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SUMMARY

The tax competition literature has long been stating that increasing international integration might impose a growing pressure on tax policies, as increasing taxes on a mobile base (such as capital) in one country creates an incentive for tax payers to relocate abroad. Because tax base relocation is proportionally more important in small countries than in large ones, this literature further shows that small countries have stronger incentives than large ones to cut taxes, and that they can initiate a "race to the bottom".

However, perfect capital mobility does not necessarily mean high sensitivity of capital movements (and especially FDI) to tax differentials. In particular, imperfect competition models show tax competition to be consistent with persistent tax discrepancies: trade costs induce a home-market bias if they combine with scale economies, leading multinational firms to locate in the largest countries. Location incentives are consequently higher in "large" countries, which can then impose higher tax rates than "small" countries without loosing attractiveness. Such conclusions are reinforced in the light of the new economic geography literature, which points out that, due to size effects and agglomeration economies, corporate tax competition need not lead to a "race to the bottom", because attractive countries might exploit their location rent to maintain higher taxation rents.

In this paper, we empirically explore the sensitiveness of foreign direct investment (FDI thereafter) to tax differentials across countries. The analysis is run on bilateral FDI flows across 11 OECD countries over the 1984-2000 period, using panel econometrics. The empirical framework is a gravity equation for FDI, and taxation is identified by four different variables (namely, statutory, ex-post effective, and ex-ante average and marginal tax rates).

We show that high relative corporate taxation does discourage FDI inflows, even when gravity factors and the provision of public goods are controlled for. Therefore, although market potentials do matter, corporate tax differentials also play a significant role in driving FDI flows. This result can be qualified in two ways.

First, this impact is not symmetric to the sign of tax discrepancies: while lower tax rates in the recipient countries fail to significantly attract FDI, higher taxes tend to discourage new FDI inflows. Second, the impact of positive tax differentials is not homogeneous regarding the tax scheme in operation in the investing country. In total, while narrow tax differentials do not much discourage inward FDI, large tax discrepancies produce proportionally more important FDI outflows.

These results bear several policy implication. First, although tax differentials do matter for FDI flows, this should not lead to a "race to the bottom", because market potential and public investment also matter, and because FDI reacts asymmetrically to positive and to

negative tax differentials so that the incentive to cut taxes essentially falls on high tax countries. Second, because there is an asymmetry in FDI stemming from countries applying exemption or credit to repatriated profits, the incentive for tax competition should depend on the tax schemes in investing countries: FDI is discouraged by higher taxes elsewhere when the investing country applies an exemption scheme, but not when a credit scheme is operated.

ABSTRACT

Using a panel of bilateral FDI flows for 11 OECD countries over 1984-2000, we show that, although agglomeration-related factors are strong determinants of FDI, tax differentials also play a significant role in understanding foreign location decisions. We further investigate non-linearities in the impact of tax differentials, and explore the role of tax schemes. We show that the reaction of FDI inflows to tax differentials is non-linear: it depends on the magnitude of the tax gap, on the sign of this gap, and on the nature of bilateral tax schemes in operation (credit vs. exemption). Our results are consistent with the imperfect competition literature which underscores the possibility of tax differentials across countries in equilibrium.

J.E.L. classification: F21, H25, H87
Keywords: Tax competition, Foreign Direct Investment, corporate tax, OECD

CONCURRENCE FISCALE ET INVESTISSEMENT DIRECT ETRANGER

RÉSUMÉ

La littérature sur la concurrence fiscale a longtemps conclu que l'intégration internationale devait limiter l'autonomie des politiques fiscales, puisque les bases mobiles (comme le capital) sont incitées à se délocaliser lorsque la fiscalité augmente dans un pays. Et dans la mesure où la délocalisation des bases fiscales est proportionnellement plus importante dans les petits pays que dans les grands, il apparaît en outre que les petits pays sont davantage incités à réduire les taux de taxation, et qu'il peuvent donc mettre en place une course au « moins disant fiscal ».

Cependant, la mobilité parfaite des capitaux n'implique pas nécessairement une forte sensibilité des flux de capitaux (et en particulier des investissements directs étrangers – les IDE) aux écarts de taux. En particulier, les modèles de concurrence imparfaite montrent que la concurrence fiscale peut s'accompagner d'écarts de taux d'imposition persistants : les coûts de transport sont à l'origine d'un biais en faveur du marché domestique dès lors qu'ils se combinent à des économies d'échelle, ce qui conduit les firmes multinationales à s'implanter dans les grands pays, plus attractifs, et qui peuvent donc imposer des taux de fiscalité plus élevés que les « petits » sans perdre de capitaux. Ces conclusions convergent avec celles de la nouvelle économie géographique, qui souligne que la concurrence fiscale en présence d'économies d'agglomération ne conduit pas nécessairement à une course au « moins disant fiscal », les pays attractifs pouvant exploiter leurs rentes de localisations et maintenir des taux de fiscalité élevés.

Dans cet article, on étudie empiriquement la sensibilité des flux bilatéraux d'IDE aux écarts de taux d'imposition des sociétés (IS) entre pays. L'analyse porte sur 11 pays de l'OCDE, sur la période 1984-2000. Les flux d'IDE sont expliqués par une équation de gravité (estimée en panel) dans laquelle on introduit quatre mesures alternatives de fiscalité (nominale, effective *ex post*, effective et marginale *ex ante*).

On montre qu'une fiscalité sur les sociétés relativement élevée décourage les entrées d'IDE, même lorsque les variables de gravité et la fourniture de biens publics sont prises en compte. Par conséquent, bien que les potentiels de marché jouent un rôle, l'IS est un élément significatif expliquant les flux d'IDE. Ce résultat doit cependant être nuancé au regard de deux éléments.

D'abord, cet effet est asymétrique et dépend du signe de l'écart de taux : des taux d'IS moins élevés dans les pays récepteurs n'attirent pas l'IDE de manière significative, tandis que des taux plus élevés tendent à décourager les nouvelles entrées d'IDE. Ensuite, l'impact de différentiels de taux dépend du régime fiscal en place dans les pays d'origine (crédit/exemption). Enfin, tandis que de faibles écarts de taux ne découragent pas l'IDE, des écarts élevés produisent des flux d'IDE proportionnellement plus importants.

Ces résultats ont plusieurs implications de politique économique. D'abord, bien que l'IS joue un rôle dans la détermination des flux d'IDE, il est peu probable qu'il conduise à une course au « moins disant fiscal », car le potentiel de marché et l'investissement public jouent un rôle important, et car l'IDE réagit de manière asymétrique aux écarts de taux négatifs et positifs, de telle sorte que les incitations à réduire la fiscalité pèsent surtout sur les pays à forte imposition. Ensuite, en raison de l'asymétrie de comportement des IDE en fonction du régime fiscal appliqué par le pays investisseur, l'incitation à la concurrence fiscale dépend de la composition géographique des sources d'IDE : l'IDE est réduit par une fiscalité plus élevée dans le pays d'accueil lorsque le pays investisseur applique un système d'exemption, mais non lorsqu'il applique un système de crédit.

RÉSUMÉ COURT

Nous étudions les flux bilatéraux d'investissements directs étrangers entre 11 pays de l'OCDE sur la période 1980-2000. Bien que les facteurs d'agglomération soient des déterminants importants de l'IDE, il apparaît que les écarts de fiscalité jouent un rôle significatif dans la compréhension des décisions d'investissement. Nous montrons également que la réaction des IDE entrants aux écarts de taux n'est pas linéaire : elle dépend de l'ampleur du différentiel de fiscalité, de son signe, et de la nature des régimes de double imposition en vigueur (crédit vs. exemption). Nos résultats sont cohérents avec la littérature de concurrence imparfaite, qui souligne la possibilité des écarts de taux persistants soient une situation d'équilibre.

J.E.L.: F21, H25, H87
Mots-clés: concurrence fiscale, investissement direct étranger, impôt sur les sociétés, OCDE

TAX COMPETITION AND FOREIGN DIRECT INVESTMENT[*]

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1. INTRODUCTION

The tax competition literature has long been stating that increasing international integration might lead to a growing pressure on tax policies (see Wilson, 1999, for a survey): for a given provision of public goods, increasing taxes on a mobile base (such as capital) in one country creates an incentive for tax payers to relocate abroad (Tiebout, 1956; Zodrow and Mieszkowski, 1986). Conversely, cutting taxes can have limited impact on tax receipts due to the relocation of tax bases in the home country. Hence, in the Nash equilibrium, tax rates are set too low compared to their socially optimal level. This is the standard result of the tax competition literature. Because tax base relocation is proportionally more important in small countries than in large ones, this literature further shows that small countries have stronger incentives than large ones to cut taxes, and that they can initiate a "race to the bottom" (Bucovetski, 1991; Wilson, 1991). For instance, perfect international capital mobility can lead to a zero taxation of capital earnings (Razin and Sadka, 1991).

However the fear of tax competition is justified only if (*i*) mobile bases do respond to tax cuts through relocation (*ii*) tax cuts produce a loss in fiscal receipts at least in some countries, and (*iii*) this revenue loss needs to be compensated for by a welfare-decreasing tax increase on other, less mobile bases, likely (non-qualified) labor. In this paper, we investigate the first point. More specifically, we study the sensitivity of foreign direct investment (FDI hereafter) to tax differentials across countries.

Perfect capital mobility does not necessarily mean high sensitivity of capital movements to tax differentials. This is especially the case for FDI, for a number of reasons.

Firstly, transfer pricing and intra-firm debt contracting allow firms to locate profits where taxation is lowest, and to disconnect the location of activity and profit (Hines and Rice, 1996). Such practices, which translate into discrepancies in export unit values (see Fontagné et al., 1998) and are directly evidenced by Swenson (2001b), allow profit shifting to substitute at least partly for capital mobility (see also Gresik, 2001, pp. 808-810, for a short review of this litterature).

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Secondly, a tax increase may not impact on FDI inflows once general equilibrium effects are accounted for. This is because a fall of the after-tax return in the host country (due to a tax increase) induces a rise in the before-tax return through falling domestic investment. The tax increase can even raise FDI inflows from countries applying a credit scheme to the taxation of repatriated profits, as investors from these countries would enjoy higher before-tax returns while being partially reimbursed of the inflated taxes in the host country (Scholes and Wolfson, 1990).

Thirdly, since Tiebout (1956), it has been recognized that tax bases will move depending on the combination of taxes and the provision of public goods offered by the various countries. Efficient governments, that raise low taxes while providing a high level of public goods, will be preferred. Among efficient governments, each tax payer will move to the place providing the combination closest to his (her) own preferences. Hence, there may not be a clear, negative link between tax rates and FDI inflows.

Finally, imperfect competition models show tax competition to be consistent with persistent tax discrepancies. Indeed, trade costs induce a home-market bias if they combine with scale economies, leading multinational firms to locate in the largest countries (Haufler and Wooton, 1999). As a consequence, location incentives are higher in "large" countries, which can then impose higher tax rates than "small" countries: large countries will stay attractive with reasonable tax discrepancies.

The new economic geography literature[1] reinforces such conclusions, arguing that agglomeration forces translate into hysteresis in the location of mobile factors. As a consequence, mobile factors may be insensitive to limited tax-rate changes if they are locked in an industrial cluster (Andersson and Forslid, 1999). Tax differentials can survive even in a highly integrated economy, since agglomeration creates rents for the mobile factor that can be taxed (Baldwin and Krugman, 2000, 2002; Ludema and Wooton, 2000). Thus, it is not straightforward whether tax differentials could still matter compared to agglomeration forces.

Given the ambiguous conclusions of the theoretical analysis, there is room for empirical investigation to arbitrate between diverging conclusions. The empirical literature on the impact of tax discrepancies on FDI has been comprehensively reviewed by Hines (1999) and de Mooij and Ederveen (2001). Estimates of the tax elasticity of FDI vary across empirical studies, depending on the geographic coverage of empirical analysis, the time sample, the definition of tax rates and the econometric methodology. According to the meta-analysis by de Mooij and Ederveen (2001) based on 371 individual estimates, the semi-elasticity of FDI to tax rates varies from –22.7 to +13.2, with a mean of –3.3 or –4.0, depending on whether non significant estimates are included or not into the sample. As far as the elasticity of FDI to tax rates is concerned, it is usually estimated to be negative, with an order of magnitude of about -0.6 on time series samples, while cross-sectional estimates provide a wider range of estimates (from –1.0 to -2.8, see Desai and Hines, 2001).

[1] See Krugman (1991), Krugman & Venables (1996) for seminal papers.

These empirical results have been qualified in several ways. For instance, the tax elasticity is often shown to differ for the various components of FDI: reinvested earnings versus direct transfers (Hartman, 1984, Slemrod, 1990, for instance) or mergers and acquisitions versus new plants and plant extensions (Swenson, 2001a). Alternatively, Desai and Hines (2001) show US FDI to be sensitive not only to profit taxes, but also to indirect (non-income) taxes, opening the way for a wider definition of tax competition.

A series of papers also underline the potential impact of tax schemes, as the foreign income of multinationals can be affected by double taxation which arises when the investing country sets residence-based taxes while the recipient country applies a source-based system. In order to avoid this problem, the investing country can apply a credit or an exemption scheme. The impact of such tax schemes on international capital movements has been theoretically studied by Hamada (1966) and Musgrave (1969), the latter arguing that credit schemes tend to increase FDI outflows. On the empirical side, investigation is not so clear about the empirical relevance of such mechanisms. For instance, Slemrod (1990) fails to find a significant difference in the foreign investment behavior of firms according to their domestic tax scheme, when investment in the US is considered. Auerbach and Hasset (1993) show that investors from foreign tax credit countries did not react to the Tax Reform Act of 1986 in the US, contrasting with Swenson (1994) who evidences some reactivity of firms from tax credit countries to changes in the after-tax cost of capital after the 1986 reform. Based on aggregated multinational data, Gropp and Kostial (2000) find that credit countries invest less abroad than exemption ones. However their use of an additive dummy to characterize double taxation schemes does not allow to conclude on differences in tax sensitiveness of FDI linked to tax schemes.

Finally, some studies find no or negligible impact of taxes on FDI, which they explain by the leading role of agglomeration economies compared to tax incentives (Wheeler and Mody, 1992, Head et al., 1999). For instance, Hubert and Pain (2002) fail to find any significant impact of tax-related determinants for German FDI to the EU, whereas agglomeration economies and public expenditure are shown to matter.

In this paper, we estimate the semi-elasticity of FDI to corporate tax differentials, for bilateral FDI flows across 11 OECD countries over the 1984-2000 period. More specifically, we use panel data econometrics to relate bilateral FDI flows to bilateral tax differentials over time. This strategy of estimation allows to work on a large number of observations and to provide results that are not country-specific. Thus, this paper departs from a series of studies that focus either on aggregate FDI, or on bilateral inflows or outflows for a single country. In addition, it explores possible non-linearities in the effect of tax differentials on FDI, as a result of tax schemes or imperfect competition.

Section 2 details our estimation strategy. Section 3 presents the estimation results together with some robustness analysis. Non-linear effects of tax differentials are analyzed in Section 4, and Section 5 concludes.

2. EMPIRICAL STRATEGY

2.1. FDI data

Our sample includes nine European countries[2], plus Japan and the United States, and covers the 1984-2000 period with an annual frequency.

The endogenous variable is the logarithm of the bilateral FDI inflow from country *i* (the investor) to country *h* (the host), measured at constant price and excluding reinvested earnings (source: Eurostat).[3]

2.2. Tax variables

Measuring tax rates is not an easy task, and there is now an extensive empirical literature on this issue. The most obvious and readily available measure is the statutory tax rate. However this first measure can be misleading since a high statutory rate in one country can be compensated by a broader tax base.[4] The apparent tax rate, which is the ratio between observed receipts and the observed tax base at the individual or at the aggregate level, accounts for such compensation. This measure bears the additional advantage of accounting for any possible exemption. It nevertheless has the drawback of being an *ex post* measure of the tax burden: if multinational firms locate in tax-friendly countries, taxation could appear heavier *ex post* than *ex ante* in those countries (Hines and Rice, 1994). In addition, Nicodème (2001) shows the apparent corporate tax rate to be cyclical, which means that changes in apparent tax rates could be endogenous to FDI inflows.

To tackle these difficulties, a series of papers inspired by King and Fullerton (1984) have computed effective, marginal or average tax rates on the basis of tax codes and of a set of assumptions especially concerning the financing of investment (retained earnings, debt or equity). Compared to statutory or *ex post* measures, these *ex ante* measures correctly reflect tax incentives, and are better candidates to gauge the impact of taxation of FDI decisions by firms. This paper uses the most recent data computed by Devereux and Griffith (2003), who provide calculations of average and marginal *ex ante* tax rates based on this methodology for 16 OECD countries over the 1982-2001 period.

According to Devereux et al. (2002), discrete location decisions by firms should be influenced by the statutory and/or the average effective tax rate, whereas the decision to increase existing capital in one country should be influenced by the marginal effective tax rate. Given that macro-economic FDI flow data do not allow to disentangle between both FDI motives, we run our estimates with each tax measure successively.

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[2] EU12 less Portugal and Greece, Belgium and Luxembourg being treated together.

[3] Except for the US and Japan, for which there were too many missing observations. But the gap in data definitions is contrelled through the use of fixed-effects in the panels estimates.

[4] Indeed, Devereux and Griffith (2002) show that there has been partial compensation between statutory tax cuts and base broadening in most OECD countries over the 1990s.

When the empirical analysis is run on a single recipient or exporting country, the tax incentive is caught through the tax rate of the partner country. Since we are working on a multinational panel, we use tax differentials between the host and the investor country.

Tax differentials are computed as simple differences between the corporate-tax rates in the host country (*h*) and in the investing country (*i*). This calculation is carried out on a set of four tax variables for the whole time period:

- statutory tax rates (TS_{hit});
- average effective tax rates (TA_{hit});
- marginal effective tax rates (TM_{hit});
- apparent effective tax rates (TE_{hit}).

The first three series of tax rates are taken from Michael Devereux's home page (see Appendix). The last measure is inspired from Mendoza et al. (1994). It is computed as the ratio between corporate tax revenues and the operating surplus, using OECD data. In order to overcome the possible endogeneity of the apparent tax rate, we also instrument apparent tax differentials with their lagged value or by the statutory tax differential. All variables and data sources are detailed in the Appendix.

2.3. Control variables

Gravity variables

We use an adapted version of the gravity model. In the latter, bilateral trade flows are explained by the size of the two countries and by impediments to trade which are generally proxied by geographic distance. This framework has been applied to FDI flows for instance by Eaton and Tamura (1994), Wei (2000), Bloningen and Davies (2000, 2002), Stein and Daude (2001, 2003). The gravity framework here is refined by using an original measure of the host country market.

When considering a foreign output location, a multinational does not evaluate the size of the host domestic market, but also its density, i.e. the concentration of domestic demand around the main productive centers. The main decision variable is therefore the market potential associated to each possible location, i.e. the distance-weighted average of national regions. This variable, labeled $LPOT_{ht}$, is inspired from Harris (1954).[5] As long as firms focus regional demand (as opposed to national demand), they can also select a recipient country on the ground of its potentialities in terms of using it as a beachhead for exporting to neighboring countries. For this reason, we also provide an estimate using this latter "enlarged market potential" ($LEPOT_{ht}$) variable in order to catch the importance of regional density (see Appendix for both definitions).

[5] Therefore, the market potential accounts for transportation costs supported when shipping output of the affiliate within the host market.

An increase in the market potential is expected to have a positive impact on inward FDI. It can be argued that market potential is partly endogenous to FDI. As a robustness check, we re-run the estimations while lagging the market potential variable.

Concerning the *size of the investing country*, we use the traditional GDP measure converted into purchasing power standards ($LGDP_{it}$) in order to cancel out the impact of nominal exchange rate fluctuations: large countries have a greater potential than small countries for investing abroad. A positive sign is expected for this variable.

Gravity models underline the role of *distance* (proxying transportation, transaction or more generally information costs) as a crucial determinant of trade flows. However the impact of distance on FDI is debated and relies on the dual effect of economies of scale and transportation costs. Increasing returns place a limit on the efficient number of plants, while transportation costs, and more generally all impediments to trade, have the opposite effect (Brainard, 1997). Hence, when plant fixed costs are limited compared to trade costs, a multinational will disseminate its units of production close to its markets, and FDI will be a substitute for trade: in this case, higher distance between the investor and the host raises FDI at the expense of trade. However geographic distance also stands for transaction costs, cultural distance, information costs. In this other meaning, distance is as detrimental to FDI as it is to trade. Furthermore, since FDI inflows generally involves additional imports (investment goods, imported inputs), distance can be thought detrimental to FDI just because it is detrimental to trade. In this case, trade and FDI are complements rather than substitutes (see Fontagné, 1999). In brief, the coefficient on the *investor-to-host distance* variable ($LDIST_{hi}$) introduced in the regression could be either positive or negative.

Finally, consistent with a number of studies using gravity equations, a *common language* dummy ($CLNG_{hi}$) is introduced in the analysis. This dummy is designed to catch cultural factors that significantly contribute to international trade and financial linkages between countries, for instance through network externalities.

Other variables

Previous studies have proved relatively hard to evidence a negative impact of relative labor costs on FDI flows. For instance, Devereux and Griffith (1998) show unit labor costs to be non-significant as determinants of the location choices of US multinationals in the European Union. They explain this result by the insufficiently disaggregated measure of productivity which does not reflect the heterogeneity of firms within each industry. An alternative explanation may relate to the cyclical behavior of unit costs. In fact, few authors include cost differentials in the estimations.[6] Here, we successively use bilateral relative unit labor costs ($LULC_{hit}$, source: OECD) and bilateral real exchange rates in level ($LRER_{hit}$, source: CEPII-CHELEM) to check for the robustness of our baseline results.

The theoretical literature on tax competition accounts for the provision of public goods that stems from tax receipts. We explore this by including two variables: the amount of total

[6] Young (1999) in an exception, who finds a negative impact of higher aggregated costs in the UK on total (domestic and foreign) investment in the country.

public expenses in the host country ($LPEXP_{ht}$) and the share of public investment in total public expenses ($ISHARE_{ht}$). The former variable catches the size of the public sector. The latter one accounts for the composition of public expenses. We expect a higher share of public investment to be an attracting factor for FDI, as this proxy is likely to be closer to the building of public goods.

2.4. Econometric methodology

Panel estimations are carried out with fixed effects on investors and host countries, with fixed coefficients. Note that the number of fixed effects (20) is much lower than the number of investor-host couples (110), which in principle allows the distance variable to catch some of the variance despite it is constant over time.

3. BASELINE ESTIMATION RESULTS

We start with the baseline specification where the FDI flow from country *i* to country *h* is explained by gravity variables as well as tax differentials. The baseline estimation is the following :

$$LFDI_{hit} = a_1 TAX_{hit} + a_2 LPOT_{ht} + a_3 LGDP_{it} + a_4 LDIST_{hi} + a_5 CLNG_{hi} + u_h + w_i + e_{hit} \quad (1)$$

where TAX_{hit} is the general expression for tax differentials between the host and the investor; this variable is computed using all four definitions of the tax burden.

The results are provided in Table 1. All coefficients bear the expected sign, and they are generally significant.

The market potential has a positive impact on inward FDI. Remind that this effect is obtained through considering not only the domestic market, but also the concentration of demand within the country.

As expected, the size of the parent country has a positive impact on its outward investment, which reflects a supply effect, large countries having a greater potential for investing abroad. The coefficient on investor-to-host distance is negative, but non significant at standard levels of confidence (the p-value is around 7%), confirming the ambiguity between the "proximity-concentration trade-off", which involves FDI to be a substitute for trade, and the documented complementarity between trade and FDI.

The coefficient on tax discrepancies is negative and highly significant, highlighting the adverse effect of higher corporate tax differentials on FDI inflows. For the statutory tax differential, the semi-elasticity is –4.22, meaning that a 1 point rise in the host statutory rate relative to the investor's one reduces FDI inflows by 4.22%. The semi-elasticity is very similar for the average effective tax differential. It is smaller (-2.89) for the marginal effective tax differential, but much higher for the apparent tax differential (-9.39), a difference that stems from the lower value in absolute level of this measure of taxation.

Table 1: Baseline estimation

		(1)	(2)	(3)	(4)
Intercept		-29.07** [3.97]	-28.10** [3.99]	-27.84** [4.02]	-23.51** [3.70]
Statutory tax differential	**TS_{hit}**	**-4.22** [0.97]**	-	-	-
Average effective tax differential	**TA_{hit}**	-	**-4.23** [.94]**	-	-
Marginal effective tax differential	**TM_{hit}**	-	-	**-2.89** [.72]**	
Apparent effective tax differential	**TE_{hit}**	-	-	-	**-9.40** [1.18]**
Market potential	$LPOT_{it}$	2.31** [.61]	2.48** [.61]	2.53** [.62]	4.09** [.59]
Size of investor country	$LGDP_t$	4.23** [0.71]	4.04** [.71]	3.99** [.72]	2.98 [.68]
Investor-to-host distance	$LDIST_{hi}$	-.14 [.09]	-.15 [.09]	-.15 [.09]	-.13 [.09]
Common language	$CLNG_{hi}$	.61** [.16]	.61** [.16]	.61** [.16]	.55** [.14]
Number of observations	-	1163	1163	1163	1307
Adjusted R^2	-	.472	.473	.540	.471
Hausman test	-	$\chi^2(5)$=141.43 p=[.000]	$\chi^2(5)$=144.86 p=[.000]	$\chi^2(5)$=187.71 p=[.000]	$\chi^2(5)$=157.18 p=[.001]
F test	-	F(9,1139)=36.99 p=[.000]	F(9,1139)=36.69 p=[.000]	F(10,1281)=36.26 p=[.000]	F(11,837)=4.794 p=[.000]
Breusch-Pagan LM test	-	$\chi^2(1)$= 1321.36 p=[.000]	$\chi^2(1)$= 1361.01 p=[.000]	$\chi^2(1)$= 1471.43 p=[.000]	$\chi^2(1)$= 1346.29 p=[.000]

Note : standard errors in brackets. **,* : significant at the 1%, 5% respectively.

In sum, Table 1 shows that, even when imperfect-competition related determinants are introduced in the estimation, tax differentials play a significant role in the location decisions of multinational firms. This result suggests that the fear for tax competition is not completely unfounded, as FDI flows do react to tax differentials. However tax differentials can also compensate for differences in market potentials: according to Column (1) estimates, a host country suffering from a 10% disadvantage in terms of market potential (compared to other host countries) can offset this handicap through a lower statutory tax rate by 5 percentage points.

Several robustness checks are provided in Tables 2a and 2b, concentrating on the average effective tax differential which Young (1999) and Devereux and Griffith (2002) point out to be the most relevant measure for the location decision of a multinational.[7] In Table 2a, two potential sources of reverse causality are accounted for. In Column (1), the market potential is lagged to account for a possible impact of FDI on market. The coefficient on the lagged

[7] The conclusions of the robustness check are the same for the three other measures of tax differentials.

market potential is highly significant (and positive), and other coefficients are virtually unchanged. In column (2), the apparent tax differential is instrumented by its lagged value. In Column (3), it is instrumented by the statutory differential. In both cases, the coefficient on tax differentials remains highly significant, while other coefficients are rather stable.

Column (4) addresses a different issue, by substituting the enlarged market potential (which takes into account the market potential of the neighbors of the recipient – see Appendix for details) for the market potential of the host. This allows to measure the impact of multinational firms focusing region-wide demand. The estimated coefficient on this new variable is much larger than the one on the host country market potential, while the size of the investor country is no longer significant. This is probably due to the fact that both variables are collinear by construction, which prevents to catch their respective impact on FDI independently. The coefficients on tax differentials are unchanged however.

Table 2a : Robustness : tracking reverse causality and accounting for enlarged market potential

		Lagged market potential	TE instrumented by TE(-1)	TE instrumented by TS	Enlarged market potential
		(1)	(2)	(3)	(4)
Intercept		-22.25** [4.35]	-20.02** [3.94]	-28.134** [4.23]	-15.07* [6.02]
Average effective tax differential	TA_{hit}	**-4.49**** **[.94]**	-	-	**-4.09**** **[.93]**
Apparent effective tax differential	TE_{hit}	-	**-11.57**** **[1.56]**	**-14.29**** **[3.44]**	-
Enlarged market potential	$LEPOT_{ht}$				5.45** [1.16]
Lagged market potential	$LPOT_{ht-1}$	2.86** [.65]	-	-	-
Market potential	$LPOT_{ht}$	-	4.01** [.61]	2.65** [.65]	-
Size of investor country	$LGDP_{it}$	3.08** [.77]	2.46** [.72]	3.99** [.75]	1.36 [1.16]
Investor-to-host distance	$LDIST_{hi}$	-.13 [.09]	-.13 [.09]	-.15 [.09]	-.16 [.09]
Common language	$CLNG_{hi}$	.59** [.16]	.54** [.15]	.67** [.16]	.61** [.16]
Number of observations	-	1105	1237	1091	1163
Adjusted R^2	-	.448	.512	.473	.475
Hausman test		$\chi^2(5)$=98.16 p=[.000]	$\chi^2(5)$=120.78 p=[.000]	$\chi^2(5)$=134.11 p=[.000]	$\chi^2(5)$=178.83 p=[.000]
F test		F(9,1081)=34.54 p=[.000]	F(10,1211)=34.77 p=[.000]	F(9,1067)=32.90 p=[.000]	F(9,1139)=33.00 p=[.000]
Breusch-Pagan LM test		$\chi^2(1)$=1452.51 p=[.000]	$\chi^2(1)$=1230.21 p=[.000]	$\chi^2(1)$=120.78 p=[.000]	$\chi^2(1)$=866.78 p=[.000]

Note: standard errors in brackets. **, * : significant at the 1%, 5% respectively. p refer to p-values.

Table 2b investigates the robustness of the results when adding other control variables. Firstly, cost variables, either bilateral relative unit labor costs (Column (1)) or bilateral real exchange rates (Column (3)) are added to the estimated equation. The impact of other variables, including the tax differential, remains unchanged. As to cost variable, they have a significant, but counter-intuitive, impact, since higher costs attract more FDI. It can be argued that cost variables are collinear to GDP (and to market potential). One reason may be the Balassa-Samuelson effect, which links the real exchange rate to GDP per capita, on both the cross-section and the time-series dimensions. Another potential source of collinearity is the cyclical pattern of relative costs stemming from the Phillips curve. A final explanation can be that unit labor costs are positively related to the quality of labor. This last interpretation cannot be tested here, however. To tackle this potential collinearity, we re-run the estimations while lagging relative unit labor costs and real exchange rates. While the results, reported in Columns (2) and (4), are not affected qualitatively, the impact of cost differentials is much lowered, which seems to confirm our interpretation. The coefficient on tax differentials is unaffected.

Secondly, public expense variables are introduced, either through the amount of total public expenses (Column (5)) or through the share of public investment in total public expenses (Column (6)).

As to public expenses, our empirical results show that higher public expenses do not impact on the amount of bilateral FDI (the estimated coefficient is not significant). However, while there seems to be no scale effect of public expenses, the composition effect appears highly significant: a higher share of investment in the host country increases inward FDI flows. This result tends to confirm that a higher provision of public goods increases the attractiveness of a country for FDI, and suggests that higher taxes can be partially compensated by an increase in the building up of public infrastructures, consistent with Tiebout's intuition.

Notice that including the composition of public expenditure leads to a weakening of both agglomeration and tax estimates: the semi-elasticity of FDI to tax differentials is cut by around 25% (from -4 to –3 approximately), which highlights that a higher tax rate can be compensated for by higher attractiveness in terms of public goods provision. The same is true as far as market potential is concerned, since the estimated coefficient falls from around 2.5 to 1.6.

Table 2b: Robustness: adding control variables

		Relative unit labour costs	Lagged relative unit labour costs	Real exchange rate	Lagged real exchange rate	Total public expenses	Share of public investment
		(1)	(2)	(3)	(4)	(5)	(6)
Intercept		-32.59** [4.06]	-26.53** [4.27]	-29.75** [3.99]	-24.78** [4.21]	-14.11** [9.82]	-34.66** [4.12]
Average effective tax differential	TA_{hit}	**-4.18** [0.93]**	**-4.63** [.98]**	**-4.17** [.94]**	**-4.58** [.98]**	**-4.00** [.96]**	**-3.03** [.96]**
Market potential	$LPOT_{ht}$	2.51** [.61]	2.62** [.63]	2.21** [.61]	2.46** [.63]	1.95** [.72]	1.63** [.63]
Size of investor country	$LGDP_{it}$	4.12** [.70]	3.42** [.74]	4.36** [.71]	3.55** [.74]	3.83** [.72]	4.88** [.72]
Investor-to-host distance	$LDIST_{hi}$	-0.15 [.09]	-.14 [.09]	-.15 [.09]	-.14 [.09]	-.14 [.09]	-.13 [.09]
Common language	$CLNG_{hi}$	.61** [.16]	.59** [.16]	.61** [.16]	.59** [.16]	.60 [.16]	.61** [.16]
Relative unit labour costs	**$LULC_{hit}$**	**1.52** [.32]**	-	-	-	-	-
Lagged relative unit labor costs	**$LULC_{hi,t-1}$**	-	**.91** [.35]**	-	-	-	-
Real exchange rate	**$LRER_{hit}$**	-	-	**-1.42** [.36]**	-	-	-
Lagged real exchange rate	**$LRER_{hi,t-1}$**	-	-	-	**-.75* [.38]**	-	-
Size of total public expenditure	**LP_EXP_{hit}**	-	-	-	-	**1.09 [.75]**	-
Public investment	**$dINV_{hit}$**	-	-	-	-	-	**13.4** [.244]**
Number of observations	-	1163	1105	1163	1105	1163	1163
Adjusted R^2	-	.483	.45	.48	.449	.474	.486
Hausman test		$\chi^2(6)$=154.01 p=[.000]	$\chi^2(6)$=104.08 p=[.000]	$\chi^2(6)$=140.34 p=[.000]	$\chi^2(6)$=95.68 p=[.000]	$\chi^2(6)$=64.69 p=[.000]	$\chi^2(6)$=153.55 p=[.000]
F test	-	F(9,1138)=24.23 p=[.000]	F(9,1080)=20.94 p=[.000]	F(9,1138)=38.63 p=[.000]	F(9,1080)=34.73 p=[.000]	F(9,1138)=35.87 p=[.000]	F(9,1138)=38.40 p=[.000]
Breusch-Pagan LM test	-	$\chi^2(1)$=866.78 p=[.000]	$\chi^2(1)$=866.78 p=[.000]	$\chi^2(1)$=1271.53 p=[.000]	$\chi^2(1)$=1305.68 p=[.000]	$\chi^2(1)$=1376.07 p=[.000]	$\chi^2(1)$=1367.56 p=[.000]

Note: standard errors in brackets. **, * : significant at the 1%, 5% respectively. p refer to p-values.

4. TAX COMPETITION

The first set of estimates strongly confirms the sensitivity of FDI to tax differentials, whatever the definition of tax rates, and the alternative specifications of the empirical model. As long as the international investment behavior of firms leads them to react to tax incentives, there might be room for tax competition. In this section, we provide further investigations that allow to conclude on the possible shape and outcomes of tax competition and on policy implications.

Indeed, the literature on tax competition does not limit itself to investigating the impact of tax levels or tax differentials on the location strategies of firms, and consequently on the optimal tax level a government should set. Three related items are addressed in this section, that contribute to clarify both qualitatively and quantitatively the impact of tax differentials on FDI flows. These are tax schemes; asymmetries according to the sign of tax discrepancies; and potential non linearities in the reaction of FDI flows to tax differentials according to the magnitude of these differentials. Once again, the emphasis is put on effective average tax differentials, but the results are robust to the use of alternative tax measures.

4.1. Tax schemes

The literature on the impact of double taxation rules on FDI has been reviewed by Gresik (2001) for the theoretical side, and Desai and Hines (2001) for the empirical part of it. In order to avoid double taxation of repatriated profits, tax authorities can adopt two kinds of tax rules. Under credit schemes, multinationals are allowed to deduce taxes paid abroad by their foreign affiliates from their domestic tax bill, which de facto means bearing the domestic tax rate on these profits. Consequently, when a credit scheme is in operation, domestic investors could be less reactive to tax differentials, since they can theoretically take no benefit from lower taxes abroad, although they do suffer from higher foreign taxes (since the credit is *de facto* limited to the amount of taxes due to the domestic tax authority). Conversely, under exemption schemes, repatriated profits from foreign affiliates only bear the foreign-country tax rate, and they are exempted from domestic taxation. Such a tax rule could provide a strong incentive to locate where taxes are the lowest.

In order to test for the impact of the tax scheme, we control for the tax scheme in operation through two multiplicative dummies – one for each type of double-taxation tax arrangement in operation. Contrasting with previous studies on this issue (see Section 2), we are able to work on a wide range of exporting/recipient countries, and to provide results that allow for more general conclusions. The estimated equation is changed as follows:

$$\begin{aligned} LFDI_{hit} = \; & a_1 CREDIT_i \times TAX_{hit} \times + a_2 EXEMPTION_i \times TAX_{hit} \\ & + a_3 LPOT_{ht} + a_4 LGDP_{it} + a_5 LDIST_{hi} + a_6 CLNG_{hi} + u_h + w_i + e_{hit} \end{aligned} \qquad (2)$$

where $CREDIT_i$ is a dummy which takes the value of 1 when the investor applies a credit scheme, and 0 elswhere, and $EXEMPTION_i$ is a dummy that takes the value of 1 when the investor applies an exemption scheme, and zero otherwise.

As shown in Table 3 (column (1)), the semi-elasticities to tax differentials are significant for both credit and exemption countries. Both coefficients are negative, but contrasting to the intuition, FDI flowing from countries operating under credit scheme seems to be more sensitive to tax differentials than FDI flowing from exemption-scheme countries (although the difference is not statistically significant). A similar result was found by Hines and Rice (1996), working on the FDI behavior of US multinationals in tax havens, who showed that firms submitted to tax credits can be willing to invest in low tax countries even though there is no immediate incentive for that. One explanation for our result could be that countries applying credit schemes (with the exception of Japan) generally display relatively low taxation rates. Since multinationals are not refunded for excess taxation paid abroad, they do react to the level of taxes in the host country.

Table 3: Tax schemes and tax asymmetries

		Credit versus exemption	Negative versus positive diff	Combination
		(1)	(2)	(3)
Intercept		-28.75** [4.03]	-27.35** [3.99]	-28.473 [4.03]
Tax differential, investor in exemption scheme	$EXEMPTION_i \times TAX_{hit}$	**-2.20** [.85]**	-	-
Tax differential, investor in credit scheme	$CREDIT_i \times TAX_{hit}$	**-2.76** [1.01]**	-	-
Positive tax differentials	$POSITIVE_{hit}$	-	**-4.69** [1.23]**	-
Negative tax differentials	$NEGATIVE_{hit}$	-	**-3.84** [1.16]**	-
Credit scheme + positive tax differential	$CREDIT_i \times POSITIVE_{hit} \times TAX_{hit}$	-	-	**-4.09** [1.36]**
Credit scheme + negative tax differential	$CREDIT_i \times NEGATIVE_{hit} \times TAX_{hit}$	-	-	**-0.63 [1.74]**
Exemption scheme + positive tax differential	$EXEMPTION_i \times POSITIVE_{hit} \times TAX_{hit}$	-	-	**-3.24** [1.35]**
Exemption scheme + negative tax differential	$EXEMPTION_i \times NEGATIVE_{hit} \times TAX_{hit}$	-	-	**-1.21 [1.14]**
Market potential	$LPOT_{ht}$	2.29** [.62]	2.46** [.61]	2.23** [.62]
Size of investor country	$LGDP_{it}$	4.21** [.72]	4.04** [.71]	4.21** [.72]
Investor-to-host distance	$LDIST_{hi}$	-.15 [.09]	-.15 [.09]	-.16 [.09]
Common language	$CLNG_{hi}$	.55** [.17]	.59** [.16]	.57** [.17]
Number of observations	-	1163	1163	1163
Adjusted R^2	-	.467	.473	.4685
Hausman test	-	$\chi^2(6)=158.04$ p=[.000]	$\chi^2(6)=156.71$ p=[.000]	$\chi^2(8)=123.16$ p=[.000]

Note : standard errors in brackets. **,* : significant at the 1%, 5% respectively. P refer to p-values.

As far as tax competition is concerned, this first set of estimates does not provide a clear-cut conclusion about the ability of credit schemes to protect investing countries from tax competition, since both credit and exemption systems seem to allow for tax differentials to impact on FDI flows. However, this result might be the consequence of credit countries imposing on average lower tax rates than exemption countries. As a consequence, a further investigation implies examining the direction of tax differentials.

4.2. Asymmetries

In the baseline estimation, investor and host countries are treated symmetrically as far as the direction of tax differentials is concerned. However, since investors operating under credit schemes are not refunded for excess taxes paid abroad, this introduces some asymmetry in their reaction to tax variations: they should be more affected by a tax variation in the host country when taxation is already higher in the latter. This is in fact the empirical evidence that emerges from Head et al. (1999), who conclude that Japanese investments in the US are indeed diverted by high tax rates, but not much attracted by low tax rates.

In order to test for asymmetric incentives, we disentangle (through a multiplicative dummy) positive tax differentials (i.e. cases where the host tax rate exceeds the investor's one) from negative ones.

The estimated equation is the following, where $POSITIVE_{hit}$ is a dummy which takes the value of 1 when taxation is higher in the host (h) than in the investing (i) country, and $NEGATIVE_{hit}$ is a dummy that takes the value of 1 when taxation is lower in the host than in the investing country.

$$\begin{aligned} LFDI_{hit} = \; & a_1 POSITIVE_{hit} \times TAX_{hit} + a_2 NEGATIVE_{hit} \times TAX_{hit} \\ & + a_3 LPOT_{ht} + a_4 LGDP_{it} + a_5 LDIST_{hi} + a_6 CLNG_{hi} + u_h + w_i + e_{hit} \end{aligned} \quad (3)$$

The results are reported in the second column of Table 3. The coefficient for positive differentials is larger (in absolute value) than that on negative discrepancies, meaning that a higher tax rate in the host country is more harmful to inward FDI than a lower tax rate is attractive for foreign capital. This conclusion provides a first qualification as regards the strength of tax incentives in determining FDI flows: FDI seems to be less sensitive to tax incentives than to tax disincentives. As a consequence, increasing FDI inflows through tax cuts could prove a more productive choice for high-tax countries than for low-tax ones, since cutting taxes when the tax pressure is already low does not attract as much FDI as when this policy is implemented by a high-tax country.

One argument for investors to react more to higher taxes than to lower taxes abroad is that, whenever they operate under credit schemes, they cannot be refunded for excess taxes paid abroad. As a consequence, a careful assessment of the impact of positive and negative tax differentials should also control for the tax scheme in operation in the investing country.

A final estimate is therefore performed, which combines both dimensions through multiplicative dummies. The estimated equation is the following,

$$\begin{aligned} LFDI_{hit} = \; & a_1 EXEMPTION_i \times POSITIVE_{hit} \times TAX_{hit} + a_2 EXEMPTION_i \times NEGATIVE_{hit} \times TAX_{hit} \\ & + a_3 CREDIT_i \times POSITIVE_{hit} \times TAX_{hit} + a_4 CREDIT_i \times NEGATIVE_{hit} \times TAX_{hit} \\ & + a_5 LPOT_{ht} + a_6 LGDP_{it} + a_7 LDIST_{hi} + a_6 CLNG_{hi} + u_h + w_i + e_{hit} \end{aligned} \quad (4)$$

The results are reported in Table 3, Column (3). They show that countries applying a credit scheme do react to the level of tax differentials when these differentials are positive (i.e.

when taxation is higher in the host than in the investor country), whereas they do not react to the level of the tax differential when it is negative, confirming that credit countries feel an asymmetric incentive. Exemption countries display the same asymmetric behavior, but to a lesser extent (although the difference with credit schemes is not statistically significant).

On the whole, our results suggest that attracting FDI through low taxation might not prove a very efficient policy, as the sensitivity of inward FDI to lower taxes abroad is not significant. On the opposite, higher tax rates are harmful to inward FDI, meaning that there should be a strong incentive for high-tax recipient countries to lower the tax burden if they intend to attract FDI. The observed asymmetry in the tax sensitivity of FDI has important implications for tax competition. Indeed, when they already display relatively low tax rates, recipient countries face little incentive to further cut taxes, whereas high taxation countries should feel a strong incentive to cut taxes. Along these lines, tax competition should not necessarily end up racing to the bottom. The underlying force behind the competition for attracting FDI could rather produce a convergence in tax rates, lead by cuts in high tax countries. These two features (limited race to the bottom, convergence in tax rates) are consistent with the stylized facts of the last ten years (see, for instance, Devereux et al., 2002, p. 464)

Finally, while the new economic geography justifies the persistence of tax differentials by the existence of taxable rents that agglomeration economies provide to large countries, our results suggests that the range of equilibrium tax discrepancies might be narrowed by the asymmetry of FDI behavior as regards tax incentives.

4.3. Non linearities

Given the complexity and instability of tax codes, information about taxation should be thought as highly imperfect. In addition, relocating from one country to another is costly. In such a framework, large discrepancies should matter more than small ones. Hence the relationship between tax differentials and FDI may be non-linear, large tax differentials having relatively more impact than small ones. We test for non-linearities by including cubic tax differentials in the estimation[8], expecting a negative sign on both differentials and cubic differentials. We also further investigate the impact of tax schemes on the sensitiveness of FDI to tax differentials, by once more introducing multiplicative dummies catching for the sign of the tax differentials (negative vs. positive) and the combination of sign and tax scheme. Three equations are therefore estimated, the results being displayed in Table 4:

$$LFDI_{hit} = a_1 TAX_{hit} + a_2 TAX^3_{hit} + a_3 LPOT_{ht} + a_4 LGDP_{it} + a_5 LDIST_{hi} + a_6 CLNG_{hi} + u_h + w_i + e_{hit} \quad (5)$$

[8] Because they are always positive, squared differentials were not included.

$$\begin{aligned} LFDI_{hit} = \; & a_1 CREDIT_i \times TAX_{hit} \times + a_2 EXEMPTION_i \times TAX_{hit} \\ & + a_3 CREDIT_i \times TAX_{hit}^3 \times + a_4 EXEMPTION_i \times TAX_{hit}^3 \\ & + a_5 LPOT_{ht} + a_6 LGDP_{it} + a_7 LDIST_{hi} + a_8 CLNG_{hi} + u_h + w_i + e_{hit} \end{aligned} \quad (6)$$

$$\begin{aligned} LFDI_{hit} = \; & a_1 EXEMPTION_i \times POSITIVE_{hit} \times TAX_{hit} + a_2 EXEMPTION_i \times NEGATIVE_{hit} \times TAX_{hit} \\ & + a_3 CREDIT_i \times POSITIVE_{hit} \times TAX_{hit} + a_4 CREDIT_i \times NEGATIVE_{hit} \times TAX_{hit} \\ & + a_5 EXEMPTION_i \times POSITIVE_{hit} \times TAX_{hit}^3 + a_6 EXEMPTION_i \times NEGATIVE_{hit} \times TAX_{hit}^3 \\ & + a_7 CREDIT_i \times POSITIVE_{hit} \times TAX_{hit}^3 + a_8 CREDIT_i \times NEGATIVE_{hit} \times TAX_{hit}^3 \\ & + a_9 LPOT_{ht} + a_{10} LGDP_{it} + a_{11} LDIST_{hi} + a_{12} CLNG_{hi} + u_h + w_i + e_{hit} \end{aligned} \quad (7)$$

The first column in Table 4 provides a first confirmation that FDI inflows do react to tax differentials in a non-linear manner: larger discrepancies have relatively more impact on FDI flows.

Decomposing the reaction of FDI according to tax schemes provides an interesting result about the sensitivity of investors to the tax scheme in operation in their home country (Column 2). Indeed, while investors submitted to exemption schemes react to tax differentials in a linear manner (the coefficient on the cubic tax differential, while negative, is not significant), investors submitted to credit schemes are only reactive to large tax differentials (the coefficient on the tax differential becomes non-significant, whereas the coefficient on the cubic differential is significantly negative). These estimates are consistent with the features of credit schemes that allow excess taxes paid abroad to be reimbursed only if they are of limited amount, whereas in the exemption scheme, any excess taxes paid abroad is lost for the investor.

Introducing asymmetries like in Section 4.2 reinforces our previous conclusions (see Column 3). First, only positive tax differentials matter, confirming that tax disincentives are more powerful on investment decisions than tax incentives. Second, when the investor is applied an exemption scheme, it reacts to tax differentials in a linear manner, which can be explained by the fact that it must support any excess tax burden. When the investor is applied a credit scheme, its sensitivity to tax differentials is non-linear, suggesting that limited positive tax differentials are not excessively harmful.

As a consequence of this asymmetric behavior of FDI from credit and exemption countries, the impact of a change in tax differential should be conditioned to the geographic composition of inward FDI: for low level of tax differentials, the loss essentially stems from exemption scheme countries. Investors submitted to credit scheme significantly react to tax differentials at larger tax differentials. Turning back to the possible shape of tax competition, these results would suggest a more complete convergence in tax rates when inward FDI mainly stems from exemption countries, whereas limited tax differentials could well survive whenever investors mainly stem from countries applying credit schemes.

Tableau 4 : Non-linear responsiveness of FDI to tax differentials

		(1)	(2)	(3)
		Baseline estimate	credit vs. exemption	Combination
Intercept		-27.50** [3.99]	-28.62** [4.04]	-28.57** [4.05]
Tax differential	TAX_{hit}	**-3.58** [.98]**	-	-
Cubic tax differential	TAX^3_{hit}	**-11.36* [4.96]**	-	-
Tax differential, investor in exemption scheme	$EXEMPTION_i \times TAX_{hit}$	-	**-1.81** [.94]**	-
Tax differential, investor in credit scheme	$CREDIT_i \times TAX_{hit}$	-	**-1.52 [1.19]**	-
Cubic tax differential, investor in exemption scheme	$EXEMPTION_i \times TAX^3_{hit}$	-	**-4.81 [5.89]**	-
Cubic tax differential, investor in credit scheme	$CREDIT_i \times TAX^3_{hit}$	-	**-23.49* [11.31]**	-
Credit scheme + positive tax differential	$CREDIT_i \times POSITIVE_{hit} \times TAX_{hit}$	-	-	**-2.40 [1.65]**
Credit scheme + negative tax differential	$CREDIT_i \times NEGATIVE_{hit} \times TAX_{hit}$	-	-	**-1.21 [3.64]**
Exemption scheme + positive tax differential	$EXEMPTION_i \times POSITIVE_{hit} \times TAX_{hit}$	-	-	**-4.71* [2.46]**
Exemption scheme + negative tax differential	$EXEMPTION_i \times NEGATIVE_{hit} \times TAX_{hit}$	-	-	**-.31 [1.35]**
Cubic, credit scheme + positive tax differential	$CREDIT_i \times POSITIVE_{hit} \times TAX^3_{hit}$	-	-	**-23.76* [12.20]**
Cubic, credit scheme + negative tax differential	$CREDIT_i \times NEGATIVE_{hit} \times TAX^3_{hit}$	-	-	**-3.65 [52.41]**
Cubic, exemption scheme + positive tax differential	$EXEMPTION_i \times POSITIVE_{hit} \times TAX^3_{hit}$	-	-	**37.44 [58.37]**
Cubic, exemption scheme + negative tax differential	$EXEMPTION_i \times NEGATIVE_{hit} \times TAX^3_{hit}$	-	-	**-7.76 [6.69]**
Market potential	$LPOT_{ht}$	2.65** [.62]	2.37** [.62]	2.27** [.63]
Size of investor country	$LGDP_{it}$	3.92** [.71]	4.155** [.72]	4.19** [.72]
Investor-to-host distance	$LDIST_{hi}$	-.16 [.09]	-.14 [.09]	-.15 [.09]
Common language	$CLNG_{hi}$	.63** [.16]	.53** [.17]	.54** [.18]

Number of observations	-	1163	1163	1163
Adjusted R^2	-	.475	.470	.471
Hausman test	-	$\chi^2(6)$=157.38 p=[.000]	$\chi^2(8)$=174.15 p=[.000]	$\chi^2(12)$=173.76 p=[.000]
F test	-	F(9,1138)=36.1 p=[.000]	F(9,1136)=33.5 p=[.000]	F(9,1132)=32.1 p=[.000]
Breusch-Pagan LM test	-	$\chi^2(1)$=1326.60 p=[.000]	$\chi^2(1)$=1137.45 p=[.000]	$\chi^2(1)$=1031.29 p=[.000]

Note : standard errors in brackets. **,* : significant at the 1%, 5% respectively. p refer to p-values.

5. CONCLUSION

The new economic geography literature points out that, due to size effects and agglomeration economies, corporate tax competition needs not lead to a "race to the bottom", because attractive countries might exploit their location rent to maintain higher taxation rents. Using a panel of bilateral FDI flows across 11 OECD countries over the 1984-2000 period and four measures of corporate tax rates, we show that high relative corporate taxation do discourage FDI inflows, even when gravity factors and the provision of public goods are controlled for. Therefore, although market potentials do matter, corporate tax differentials also play a significant role in driving FDI flows. This result can be qualified in two ways.

First, this impact is not symmetric to the sign of tax discrepancies: while lower tax rates in the recipient countries fails to significantly attract FDI, higher taxes tend to discourage new FDI inflows. Second, the impact of positive tax differentials is not homogeneous regarding the tax scheme in operation in the origin country. In total, while narrow tax differentials do not much discourage inward FDI, large tax discrepancies produce proportionally more important FDI outflows.

These results bear several policy implication. First, although tax differentials do matter for FDI flows, this should not lead to a "race to the bottom", because market potential and public investment also matter, and because FDI reacts asymmetrically to positive and to negative tax differentials so that the incentive to cut taxes essentially falls on high tax countries. Second, because there is an asymmetry in FDI stemming from countries applying exemption or credit to repatriated profits, it appears that the incentive for tax competition should depend on the composition of investing countries. Typically, in an integrated area like the EMU, where most FDI stems from countries applying exemption schemes, tax competition might well end up in a convergence of tax rates to the lowest continental level.

APPENDIX: VARIABLES AND DATA SOURCES

Endogenous variable

FDI data is extracted from the Eurostat data-base Cronos. The first chain ownership concept (as opposed to the ultimate beneficial owner concept) is applied in order to identify the source country. We consider total FDI in all sectors, excluding reinvested earnings for all countries except the US and Japan, this difference in data definition being controlled for by the use of fixed effects for investing and host countries. Germany includes East Germany from 1991. Flows are recorded in current ECU millions at market values. They are converted into constant dollars using IMF exchange rates and prices of investment in the host country.

FDI flows are transformed through natural logarithms (our dependent variable $LFDI_{hit}$), which excludes null and negative observations. 398 FDI values are missing, and 268 negative or zero values are skipped from the analysis. Preliminary estimations carried out on FDI levels showed that working on logarithms (without null and negative values) does not introduce a selection bias.

Control variables

Market potential

We use a measure of market potential which accounts for transportation costs within the host country. In a second stage, we also account for transportation costs between the host country and the regional market, including internal transportation costs in each foreign market.

The first step is to compute distances weighted by regional GDPs. The average distance between countries i and h (d_{ih}) is calculated as the weighted average of distances between each region of i and each region of h: (with $i=h$ in the case of internal distances):

$$d_{ih} = \sum_{k \in i} \left(\sum_{k' \in h} z_{k'} d_{kk'} \right) z_k \quad ; \quad d_{kk'} = \text{distance between regions k and k'}$$

$$z_k \equiv \frac{GDP_k}{GDP_i} \quad ; \quad z_{k'} \equiv \frac{GDP_{k'}}{GDP_h}$$

We are grateful to Thierry Mayer for providing us ready-to-use average distances.

In a second step, the market potential of country h is defined as the ratio of its GDP to its average internal distance:

$$POT_{ht} = \frac{GDP_{ht}}{d_{hh}}$$

Finally, in the case of the European Union, an enlarge market potential is defined as the weighted sum of European GDPs, where the weights correspond to the distance between the host country and each European market:

$$EPOT_{ht} = \frac{GDP_{ht}}{d_{hh}} + \sum_{j \in Europe} \frac{GDP_{jt}}{d_{hj}} \text{ if } h \in \text{Europe}$$

$$EPOT_{ht} = POT_{ht} \text{ if } h \notin \text{Europe}$$

The GDPs used in this calculation are in purchasing power parity (source: CEPII-CHELEM). We use the logarithm of the host market potential ($LPOT_{ht}$) and the logarithm of the enlarged market potential ($LEPOT_{ht}$).

Size of the investing country

$LGDP_{it}$ is the logarithm of the GDP of the investing country, in USD using PPP exchange rates (CHELEM-CEPII database). It is used as a proxy for the size of the investing country.

Transportation costs

$LDIST_{hi}$ is the logarithm of the great arc-cycle distance between *i* and *h* economic centers. We are grateful to Daniel Mirza for providing the data.

Common language

$CLNG_{hi}$ is a dummy controlling for potential network externalities provided by the sharing of a common culture. It takes the value of one when countries use the same language.

Cost variables

$LRER_{hit}$ is the logarithm of the bilateral, real exchange rate between the host country *h* and the investor country *i*, defined as the relative price level of the investor country vis-à-vis the host (hence, a rise in $LRER_{hit}$ points to a real appreciation in country *h*). It is constructed with the CEPII-CHELEM database, where data are all expressed as relative prices against the US. which allows for both geographic and time variance in real exchange rates..

Unit labor costs (ULC) are taken from the OECD, and converted into a common currency (the dollar) using IMF exchange rates. Relative unit labor costs are computed as the difference in the (natural logarithm of) host against the invrestor ULC, and are labelled $LULC_{hit}$.

Public expenses

Public consumption data in volume are provided by the OECD, line CGV. Public investment data come from the same source, line IGV. When necessary, these variables are converted into a common currency (the US dollar) using IMF (International financial Statistics) data. Two alternative variables are used in order to catch both the relative amount of total public expenses and its composition.

- The size of total public expenses. Denoting public consumption by PC and public investment by PI, both in volume and current US dollar, this variable is designed as follows: $LPEXP_{ht} = \ln(PC_{ht} + PI_{ht})$.

- The composition of public expenses. Using the same notations, this variable is defined as follows: $ISHARE_{ht} = \left(\frac{PI_{ht}}{PI_{ht} + PC_{ht}} \right)$.

Corporate tax differentials

Tax differentials are calculated as simple differences between the corporate-tax rates in the host country (*h*) and in the investing country (*i*). This calculation is carried out on a set of four tax variables:

- statutory tax rates (TS_{hi});
- average effective tax rates (TA_{hi});
- marginal effective tax rates (TM_{hi});
- apparent effective tax rates (TE_{hi}).

Statutory, average effective and marginal effective tax rates are taken from Michael Devereux's home page (http://www2.warwick.ac.uk/fac/soc/economics/staff/faculty/devereux/).

Apparent effective tax rates are calculated as the ratio between corporate tax revenues and the operating surplus, using OECD data, namely taxes on corporate income as a % of GDP (Line 12 OECD, Financial and Fiscal Affairs, Compendium), available for the whole time sample; GDP in local currency (OECD, national accounts); Operating surplus in local currency (OECD, national accounts).

All tax rates are in percentage.

Note that other location incentives such as subsidies or exemptions granted by local authorities should be considered too. However, reliable data is missing especially on a multi-country basis, and there is some evidence that these policies are implemented everywhere and thus are likely to at least partially offset each other.

Number of observations

The theoretical number of observations for bilateral FDI is 1870 (11 investors x 10 hosts x 17 years). However there are 398 missing values, and 268 negative or zero values need to be excluded since we are working on the logarithm of FDI flows.

There are also missing values among explanatory variables. In particular, Denmark is missing in the Devereux and Griffith database. This leaves us with 1163 observations when the Devereux and Griffith database is used, and to 1307 observations when apparent taxation is used.

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