savings are not affected[22] and thus, liberalising FDI only affects the distribution of the total capital stock between countries. Because capital in Europe becomes cheaper, capital from other, mainly OECD, countries is attracted to fulfil the extra demand for capital.

The variation in results over countries depends on the net capital inflows, the specialisation in commercial services and the share of foreign capital ownership. Table 6.3 shows that the output of the commercial services sector decreases slightly in the Netherlands, Denmark, and Portugal. For the other countries, the increase in capital stimulates an increase in the production of commercial services.

Changes in capital inputs correspond directly to changes in outputs, which are approximately one-third of the capital input changes. The highest increases in capital inputs are found in the NMS (New Member States), while capital contracts in the Netherlands and Portugal.

Column 2 in Table 6.3 shows that the foreign capital inflows for commercial services have increased substantially (between 10 en 50 %). This corresponds to the bilateral increases in foreign capital found by Kox *et al.* (2004) presented in appendix B. This is not surprising because the tax shocks presented in Table 6.2 are based on their results. Because the capital outflows are also increasing with roughly the same amount for most EU countries, the net capital stock will not change substantially. This small changes in the net inflows of FDI is a crucial determinant of our results. As was highlighted in Section 2, previous CGE models only found substantial welfare gains when there were positive FDI inflows.

[22] Lejour *et al.* (2006) explain that the change in the savings rate is an empirically estimated function with GDP growth and changes in the composition of the population as explanatory variables. From their empirical analysis it follows that the interest rate (or user cost of capital) has no significant statistical relation with changes in the savings rate. From the theory the effects of the interest rate on savings is ambiguous because of countervailing income and substitution effects.

Table 6.3 Capital inputs and output for Commercial Services for the lower bound Services Directive

	Domestic capital	EU capital	nNon-EU capital	Total capital	Output
EU25	– 0.7	18.5	3.1	0.3	0.1
Germany	– 0.7	16.7	4.3	0.1	0.0
France	– 0.7	16.0	3.4	0.9	0.2
United Kingdom	– 0.6	13.2	2.1	0.0	0.0
Italy	0.0	18.9	5.3	0.0	0.0
Spain	– 0.4	24.3	2.5	0.4	0.1
Netherlands	– 1.9	12.7	3.5	– 0.2	– 0.1
Belgium-Luxembourg	– 7.3	16.2	1.9	1.3	0.4
Denmark	– 4.0	18.7	3.0	0.1	– 0.1
Sweden	– 1.5	21.1	4.0	0.3	0.1
Finland	– 1.0	27.0	7.1	1.1	0.2
Ireland	– 2.1	13.7	2.0	0.5	0.2
Austria	– 0.6	42.8	9.8	0.9	0.2
Greece	– 0.2	23.3	5.7	0.0	0.0
Portugal	– 2.2	30.1	8.7	– 0.8	– 0.2
Poland	– 0.3	34.0	7.1	1.9	0.6
Czech Republic	– 0.8	27.3	6.0	1.7	0.6
Hungary	– 0.6	28.2	3.6	1.7	0.7
Slovakia	– 0.3	28.2	7.5	0.7	0.4
Slovenia	– 0.3	30.6	8.6	0.2	0.1
Rest EU25	– 0.7	36.3	4.4	2.2	0.7

Source: WorldScan simulations. Numbers are percentage differences from the baseline in 2040.

In our application, the main change is on the composition of capital ownership, with an increase of foreign capital and a decrease of the share of domestic capital.[23] The inflows and outflows of capital are determined exogenously and depend only on the scenario, i.e. lower or upper bound. This additional output in commercial services will only partly be absorbed by the domestic market; the rest has to be exported, while the imports of commercial services will decline. EU producers set lower output prices for commercial services compared with the global market price to increase their foreign market shares.

The macro effects for the lower bound Services Directive can be found in Table 6.4. The change in GDP is modest for all European countries, between –0.2 and 0.5. Belgium-Luxembourg, the Netherlands, Denmark, Ireland and Portugal face a small GDP loss because of a reduction in exports and capital outflow. Most of these countries are specialized in commercial services, measured in terms of relative exports (see Table 6.1). The shift from exports to sales of foreign establishments could cause this effect. However, the GDP decrease in these countries is compensated by a rise in the returns to their FDI abroad, which increases national income and consumption. For most countries national income changes are not visible at the first digit level, and a few countries experience a very modest increase.

[23] This change in the share of foreign capital is crucial to our outcomes when we assume productivity differences between domestic and foreign capital.

Table 6.4 Macroeconomic effects for the lower bound Services Directive

	GDP	National Income	Exports	Imports
EU25	0.1	0.0	0.0	0.0
EU15	0.0	0.0	0.0	0.0
Germany	0.0	0.0	0.0	0.0
France	0.2	0.1	0.4	– 0.1
United Kingdom	0.0	0.0	– 0.1	0.0
Italy	0.0	0.0	0.0	0.0
Spain	0.1	0.0	0.1	0.0
Netherlands	– 0.1	0.0	– 0.3	0.1
Belgium-Luxembourg	– 0.1	0.3	– 0.6	0.2
Denmark	– 0.2	0.0	– 0.5	0.1
Sweden	0.0	0.0	0.0	0.0
Finland	0.1	0.1	0.2	0.0
Ireland	– 0.1	0.0	– 0.2	– 0.1
Austria	0.2	0.1	0.3	0.0
Greece	0.0	0.0	0.0	0.0
Portugal	– 0.2	0.0	– 0.5	0.1
New Member States	0.5	0.2	0.7	– 0.1
Poland	0.5	0.2	1.2	– 0.4
Czech Republic	0.5	0.2	0.5	0.1
Hungary	0.5	0.2	0.7	0.1
Slovakia	0.3	0.1	0.4	0.1
Slovenia	0.0	0.0	0.1	0.0
Rest EU25	0.5	0.2	0.6	0.0

Source: WorldScan simulations. Numbers are percentage differences from the baseline in 2040.

6.2 Alternative scenarios

Table 6.5 shows the changes in GDP for three variations on the benchmark scenario: an upper-bound scenario, an upper bound scenario in which the tax equivalents do not generate revenues, and a lower-bound scenario with productivity effects.

The first scenario considers the upper bound scenario of the Services Directive, i.e. the maximum change in foreign capital due to this Directive. As for the benchmark scenario tax equivalents on intra-EU bilateral capital stocks are eliminated. In this scenario, the values of the tax equivalents are calibrated at a higher level than in the benchmark scenario such that the elimination of the tax equivalents mimics the FDI stock increases according to the upper bound. Intra-EU FDI increases by 35% on average instead of 20% (see Kox *et al.*, 2004). The third and fourth column of Table 6.5 present the GDP and national income effects, respectively. The effects are about twice as large as the effects of the lower bound scenario. However, even these effects are modest. The largest GDP gains are observed for the NMS, Austria, and France. United Kingdom, Belgium-Luxembourg, the Netherlands, Denmark and Portugal face small GDP losses. The NMS and Belgium-Luxembourg experience the largest income gains.

Table 6.5 Effects of different FDI liberalisation scenarios on GDP and national income (NI)

2040	Lower-bound (Benchmark, see also Table 6.4)		Upper bound		Upper bound and no revenues from tax equivalents		Lower bound and productivity effects	
	GDP	NI	GDP	NI	GDP	NI	GDP	NI
EU25	0.1	0.0	0.1	0.1	0.4	0.3	0.8	0.8
EU15	0.0	0.0	0.1	0.1	0.3	0.3	0.7	0.7
Germany	0.0	0.0	0.0	0.0	0.3	0.3	0.6	0.6
France	0.2	0.1	0.3	0.1	0.7	0.5	1.3	1.2
United Kingdom	0.0	0.0	– 0.1	0.0	0.1	0.1	0.3	0.4
Italy	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1
Spain	0.1	0.0	0.1	0.1	0.3	0.3	0.7	0.6
Netherlands	– 0.1	0.0	– 0.2	0.0	0.1	0.2	0.9	1.0
Belgium-Luxembourg	– 0.1	0.3	– 0.1	0.5	0.5	1.1	1.8	2.0
Denmark	– 0.2	0.0	– 0.3	0.0	0.1	0.3	1.2	1.4
Sweden	0.0	0.0	0.0	0.0	0.3	0.3	1.0	1.0
Finland	0.1	0.1	0.2	0.1	0.4	0.3	1.2	1.2
Ireland	– 0.1	0.0	-0.1	0.0	0.2	0.3	0.7	0.8
Austria	0.2	0.1	0.4	0.2	0.6	0.4	1.4	1.3
Greece	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2
Portugal	– 0.2	0.0	– 0.3	0.0	0.0	0.2	0.9	0.9
New Member States	0.5	0.2	0.8	0.4	1.2	0.8	1.8	1.5
Poland	0.5	0.2	0.9	0.4	1.2	0.8	1.9	1.6
Czech Republic	0.5	0.2	0.8	0.4	1.2	0.9	1.8	1.6
Hungary	0.5	0.2	1.0	0.4	1.5	1.0	2.0	1.7
Slovakia	0.3	0.1	0.5	0.3	0.7	0.5	0.9	0.8
Slovenia	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.3
Rest EU25	0.5	0.2	1.0	0.5	1.3	0.9	2.2	1.8

Source: WorldScan simulations. Numbers are percentage differences from the baseline in 2040.

The second scenario considers the impediments to FDI flows to be of a kind iceberg cost type as is commonly modelled for trade flows; part of the foreign capital is lost (or becomes less efficient) as a result of the transfer from one region to other regions. The price of capital is raised with the same amount, keeping the value of the foreign capital flows constant. This scenario addresses a discussion issue in Section 4.4. In this formulation, the FDI barriers do not create rents for the host country. This alternative specification increases the GDP and national income somewhat compared to the benchmark (see column 5 and 6 of Table 6.5), because costs for investing abroad are eliminated, without a loss of rent income. This specification of FDI liberalisation increases GDP gains, because extra inefficiencies are removed. In the tax-specification of FDI barriers, income is reduced due to lost rents. In the iceberg-specification the barriers do not generate income such that liberalisation does not imply an income loss. In particular, the larger EU countries seem to benefit from liberalising FDI in commercial services in this specification. For the EU as a whole the GDP gain is about 0.4% and the gain in national income is nearly the same. All member states raise their production and income. The largest

gains are still for the NMS, Belgium-Luxembourg, Austria and France. For most of the countries facing GDP losses in the tax specification, GDP increases are modest. An exception is Belgium-Luxembourg, where there are relatively high GDP gains for this scenario. Although the barrier itself for inward EU capital was relatively low, the income loss was relatively large because of the high share of foreign EU capital in Belgium-Luxembourg. If the barriers do not create rents, the income loss vanishes by definition.

The third scenario considers the productivity effect of extra foreign capital on the productivity of the domestic firms using the specification in Section 5. These effects are substantially larger than in the previous scenarios. This is not surprising given the fact that gamma is 1.09 (equation 5.2) and the ratio of the foreign capital stock to the total capital stock in other commercial services is about 5%, resulting in a value for the elasticity of the foreign capital stock on productivity of 6.5%. This suggests that a FDI increase of about 20% would imply a value added increase of about 1.3% in other commercial services, resulting in a GDP increase of about 0.6%.

The country effects vary widely. First of all, the increase in the inward foreign capital stocks per country varies (as for all simulations). It is the largest for Austria, Finland, NMS, and some Mediterranean countries. Second, the share of inward foreign capital in commercial services varies (see Table 6.1). As a result the elasticity of foreign capital to productivity differs per country (equation (5.2)). Finally, the increase in FDI exerts a downward pressure on the price for capital and production in commercial services. The size of this effect varies per country and leads to changes in the allocative efficiency of production.

It is obvious that the introduction of external effects in productivity due to extra foreign capital magnifies the economic effects of facilitating foreign services establishments in Europe. The estimate of gamma is crucial here. As explained in Rojas-Romagosa (2006), the value we have chosen is a rough estimate (and upper bound) of productivity effects of inward FDI based on Keller and Yeaple (2003). Moreover, it is expected that this value varies between countries. Therefore, these results point to the large potential gains associated with increases in productivity, but we are less sure about the precise numerical impact.

7 Conclusions

We have modelled FDI in WorldScan by introducing a capital stock in production composed of domestic and foreign (EU and non-EU) capital. In this way we avoided the complications of extra varieties based on capital ownership as in other CGE models. As a result we are able to distinguish more regions and sectors. We are convinced that the modelling fits best to the availability and quality of the data. However, the introduction of product varieties based on ownership as in other models could increase welfare by the love-of-variety effects.

In our application of the Services Directive, the economic gains of liberalising FDI in other commercial services are modest, from 0.1% for the EU25 as a whole (if the barriers are low and do generate income rents), up to 0.4% (if the barriers are high and are cost creating). Opening up European services markets by facilitating the establishment of foreign affiliates increases the share of foreign capital in services, but it does not improve substantially the allocative efficiency. Capital becomes slightly cheaper, but this does not increase the supply of productive capital, since the lower price of capital does not effect savings.

The results of other CGE studies with multi-country models show a similar pattern. Overall effects are modest, and only countries with large FDI inflows benefit significantly. If FDI barriers are specified as non-tariff/tax barriers, liberalising FDI implies larger effects, as expected, but the macro gains of liberalising FDI are still modest.

However, if foreign capital increases productivity, either because foreign establishments are directly more productive, or because they induce productivity spillovers to domestic firms, the economic effects of liberalising FDI increase substantially. The size of these productivity effects is uncertain. In most cases foreign affiliates are more productive than the domestic firms in the host country. Moreover extra competition and spillovers by inter industry linkages could increase productivity. The empirical literature suggests that these effects are country and sector specific and in particular good data on commercial services are lacking. In this paper we used the results from Keller and Yeaple (2003). Then GDP and national income could increase by about 0.8% on average in the EU25 for the benchmark case.

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Appendix A: Modelling the regional capital stocks

This appendix contains a description of the capital stock formation and its calibration.

Dynamics of capital formation

The capital stock of a region accumulates and this is by definition an inter-temporal process. In the region owning the capital stock, all savings are added in the form of investment goods and services to the depreciated capital stock of the current period:

$$k_{o,t+1} = (1-\delta)k_{o,t} + \frac{S_{o,t}}{p^{I}_{o,t}} \tag{A.1}$$

with the value of the savings S_o being deflated by the macro investment price p^I_o, and δ denoting the depreciation rate. In the next period, this new capital stock is allocated over the capital demanding sectors and regions and then used for production.

Calibration of the capital stocks

The calibration of the initial capital stocks is based on data for the capital-GDP ratio. The capital-GDP ratio is assumed to be a reliable statistic and can be derived from the OECD analytical database for OECD regions (2002), and is given for non-OECD regions by the DART-model (Springer, 1998).[24] Using the usual unit price convention for the investment price p^I_r and the GDP price in the base year, the capital stock could be directly derived from the capital-GDP ratio (the macro GDP values are known from the GTAP database). However, in the WorldScan model it is more convenient to use the rate of return on capital. The information on the capital-GDP ratio is therefore translated into rate of returns, using data for the capital income share from GTAP (Dimanaran and McDougall, 2005). First, the rate of return is expressed as the ratio of the capital reward R^K_r and the value of the capital stock. Since we assume that p^I_r=1, then:

$$\frac{R^K_r}{p^I_r\, k_r} = \frac{r_r\, k_r}{p^I_r\, k_r} \approx r_r \tag{A.2}$$

Second, the terms of the ratio are expressed in GDP units (or roughly equivalent, value added):

$$r_r \approx \frac{R^K_r / Y^{VA}_r}{k_r / y^{GDP}_r} \tag{A.3}$$

[24] The DART model uses modified capital stocks and GDP values from the GTAP database.

again using the unit price convention for the price of GDP. Equation (A.3) gives the relation between the rate of return and the capital-GDP ratio.

However, in order to enforce a stable relationship between the capital stock and GDP, only the rates of return relative to a numeraire region are imposed and the global capital stock is assumed to be in a steady state. The Solow growth model is used to derive the condition for this global steady state[25]:

$$\sum_r i_r = \sum_r \left(\delta_r + \frac{a_r^0}{R_r^K / Y_r^{VA}} + ls_r^0 \right) k_r^D \qquad \text{(A.4)}$$

with i_r denoting the volume of investment, δ_r the rate of depreciation, a_r^0 the growth rate of total factor productivity (divided by the capital income share), ls_r^0 the growth rate of labour supply, and k_r^D the demand for capital. This additional restriction, combined with the relative rates of return, yields a unique solution for the rates of return and is used to calculate the corresponding initial capital stocks.

[25] Using of the Solow growth model is rather pragmatic. The production function in WorldScan differs from the production function in the Solow growth model, and the Solow model involves only one region.

Appendix B: Bilateral increase in foreign capital stocks in commercial services

	DNK	GRC	SWE	UKG	AUT	BLX	FIN	FRA	GER	IRE	ITA	NLD	POR	SPN	CZE	POL	HUN
Denmark (DNK)		27.3	25.1	17.0	47.2	20.0	34.0	21.4	21.3	14.3	23.8	16.3	30.5	33.7	34.8	48.1	39.1
Greece (GRC)	22.0		24.4	15.0	52.6	20.0	34.7	22.6	19.8	15.5	26.2	19.2	26.7	29.1	29.3	37.2	28.3
Sweden (SWE)	18.5	23.1		12.3	46.8	13.4	29.5	15.6	17.7	12.6	19.3	12.1	27.9	27.3	33.5	39.4	29.3
United Kingdom (UKG)	19.6	22.9	21.5		47.6	17.4	28.7	19.1	17.9	14.4	21.9	14.4	29.4	23.6	32.4	41.7	31.4
Austria (AUT)	20.1	30.7	26.3	17.9		21.9	30.8	20.7	19.3	15.8	20.5	15.6	30.4	33.9	31.1	33.3	36.0
Belgium-Luxembourg (BLX)	19.5	24.8	19.5	14.3	48.6		30.4	16.3	17.7	13.0	20.2	12.5	27.8	29.3	31.4	39.5	30.4
Finland (FIN)	22.2	28.2	24.3	14.2	46.1	19.0		18.1	17.6	17.0	22.3	13.7	27.6	29.8	28.4	38.0	29.6
France (FRA)	18.5	25.0	19.3	13.7	45.0	13.9	27.1		18.9	15.2	16.4	11.6	27.8	29.0	29.8	34.6	29.9
Germany (GER)	21.7	25.5	24.6	15.6	46.8	18.5	29.8	22.1		17.1	22.2	15.5	24.9	30.0	26.5	40.2	30.7
Ireland (IRE)	15.8	22.3	20.7	13.3	44.5	1.5	30.3	19.5	18.3		23.4	14.7	26.3	28.1	3.1	44.7	32.1
Italy (ITA)	22.6	30.3	24.8	18.1	46.4	19.5	33.0	18.1	20.7	20.7		18.0	33.1	32.7	34.1	37.6	34.1
Netherlands (NLD)	16.8	25.0	19.2	12.3	43.3	13.5	26.0	15.0	15.6	13.6	19.6		25.5	26.8	30.6	33.8	28.3
Portugal (POR)	21.6	23.1	25.6	17.8	48.6	19.3	30.5	21.8	15.6	15.9	25.3	16.1		30.1	26.3	36.3	28.2
Spain (SPN)	23.6	24.3	23.8	10.9	51.0	19.7	31.5	21.8	19.6	16.5	23.8	16.3	29.0		32.1	44.6	29.9
Czech Republic (CZE)	23.8	23.6	29.2	18.9	47.3	20.9	29.3	21.7	15.2	18.6	24.3	19.2	24.3	31.2		33.8	27.5
Poland (POL)	30.7	25.1	28.6	21.7	43.0	22.5	32.4	20.1	22.4	25.8	21.3	15.9	27.8	37.3	27.3		24.0
Hungary (HUN)	29.2	23.6	26.0	18.9	53.2	20.9	31.5	22.8	20.4	20.7	25.3	17.9	27.2	30.0	28.5	31.5	