Multinational Firms' Heterogeneity in Tax Responsiveness: the Role of Transfer Pricing*

Céline Azémar† Gregory Corcos ‡

This version: November 19, 2008

Abstract

In this paper we show that the ability of multinational firms to manipulate transfer prices affects the tax sensitivity of foreign direct investment (FDI). We offer a model of international capital allocation where firms are heterogeneous in their ability to manipulate transfer prices. Perhaps paradoxically, we show that the ability to shift profits can make parent companies' investment *more* sensitive to host-country tax rates, as long as investors expect fiscal authorities to use price and profit detection methods. We then offer a comprehensive empirical study to test our predictions in the case of Japanese FDI. We exploit the finding that the unobservable ability to manipulate transfer prices is correlated with whole ownership of affiliates and R&D expenditure. Based on country, parent firm and sector characteristics, we estimate an investment equation on a sample of 3614 Japanese affiliates in 49 emerging countries. We obtain a greater semi-elasticity of investment to the statutory tax rate in affiliates that are wholly-owned and that have R&D intensive parents. We interpret these results as indirect evidence that abusive transfer pricing is one of the determinants of FDI activity.

Keywords: International Taxation, Transfer Pricing, FDI, Ownership Structure, R&D, Japanese Investment, Tax Sparing.

JEL classification: F23, H25, H32.

*We thank the University of Waseda (Tokyo) for its hospitality. We gratefully acknowledge helpful comments and discussions from Andrew Delios, Rodolphe Desbordes, Mihir Desai, Karolina Ekholm, Peter Egger, Lionel Fontagné, Shinji Hasegawa, Peter Neary, Armando Pires, Olivier Poindron, Dirk Schindler, Guttorm Schjelderup, Doina Radulescu, Hylke Vandenbussche, Rodrigo Wagner and Ian Wooton as well as seminar participants at the Kennedy School of Government, the University of Strathclyde, NHH, the Paris School of Economics, the CESifo Workshop on the Taxation of Multinationals (Venice), the EEA conference (Vienna), the NOITS workshop (Bergen), the RIEF workshop (Barcelona) and the University of Waseda. The usual disclaimer applies.

†Corresponding author: Department of Economics, Adam Smith Building, University of Glasgow, G12 8RT Glasgow, United Kingdom. Tel: +44 1 41 330 3332. Fax: +44 1 41 330 4940. E-mail address: c.azemar@lbss.gla.ac.uk.

‡Department of Economics, Norwegian School of Economics and Business Administration (NHH).

1 INTRODUCTION

Cross-country differences in corporate income tax rates lead multinationals to find strategies in order to diminish their tax liabilities. The manipulation of transfer prices represents a common way to minimize the fiscal burden. The extent to which multinational corporations shift income from high-tax countries to low-tax countries is documented in a number of empirical studies, such as Jenkins and Wright (1975), Grubert and Mutti (1991), Hines and Rice (1994), Swenson (2001a), Clausing (2003), Bartelsman and Beetsma (2003), and Bernard et al. (2006). The widespread practice of abusive transfer pricing is suspected to lead to a fiscal loss of a large magnitude. The best evidence available comes from Bernard et al. (2006), who use highly disaggregated US data to compare the value of intrafirm and arms' length transactions for all American multinationals in the year 2004. Their estimates of tax losses range from $5.5 billion to $33 billion. This illustrates how important a concern this phenomenon is to tax authorities.

The starting point of this paper is that firms are heterogeneous in their ability to manipulate transfer prices. Since the distinctive feature of multinationals that allows them to avoid taxation is their ability to coordinate internal pricing and production decisions, it is not surprising that tax planning should be easier for some multinationals than for others. Previous research has shown that the ability to manipulate transfer prices is closely related to some observable firm characteristics, such as ownership structure or intensity in R&D. For instance empirical findings by Desai et al. (2004) suggest that whole ownership facilitates transfer pricing manipulation, as the decision to shift profits is not limited by the divergent interests of partners, as in the Kant (1990) model. Similarly, Lall (1979) suggests that firms that use advanced technologies intensively also find it easier to manipulate transfer prices, as the market price of a differentiated product is more difficult to establish. Grubert (2003) finds indeed that US R&D intensive parent firms are more likely to shift income, and engage in a greater number of intrafirm transactions.

Considering that multinational corporations integrate transfer pricing manipulations in their investment decisions, this paper is interested in the remaining unknown mechanisms linking firms' ability to shift income and the tax responsiveness of their capital invested abroad. A first intuitive hypothesis is to consider that firms which are more able to manipulate transfer pricing are *less* sensitive to corporate tax rates since they can shift profit earned in a high tax country to an affiliate located in a low tax country. The second hypothesis, which is the one supported by this paper, comes from the observation of the methods employed by fiscal

authorities to regulate transfer pricing. Fiscal authorities do not only compare the price paid in an intra-group transaction to the price paid in a similar transaction between independent parties, as it is usually considered by the literature modelling transfer pricing[1]. They also routinely compare rate of returns on capital employed between affiliates of a same group, and with comparable business entities.[2] If firms want to minimize the probability of being audited and penalized for transfer pricing manipulation, then the 'profit method' of detection should affect their investment decisions. Firms that have a greater ability to manipulate transfer pricing will invest *more* in countries where they can transfer taxable income, in order to maintain acceptable profit-to-asset ratios.

This paper investigates whether firm heterogeneity in ownership structure and R&D intensity has an impact on the sensitivity of a firm's investment to tax rates. In a first step, we present a model of international capital allocation and income shifting by a multinational firm. In the model we assume that the probability to detect illegal profit-shifting increases with the amount of income shifted and decreases both with the capital invested in the low tax country and the R&D intensity of the firm. This assumption can be justified by the detection methods used by fiscal authorities, which take into account financial indicators and arms' length prices. A risk-neutral investor with rational expectations on the detection process will then adjust the size of her investment to minimize detection. At the margin, the effect of a tax rate cut on investment should be greater for firms that are better equipped to shift income. Therefore tax sensitivity should differ between wholly-owned firms and joint-ventures, and between firms which are intensive in technologies and firms which are not. Hence, the model offers a prediction of how the sensitivity of capital investment to taxation varies with the ownership share and with parent R&D expenditure.

In a second step, we conduct a comprehensive empirical analysis to consider these potential asymmetries. We exploit affiliate-level data on Japanese multinational activity in the year 2001 in 49 'emerging countries'.[3] Taking into account sample selection bias and outliers, we find that the tax responsiveness of foreign capital is higher in settings that are favourable to tax planning, such as wholly-owned and R&D intensive affiliates. To complete our assessment of tax planning

[1] See among others Kant (1990) and Devereux et al. (2004).

[2] An overview of the most widely-used methods to detect abusive transfer pricing can be found for example in UNCTAD (1999).

[3] Almost all countries of the sample could be considered 'developing' countries according to the operational classification of the World Bank, i.e. countries with gross national income below $10,726. However, the sample also contains countries with middle-to-high income countries commonly referred to as 'emerging' economies. We will refer to the countries in our sample as 'emerging countries' throughout the paper.

in emerging countries, we also examine the impact of tax sparing provisions. We find that these provisions, which are usually granted by developed countries to emerging countries only, have an impact on the sensitivity of capital to tax rates.

Our empirical work focuses on emerging countries for three reasons. First, multinational tax planning opportunities are expected to be larger in countries experiencing more difficulty in the regulation of transfer pricing. Emerging countries typically suffer from "the lack of institutional framework and the inadequacy of expertise and resources to tackle this issue" (Chan and Chow, 1997, p84). Second, perhaps for data availability reasons, little attention has been paid on the impact of taxation on FDI in emerging countries, where tax incentives are common. Yet such studies are not redundant since, as emphasized by Wheeler and Mody (1992) and Blonigen and Wang (2005), the determinants of FDI in developing and developed countries may differ. Mutti and Grubert (2004) and Azémar and Delios (2008) effectively measure a higher tax sensitivity in low-income countries. Third, emerging countries are also characterized by a differential treatment of high R&D multinational firms. Indeed the expectation of higher positive technological spillovers leads these countries to offer such firms relatively more generous fiscal incentives than to low R&D affiliates (PricewaterhouseCoopers, 2000 edition of the 'Doing Business and Investment Series'). In some emerging countries the desire to attract technological investments can be such a priority that tax authorities voluntarily avoid to audit high-technology affiliates, for fear of losing them to another country (Chan and Chow, 1997). Hence, focusing on emerging countries allows to shed light on how corporate taxation is perceived by foreign investors in these countries according to their ownership structure and their intensity in R&D.

While the empirical exercise is restricted to emerging countries, we believe that it can be of interest to European countries as well. First, the findings can be of interest to European countries as host countries, especially in the light of recent debates on corporate taxation in the EU. In 2001 the European Commission proposed the introduction of a common European tax base with formula apportionment. This proposal was aiming at reducing the potential for intra-EU profit-shifting. While we do not review the debate on this proposal[4], we believe that evidence of how real investment is affected by profit-shifting can be useful. If profit-shifting distorts real investment in addition to the negative fiscal externality, there is a stronger theoretical case for such partial coordination in the EU. Second, the findings can be interesting to European countries as origin countries. Indeed, income-shifting causes tax revenue losses

[4]A good discussion is offered by Eggert and Haufler (2006).

to Europe and Japan in the same way. Bartelsman and Beetsma (2003) show that two-thirds of the tax revenue gains from a unilateral increase in the corporate tax rate are lost due to income-shifting in the OECD. Likewise, Japanese detection methods do not significantly differ from the ones used by most European countries. Therefore, we believe that our methodology can reveal patterns of FDI of interest to European policymakers as well.

The paper is organized as follows. The next section reviews the literature on possible links between taxation and the ownership structure of the firm and its intensity in technology. Section 3 offers a formal treatment of our idea. It presents a model which shows that firms' ability to manipulate transfer pricing has an impact on their responsiveness to corporate taxes. Next, an empirical section analyzes the effect of taxes on the Japanese capital invested abroad by distinguishing the mode of establishment of the affiliate and by considering the R&D intensity of the affiliate. The last section offers concluding remarks.

2 CORPORATE TAX RESPONSIVENESS VARIES WITH OWNERSHIP STRUCTURE AND R&D INTENSITY

This section reviews findings on heterogeneity between firms in the ability to manipulate transfer prices. As the model in the next section will show, this results into heterogeneity in tax responsiveness.

A first source of heterogeneity comes from the mode of ownership. A multinational corporation can produce a commodity abroad by establishing a wholly-owned venture or by forming a joint-venture with another firm. In both cases transfer pricing represents a way to maximize their after-tax rate of return. However, the conflicting interests of joint-venture partners can diminish the incentives to shift profits away. Svejnar and Smith (1984) theoretically investigate transfer pricing behavior in joint-ventures established in less developed countries. Using several bargaining models, they show that transfer pricing manipulation can be used as a tool to share profits. But transfer prices will be set so as to minimize tax liabilities in the host country only with joint-profit-maximizing (efficient) bargaining. Indeed, conflicts of interest that can arise between partners limit the scope for transfer pricing manipulation in a joint venture. Kant (1990) offers a model of transfer pricing abuse with partial ownership and studies its effect on government revenue. His model states precise conditions for the alignment of partners' incentives.

In line with the theory, the empirical analysis of Desai et al. (2004) suggests that multinationals trying to benefit from worldwide tax planning are more willing to establish their affiliates as wholly-owned establishments. Basically, Desai et al. (2004) examine the determinants of partial ownership of US foreign affiliates from 1982 to 1997. Distinguishing between wholly-owned, majority-owned and minority-owned affiliates, they analyze the influence of tax policies in host countries on the choice of ownership structure. They find that tax rate differentials between the US and the host countries increase the likelihood of a firm establishing wholly-owned ventures. This finding suggests that multinationals with tax planning opportunities are more likely to establish their foreign affiliates as wholly-owned entities. Two other important results strengthen this relationship. First, affiliates with a higher ratio of related party sales to the affiliate's total sales are more likely to be wholly owned. Second, returns on assets of wholly-owned affiliates are significantly more sensitive to foreign tax rates than are net incomes of partially-owned affiliates. Corroborating their results with German data, Weichenrieder (2008) finds that corporate tax rates have a stronger impact on the profitability of German wholly-owned affiliates as compared to joint-ventures.

Empirical work by Swenson (2001b) sheds additional light on the link between taxation and the ownership structure of firms. She studies the tax responsiveness of FDI into the US between 1984 and 1994 for 6 different forms of FDI: new plants, plant expansions, merger and acquisitions, joint ventures, equity increases and other. The data comprise 3,212 investment projects in the manufacturing sector across 50 States realized by investors coming from 46 countries. Her results indicate that plant creation, plant expansion and equity increase decisions are negatively and significantly correlated with the level of US tax rates for investors coming from tax credit system countries, with an elasticity of -5.65, -4.98 and -8.59 respectively. In contrast, joint venture decisions appear not to be influenced by taxation as the coefficient is not statistically significant. There is good reason to suspect that joint-ventures' inferior coordination of pricing and production processes, limiting their incentives to shift profit away, may lead to a lower sensitivity with respect to taxes.

A second source of heterogeneity among firms comes from the R&D expenditure of parent companies. For several reasons, parent companies with high R&D expenditure are more likely to escape the scrutiny of tax auditors. First, as suggested by Lall (1979), high technology multinationals have a greater propensity to manipulate transfer pricing since the market price of very specialized products is difficult to establish. Similarly, technology-intensive operations involve royalty payments for which standard levels are difficult to compute.

Second, affiliates of high R&D can be treated with more leniency by host-countries when it comes to compliance with accounting standards. This is part of the observed differential treatment offered by emerging countries to high-R&D multinational firms. Indeed, the expectation of higher positive technological spillovers to FDI leads these countries to offer such firms relatively more generous fiscal incentives than to low R&D affiliates (PricewaterhouseCoopers, 2000 edition of the *Doing Business and Investment Series*). As previously mentioned, in some emerging countries such as China, attracting technological investments is a priority and tax authorities voluntarily avoid to audit high-technology affiliates, for fear of losing them to another jurisdiction (Chan and Chow, 1997). This makes tax auditing in the home country more difficult.

The literature supports the idea that wholly-owned affiliates and affiliates of high-R&D parents are more likely to engage in abusive transfer pricing. In addition, wholly-owned subsidiaries are more likely to be located in low-tax countries than joint-ventures. One important related issue is the extent to which this ability to manipulate transfer pricing affects the tax responsiveness of capital, once a location has been chosen.

As mentioned above, without considering fiscal authorities' methods in transfer pricing regulations, the first intuition is that the more likely transfer pricing manipulation is, the less foreign investment is sensitive to taxes. Indeed, firms that can engage in transfer pricing should be more willing to invest in high-tax locations since they are able to move profits out of these locations without actually incurring taxes.

This argument becomes less realistic when we consider the methods used by tax authorities to detect abusive transfer pricing. Transfer pricing regulations typically include "price methods" and "profit methods". Price methods[5] should not affect the tax sensitivity of capital as long as transfer pricing abuse does not require capital, as with under- or over-invoicing, as in Kant (1990). However, fiscal authorities also use profit methods that are based on profitability indicators.[6] A typical indicator is the rate of return on capital employed, which is a ratio of operating profit to productive assets. Therefore multinationals that wish to manipulate transfer prices can be led to over-invest in countries where they shift their income, in order to

[5]Price methods include the "comparable uncontrolled price (CUP) method", the "resale price method" and the "cost plus method". For example, the CUP method compares the actual price paid in an intra-group transaction to the actual price paid in a similar transaction between independent parties.

[6]Profit methods include the "transactional profit method" or the "profit split method". The transactional profit method evaluates the amount charged in an intra-group transaction by comparing the profits generated by the company to that of a number of comparable companies, and the profit split method allocates the profit in the transaction based on the relative value of each participant's contribution to the combined profit.

depress observed rates of return. Considering this relationship between invested capital and the probability of being audited and penalized changes the understanding of the relationship between taxation and FDI.

In sum, some firms have a greater ability to manipulate transfer prices, as for instance high-R&D parents or parents with wholly-owned affiliates. These firms should be more willing to invest in low-tax locations in order to minimize the risk of being audited and penalized when they move profits out of the high-tax locations. The next section details how the ownership structure of an affiliate and its intensity in R&D may lead to an unambiguously stronger relationship between corporate tax rates and the capital invested abroad.

3 A MODEL OF FDI AND TRANSFER PRICING MANIPULATION

We start by presenting a model illustrating how firms' investment decisions depend on affiliate ownership structure and their intensity in R&D, when both price and profit methods are used by governments to regulate transfer pricing.

3.1 Basic Framework

Consider the case in which there are two countries, Home (H) and Foreign (F), that differ by their statutory corporate tax rates, with $t_H > t_F$, but that are otherwise identical.

Investment decision One multinational firm (MNC) from country H controls an affiliate in F with ownership share α. Production uses capital only. The controlling multinational chooses the *total* capital stock of the affiliate and the extent of transfer pricing that maximize its global profits. In both countries the same technology is available so that the same pre-tax profit function $\Pi(k)$ applies. We assume $\Pi(\cdot)$ to be concave. The multinational's opportunity cost of capital equals ρ. Home and foreign investment decisions are separable: there are no economies of scale or scope between the two companies.

Taxation It is assumed that there is no dividend repatriation. Therefore the foreign tax rate is relevant for investors, irrespective of the home country's tax system (exemption or credit). This is an analytically convenient limit case of deferred repatriation. However, the analysis carries over to arbitrary levels and schedules of repatriation, as long as part of this

repatriation is deferred.[7] Depreciation allowances, tax holidays, and other fiscal incentives are not considered, so that the relevant tax rate is the statutory rate, rather than the effective tax rate. The analysis would be left unchanged.

Profit-shifting Tax differentials between countries H and F create an incentive to shift profits from H, the high-tax country, to F, the low-tax country. It is assumed that trade costs are negligible and that the profit-shifting activity does not require capital. This assumption is realistic insofar as skilful managers can find economical means to shift profits across locations.

The parent firm can choose to report a value X of intrafirm trade flows, which under our assumptions is equal to the amount of profits shifted from one country to another. Transfer pricing manipulation should thus be understood as choosing a value X different from zero.[8] Exporting goods or services of value X to the parent company increases affiliate profits by $\alpha(1-t_F)X$, while it costs $(1-t_H)X$ to the parent.

Enforcement of transfer pricing laws The tax authority of the losing country (H, the high-tax country) can detect and prove illegal profit-shifting with probability $\Phi(k_F, X; t_F, RD)$ when RD denotes the parent's investment in research and development (we come back to the role of RD in the following subsection). When the tax authority's case is successful, it can imposes a fine Ψ. $\Phi(k_F, X; t_F, RD)$ is assumed to be convex. That the detection and enforcement process is not deterministic reflects the limited resources of tax authorities compared to those of multinationals.

We further assume that $\Phi(k_F, X; t_F, RD)$ is increasing in X and decreasing in k_F. The first assumption is intuitive. The second assumption is justified if the detection process is based on some financial ratios (such as the affiliate's gross margin, operating margin, return on capital employed, as mentioned in the previous section) that decrease with k_F.

Finally, we assume that tax auditors' detection methods are not country-specific, in the sense that $\Phi_{kt} = \Phi_{Xt} = 0$. In other words, tax auditors associate the same likelihood of abuse to a given underlying (k, X) pair in all countries. This assumption simplifies a lot the analysis,

[7] In a tax credit system such as Japan's, investors are taxed on their worldwide profits at the home tax rate, but receive tax credits for taxes paid abroad by their affiliates in order to avoid double taxation. In such a system, low taxation should not affect the location and the amount of investment if all profits are immediately repatriated. When repatriation is deferred, however, foreign profits are capitalized at a different rate of return before repatriation, so that foreign tax rates matter.

[8] In a more realistic setting, the production process of the affiliate would involve some physical exchange of goods or services. The parent would simply manipulate the price of those transactions, with the shifted profits equal to the manipulated price times this quantity, minus production costs. Our setting is equivalent as long as there are no additional capital costs of producing the traded goods or services related to the profit-shifting activity *per se*.

and has some plausibility.[9] In particular this assumption holds even if the tax authority devotes a greater share of its resources to affiliates in low-tax countries, as long as the methods used are the same in all countries.

Exogeneity of firm characteristics The parent's ownership share in the affiliate and its total R&D expenditure are assumed to be exogenous. In addition the foreign investment process is assumed to be insensitive to home investment in R&D.

3.2 Tax Responsiveness

3.2.1 Investor's Program

The multinational's objective function is:

$$\begin{aligned} V(k_H, k_F, X) =& (1-t_H)\Pi(k_H) - \rho k_H + \alpha\left[(1-t_F)\Pi(k_F) - \rho k_F\right] \\ &+ \left(\alpha(1-t_F) - (1-t_H)\right) X - \Phi(k_F, X; t_F, RD)\Psi \end{aligned} \tag{1}$$

where the first line represents profits in the absence of abusive transfer pricing and the second line represents the net expected gains from abusive transfer pricing.

Since $\Pi(\cdot)$ is concave and $\Phi(\cdot)$ is convex, $V(\cdot)$ is concave. First-order conditions for profit maximization are given by:[10]

$$V_{k_H} = 0$$
$$V_{k_F} = 0$$
$$V_X = 0$$

The first condition gives home investment as an implicit function of the home tax rate:

$$(1-t_H)\Pi'(k_H) = \rho$$

Foreign investment would be obtained in the same way, absent transfer pricing manipulation. We now focus on that decision. For commodity we drop all F subscripts hereafter.

[9] This assumption has some plausibility since most countries (including Japan) have adopted the OECD transfer pricing guidelines for multinational enterprises and tax administrations, which were first issued in 1979 and have become internationally respected.

[10] Subscripts of the $V(\cdot)$ and $\Phi(\cdot)$ functions consistently denote their partial derivatives.

3.2.2 Understanding the Effect of Taxation in A Special Case: $V_{kX} = 0$

Our objective is to determine the tax responsiveness of capital investment in the model, that is the expression of $\frac{dk}{dt}$. This term will depend on the cross-derivative V_{kX}. This depends in turn on the derivative of the detection function with respect to k and X, since no other term in the profit function depends on both k and X.

For the sake of clarity we first derive the effect of taxation on investment in the special case of $V_{kX} = 0$. In that case the effects of investment and of transfer pricing manipulation on the probability of detection are completely separable.

Totally differentiating the two first-order conditions $V_k = V_X = 0$ around the optimum:

$$V_k = 0 = V_{kk}dk + V_{kt}dt$$
$$V_X = 0 = V_{XX}dX + V_{Xt}dt$$

so that

$$dk = -\frac{V_{kt}}{V_{kk}}dt = \frac{\alpha\Pi'(k)}{\alpha(1-t)\Pi''(k) - \Phi_{kk}\Psi}dt$$

V_{kt} is the depressing effect of tax on the marginal product of capital. V_{kk} measures marginal returns to capital, including those of the dissimulation component of capital investment.

The stronger the depressing effect of tax on the marginal product is, the more taxation reduces investment. The weaker diminishing marginal returns are, the more it is necessary to rescale an investment as a result of a variation in tax, and therefore the more taxation reduces investment.

In this model transfer pricing manipulation affects tax responsiveness through the probability of detection. In the special case of a separable detection function ($V_{kX} = 0$) over-investing reduces the likelihood of detection irrespective of the extent of manipulation. However, there are diminishing marginal returns to this dissimulation component of investment too. This is because the ability to dissimulate fades away as investment increases. As in the case of 'technological' marginal returns, the stronger these diminishing returns are, the less effect taxation has on investment. In a sense they work in addition to technological diminishing returns.

3.2.3 Understanding the Effect of Taxation in the General Case

We are now interested in the expression of tax responsiveness $\frac{dk}{dt}$ in the case of a general detection function.

Totally differentiating the last two first-order conditions around the optimum:

$$V_k = 0 = V_{kk}dk + V_{kX}dX + V_{kt}dt$$
$$V_X = 0 = V_{Xk}dk + V_{XX}dX + V_{Xt}dt$$

or

$$dk = -\frac{V_{kt}}{V_{kk}}dt - \frac{V_{kX}}{V_{kk}}dX$$
$$dX = -\frac{V_{Xt}}{V_{XX}}dt - \frac{V_{Xk}}{V_{XX}}dk$$

Solving the linear system in $\frac{dk}{dt}$ and $\frac{dX}{dt}$:

$$\begin{pmatrix} \frac{dk}{dt} \\ \frac{dX}{dt} \end{pmatrix} = \begin{pmatrix} \frac{V_{kt}V_{XX} - V_{kX}V_{Xt}}{(V_{kX})^2 - V_{kk}V_{XX}} \\ \frac{V_{Xt}V_{kk} - V_{kX}V_{kt}}{(V_{kX})^2 - V_{kk}V_{XX}} \end{pmatrix}$$

Focusing on tax responsiveness:

$$\frac{dk}{dt} = \frac{V_{kt}V_{XX} - V_{kX}V_{Xt}}{(V_{kX})^2 - V_{kk}V_{XX}} \tag{2}$$

Straightforward calculations yield:

$$V_{kk} = \alpha(1-t)\Pi''(k) - \Phi_{kk}\Psi$$
$$V_{XX} = -\Phi_{XX}\Psi$$
$$V_{kX} = -\Phi_{kX}\Psi$$
$$V_{kt} = -\alpha\Pi'(k) - \Phi_{kt}\Psi$$
$$V_{Xt} = -\alpha - \Phi_{Xt}\Psi$$

The concavity of $V(\cdot)$ guarantees $V_{kk} < 0$, $V_{XX} < 0$ and $(V_{kX})^2 - V_{kk}V_{XX} < 0$. Concavity and the fact that auditing methods are not country-specific imply that $V_{kt} < 0$ and $V_{Xt} < 0$.

Therefore it can be seen in (2) that the sign of $\frac{dk}{dt}$ depends on the sign of V_{kX}, and in turn that of Φ_{kX}. A sufficient condition for $\frac{dk}{dt} < 0$ is that Φ_{kX} be negative or zero. This condition states that investing more in the low-tax country helps dissimulate some abusive transfer pricing, or at least does not facilitate detection. This is consistent with actual practice in the detection of transfer pricing abuse, as argued in the previous Section.

Finally, using (1), we obtain:

$$\frac{dk}{dt} = \frac{\alpha\Pi'(k)\Phi_{XX}\Psi - \alpha\Phi_{kX}\Psi}{(\Phi_{kX}\Psi)^2 + (\alpha(1-t)\Pi''(k) - \Phi_{kk}\Psi)\Phi_{XX}\Psi} \tag{3}$$

3.3 Results

3.3.1 Tax Responsiveness and the Ownership Share

Ownership has two effects on tax responsiveness.

First, if the ownership share is sufficiently low relative to tax differentials, in the sense of $\alpha(1-t_F) - (1-t_H) < 0$, then the multinational has an incentive to shift profits *from the low-tax country to the headquarter country* (and not in the other direction). This is because the multinational will gain more from extracting profits from its partners, rather than reducing tax liabilities. If this occurs, conflict among partners should reduce abusive transfer pricing, and therefore tax responsiveness.

Second, when the ownership share is large enough to make profit-shifting towards the low-tax country more profitable, the gains from abusive transfer pricing increase with this share.

To see this, let us study how $\frac{dk}{dt}$ varies with α. Careful examination of equation (3) shows that the numerator is proportional to α. Let A denote its value under whole ownership. The denominator is a decreasing function of α, which we will denote by $B(\alpha)$. Then $\frac{dk}{dt} = \frac{\alpha A}{B(\alpha)}$.

Hence:

$$\frac{d^2k}{dtd\alpha} = \frac{AB(\alpha) - \alpha AB'(\alpha)}{B(\alpha)^2} \tag{4}$$

Straightforward calculations show that:

$$B(\alpha) - \alpha B'(\alpha) = \Psi^2\left[\Phi_{kX}^2 - \Phi_{kk}\Phi_{XX}\right]$$

The term in brackets is the opposite of the determinant of the Hessian of $\Phi(\cdot)$, which is non-negative due to the assumed convexity. Since $A > 0$, it follows that $\frac{d^2k}{dtd\alpha}$ is negative. Hence our first result.

Result 1 Tax responsiveness increases with the ownership share in a discontinuous way. When this share is low relative to tax differentials (in the sense of $\alpha(1-t_F) - (1-t_H) < 0$), no transfer pricing abuse occurs. When this share increases above $\alpha(1-t_F) - (1-t_H)$, the sensitivity of capital investment to taxation increases monotonically.

A large ownership share confers two advantages for transfer pricing manipulation. First, it aligns the controlling firm's interests with its partners'. Second, gains from manipulation are greater while the expected losses remain the same. This increased incentive to manipulate alleviates the effects of diminishing returns and raises the effect of taxation on the size of investment.

3.3.2 Tax Responsiveness and R&D Expenditure

We assumed that R&D expenditure influences only the likelihood of detection. In particular, it makes artificial intrafirm trade less likely to trigger detection.

Let RD denote parent R&D expenditure. Technically, we assume that $\frac{d^2\Phi}{dkdRD} = 0$, and that $\frac{d^2\Phi}{dXdRD} < 0$ and $\frac{d\frac{d^2\Phi}{dX^2}}{dRD} < 0$. In other words R&D intensity reduces the slope and the curvature of the detection schedule. Let Φ_{XXRD} denote the latter derivative.

Consider the tax responsiveness equation (2). Denoting the numerator by $A(RD)$ and the denominator by $B(RD)$, we have:

$$\frac{d^2k}{dtdRD} = \frac{A'(RD)B(RD) - A(RD)B'(RD)}{B(RD)^2}$$

Differentiating the various terms in (2) with respect to RD yields:

$$A'(RD) = \Psi\Phi_{XXRD}(\alpha\Pi'(k))$$
$$B'(RD) = \Psi\Phi_{XXRD}(\alpha(1-t)\Pi''(k) - \Phi_{kk}\Psi)$$

Straightforward calculations show that:

$$\frac{d^2k}{dtdRD} = \Psi\Phi_{XXRD}\frac{\alpha\Pi'(k)(\Phi_{kX}\Psi)^2 + (\alpha(1-t)\Pi''(k) - \Phi_{kk}\Psi)\Phi_{kX}\Psi}{B(RD)^2} \tag{5}$$

The fraction is unambiguously positive. Under our assumption on Φ_{XXRD}, the whole derivative is unambiguously negative. This yields the following result:

Result 2 Assume parent R&D expenditure reduces the likelihood that an additional dollar of intrafirm trade triggers detection. Then the sensitivity of investment to taxation unambiguously increases with parent R&D expenditure.

Parent R&D expenditure acts as a facilitator for tax evasion in this model by decreasing the probability of detection. As mentioned earlier, this can be justified by a combination of

decreased accuracy in price and profit comparisons, and leniency in the host country's enforcement of accounting standards. When it allows firms to shift an increasing amount of profits without being detected, the sensitivity of manipulation to taxation is increased. This is the diminishing returns argument applied to the activity of transfer pricing manipulation. This increased sensitivity of manipulation translates into a greater sensitivity of investment under our maintained assumption that over-investment helps dissimulate manipulation.

3.4 A Summary

In this section we showed that a simple model of investment and transfer pricing manipulation can generate interesting predictions on the effect of taxation on investment. In particular, the model predicts that some firm characteristics such as parents' ownership shares and R&D expenditure increase the tax sensitivity of investment. These results have been derived under the mild assumption that over-investment helps justify large profits from affiliates in low-tax countries. This assumption is plausible in a world where tax authorities rely on financial ratios to detect abuse, and where these financial ratios are depressed by over-investment.

We now turn to the empirical exercise, where we attempt to validate the theoretical implications of this maintained hypothesis.

4 DATA AND ESTIMATION

We estimate the influence of taxation on the international strategies of Japanese multinational enterprises that own affiliates in emerging countries. Affiliate-level data come from the 2001 annual edition of *Kaigai Shinshutsu Kigyo Soran - Kuni Betsu* (Survey of Japanese Overseas Investments - by country). The data is compiled by Toyo Keizai, a statistical publisher, using a staff of 150 reporters and data analysts.

The database provides information on virtually all (more than 18,000) affiliates of Japanese multinationals worldwide. Affiliates are defined as corporations with 10 percent or more of their equity owned directly or indirectly by a Japanese company. We are interested in emerging countries, but due to the lack of macro-economic data we must restrict ourselves to 49 countries. In the database 5082 affiliates are located in these emerging countries. We have information on shareholdings and on capital invested for 3614 of them, which is the sample we consider.

The main variable of interest is the *total* stock of capital, measured at book value, invested

by parent firms in Japanese affiliates in 2001. Table 1 summarizes the number of Japanese establishments and the stock of capital invested in these affiliates in each emerging country of the sample. We distinguish between two modes of establishments of Japanese affiliates: wholly-owned affiliates and joint ventures. Wholly-owned affiliates represent 1000 establishments, i.e. 27.7% of the total number of affiliates considered. Joint-ventures, that is affiliates in which the parent has a share strictly lower than 100%, represent 2614 entities, i.e. 72.3% of the total number of affiliates considered.

Information on parent firms comes from the "Analysts' Guide" published by the Daiwa Institute of Research. Parent firms are defined as the main shareholders, while partners can either be Japanese or local firms. We use data on the parent's stock of capital. When the affiliate is a joint-venture firm, with two or more parents, the stock of capital of the parent firm which possesses the larger share of the affiliate is considered. We also use data on the R&D intensity of the parent firm, measured as the ratio of parent R&D expenditure to sales revenues.

Country-level characteristics are captured by usual determinants such as GDP, GDP per capita, the distance between the host country and Japan, and the host country's value of the ICRG composite risk index. In empirical studies such as Wheeler and Mody (1992) and Mody and Srinivasan (1998) these variables are major determinants of FDI in emerging countries. The GDP and the GDP per capita data come from the "Global Development Network Growth Database" published by the World Bank. Data on the distance between the host country and Japan come from CEPII. ICRG refers to a composite risk rating of economic, financial and political risks published in the International Country Risk Guide. This index takes a value between 0 and 100, a higher score indicating a *lower* risk. Finally, the level of foreign taxation is observed through the only available measure of tax rates in emerging countries : the statutory tax rate. These data come from the University of Michigan World Tax Database. They correspond to the maximum marginal tax rates faced by corporations.

While our data cover Japanese parents fairly well, no parents own affiliates in all the countries of our sample. Our results could therefore be affected by sample selection bias. Since the selection of parent-country pairs results from a non-random location choice, we follow a two-step Heckman correction approach. The first stage of the Heckman procedure estimates a probit equation to obtain the probability of locating production in a foreign market. This first stage results in the estimation of a non-selection hazard rate, the inverse Mills ratio, which is included in the second stage as an extra explanatory variable. Assuming joint normality of the

Table 1: Number and capital stock of Japanese affiliates in emerging countries in 2001

Country	Capital Inv.	Nbr of entities	Country	Capital Inv.	Nbr of entities
Argentina	28.4	14	Nigeria	0.21	3
Bahrain	1.31	2	Oman	0.39	1
Bangladesh	0.91	2	Pakistan	70.4	8
Bolivia	0.48	1	Panama	19.1	21
Brazil	1210	142	Papua N. G.	4.20	1
Chile	67.3	23	Paraguay	5.64	1
China	12500	1090	Peru	31.9	13
Colombia	7.02	10	Philippines	1150	209
Costa Rica	2.79	1	Poland	86.5	28
Czech Rep.	98.9	15	Romania	6.59	4
Ecuador	0.37	4	Russia	6.52	13
Egypt	20.1	3	Saudi Ar.	15.6	6
El Salvador	24.6	3	Slovak Rep.	0.27	2
Ethiopia	0.44	2	South Africa	15.5	12
Ghana	0.96	1	Sri Lanka	11.1	6
Guatemala	0.59	2	Tanzania	0.25	1
Hungary	120	18	Thailand	4360	658
India	987	101	Trinidad and T.	1.22	2
Indonesia	2560	343	Tunisia	0.01	1
Iran	8.02	7	Turkey	22.4	7
Kenya	0.03	1	Ukraine	2.01	4
Korea	1670	237	Venezuela	46.7	13
Malaysia	2910	418	Vietnam	528	73
Mexico	512	85	Zambia	0.12	1
Morocco	0.24	1			

Notes: Capital Inv. stands for capital invested, in million of US dollars.

residuals in the two equations, this method provides consistent estimates.

The model to be estimated is of the form:

$$Prob[CAP_{pc} > 0] = \ln Z_c' b + \ln P_p' g + h\, STR_c + f\, RDEXP_p + \xi_{pc} \qquad \text{(first stage)}$$

$$\ln(CAP_{ipc}) = \alpha + \ln Z_c' \beta + \ln P_p' \gamma + \zeta\, \mathrm{S}_i + \eta\, STR_c + \rho \hat{\lambda_{pc}} + \varepsilon_{ipc} \qquad \text{(second stage)}$$

where CAP_{ipc} is the stock of capital of affiliate i in country c owned by parent p. Z_c is a vector of standard country-specific determinants, P_p is a vector of parent-specific variables, S_i is a vector of sector fixed effects and STR_c is the host country's statutory tax rate. $\hat{\lambda_{pc}}$ denotes the inverse Mills' ratio obtained from the estimation of the first stage equation. ξ_{pc} and ε_{ipc} are the error terms. For identification purposes, the selection equation should contain at least one variable that is not in the second stage equation. We choose to include the parent firm expenses in research and development ($RDEXP_p$). This choice is based on the assumption that a corporation spending more on R&D is more likely to have an ownership-specific advantage and to locate its production abroad.

Logarithms of vectors denote vectors of logarithms of the elements. We take the natural logarithms of independent variables (except for the tax variable) for two reasons: such a transformation reduces the influence of large values and allows the coefficients to be interpreted as ordinary elasticities. The coefficient of the statutory tax rate in the second stage equation will be directly interpreted as the semi-elasticity of investment with respect to that tax rate.

5 EMPIRICAL RESULTS

5.1 Tax Responsiveness of Capital and Affiliate Ownership Structure

Table 2 reports estimates of the determinants of Japanese investments in emerging countries in 2001. The results of the selection equation are shown in column 7. Columns 1-6 report the coefficients of the second stage estimations. The coefficient of the inverse Mills ratio (reported at the bottom of each columns) is not significant in Table 2, but is statistically significant in Tables 3 and 4, indicating that there is a sample selection bias. Not accounting for this selection issue would bias the parameter estimates. Leverage observations and outliers have

been removed using a Cook's D test. In non-reported tests, we check for multicollinearity and for model specification error. The results of these tests indicate first that the variables used in the model are not redundant as no variables can be considered as a linear combination of other independent variables. Second, general tests for functional form misspecification suggest that the model is well specified.[11] As conditions for attracting FDI may vary across sectors, we add sector dummies to the model. Seven sectors are considered: agriculture, wholesale trade, retail trade, manufacturing, services, transport and finance.

As can be seen in Table 2, most of the coefficients have the expected sign and are statistically significant across the estimations. As suggested by Schneider and Frey (1985) or Wheeler and Mody (1992), market size, proxied by the level of GDP, appears to be an important determinant of the capital invested in emerging countries. The effect of GDP per capita is more controversial as this variable can proxy the host country's development level but also labor costs.[12] The empirical specification suggests that Japanese investments are deterred by a high level of GDP per capita. *The stock of capital of the parent firm positively affects the amount of capital invested in the affiliate, implying that large firms are more able to invest abroad.* There is also strong evidence that Japanese capital is attracted by low-risk destinations, since the ICRG composite risk rating coefficient is statistically significant with a positive sign. The distance between the host country and Japan tend to discourage Japanese FDI as distance can increase transaction costs such as information costs and cultural differences. However, this variable seems to play a more important role in the probability to establish an affiliate abroad than in the amount of capital invested.

The coefficient of our variable of interest, the statutory tax rate, is statistically significant and has the expected sign. A 1% point increase in the statutory tax rate generates a 3.6% decrease in the capital invested abroad. Thus without distinguishing investment by the mode of establishment or by the intensity in R&D, there is support for a link between the level of foreign taxation and the amount of Japanese capital invested in emerging countries.[13]

[11] We run two main tests: a link test and a RESET test. The link test creates two new variables, a variable of prediction and one of squared prediction. The second variable should not have any explanatory power if the model is properly specified when the model is refitted using the prediction and the squared prediction variables as predictors. The Ramsey (1969) regression specification error test (RESET) adds polynomials in the OLS fitted values to detect functional form misspecification.

[12] Wages and GDP per capita can be strongly correlated. Rama and Artecona (2002) report a correlation of about 0.7 between GDP per capita and labor costs per worker in the manufacturing sector.

[13] While it is well established that high tax rates deter FDI into developed countries, this relationship is not obvious dealing with emerging countries, since very few studies focus on the effects of taxes on FDI in these type of countries.

In column 2, we address the differential effect of tax rates on capital invested according to affiliate ownership structure. To do so we interact the statutory tax rate variable with a wholly-owned (WO) dummy. This dummy variable takes value 1 when the affiliate is 100% owned by a Japanese parent. As predicted by the model in Section 3, we find capital invested in wholly-owned affiliates to be more sensitive to taxes relative to joint-ventures, but the difference is not statistically significant.

However, at this stage of the analysis one may object the regression results reported in column 2 do not account for the influence of tax sparing provisions in bilateral fiscal agreements. Indeed, Hines (2001), Azémar et al. (2007) and Azémar and Delios (2008) have recently shown the importance of accounting for these provisions when measuring the effect of taxes on FDI in developing countries. Basically, such provisions ensure that host-country tax incentives to foreign investors are not nullified by home-country income taxation.[14] Developed countries that use worldwide income taxation (such as Japan, see Appendix 1) have signed such agreements with a number of countries to promote economic development. According to these authors, tax sparing provisions affect the tax responsiveness of capital in countries that have signed such agreements. Indeed, the direct relationship between the statutory tax rate and FDI is not obvious under tax sparing. On the one hand, under a tax incentive program a high statutory tax rate generates a larger fictitious tax credit in the home country, which reduces the fiscal burden owed in Japan. On the other hand, since we do not observe whether a particular affiliate in a tax sparing country benefits from tax incentives or not, the statutory tax rate may also have its traditional deterring effect. Overall the effect of the statutory tax rate on capital is indeterminate in tax sparing countries, which may reduce the coefficient of that variable in the whole sample.

It should be noted that the reduced significance of the statutory tax rate in tax sparing countries applies equally to investment in wholly-owned and joint ventures. We should therefore expect a smaller divergence in tax responsiveness between the two types of ventures in those tax sparing countries. In addition, as suggested by Hartman (1981), bilateral tax agreements

[14]To see how this provision works, consider the following numerical example. Suppose that the profit of a foreign affiliate in a developing country is \$100. Suppose further that the corporate income tax rate is 30% in the host country and 40% in the home country. The parent firm can claim an income tax credit in the home country for the foreign taxes paid. Thus it pays \$30 to the host country and \$40-\$30= \$10 to the home country. Suppose now that a tax holiday is granted by the host country: the firm does not have to pay the 30% tax rate any more. Without tax sparing provisions the firm has to pay \$40 to the home country as it does not pay foreign taxes. With tax sparing provisions, the 30% foreign corporate tax rate is deemed to have been paid and thus become creditable. In our example the firm would pay \$0 to the host country and \$40-\$30=\$10 to the home country.

Table 2: Japanese Capital Responsiveness to Taxes: Wholly-Owned versus Joint Ventures

	Dependent variable: ln Capital						
	Heckman second stage						First stage Selection
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln GDP	0.143^a	0.141^a	0.170^a	0.161^a	0.171^a	0.174^a	0.413^a
	(0.044)	*(0.044)*	*(0.044)*	*(0.044)*	*(0.044)*	*(0.045)*	*(0.009)*
ln GDP per capita	-0.184^a	-0.189^a	-0.171^a	-0.201^a	-0.181^a	-0.189^a	-0.360^a
	(0.049)	*(0.049)*	*(0.049)*	*(0.049)*	*(0.049)*	*(0.050)*	*(0.015)*
ln distance	-0.081	-0.088	-0.053	-0.066	-0.050	-0.043	-0.537^a
	(0.072)	*(0.072)*	*(0.072)*	*(0.072)*	*(0.072)*	*(0.074)*	*(0.018)*
ln total capital	0.316^a	0.316^a	0.327^a	0.336^a	0.328^a	0.337^a	0.200^a
	(0.032)	*(0.032)*	*(0.032)*	*(0.032)*	*(0.032)*	*(0.032)*	*(0.010)*
ln ICRG	0.764^c	0.784^b	0.847^b	1.018^b	0.862^b	0.960^b	2.719^a
	(0.391)	*(0.391)*	*(0.394)*	*(0.398)*	*(0.395)*	*(0.399)*	*(0.152)*
STR	-3.616^a	-3.248^a	-2.373^a	-3.440^a	-2.950^a	-2.292	-3.919^a
	(0.792)	*(0.999)*	*(0.854)*	*(0.793)*	*(0.999)*	*(1.537)*	*(0.171)*
STR*WO		-0.761					
		(1.233)					
STR*WO no tax sparing			-6.222^a		-5.634^a	-6.383^a	
			(1.779)		(1.854)	(2.204)	
STR*WO tax sparing					1.570	0.944	
					(1.362)	(1.895)	
STR*JV tax sparing						-1.031	
						(1.913)	
WO		0.306					
		(0.366)					
WO no tax sparing			1.518^a	-0.127	1.385^b	1.807^a	
			(0.554)	(0.193)	(0.576)	(0.688)	
WO tax sparing				0.338^b	-0.337	0.092	
				(0.158)	(0.402)	(0.570)	
JV tax sparing				0.231		0.563	
				(0.156)		(0.578)	
Ln R&D							0.099^a
							(0.005)
Constant	5.574^b	5.494^b	3.604	3.381	3.684	2.588	-17.687^a
	(2.383)	(2.400)	(2.441)	(2.505)	(2.446)	(2.522)	(0.734)
Sector fixed effects	yes	yes	yes	yes	yes	yes	-
Inverse Mills ratio	-0.150	-0.146	-0.089	-0.057	-0.083	-0.051	-
	(0.132)	*(0.132)*	*(0.134)*	*(0.135)*	*(0.134)*	*(0.135)*	-
Observations	63790	63790	63790	63790	63790	63790	63790
Uncensored Observations	3614	3614	3614	3614	3614	3614	-

Notes: The model includes a full set of interaction terms between the statutory tax rate (STR) and characteristics of each firm (if they are wholly-owned or joint ventures, and if they can benefit or not from tax sparing agreements). Sector fixed effects are included in the model, but not shown for the sake of brevity. The letters "a", "b" and "c" indicate respectively a significance level of 1, 5 and 10 percent. STR stands for statutory tax rate, JV for joint-ventures, WO for wholly-owned firms.

increase information exchange between tax authorities of the signatories, which limits the scope for transfer pricing manipulation. This is an additional reason why we should not expect capital in wholly-owned affiliates to be more tax-sensitive than in joint-ventures.

To focus on the mechanism we want to identify in our data, we now distinguish between affiliates according to two characteristics: (i) their ownership structure (wholly-owned versus joint-ventures), (ii) the tax sparing characteristics of the host country.[15] We interact a dummy variable for no tax sparing with the WO variable, and construct two other dummy variables corresponding to, respectively, wholly-owned and joint venture affiliates in tax sparing countries. As can be seen from column (4), the amount of Japanese capital invested does not significantly differ between affiliates of differing ownership structures in no tax sparing countries. The capital invested in wholly-owned firms in non tax sparing countries reacts strongly to corporate taxes (semi-elasticity of -6.22), more than in other firms (column 3) and in particular more than in joint-ventures (column 5) and than in joint-ventures in non tax sparing countries (column 6).

Overall, our results support the idea that investment by multinationals with greater ability to exploit tax planning opportunities is more responsive to corporate tax rates. These results complement the analysis in Desai et al. (2004). These authors find that in the presence of tax rate differences between the United States and host countries, the likelihood of establishing a wholly-owned firm is higher than the likelihood of establishing a joint venture. Our results suggest that tax differentials do not only make firms more willing to establish wholly-owned affiliates, but also to allocate more capital to these affiliates. While these authors found that tax differentials and abusive transfer pricing opportunities affect reported affiliate sales and returns, we find that they also affect real investment.

We next consider whether the capital invested in affiliates with higher R&D expenditure is more sensitive to the level of corporate tax rates than low R&D affiliates. Following Blonigen (1997), firms are considered to be high R&D affiliates if the R&D expenditure to sales ratio of their parent firm is above average. Other affiliates are considered to be low R&D affiliates. In Column 1 of Table 3, we simply investigate the sensitivity of Japanese capital to foreign corporate tax rates by distinguishing high R&D affiliates from low R&D affiliates through an interaction term between the statutory tax rate and a dummy for high R&D affiliates. Without controlling for tax sparing provisions, we obtain a statistically significant greater semi-elasticity

[15]The list of countries in our sample with which Japan has agreed on tax sparing provisions is given in Appendix 1.

Table 3: Japanese Capital Responsiveness to Taxes: High-R&D versus low-R&D affiliates

	Dependent variable: ln Capital			
	Heckman second stage			
	(1)	(2)	(3)	(4)
ln GDP	0.107^{b}	0.127^{a}	0.107^{b}	0.118^{b}
	(0.046)	*(0.044)*	*(0.047)*	*(0.048)*
ln GDP per capita	-0.150^{a}	-0.152^{a}	-0.144^{a}	-0.129^{b}
	(0.051)	*(0.049)*	*(0.051)*	*(0.052)*
ln distance	-0.024	0.001	0.018	0.041
	(0.075)	*(0.073)*	*(0.076)*	*(0.077)*
ln total capital	0.303^{a}	0.305^{a}	0.304^{a}	0.304^{a}
	(0.032)	*(0.032)*	*(0.034)*	*(0.034)*
ln ICRG	0.515	0.654^{c}	0.583	0.548
	(0.406)	*(0.390)*	*(0.417)*	*(0.417)*
STR	-2.364^{a}	-2.360^{a}	-2.645^{a}	-2.924^{b}
	(0.904)	*(0.833)*	*(0.821)*	*(1.333)*
STR*high R&D	-2.783^{b}			
	(1.355)			
STR*high R&D no tax sparing		-5.856^{b}		-5.129^{c}
		(2.464)		*(2.670)*
STR*high R&D tax sparing				0.446
				(1.897)
STR*low R&D tax sparing				1.531
				(1.621)
high R&D	0.664			
	(0.405)			
high R&D no tax sparing		0.991	-0.852^{a}	0.815
		(0.809)	*(0.219)*	*(0.871)*
high R&D tax sparing			-0.009	-0.122
			(0.151)	*(0.565)*
low R&D tax sparing			0.097	-0.334
			(0.138)	*(0.481)*
Constant	6.827^{a}	5.384^{b}	6.101^{b}	5.714^{b}
	(2.480)	*(2.380)*	*(2.629)*	*(2.631)*
Sector fixed effects	yes	yes	yes	yes
Inverse Mills ratio	-0.290^{b}	-0.225^{c}	-0.278^{c}	-0.279^{c}
	(0.144)	*(0.133)*	*(0.150)*	*(0.150)*
Observations	63790	63790	63790	63790
Uncensored Observations	3614	3614	3614	3614

Notes: The model includes a full set of interaction terms between the statutory tax rate (STR) and characteristics of each firm (if they are high-R&D or low R&D affiliates, and if they can benefit or not from tax sparing agreements). Sector fixed effects are included in the model, but not shown for the sake of brevity. The letters "a", "b" and "c" indicate respectively a significance level of 1, 5 and 10 percent. STR stands for statutory tax rate.

Table 4: Japanese Capital Tax Responsiveness, Ownership Structure and R&D Intensity

	Dependent variable: ln Capital Heckman second stage				
	(1)	(2)	(3)	(4)	(5)
ln GDP	0.140^a	0.105^b	0.104^b	0.134^a	0.116^b
	(0.044)	*(0.046)*	*(0.046)*	*(0.044)*	*(0.048)*
ln GDP per capita	-0.178^a	-0.157^a	-0.155^a	-0.162^a	-0.144^a
	(0.050)	*(0.051)*	*(0.051)*	*(0.049)*	*(0.052)*
ln distance	-0.076	-0.034	-0.029	-0.027	0.035
	(0.073)	*(0.075)*	*(0.075)*	*(0.072)*	*(0.076)*
ln total capital	0.316^a	0.302^a	0.303^a	0.309^a	0.306^a
	(0.032)	*(0.032)*	*(0.032)*	*(0.032)*	*(0.033)*
ln ICRG	0.759^c	0.511	0.524	0.694^c	0.551
	(0.395)	*(0.406)*	*(0.406)*	*(0.389)*	*(0.414)*
STR	-3.095^a	-3.178^a	-2.281^b	-2.645^a	-1.122
	(0.842)	*(0.812)*	*(1.125)*	*(0.810)*	*(1.347)*
STR*high R&D WO	-2.937^c		-3.431^c		
	(1.664)		(1.815)		
STR*high R&D JV			-2.079		
			(2.030)		
STR*low R&D WO			-0.185		
			(1.445)		
STR*high R&D WO no tax sparing				-10.208^a	-11.499^a
				(3.315)	*(3.462)*
STR*high R&D JV no tax sparing					-5.135
					(3.652)
STR*low R&D WO no tax sparing					-4.257^c
					(2.246)
STR*high R&D WO tax sparing					0.648
					(0.686)
STR*low R&D WO tax sparing					0.573
					(1.806)
STR*low R&D JV tax sparing					-1.226
					(1.783)
STR*high R&D JV tax sparing					-2.940
					(2.457)
high R&D WO	0.815^c	-0.075	0.924^c		
	(0.493)	(0.099)	(0.539)		
high R&D JV		-0.159^b	0.458		
		(0.077)	(0.610)		
low R&D WO		0.089	0.147		
		(0.065)	(0.428)		
high R&D WO no tax sparing				2.054^c	2.495^b
				(1.102)	*(1.135)*
high R&D JV no tax sparing					1.278
					(1.201)
low R&D WO no tax sparing					1.381^b
					(0.678)
low R&D JV TS					0.500
					(0.512)
low R&D WO tax sparing					0.049
					(0.514)
high R&D JV tax sparing					0.859
					(0.722)
Constant	5.456^b	7.286^a	6.922^a	5.359^b	5.310^b
	(2.405)	(2.478)	(2.500)	(2.376)	(2.613)
Sector fixed effects	yes	yes	yes	yes	yes
Inverse Mills ratio	-0.160	-0.289^b	-0.292^b	-0.196	-0.272^c
	(0.135)	(0.144)	(0.145)	(0.132)	(0.149)
Observations	63790	63790	63790	63790	63790
Uncensored Observations	3614	3614	3614	3614	3614

Notes: The model includes a full set of interaction terms between the statutory tax rate (STR) and characteristics of each firm (if they are wholly-owned, joint-ventures, high-R&D or low R&D affiliates, and if they can benefit or not from tax sparing agreements). Sector fixed effects are included in the model, but not shown for the sake of brevity. The letters "a", "b" and "c" indicate respectively a significance level of 1, 5 and 10 percent. STR stands for statutory tax rate, JV for joint-ventures, WO for wholly-owned ventures.

between Japanese capital and taxes for R&D intensive firms.

The magnitude of this semi-elasticity is higher in non tax sparing countries. The capital invested in firms which are intensive in R&D and which do not benefit from tax sparing is significantly more deterred by corporate taxation than the capital invested in other firms (column 2, semi-elasticity of -5.86), and particularly than the capital invested in low R&D affiliates which do not benefit from tax sparing (column 4). We also estimate the impact of firm characteristics on the capital invested (column 3). It appears that firms which are intensive in R&D invest significantly less in developing countries than firms with low R&D expenditure.

At this stage, one could argue that a statistically significant part of the R&D intensive firms of this sample may also be wholly-owned affiliates. Indeed, in order to protect intangible assets, a technologically advanced firm is less likely to engage in joint-venture activity in emerging countries where intellectual property protection is weak, as shown for example by Wei and Smarzynska (2000). Our methodology so far has not allowed us to investigate if the relationship between taxes and capital can be explained by tax planning opportunities that are best exploited by wholly-owned firms, or by intensive R&D firms, or by both.

Accordingly, to make this test, we interact the statutory tax rate with a dummy variable taking value 1 if the firm is a wholly-owned affiliate of a parent that is intensive in R&D (Table 4). In the full sample of countries, the capital invested in these high-R&D wholly-owned affiliates significantly reacts more to taxes than the capital invested in other firms (column 1) and, more precisely, than the capital invested in low-R&D joint-ventures (column 3). As we did in Tables 2 and 3, we test separately in Column 2 the impact of both the ownership structure of the firm and its intensity in R&D on the allocation of capital; the low-R&D joint-venture dummy being the benchmark case. Japanese parents tends to invest less in high-R&D joint-ventures in emerging countries, but the difference with other firms is only statistically significant for high-R&D joint-ventures.

Once again we consider the influence of tax sparing provisions on tax sensitivity. The capital invested in high-R&D wholly-owned affiliates which do not benefit from tax sparing strongly reacts to corporate taxes, it is significantly more deterred by taxes than the capital invested in other affiliates (column 4, semi-elasticity of -10.21), and more precisely, than the capital invested in low-R&D joint-ventures (column 5). Note that a low R&D multinational operating abroad *via* joint-ventures represents the combination which is the less likely to benefit from tax planning opportunities. As we expected, its capital invested abroad appears to be the least responsive to the level of taxes, among firms which do not benefit from tax sparing.

Conversely, it is interesting to find that the strongest negative relationship between capital and taxes appears in high-R&D wholly-owned affiliates. Such affiliates indeed offer parent firms the greatest ability to manipulate transfer pricing, benefiting from the cumulation of, first, their ability to fully coordinate pricing and production across borders and, second, their lower probability to be sanctioned since the market price of highly differentiated products is difficult to establish. These findings have interesting implications since emerging countries frequently use taxes to attract foreign investment in order to benefit from technology transfer or spillovers.

6 CONCLUSION

This paper attempts to shed light on the responsiveness of capital investment to foreign corporate tax rates. Our starting point has been that tax differentials encourage transfer pricing abuse, and that some firms have a greater ability to manipulate transfer prices. Our theoretical model shows, under mild assumptions on technology and the detection of abusive transfer pricing, that such firms will invest more in low-tax countries. The intuition is that multinationals engaging in abusive transfer pricing will try to maintain standard profit-to-assets ratios in order to minimize the risk of detection and punishment. While we cannot observe abusive transfer pricing, the literature suggests that some parent and affiliate characteristics are correlated with a greater ability to shift income. In particular we expect R&D intensive parents investing in wholly-owned affiliates to have a greater ability to manipulate transfer prices. We show that investment by such firms will indeed be more sensitive to host-country taxation.

We test this prediction on a sample of affiliates of Japanese multinationals in emerging countries in 2001. As in similar studies of FDI into developed countries, we find statutory taxes to be significantly negatively correlated with affiliate capital stock at the firm-level. In addition, we find a stronger negative relationship between statutory tax rates and the Japanese capital invested in wholly-owned affiliates and high R&D affiliates, relative to joint-ventures and low R&D affiliates. The results are stronger when we focus on firms that do not benefit from the fiscal advantages provided by tax sparing agreements. The lack of clear alternative interpretations makes us interpret these results as evidence for the importance of abusive transfer pricing in FDI activity.

It is interesting to note that in a tax credit system such as Japan's, investors should be indifferent to foreign tax rates as long as they are lower as the Japanese rate. We confirm on our sample the consistent result in the literature that credit investors are indeed sensitive

to host-country tax rates, as surveyed by Hines (1999). Deferred dividend repatriation and cross-crediting have been advanced as the main explanations. Another reading of our results is that whenever these practices exist, transfer pricing manipulation provides an additional explanation to this tax sensitivity.

One caveat should be mentioned. We haven't considered thin capitalization strategies. Because interest is tax-deductible, multinationals may bias the capital structure of their affiliates towards debt financing (thin capitalization) in high-tax countries. A thin capitalization strategy should have an observationally equivalent effect of statutory tax rates on affiliate capital, and unfortunately we do not have data on affiliate debt. However, while thin capitalization may be correlated with the ownership share, it is hard to see why it should be correlated with parent R&D expenditure. For this reason, we favor the transfer pricing manipulation interpretation.

Our results have interesting implications for European countries. First, we add to the literature by showing that Japanese firms too engage in profit-shifting activities. This may be problematic for some European tax authorities as Japan is a major investor into the EU. Since we show that profit-shifting affects the volume of investment as well, we confirm that European countries must compete in tax bases as well as tax rates. Second, our findings have implications for the current debate in the EU on the introduction of a common tax base with formula apportionment. In theory, if profit-shifting distorts real investment in addition to the usual negative fiscal externality, there is a stronger case for partial coordination in tax-setting to avoid intra-EU income shifting. Third, extra-EU tax shifting is also likely to work in the same way as income-shifting between Japan and emerging countries. Indeed, Japanese tax authorities use detection methods that are comparable to those used by European countries. Tax minimization practices among Japanese and European multinationals are likely to be similar. —

References

Azémar, Céline and Andrew Delios, "Tax Competition and FDI: The Special Case of Developing Countries," *Journal of the Japanese and International Economies*, March 2008, *22* (1), 85–108.

_ **, Rodolphe Desbordes, and Jean-Louis Mucchielli**, "Do Tax Sparing Agreements Contribute to the Attraction of FDI in Developing Countries?," *International Tax and Public Finance*, 2007, *14* (5), 543–562.

Bartelsman, Eric J. and Roel M. W. J. Beetsma, "Why pay more? Corporate tax avoidance through transfer pricing in OECD countries," *Journal of Public Economics*, September 2003, *87* (9-10), 2225–2252.

Bernard, Andrew B., J. Bradford Jensen, and Peter K. Schott, "Transfer Pricing by U.S.-Based Multinational Firms," August 2006. NBER Working Paper n^o 12493.

Blonigen, Bruce, "Firm-Specific Assets and the Link Between Exchange Rates and Foreign Direct Investment," *The American Economic Review*, 1997, *87*, 447–465.

_ **and Miao Wang**, "Inappropriate Pooling of Wealthy and Poor Countries in Empirical FDI Studies," in Theodore Moran, Edward Graham, and Magnus Blomström, eds., *Does Foreign Investment Promote Development?*, Institute for International Economics, 2005, pp. 83–112.

Chan, Hung and Lynne Chow, "An Empirical Study of Tax Audits in China on International Transfer Pricing," *Journal of Accounting and Economics*, 1997, *23*, 83–112.

Clausing, Kimberly, "Tax-Motivated Transfer Pricing and US Intrafirm Trade Prices," *Journal of Public Economics*, 2003, *87*, 2207–2223.

Desai, Mihir, Fritz Foley, and James Hines, "The Costs of Shared Ownership: Evidence From International Joint Ventures," *Journal of Financial Economics*, 2004, *73* (2), 323–374.

Devereux, Michael, Ben Lockwood, and Michela Redoano, "Do Countries Compete Over Corporate Tax Rates?," 2004. CSGR Working Paper n^o 97/02.

Eggert, Wolfgang and Andreas Haufler, "Company-Tax Coordination cum Tax-Rate Competition in the European Union," *Finanzarchiv*, 2006, *62* (4), 579–601.

Grubert, Harry, "Intangible Income, Intercompany Transactions, Income Shifting, and the Choice of Location," *National Tax Journal*, 2003, *56*, 221–242.

_ **and John Mutti**, "Taxes, Tariffs and Transfer Pricing in Multinational Corporate Decision Making," *Review of Economics and Statistics*, 1991, *73* (2), 285–283.

Hartman, David, "Domestic Tax Policy and Foreign Investment: Some Evidence," 1981. NBER working Paper n^o 784.

Hines, James, "Lessons from Behavioral Responses to International Taxation," *National Tax Journal*, 1999, *52* (2), 305–322.

_ , "Tax Sparing and Direct Investment in Developing Countries," in James Hines, ed., *International Taxation and Multinational Activity*, University of Chicago Press, 2001, pp. 39–66.

_ **and Eric Rice**, "Fiscal Paradise: Foreign Tax Havens and American Business," *Quarterly Journal of Economics*, 1994, *109* (1), 149–182.

Jenkins, Glenn and Brian Wright, "Taxation of Income of Multinational Corporations: the Case of the United States Petroleum Industry," *Review of Economics and Statistics*, 1975, *57*, 1–11.

Kant, Chander, "Multinational Firms and Government Revenues," *Journal of Public Economics*, 1990, *42*, 135–147.

Lall, S., "Transfer Pricing and Developing Countries: Some Problems of Investigation," *World Development*, 1979, *7*, 59–71.

Mody, Ashoka and Krishna Srinivasan, "Japanese and United States Firms as Foreign Investors: Do they march to the same tune?," *Canadian Journal of Economics*, 1998, *31* (4), 778–799.

Mutti, John and Harry Grubert, "Empirical Asymetries in Foreign Direct Investment and Taxation," *Journal of International Economics*, 2004, *62*, 337–358.

Rama, Martin and Raquel Artecona, "A Database of Labor Market Indicators across Countries," 2002. Washington: World Bank, Development Reasearch Group.

Schneider, Friedrich and Bruno Frey, "Economic and Political Determinants of Foreign Direct Investment," *World Development*, 1985, *13* (2), 161–175.

Svejnar, Jan and Stephen Smith, "The Economics of Joint Ventures in Less Developed Countries," *The Quarterly Journal of Economics*, 1984, *99* (1), 149–168.

Swenson, Deborah, "Tax Reforms and Evidence of Transfer Pricing," *National Tax Journal*, 2001, *LIV* (1), 7–25.

_ , "Transaction Type and the Effect of Taxes on the Distribution of Foreign Direct Investment in the U.S.," in James Hines, ed., *International Taxation and Multinational Activity*, University of Chicago Press, 2001, pp. 89–108.

UNCTAD, "Transfer Pricing," 1999. UNCTAD Series on International Investment Agreements.

Wei, Shang-Jin and Beata K. Smarzynska, "Corruption and Composition of Foreign Direct Investment: Firm-Level Evidence," 2000. NBER Working Paper n^o 7969.

Weichenrieder, Alfons J., "Profit shifting in the EU: Evidence from Germany," *International Tax and Public Finance*, 2008, *forthcoming.*

Wheeler, David and Ashoka Mody, "International Investment Location Decisions," *Journal of International Economics*, 1992, *33*, 57–76.

7 Appendix

Table 5: Japanese Tax Sparing Agreements

Countries	Date of conclusion	Entry into force
Bangladesh	28 February 1991	25 June 1991
Brazil	24 January 1967	31 December 1967
China	6 September 1983	28 May 1984
India	5 January 1960	13 June 1960
Indonesia	3 March 1982	31 December 1982
Korea	3 March 1970	29 October 1970
Malaysia	30 January 1970	23 December 1970
Mexico	9 April 1996	6 November 1996
Pakistan	17 February 1959	14 may 1959
Philippines	13 February 1980	20 July 1980
Sri Lanka	12 December 1967	22 September 1968
Thailand	1 March 1963	24 July 1963
Vietnam	24 October 1995	31 December 1995

Source: International Bureau of Fiscal Documentation.