

THE IMPACT OF TAXATION ON THE
LOCATION OF CAPITAL, FIRMS AND
PROFIT: A SURVEY OF EMPIRICAL
EVIDENCE

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The Impact of Taxation on the Location of Capital, Firms and Profit: A Survey of Empirical Evidence¹

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¹ Paper prepared for the European Tax Policy Forum conference “The Impact of Corporation Taxes across Borders”, April 2006. This paper draws partly on an earlier survey with Rachel Griffith: Devereux and Griffith (2002). That paper has been almost completely rewritten, and expanded considerably to include more recent work on the location of capital, a survey of research on financial activities and the location of profit, and also a detailed description of data. All errors are the responsibility of the authors.

1. Introduction

With increasing globalisation, there has been increasing interest in the impact of international flows of capital, and the income from capital, between countries. Policy makers are naturally concerned about the impact of such flows on economic welfare, and the constraints that mobility of capital may place on their ability to tax the income arising from capital. This has been matched by academic interest. A substantial empirical literature has grown up in the last two decades, which has investigated the determinants of flows of capital and the income from capital, and specifically the impact of taxation on such flows. This paper aims to survey this empirical evidence.

The broad theme of this survey is that, although a great deal has been learnt, there remain significant areas where further research is required. Research has progressed rapidly over the last few years, and there are promising signs that it is beginning to overcome two weaknesses that were especially apparent in the earlier literature. First, until recently, there has been a lack of detailed microeconomic data available; most researchers have been forced to use aggregate data, which cannot account for differences between companies, industries, or in some cases, countries. Second – a weakness which arises partly out of the first – is that there has generally been a lack of structural modelling which enables the researcher to more carefully frame and test hypotheses. The literature has instead relied mostly on estimating reduced form models, using the most easily acquired data. Recently, more detailed data has become available. The availability of microeconomic data, and the prospect of more carefully framed and detailed modelling, suggests that a lot more can be learnt from future research.

Before jumping into a detailed description of research which has been undertaken, the paper begins by asking what questions should be of most interest to policy makers. This is a useful point to start, because it is far from clear that some aspects of international flows of capital have a very great impact on economic welfare.

To take an example, the basic model of capital flows and taxation suggests that a rise in the tax rate in an open economy will cause a net capital outflow, and a lower aggregate capital stock. The lower capital stock may well have a negative impact on economic welfare of the residents of the country. It may therefore be natural to investigate the impact of capital taxes on the aggregate capital stock. Alternatively, if domestic savings were unaffected, then the change in aggregate investment would match the net capital outflow, which could also be examined. However, much of the empirical literature on the impact of taxes on capital flows instead examines the impact of tax on foreign direct investment (FDI): that is, broadly, the aggregate of flows of capital from a parent to a controlled affiliate in another country. But FDI is unlikely to be closely correlated with changes in the domestic capital stock, for a number of reasons, set out briefly in Section 2.

There may be other reasons to focus on the activities of multinational companies. They may make a positive (or negative) contribution to economic welfare in a number of ways: relaxing financial constraints on investment, so that the capital stock may indeed rise with FDI; paying higher wages made possible through greater productivity; inducing higher productivity in domestic firms through positive spillovers; or crowding out activities by domestic firms, and reducing competition. These are all good reasons for exploring the impact of multinational companies on economic welfare. This paper does not attempt to survey work on these questions.² However, given that multinationals may have a significant impact on economic welfare, this paper does survey papers which examine the impact of taxation on the decisions taken by multinational companies.

This survey is broad in scope and considers a number of different decisions facing multinational companies, particularly those which concern the location of capital, and the income from capital. Section 3 briefly sets out simple model which is useful for analysing and linking these decisions: it sets out a decision tree, with four levels of decisions, which are all related to each other.

² Some of these questions are the focus of Phase 2 of the ETPF research programme.

The first two levels of the decision tree represent discrete choices: for example, in which of two possible locations to site a new plant, or more generally, in which of many jurisdictions a multinational should want to have a presence. The third and fourth levels of the decision tree represent continuous choices: conditional on being present in some jurisdictions, how does the multinational allocate its capital expenditure and profit between jurisdictions? A natural way to address these separate decisions is in a two-stage process. First, identify the determinants of the discrete choice of in which jurisdictions a multinational operates. Then, conditional on that discrete choice, and allowing for the selection of particular jurisdictions, identify the continuous choice of the allocation of capital expenditure and profit. However, not a single paper amongst those surveyed here takes such an approach. Indeed, only a small minority of papers even distinguishes between the two types of decision at all.

There are a number of reasons why the literature has failed to follow such an approach. One is theoretical. The basic model which many empirical papers seem to have in mind is one in which capital shifts between jurisdictions to maximise the total income of capital owners, which is achieved when the post-tax rate of return is equal across all jurisdictions. This does not require a distinction between discrete and continuous choices. But this model seems more suitable for describing flows of portfolio capital rather than the location and investment decision of multinational companies, which by contrast are characterised by the presence of imperfect competition and economic rent.

A second is the availability of data. To jointly model both the discrete and continuous decisions of multinational companies it would be necessary to have data both on the geographical spread of a company's activities and sufficient information on the activities in each jurisdiction. Such data is beginning to be available, but empirical papers up to now have generally relied on more aggregate data, or investigated only part of the decision tree outlined here. The availability of data is so important in the study of the location of investment and profit that Section 4 of this paper is devoted to a brief review

of datasets which have been used to date; and a more detailed summary of available data is included as an Appendix to this paper.

Broadly, the empirical literature on the location of capital and the income from capital plants falls into a small number of groups, reflecting the data used. One group of papers, beginning in the 1980s, studies aggregate flows of FDI. The earliest papers tended to study flows to the USA, but more recent papers have studies bilateral flows between pairs of countries. At a slightly less aggregate level, a number of papers have used data from the US Bureau of Economic Analysis on the aggregate activities of affiliates of US multinationals in other countries, and on the US affiliates of non-US multinationals. These data include information on the value of assets, income and some tax information, which enables research on capital expenditure and on the location of income.

More detailed information on individual companies has used accounting information, most commonly from Compustat. In most cases, the data on investment and profit reflects the consolidated position for the multinational company as a whole, and only limited data is available to differentiate activities in different countries. Some studies have also used financial data on individual affiliates, which are not linked with the rest of the multinational company.

Some datasets do, however, allow the researcher to link different parts of the same multinational company. Most significantly to date, researchers based at the United States Treasury have had access to detailed and confidential tax return data of US multinationals. More recently, researchers have also begun to use other confidential datasets in the US and in Germany. There is also a relatively new dataset, now available to all researchers, known as Amadeus. This includes the unconsolidated financial accounts of European companies, together with ownership data which enables the structure and geographic location of a multinational company to be identified.

Apart from data on the activities of the multinational companies themselves, there is another important problem with respect to data: measuring an effective tax rate. In the empirical literature, by far the most studied form of taxation is a tax levied on corporate profit, and this is primarily what is reviewed in this paper. This raises many problems for empirical implementation. Typically corporate tax liabilities are extremely complex; it is common for liabilities to be agreed with tax authorities many years after the period in question. Typically, too, the researcher cannot observe precise tax payments in any jurisdiction. Even then, a multinational firm may be liable for further tax on profits repatriated to the parent company. Section 4 and the Appendix give further details of the approaches which have been taken to measure effective rates of taxation.

Having set the scene with a discussion of policy (Section 2), a framework for analysis (Section 3) and a summary of the available data (Section 4), the survey finally turns to a more detailed examination of the existing empirical work in Sections 5 and 6. Section 5 examines, broadly, studies which investigate the impact of taxes on flows of capital. This includes studies on FDI, discrete location choices, and the ownership of capital by affiliates of US multinationals. Section 6 examines the evidence on how taxes affect the location of the income from capital: or, alternatively, the evidence on the prevalence of profit shifting by multinational companies to reduce their worldwide tax liabilities. Section 7 briefly concludes.

2. What should be studied?

Before beginning a review of the literature, it is useful to ask briefly what questions are the most interesting to address. From a policy perspective, the most natural questions to address relate to economic welfare.

In the basic framework used by many theoretical and empirical studies of capital flows between small open economies, the post-tax real rate of return is equated across economies. In this model, a source-based tax tends to raise the required pre-tax required rate of return and, in so doing, reduce aggregate investment in the economy. One important question for empirical study might therefore be the extent to which the aggregate capital stock depends on the effective tax rate.

However, studying the impact of taxes on the aggregate capital stock might not involve capital flows at all, since the aggregate capital stock depends on domestic saving plus net capital inflows.³ Higher capital inflows may crowd out domestic saving, leaving the aggregate capital stock unaffected. And in principle, a higher tax rate may simply depress domestic saving, leaving capital flows unaffected. Even if capital flows are of interest, it is not clear that we should be concerned with *direct* capital flows, as measured by FDI - that is, broadly, those controlled by a multinational company.⁴ Many of the studies identified in this survey attempt to identify the impact of tax on such flows; but the question of whether such flows have an impact on economic welfare has been largely unexplored.

A second policy-related question arises if there is some heterogeneity in the capital stock, particularly across types of capital or ownership. The role of multinational companies might be important here. A common starting point for theory about multinational companies is the OLI framework of Dunning (1981). This suggests that multinationals have some superiority over domestic firms: because there are costs to setting up production in a foreign country, then if the multinational is to compete with local firms

³ The only study to address the impact of international differences in taxation on the aggregate capital stock is Young (1999), who finds a significant impact of the UK's tax competitiveness on the UK manufacturing capital stock. Feldstein (1995) and Desai et al (2005) address the issue indirectly, by examining the impact of outbound FDI on the domestic capital stock in the US.

⁴ The Appendix briefly outlines the differences between flows of foreign direct investment and increases in the aggregate capital stock.

(which do not face such costs), then it must have some other advantages.⁵ Such advantages may take a number of forms, such as lower production costs or a higher quality product, made possible by research and development, or a better organised or managed structure. However, the advantage may also reflect market power, due perhaps to advertising and branding. There is certainly now considerable evidence that multinational firms are more productive, more intensive in capital, skilled labour and intellectual property and are more profitable.⁶

Given the importance of multinational corporations in all economies, it is clearly of interest to improve our understanding of their activities. Indeed their activities are particularly important if they generate positive (or negative) spillovers to domestic firms - for example, if domestic firms were able to copy the technically superior multinational to improve their own efficiency. Recent evidence on such spillovers using micro data has been mixed. For example, Aitken and Harrison (1999) found that productivity growth in Venezuelan manufacturing plants was negatively correlated with the foreign presence in that sector. A similar result was found by Haddad and Harrison (1993) for Moroccan firms. Javorcik (2004) studied data on Lithuania, and found mixed results: there was evidence of positive externalities between foreign affiliates and their local suppliers in upstream industries, but there was no indication of spillovers within the same industry. By contrast, there has been some more positive recent evidence from the UK. Haskel et al (2002) analyse plant level data in the UK and find a positive correlation between the productivity of domestic plants and the foreign-affiliate share of that industry. Griffith et al (2002) use the same UK dataset to investigate whether there has convergence in productivity towards the technological frontier. Multinationals make up a significant proportion of plants at the frontier, and therefore make a contribution to productivity growth through technology transfer.

⁵ Of course, there may also be domestic multinationals similar to foreign multinationals. See, inter alia, Griffith, Simpson and Windmeijer (2001).

⁶ See, for example, Haddad and Harrison (1993), Aitken et al. (1997), Aitken and Harrison (1999), and Blomstrom and Sjöholm (1999).

Although this evidence is not conclusive as to the impact of multinational companies on host country welfare, it is reasonably clear that they do have some effects. In turn, that suggests that it is useful to understand how taxes impact on the major decisions of multinational companies. Clearly important here is the extent to which the domestic capital stock is owned by multinationals (and note that this can be achieved through acquisition, as well as new capital expenditure).

Also important from a policy perspective is the degree to which a host country government can tax the profit generated by affiliates of multinational companies located within its jurisdiction. Clearly a higher tax rate may induce lower investment. But, conditional on the level of investment, it may also induce lower taxable income as the multinational seeks to shift its profit to a lower-taxed jurisdiction. The policy implications of profit shifting are not as obvious as might be first thought. In the simplest case, conditional on the location of real capital, if it is the case that non-residents bear the effective incidence of the tax levied by the host government, then in the absence of any cooperative or strategic considerations, a higher tax revenue would increase host country welfare. However, the tax burden may well be shifted onto domestic residents; or the host country may improve welfare if it cooperated with other countries in setting tax. Either of these reasons – and others - may imply that limiting the extent of profit shifting may not be the best option. In any case, for the purposes of this survey, it is clearly of interest to examine empirical evidence of the extent to which the degree of profit shifting depends on the host and home country tax systems.

3. A framework for analysis

A useful approach to classifying empirical studies of flows of capital, firms and profit is to first describe a simple model of the choices of multinational firms. Studies can then be discussed with reference to how they fit into this framework. The model described here is

a simple extension of the basic model of horizontal expansion of multinational firms, drawing specifically on Horstman and Markusen (1992).

Suppose a company resident in country i wants to enter the market in country j . It is useful to think of four steps, summarised in Figure 1. First, a company must choose whether to access the market by producing at home and exporting, or by producing abroad. To make this discrete choice, the company must assess the net post-tax income of each strategy. Exporting from i to j will incur transport costs per unit of output transported. Producing in j will eliminate, or at least reduce, transport costs, but may incur additional fixed costs of setting up a facility in a foreign country. The choice therefore depends on the scale of activity, and the size of the various costs. The scale of the activity would depend on the choices made in stages 2 to 4 below. There may also be general equilibrium issues: since marginal costs would be lower if production takes place in j , the company would tend to have higher output, which may affect the market equilibrium. Many of these issues are examined in detail by Markusen (2002), but we do not address them directly here.

The role of taxes on profit is worth pointing out, however. If production takes place in i , then the net income generated would typically be taxed in i . There may be other considerations – for example, tariffs imposed by j on imports from i , but we leave those to one side. If production takes place in j , then the net income generated in j will generally be taxed by the government in j . Depending on the tax system in i , there may be a further tax charge on the repatriation of any income from j . Taking all these taxes into account, the company would choose the higher post-tax profit. Conditional on a pre-tax income stream, the role of tax is captured by an effective average tax rate – essentially the proportion of the pre-tax income which is taken in tax.

Conditional on choosing to produce abroad, the second step faced by the company is where to locate production. Here we should expand the definition of “country j ” somewhat. As an example, consider the position of a company resident in the USA,

aiming to access the EU market – so that i represents the USA and j the EU. Given this, the company must choose a specific location within the EU to produce, for example within Germany or France. This is a second discrete choice. The role of tax is similar to that in the first discrete choice, and can be measured by an effective average tax rate.

The third step represents the traditional investment model in the economics literature: conditional on a particular location, the firm must choose the scale of its investment. This is a marginal decision: the company should invest up to the point at which the marginal product of capital equals the cost of capital. As such the impact of taxation should be measured by the influence of the tax on the cost of capital – determined by an effective marginal tax rate.

In a slightly different model, this third step might play a more important role. Consider a multinational firm which already has production plants in several locations. If it has unused capacity in existing plants, then it could choose where to generate new output amongst existing plants. The role of tax would again be at the margin, in that the company need not be choosing between alternative discrete options. However, note that this is a different framework: in effect, it implies that the firm has not already optimised investment in each plant up to the point at which the marginal product equalled the cost of capital.

The final step is the choice of the location of profit. Having generated taxable income, a company may have the opportunity to choose where it would like to locate the taxable income. Multinationals typically have at least some discretion over where taxable income is declared: profit can be located in a low tax rate jurisdiction in a number of ways. For example, lending by a subsidiary in a low tax jurisdiction to subsidiary in a high tax jurisdiction generates in a tax-deductible interest payment in the high tax jurisdiction and additional taxable income in the low tax jurisdiction. Hence taxable income is shifted between the two jurisdictions. The transfer price of intermediate goods sold by one subsidiary to the other may also be very difficult to determine, especially if the good is

very specific to the firm. Manipulating this price also gives the multinational company an opportunity to ensure that profit is declared in the low tax jurisdiction rather than the high tax jurisdiction.

Of course, there are limits to the extent to which multinational companies can engage in such shifting of profit. (If there were no limit, then we should expect to observe all profit arising in a zero-rate tax haven, with no corporation tax collected elsewhere). Indeed, companies can argue that complications over transfer prices may even work to their disadvantage: if the two tax authorities involved do not agree on a particular price, then it is possible that the same income may be subject to taxation in both jurisdictions.

Broadly, the location of profit can be expected to be determined primarily by the statutory tax rate. It is plausible to suppose that companies take advantage of any tax allowances in any jurisdiction in which they operate. Having done so, the advantage in being able to transfer a dollar of profit from a high tax jurisdiction to a low tax jurisdiction depends on differences in the statutory rate.⁷ However, many of the complications of corporation tax regimes have been developed precisely to prevent excessive movement of profit; so there are many technical rules which are also important, but which are much more difficult to model.

Solving this four-stage problem of course requires beginning at stage 4 and working back. In principle, the multinational should identify its effective statutory tax rate in any jurisdiction, taking into account the opportunity for moving profit to low-tax jurisdictions elsewhere (or into that jurisdiction from high-tax jurisdictions elsewhere). Having done so, it reaches a position to determine the optimal scale of investment in each location, taking account of the effective marginal tax rate. This in turn determines the post-tax income stream in each location. It is then in a position to move back to stage 2 and then stage 1, taking into account the effective average tax rate.

⁷ It may also depend on withholding taxes and the tax treatment the parent company.

Of course, this exercise would be an extremely demanding exercise for a researcher, and it has not yet been attempted. Most papers described below consider either capital flows or profit shifting, effectively selecting only a subset of the four elements of the decision tree. Only a subset of these have considered the role of different measures of taxation related to the different levels. Some papers do consider flows of capital and profit; but none has attempted to create and use a measure of effective taxation of capital taking into account the possibility of profit shifting.

4. Data and measurement

A number of data sources have been used to investigate the determinants of the location of both capital and profit. The Appendix outlines in more detail the data used: for example, it shows the sources available, and the definitions of variables used. The first subsection here briefly describe the main approaches taken, and the sources of data, for the location of capital, finance and profit. The subsequent subsection addresses issues in the measurement of taxation. The final subsection makes some brief comments on the need to control for non-tax influences, and the approaches taken to do so.

4.1. Flows of capital and profit

The empirical literature on flows of capital, investment and profit has used a number of different data sources, as indicated in the rows of Table 1. The earliest group of studies analysed aggregate data on flows of foreign direct investment (FDI). As discussed in more detail in the Appendix,⁸ FDI broadly represents flows of funds from a parent company to affiliates in other countries. It does not necessarily reflect either the capital owned by affiliates in foreign countries, nor new capital expenditure. There is also no

⁸ And pointed out by Auerbach and Hassett (1993).

direct link with the aggregate capital stock. However, it is easily accessible data, and is at least related to the activities of multinational companies.

A second group of studies has used slightly less aggregated data to investigate the location of capital and – directly and indirectly – the location of profit. These studies use relatively detailed data from the Bureau of Economic Analysis (BEA) at the US Department of Commerce. The BEA makes available data on the foreign affiliates of US companies, and the US affiliates of foreign companies. These data are aggregated by country or by industry, to maintain confidentiality of the companies. The data include some information on the capital stock, income, financial activities, employment and taxes paid. Hence it is possible for example to collect data on the aggregate capital stock of affiliates of US companies in each of the EU countries, and relate that to rates of profit and to taxes paid. This has proved a fruitful dataset, and has been used to examine a number of issues concerning the investment and profit-shifting activities of multinational companies.

However, since only aggregate data is available to most researchers, these studies implicitly incorporate at least the first 3 stages of the decision making process described in Figure 1 into a single reduced form. By contrast, other studies use more disaggregated data, which permit analysis more closely related to the decision tree in Figure 1.

One group of such studies considers the discrete choices in the first two steps in Figure 1 – whether to export and locate production abroad and where to locate. The studies typically use individual firm level data; in practice, most studies have used accounting data on US multinationals from Compustat. Although these data are usually based on consolidated accounts for the whole of the corporation, researchers have made use of more detailed information available on, for example, the split of sales between goods produced domestically and abroad. This permits the study of the highest level of the decision tree – whether to export or to produce locally. Compustat also contains some geographic information which can be used in some cases to identify where the affiliates

of US multinationals are located, which permits an analysis of the second level of the decision tree.

Another group of studies uses firm level unconsolidated accounting data on affiliates to examine the determinants of the level of their investment. These data are typically not, however, linked to the parent, so the affiliates are, in effect, treated as independent companies. This does not permit a direct analysis of capital flows, although researchers have incorporated international aspects of the tax system to examine whether taxes paid by the parent affect investment decisions.

The richest source of data for examining the decisions of multinational companies, however, must come from data where it is possible to match the parent and its affiliates in different countries. The availability of such data has typically been extremely limited, however, and not generally available to researchers. And even when the data is available, the links between affiliate and parents have not always been exploited.

The most well-known, and most-used data in this regard stem from confidential US tax returns which are available to researchers in the US Treasury (but not outside the US Treasury). These data have been used for a number of purposes – to examine the investment and financial decisions and also the location of profit of US multinationals. More recently, however, other datasets have begun to be exploited. The individual firm-level data underlying the BEA aggregate data, described above, has been made available to researchers working at the BEA. This is a very rich dataset for exploring the decisions of US multinational companies. A similar dataset – although more limited in the number of years of data available - has now been made available to German researchers at the Bundesbank.

All of these datasets remain confidential: they can only be used by government officials, or by academics researchers under contract with the appropriate government department. However, one useful dataset has now become available to researchers more generally,

although it has barely begun to be used. That is a dataset known as Amadeus, published by the Bureau Van Dyjk, which contains the unconsolidated financial accounts of effectively all EU companies, and crucially also contains ownership data. In principle, it is therefore possible to build up a picture of the activities of groups of companies, with detailed information on their activities in each European country. For the future, the availability of these data should enable researchers to study the branches of the decision tree in Figure 1 in more detail.

4.2. Measuring the taxation of capital

Just as the measures of capital and profit used in empirical studies differ widely in the empirical literature, so too do the measures of taxation. To some extent this should be expected, since different decisions depend on different measures. For the most part, studies investigating the location of profit and sources of finance use the statutory tax rates, which is usually appropriate.

However, studies concerned with the allocation of investment have used a number of measures, which have not always corresponded to that suggested by theory. A summary of the approaches taken in studies examining the location of capital is provided in Table 1. It is useful to relate the measures of taxation to the decision tree discussed above. As described above, the first two stages of the decision tree are essentially discrete choices, which should depend on an effective *average* tax rate. However, conditional on having chosen a location, the scale of investment should depend on an effective *marginal* tax rate.

Corporate income tax systems are in general non-linear, and so the impact of tax on the return a firm earns will vary with the rate of return. This means that the tax rate on a marginal investment (which just breaks even) may be very different from that on an infra-marginal investment. Hence the effective *marginal* tax rate can be very different from the effective *average* tax rate (and both can be quite different from the statutory rate).

There is a large literature on the measurement of how tax affects firms' incentives to invest, which we do not have space to survey here.⁹ However, it is important to note one further important distinction: between backward- and forward-looking measures. In theory, an investment consists of cash flows in the present and future, which suggests that forward-looking measures should be generally preferred. In practice however there may be reasons why backward-looking measures capture important variation in tax rates that forward measures do not capture.

Forward-looking measures are typically calculated for a hypothetical investment on the basis of the rules of the tax base and tax rate, and can be computed for any well-defined investment project. However, they are computed for a specific type of investment, financed in a specific way (for example, a purchase of plant and machinery financed by borrowing). It can therefore be difficult to find the appropriate measure when investment across many projects is aggregated (which is true even at the firm level). In addition, many complexities of the tax system may be difficult to capture in these forward-looking measures.

Marginal tax rates can generally only be calculated using effective tax rates.¹⁰ By contrast, average tax rates can also be calculated using backward-looking data on observed tax payments. For studies based on individual company decisions, one of the most common measures of the average tax rate is calculated by dividing the tax charge in the financial accounts by a measure of profit. At a more aggregate level, backward-looking tax rates can be based on national accounts.¹¹ Other attempts to measure average tax rates in the literature include using aggregate data to discriminate between the pre- and post-tax earnings of foreign-owned as opposed to domestic-owned firms.

⁹ The interested reader can see, *inter alia*, Hall and Jorgensen (1967), King and Fullerton (1984), Alworth (1988), OECD (1991), Keen (1991), Ruding (1992), Devereux and Pearson (1995), Devereux and Griffith (2003), Devereux (2004), Devereux and Klemm (2004).

¹⁰ Although Gordon et al (2004) propose a method for calculating marginal tax rates from tax revenue data.

¹¹ See Mendoza et al (1994).

The backward-looking average tax rate can be very different from the forward-looking effective average tax rate.¹² The principal reason is that the latter incorporates the tax payments due over the lifetime of an investment, along with all the other cash flows of the project. In contrast, the tax liabilities of a firm at any point in time reflects (i) the history of its investment up to that point (in determining what allowances it can claim in that period) (ii) tax liabilities in possibly several jurisdictions, (iii) the history of losses in the firm (that is, it may be carrying forward losses from some previous period), and (iv) the history of the tax system up to that point.

One other issue arises with the use of backward-looking average tax rates. Since they are based on data on profits and tax payments, they may depend directly on investment and the capital stock (this is not generally true of effective tax rates, which depend only on the tax regime). This introduces what may be important endogeneity bias into regressions aiming to explain capital or investment using such measures. For example, a period of high investment is likely to generate high allowances which depresses the tax liability in that period. This will generate a negative correlation between investment and the average tax rate - but the direction of causation would be the opposite of what the study was aiming to investigate. That is, instead of investment responding positively to a lower tax rate, the tax rate falls as a result of higher investment. This consideration suggests that such studies need to use estimation techniques, such as instrumental variables, which can overcome this endogeneity problem.

One final issue which may be relevant for cross border investment flows is whether home country taxation is included. In theory this is not relevant for the marginal tax rate in the case in which the investment is financed by retained earnings.¹³ Some studies have

¹² For evidence on this, see Devereux and Klemm (2004).

¹³ See Hartman (1985). This is because the rate at which tax is saved when the original dividend is foregone to fund the investment is the same as the rate charged when the return from the investment is paid. These two effects cancel out in determining the required rate of return on the investment.

therefore tried to distinguish between FDI financed by retained earnings from FDI financed by new equity.

4.3. Conditioning variables

No-one would argue that taxes are the sole determinant of investment or location decisions. In trying to identify the impact of tax, it is therefore important to allow for the effects of other factors. If this is not done, then it may be the case that any effect attributed to taxation may in fact be due to some other factor. Suppose for example, that inflows of investment do not depend on taxes at all. Instead firms choose to locate near other firms in the same industry. It may be that where there are a large number of firms located close to each other, they have political influence which enables them to drive down the tax rate. Ignoring the agglomeration of other firms within the same industry might lead to the spurious conclusion that low tax rates are attracting new firms. Another example is the link between taxes and government expenditure, such as investment in infrastructure. Such spending may attract capital; but if it is excluded from the analysis, and if it is financed by taxes on capital, then a regression may indicate a positive, but spurious, correlation between firms' taxes and firms' investment decisions.

The studies described below differ in the extent to which they allow for other factors to influence firms' behaviour. Some explicitly allow for factors such as the local wage rate (adjusted for productivity) and proximity to other firms or demand. Others use a measure of the observed rate of return on investment, which may incorporate the effects of such factors, but which may itself be endogenous, since it may depend on the size of investment flows. Still others use econometric methods to control for unobservable factors.

5. Empirical evidence on the location of capital and investment

We now turn to a discussion of the empirical literature. Given the large number of contributions, it is not feasible to provide a comprehensive survey of all relevant work.¹⁴ Instead, the discussion aims to give a coherent framework of the development of the various strands of the empirical work, and to place particular papers in the context of that framework. Emphasis is also given to papers which most closely address the policy issues raised in Section 2. This section summarises work on the impact of taxes on investment and the location of capital; the next section focuses on work on the impact of taxes on financial policies and the location of profit. Some papers make a contribution to both areas; these are noted in the course of the general discussion.

5.1. Studies using aggregate FDI data

Slemrod (1990) provided a useful review and extension of earlier work¹⁵ on inflows of FDI to the USA. Previous work had closely followed the approach of Hartman (1984), who regressed an annual time series of FDI inflows into the USA on a measure of the post-tax rates of return and the relative tax rates of US and non-US investors. One of the main problems with this approach is that it is very difficult to distinguish the impact of taxes from other contemporaneous macroeconomic events.

Slemrod critiqued and extended this early literature in several ways. He introduced new control variables, including US unemployment, the real exchange rate and a measure of relative GDP. His more significant innovations were that he introduced the use of a forward-looking effective marginal tax rate,¹⁶ instead of a backward-looking average tax rate, and he looked separately at inflows of FDI from seven different countries. The second of these innovations was intended to allow for tax effects to differ according to

¹⁴ Earlier surveys of the impact of taxes on the location of capital or profit include Hines (1997, 1999), Newlon (2000) and De Mooij and Ederveen (2003).

¹⁵ See Hartman (1984), Boskin and Gale (1987), Newlon (1987), Young (1988) and Murthy (1989).

¹⁶ From Auerbach and Hines (1988).

whether the foreign investor would be taxed at home on repatriations of income from the USA (ie. depending on whether the foreign country operated a credit or exemption system, and on its tax rate). However, the results generally did not support the basic hypothesis that differences in home country taxation affect inflows to the USA. Slemrod discusses several reasons for this, including the poor quality of data and the ability of firms from foreign tax credit countries to defer home country taxation.

Devereux and Freeman (1995) extended this approach further. They examined bilateral FDI flows between seven countries. They estimated the effect of tax using a panel data approach. They also used a more sophisticated measure of the effective marginal tax rate, which took account of both home and host country taxation relevant for each FDI flow, and which therefore varied across country pairs, as well as over time.¹⁷ They found a significant impact of this measure in explaining the size of FDI flows relative to GDP, but not on the balance between domestic investment and outward FDI. They attempted to identify the size of the tax effects by considering a hypothetical large tax reform in the USA. While this had a large effect on FDI inflows from countries with exemption systems, there are only small effects from countries with credit systems. In aggregate, since the major sources of FDI into the US are from countries with credit systems, the impact on total flows was rather small.

A number of other papers have also examined the impact of various tax measures on FDI flows and found broadly similar results.¹⁸ Several other more recent papers also use bilateral FDI flows data. For four of the papers,¹⁹ their distinguishing characteristic is that they investigate alternative specifications of the tax rate, and in particular they distinguish between effective average and marginal tax rates, and between forward-looking measures

¹⁷ The measure is described in OECD (1991) and Devereux and Pearson (1995).

¹⁸ See, for example, Jun (1994), Billington (1999), Cassou (1997).

¹⁹ Wei (2000) and Stöwhase (2005) also examine the sensitivity of bilateral flows of FDI to taxes. Wei compares the impact of taxation to the impact of host country corruption. comparing three sectors. Stöwhase finds a particularly high response for the tertiary sector, and no response in the primary sector.

and backward-looking measures.²⁰ Buettner (2002), Gorter and Parikh (2003) and Bénassy-Quéré et al (2005) all investigate the impact of various measures of taxation on bilateral FDI flows between major developed countries. Given data limitations, Buettner investigates the impact of the forward-looking EMTR and the statutory rate, noting that the EATR is a linear combination of these two measures. Gorter and Parikh compare the EMTR and a measure of an average tax rate based on accounting data. Bénassy-Quéré et al consider both forward-looking measures, as well as the statutory rate and the aggregate average tax rate proposed by Mendoza et al (1994). Bellak and Leibrecht (2005) also follow a similar approach, but concentrate on flows of bilateral FDI flows where the inflow is to a central or Eastern European country; they examine the role of the EATR and the statutory rate.

A striking result of these papers is that they find almost all of the measures of taxation to have a significant impact on FDI flows. Buettner finds a significant impact of the EMTR and statutory rate, which he interprets as evidence that the EATR is important. Gorter and Parikh find a slightly higher elasticity of FDI flows relative to the EMTR than to the average tax rate, which is consistent with the meta analysis of De Mooij and Ederveen (2003). Bénassy-Quéré et al find similar effects for all of the measures used. And Bellak and Leibrecht find both measures they use are significant, although the EATR generates a higher elasticity with respect to FDI flows.

These studies are interesting in that they investigate different aspects of tax regimes, along the lines implied by the framework set out above. However, as argued in Section 2, the relevance of FDI flows in this framework is limited, since they do not correspond precisely to any of the investment decisions described. Rather FDI effectively describes one method of financing expansion. We therefore now turn to a number of papers which use more disaggregated data, which can be more closely understood within the framework of Figure 1. We classify empirical papers according to which level of this

²⁰ The forward-looking measures are generally taken from Devereux, Griffith and Klemm (2002), and the backward-looking measures from Mendoza et al (1994); both sources have updated measures available on websites.

decision tree they consider. To begin with, though, we stay with studies using relatively aggregate data – on affiliates of multinational companies.

5.2. Studies using aggregate data on affiliates of multinational companies

Four papers - Grubert and Mutti (1991), Wheeler and Mody (1992), Hines and Rice (1994) and Mutti and Grubert (2004) - make use of the BEA data from the US Department of Commerce on the aggregate activities of affiliates of US firms within specific foreign countries.²¹ Wheeler and Mody investigate the level of investment in property, plant and machinery (ppe) in each country, while Grubert and Mutti, and Hines and Rice, analyse the level of the capital stock (of ppe). Mutti and Grubert (2004) follow a different approach, described below.

It is useful to think of the first three of these papers as encompassing the three higher levels of the decision tree in Figure 1. That is, they reduce these levels to a single reduced form equation. This approach is interesting, but raises issues of principle: that is, if the aggregate capital stock of US affiliates in, say, the UK reflects each stage of the decision tree, then both effective average and marginal tax rates may be relevant to the decision (possibly in a rather complex way). Unfortunately, none of these papers raise or discuss this issue. In fact, they all use a backward-looking average tax rate measure, based on aggregate tax payments and profits in each jurisdiction.²² It is therefore not possible to identify from these studies whether, say, the capital stock of US affiliates in the UK is affected more by the discrete choice of locating in the UK, or by the choice of how much to invest, conditional on having chosen the UK.

²¹ Two other papers – Swenson (1994) and Hines (1996) – use BEA data on the aggregate activities of US affiliates of non-US multinational companies. Swenson examines variation by industry, and Hines examines variation by US state. Swenson (2001a) examines transaction and count data for foreign-owned investments into US states. Bartik (1985) and Papke (1991) examine discrete location choices between US states.

²² Although the tax measure used by Wheeler and Mody is not clearly described.

Grubert and Mutti (1991) and Hines and Rice (1994) both find large and significant negative effects of the average tax rate on the aggregate capital stock of affiliates. For example, Grubert and Mutti report that a reduction in the host country tax rate from 20% to 10% would result in an increase in the capital stock of 65%. Some of the estimates from Hines and Rice are even larger. By contrast, though, Wheeler and Mody find that tax does not play a significant role in investment decisions. There are three obvious possible reasons for these different results are: (i) the differences in the dependent variable, (ii) differences in the determination of the host country tax rate and (iii) differences in control variables. Wheeler and Mody - in contrast with the other two papers - control for a number of other important factors, including openness, risk, infrastructure, market size, labour costs, and relations with the West and with neighbours. It is possible that the other two papers find a spurious effect of tax resulting from the absence of these control variables. This merits further research.

Mutti and Grubert (2004) take a different approach, using a newly available measure of the real gross product originating in a country, instead of a measure of the capital stock. This enables them to compare export-oriented production with domestic-oriented production.²³ They find that export-oriented production is particularly sensitive to tax differences. This is as might be expected: if the location of production is not determined by the need to have close proximity to a market, then it is likely to be more sensitive to other factors, such as taxation. Mutti and Grubert also find that responsiveness to host country taxation is lower in high-income OECD countries, and that the tax elasticity has grown over time.

5.3. Studies using individual company data

Studies which examine individual company data are able to exploit differences between companies, in a way which is not possible using more aggregate data. The analysis of

²³ This distinction is to some extent more in keeping with a model of a vertically-integrated multinational, rather than the horizontally-integrated case outlined in Figure 1. See Markusen (2002) for a thorough description of such models.

such data also enables researchers to focus more carefully on one or more aspects of the decision tree in Figure 1. The use of company-level data has been increasing over the last few years. In particular, some recent studies have been able to use data which match both a parent and its affiliates; this enables the researcher to consider a much richer set of decisions and, for example, to control for characteristics of other affiliates.

Kemsley (1998) examines the impact of tax on the first level of the decision tree: whether to export or produce abroad. He uses individual firm data from Compustat to examine the determinants of the ratio of exports to foreign production sales. This is regressed on the average foreign tax rate for the firm (foreign taxes expressed as a proportion of foreign profit), the US statutory tax rate and an estimate of whether the firm is in a binding foreign tax credit position. He also controls for a number of other factors, including country risk. Kemsley finds that taxes induce US firms who are in a binding foreign tax credit position to prefer exports to foreign production. He also finds that US firms are more likely to use exports to serve high-tax foreign markets than low-tax ones.

Devereux and Griffith (1998) concentrate primarily on the second stage of the decision tree: where to produce, conditional on producing abroad. They also use Compustat data and investigate the choice of US firms as to whether - conditional on having chosen to locate in Europe - to locate in the UK, France or Germany. One contribution of this paper is to analyse the impact of effective average tax rates on this discrete decision. There is strong evidence that the effective average - but not the effective marginal - tax rate is significant in this decision. The size of the effect varies between countries, but as an example, the results indicate that a one percentage point fall in the UK effective average tax rate would increase the probability of a US firm choosing to locate in the UK by around one per cent.

Stöwhase (2002) uses a similar data set on German multinational companies to examine the impact of taxes on the number of affiliates of German multinational companies in 8 host countries. He finds a significant impact of an average tax rate for companies in

production industries, and a significant impact of the statutory tax rate for companies in service, finance and R&D industries. This is consistent with evidence presented here and below: the effective average tax rate is a significant determinant of investment. However, for companies which find it relatively easily to move taxable income to lower-taxed countries, the statutory rate is more important. Stöwhase interprets this result as indicating that the location of service, finance and R&D sectors may be affected more by the possibility of shifting any income earned to low tax jurisdictions.

Buettner and Ruf (2006) examine the location decisions of German multinational companies, using a firm-level dataset collected by the Bundesbank. This dataset is extremely useful in that it is possible to pair parent companies and their affiliates located outside Germany. Using these data, they take a different approach to a technical issue effectively sidestepped by Devereux and Griffith: that multinational companies tend to locate in more than one foreign country. This means that it is inappropriate to use a multinomial logit model, which requires the agent to choose only one option from a set of choices. This is a difficult issue to solve. Buettner and Ruf address it by effectively assuming that all location choices are independent, and estimate a fixed effects logit model on the choice of each company to locate in each country. In so doing they are able to control for unobserved characteristics of both the company and the location. Like Devereux and Griffith, they find no significant effect of an effective marginal tax rate. However they find that the statutory tax rate has considerably more predictive power than the effective average tax rate.

One paper is clearly directed towards the third level of the decision tree. Cummins and Hubbard (1995) use Compustat data on the investment of foreign affiliates of individual US firms. They treat these affiliates as independent firms, and consider a standard investment model. The equation they estimate - using a panel of data on affiliates - is the Euler equation. It includes a term which captures the cost of capital and which is implicitly affected by the effective marginal tax rate. The innovation in this paper is that the cost of capital includes both host and home country tax parameters and that the model

is applied to foreign affiliates. Cummins and Hubbard find that they cannot reject the version of the model which includes these tax effects, thus concluding that taxes do matter.

Three other papers are also most clearly associated with the third level of the decision tree, but aim also to shed light on location choices. Grubert and Mutti (2000), Altshuler et al (2001) and Altshuler and Hubbard (2003) all use confidential tax return data available only to researchers inside the US government, which incorporates detailed information about the activities of individual foreign affiliates of US firms. All three papers consider the impact of average tax rates on the location of capital owned by affiliates of US multinational companies. Altshuler et al examine whether the sensitivity to tax has changed over time, and Althsuler and Hubbard investigate whether financial services firms are more responsive to tax. However, all three papers aggregate the data on affiliates within each host country. By doing so, they cannot exploit variation in the data between affiliates, and between parents, and the additional information which links parents and their affiliates.

Desai, Foley and Hines (2004b) is one of a number of recent papers by these authors to exploit another micro dataset: the data underlying the aggregate data published by the BEA. These data are also available on a confidential basis, and are not generally available to researchers. Unlike the previous papers, this paper estimates the effects of tax using the affiliate-level data. Apart from using very detailed information, the paper makes another interesting innovation: it exploits the fact that the BEA data contains information not only on taxes on capital income, but also on “indirect” taxes as well. They find that indirect taxes are sizable, and that they are strongly associated with patterns of foreign investment and production. But in some ways, this raises more questions as it answers. First, it is not clear exactly which taxes are included in the category of “indirect”. Second, the analysis would be much clearer with a model to guide thinking on how other taxes might be expected to affect the location of capital. To take only one example, in most simple models, VAT is passed onto consumers, in the form of higher prices. And goods which

are exported typically face zero rates of VAT. So it is far from clear why a high rate of VAT would matter for location decisions. These questions require further research.

6. Empirical evidence on the Location of profit

Studies examining the location of profit can be differentiated in a number of ways; Table 2 differentiates them in two dimensions: the nature of the question examined, and the type of data used.

There are three broad areas which have been addressed in the empirical literature. The first of these is a comparison of rates of profit amongst jurisdictions: the basic approach is to see whether – and if so, by how much – taxable income is lower in jurisdictions with high tax rates. Such comparisons have been carried out using a variety of different datasets. Although these studies consider the rate of profit, they are indirect tests of the extent to which multinational companies shift profits between countries, since differences in profit may be due to a number of other factors as well as tax. In trying to gauge the impact of tax, it is important to control for these other factors.

A second indirect approach is to examine the impact of taxes on financial policy. In particular, two aspects of financial policy have been studied in this context: the use of debt across subsidiaries, and whether, and if so how, profits in subsidiaries are repatriated to parent companies. Both these issues can be related to measures designed to reduce the overall tax liability of the multinational. Other indirect approaches have also been taken. For example, one paper examines the extent to which the legal form chosen by the multinational is affected by taxes. Another examines the pattern of intrafirm trade between US companies and associated companies elsewhere; manipulating transfer prices to shift profits to low tax jurisdictions would imply

Finally, three papers directly address the extent to which taxes affect transfer prices, using data on the prices themselves. We address these three groups of papers in turn.

6.1. Rates of profit

The first general papers comparing rates of profit across the countries of affiliates of US parent companies were Grubert and Mutti (1991) and Hines and Rice (1994).²⁴ Both papers use the 1982 benchmark survey of US non-bank majority-owned affiliates, aggregated within each host country. Grubert and Mutti use data on 33 countries, Hines and Rice use data from 59 host countries. Both papers regress total reported pre-tax net income on measures of the statutory and average tax rate. The average tax rate is essentially total tax expressed as a percentage of total profit, although Hines and Rice impose an upper bound, equal to the host country statutory rate. As noted above, this introduces a possible endogeneity problem - the average tax rate itself depends on the rate of profit. Hines and Rice therefore use an IV approach, using population as an instrument, on the grounds that tax rates are correlated with country size. Grubert and Mutti control for growth in GDP, while Hines and Rice in some cases attempt to control for capital and labour inputs into production. Both papers find evidence of very large effects of taxation on the location of profit. For example, Hines and Rice find that an increase of one percentage point in the host country tax rate can reduce reported profit by 6% (and even higher estimates are also presented).

Since the data used in these papers represent only small cross sections of countries for a single year, they cannot account for unobserved characteristics of the host country, or

²⁴ An earlier paper, Jenkins and Wright (1975), presented evidence on the profits and tax position of affiliates of US corporations in the petroleum industry from 1966 and 1970. They found that virtually no tax accrued to the US government from its foreign petroleum investments, and that the total host country taxes paid on income to the petroleum-consuming countries were much smaller than for manufacturing in these countries, an effect which they attribute to the greater opportunity to shift profits in the petroleum sector.

differences in the affiliates present in each country. Another group of papers instead use firm level accounting data from Compustat.

Collins et al (1998) use Compustat data between 1984 and 1992 to aggregate foreign activities for multinational companies. They compute the rate of profit and effective tax rate abroad²⁵ and compare the effective tax rates with the US statutory tax rate to determine whether the company is in a binding or non-binding foreign tax credit position (that is, it is taken as binding if the foreign effective tax rate exceeds the US rate).²⁶ They find that these tax measures have significant effects on the profit rate. A firm facing a binding constraint tends to have lower income abroad, and this income falls further as the foreign effective tax rate rises. This is as expected: such companies would have an incentive to shift income to the US, and this incentive increases with the foreign tax rate. However, this effect is not observed for firms not facing a binding constraint; indeed there is evidence of shifting in the other direction.

Four other papers investigate the impact of taxes on taxable income in the United States. Klassen et al (1993) compare a group of 191 US multinationals (with US and non-US assets in each year from 1984 to 1990), with a control group of US and non-US firms. They find a significantly higher rate of profit in the US in 1986-7 and a significantly lower rate of profit in the US in 1987-8. In other periods they find no significant difference. They interpret this as implying that the lower US tax rate after the 1986 tax reform induced US multinationals to shift profit to the US; the magnitude is consistent with a 10% increase in profitability. They interpret the reverse effect the following year as being a reversal of that strategy as other countries responded by reducing their tax rates. However, such results need to be treated with caution; essentially all unexplained variation between the treatment and control groups is here attributed to tax. But there are

²⁵ Defined as tax paid plus deferred tax, expressed as a proportion of pretax income.

²⁶ Of course, this measures the tax credit situation for each company with considerable error, because all foreign activities are aggregated together and because no account is taken of repatriations of income. However, results are apparently robust to a number of alternative forms of measurement.

very few other variables included in the regression, and since effectively each year is a cross section, there are again no controls for either company or years.

Harris et al (1993) use similar data for US manufacturing firms between 1984 and 1988. They examine how tax payments of the parent company to the US federal government depend on where foreign affiliates are located (the location data are from the geographic segment of Compustat). Their evidence suggests that, controlling for a variety of other factors, firms with subsidiaries in low-tax countries have relatively low US tax payments per dollar of assets or sales, while having a subsidiary in a high tax region is associated with higher US tax payments. Both results are consistent with income shifting; but although the estimates vary and are not very precisely estimated.

Harris (1993) conducts a difference-of-difference analysis around the 1986 Tax Reform Act. He argues that multinational corporations had a greater incentive to report income in the US after 1986 because (a) the lower statutory tax rate, (b) a greater incentive to report expenses, and particularly capitalised expenses, abroad.²⁷ Harris tests the determinants of the US tax liability for 240 multinational companies and 646 US domestic firms, comparing pre- and post-1986, and multinational versus domestic companies. Conditioning on a range of factors, he finds multinationals pay higher tax in the US post-1986. He also finds lower foreign profit in 1987 and 1988, consistent with shifting profit to the USA.

Grubert et al (1993) use confidential US tax return data to investigate possible reasons for the apparently low taxable income – and hence low tax payments - declared by foreign-controlled affiliates in the United States. They find about 50% of the differential between foreign-owned and domestically-owned firms can be explained by variety of reasons unconnected to taxes. They do not find any differences in financial factors, such as the use of debt or the cost of equity between US and foreign-owned affiliates. The unexplained 50% may be evidence of transfer pricing distortions: however, given the

²⁷ Of course, these effects are diminished by other countries instituting similar reforms.

difficulty of explaining all differences in rates of profit, it is hard to attribute all of this difference to profit shifting. .

Finally, two more recent papers do not use (solely) US data. Demingüic and Huizinga (2001) examine individual data on the profitability of banks in 80 countries to infer the scale of profit shifting. They compare domestic-owned and foreign-owned banks, reasoning that the pre-tax profits of foreign-owned banks may rise less with the host country tax because of generous foreign tax credits, or because of the existence of relatively more profit shifting possibilities. They find evidence to support this, using data on statutory and effective tax rates. They support this by further evidence which suggests that foreign-owned banks pay lower taxes in several developed countries; indeed taxes paid by foreign-owned banks tend to fall as the statutory rate rises.

Bartelsman and Beetsma (2003) use industry level data on value added to investigate profit shifting within 16 OECD countries, between 1979 and 1997 (the data comes from the Structural Analysis Database, or “STAN”). Their approach is to estimate a production function, treating transfer pricing problems as measurement error. By making assumptions about the production function, it is possible to infer information about the measurement error, and hence the degree of profit shifting, taking into account the tax rates in other countries. Their central estimate is that at the margin more than 65% of the additional revenue from a unilateral tax increase is lost due to a decrease in the reported income tax base.

6.2. Financial Policy

One avenue for companies to shift profits between jurisdictions is the appropriate use of financial policy. The effects of tax on two aspects of financial policy in particular have been examined: the use of debt and the form and size of income repatriated to the parent company.

6.2.1. The use of debt

Three papers examine the impact of the US 1986 Tax Reform Act on the use of debt by US multinational companies. The 1986 Act significantly reduced the tax deductibility of US interest expenses for certain US multinational corporations. This increased their US tax liabilities and made their borrowing more expensive. Only firms with deficit foreign tax credits, or with no foreign assets, retained full interest deductibility.

Collins and Shackelford (1992) and Froot and Hines (1995) use consolidated financial accounting data from Compustat. Collins and Shackelford test whether firms adversely affected by the tax reforms changed their financing behaviour by substituting preferred stock instead of debt. Their analysis is conducted by comparing two small samples of firms (around 100 firms in each sample) for 3 years before and after the tax reform. They find that the percentage of worldwide assets domiciled abroad is positively related to increases in preferred stock before the reform, but not after the reform.

Froot and Hines find that, over the 1986-1991 period, firms that were unable to deduct all their interest expenses against US federal tax liabilities issued 4.2% less debt, and invested 3.5% less in property, plant and equipment, compared to other firms. They also showed an inclination to lease more assets and to reduce the scope of their foreign operations. Like Collins et al (1998), firms were classified into excess or deficit credit positions for the whole period, according to whether the average foreign tax rate exceeded the US statutory tax rates. Unfortunately, Froot and Hines do not present evidence from before the tax reform, and so do not control for differences between these two groups of firms which existed prior to the reform.

Altshuler and Mintz (1995) also study the impact of the changes to interest allocation rules in the 1986 tax reform, using data from only 17 very large US parents and, for each corporation, their largest 10 subsidiaries in Canada, Japan and the UK for 1986, 1988,

1990 and 1991. The advantage of this dataset is that it contains debt held in the foreign subsidiary; data for 1986 are taken to represent the position prior to the tax reform. As would be expected, they show that for a company in an excess foreign credit position, an increase in the US tax rate increases the proportion of debt held abroad, but the reverse is true for a company in a deficit credit position. However, as they acknowledge, more work with larger data sets is needed.

A more recent paper, Desai et al (2004a), exploits the confidential individual data used to construct the BEA aggregate data to examine the use of debt in the affiliates of US multinational companies. Using data from three benchmark surveys (1982, 1989 and 1994), they have access to data on a total of 32,000 affiliates and 3,600 parents. This very rich dataset includes information both on the total amount of external debt in each affiliate and on the amount of debt from the parent. They find evidence that tax rates strongly affect the use of debt by affiliates. Their central estimate is that 10% higher tax rates are associated with 2.8% higher affiliate debt as a proportion of assets. Internal debt is particularly sensitive: while the estimated elasticity of external borrowing with respect to the tax rate is 0.19, the estimated elasticity of borrowing from parent companies is 0.35.

6.2.2. Repatriation policy

A large number of papers has investigated the impact of taxes on the form and size of income repatriated to US parents. Early work by Kopits (1972, 1976) examined the impact of taxes on the size of dividend payments and royalties.

A series of subsequent papers has used confidential US tax return data. One early paper was Mutti (1981), which used 1972 data to provide evidence of the effects of taxes on dividend repatriations. However, this has been challenged and reinvestigated in a number of subsequent papers. One issue here is whether we would expect the taxation of dividend

repatriations to affect such flows. Hartman (1985) pointed out that taxes on dividend repatriations should not affect investment decisions of affiliates when the investment is financed by retained earnings. In effect, just as with the “new view” of dividend taxes, if companies choose between paying a dividend now and in the future, then as long as the tax rate is expected to remain unchanged, it plays no role in the choice of dividend payment now.

Hines and Hubbard (1990) and Altshuler and Newlon (1993) both used tax return data from a single cross section (1984 and 1986, respectively) to examine this question. Both papers used matched data on US parents and their foreign affiliates. It is interesting to note that only 16% of the Hines and Hubbard sample paid dividends to their parents, although the average payout ratio was 42%. And very little US tax revenue is raised from the receipt of dividends from foreign affiliates. Both papers found a significant impact of the tax price on the size of dividend repatriations, though Altshuler and Newlon found a stronger effect, which they attribute to the development and use of more sophisticated measures of the tax price of dividend repatriation.

Altshuler, Newlon and Randolph (1995) attempted to see whether these results could be reconciled with the Hartman (1986) hypothesis: they reasoned that the effects on repatriations may be due to changes in the expected future tax price, an effect consistent with the Hartman hypothesis. They attempt to separate permanent and temporary components of the tax price, and investigate whether dividend repatriations only depend on the transitory effects.²⁸ The “permanent” tax price is estimated by a preliminary regression of the tax price on the country average tax price and country statutory withholding tax rate. Using data from 1980, 1982, 1984 and 1986, the authors found evidence consistent with the hypothesis: transitory effects are significant, but permanent effects are not. However, this result needs to be treated with some caution, since it

²⁸ Transitory differences may depend on (a) variations in the difference in the tax base between the US and host countries; firms have the opportunity to manipulate taxable profit by choosing the time at which allowances and deductions are taken, to maximise the foreign tax credit – this was more prevalent before the 1986 reform (b) variation in excess credit or excess limitation positions.

depends crucially on whether the strategy to separate permanent and temporary components was successful; little evidence is presented on this.

Grubert (1998) takes a different approach. If companies can choose the form in which income is repatriated, then the Hartman hypothesis may again not hold, at least with respect to dividends. For example, if the tax price of royalties is low, then a high fraction of income repatriated may be as a royalty; an increase in the tax price of royalties relative to the tax price of dividends would lead to an increase in dividend repatriations. Grubert therefore examines tax return data from 1990 on payments of royalties, interest and dividends from foreign affiliates to US parents, taking into account the tax price of all three. The results indicate that the form of repatriation is strongly influenced by the relative tax rates on the three forms. For example, the overall tax rate on dividend repatriation negatively affects the payment of dividends and positively affects the payment of royalties and interest. The same results apply to the tax rates on royalties and interest, which suggests that these three forms of payment are seen as substitutes for each other. Grubert explains the difference from the results of Altshuler et al (1995) as being due to the inclusion of the tax price of royalties and interest, as well as dividends. By contrast, and consistent with the Hartman hypothesis, Grubert (1998) finds no significant impact on the overall size of repatriated flows; that is, retained earnings are not affected by the relevant tax rates.

Altshuler and Grubert (2003) take this line of analysis yet another stage further, by considering a number of more complex uses for income arising in affiliates of US multinationals. Specifically, they consider cases in which the affiliate can invest in passive assets, which the parent can borrow against, or in related affiliates which can be used as vehicles for tax-favoured repatriations. They test a series of detailed propositions, again using tax return data, and find significant effects of taxation on the choice of alternative strategies. They also find that the availability of such strategies can have real effects on investment.

Desai et al (2001, 2006) reinvestigate the basic issue of the impact of taxes on dividend repatriations using not tax return data, but the confidential individual data underlying the BEA aggregate data. They use data on matched affiliates and parents over the period 1982-97. One of the main advantages of this dataset, exploited here, is that it contains data on both foreign subsidiaries and branches. Dividends remitted by the former face a tax charge in the US (after the US tax credit), while dividends remitted by the latter do not.²⁹ They find that dividends from subsidiaries are sensitive to the host country tax rate, consistent with an implied low tax price of repatriation. By contrast, this does not hold for branches.

6.3. Other indirect approaches

Grubert and Slemrod (1998) investigate the impact of the fact that the income of Puerto Rican affiliates of US corporations is essentially untaxed – either in Puerto Rico or the United States. They use 1987 tax return data on 150 US corporations owning affiliates in Puerto Rico, and compared these data to similar data on 4000 other US companies which did not locate in Puerto Rico. Unfortunately, they do not observe data on profit earned in Puerto Rico; also tax rates facing all US corporations are the same, so there is no variation in the sample. The study therefore relies on identifying whether parameters assumed to be related to the costs of income shifting are a significant factor in determining whether a corporation is present in Puerto Rico. These parameters, related to R&D, advertising and profitability are all significant, which the authors interpret as indicating that taxes play a significant role in the decision to locate an affiliate in Puerto Rico.

A related approach is taken by Desai et al (2006), who investigate the use of tax havens by US multinationals, using the confidential firm level data underlying the aggregate

²⁹ The data contain considerably more subsidiaries – around 5,000 to 7,000 per year, compared to 300 – 600 branches.

BEA dataset. They classify countries as havens according whether or not they have low tax rates, and they estimate the determinants of whether US multinationals choose to locate in havens. Using data from 1982, 1989, 1994 and 1999, they use information on up to 3,000 affiliates in tax havens per year, and up to nearly 20,000 affiliates not in tax havens. They find that larger, more international firms, and those with extensive intrafirm trade and high R&D intensities, are more likely to use tax havens. This is consistent with the evidence of Grubert and Slemrod (1998); these factors are likely to be correlated with the ability of firms to shift income more easily. Desai et al also find that larger tax havens tend to be used to reallocate income amongst affiliates, while smaller tax havens tend to be used to defer repatriation of income to the US parent.

Desai and Hines (1999) investigate the impact of profits taxes on organisational form. In particular, the US 1986 tax reform introduced a change to the system of foreign tax credits which reduced the attractiveness of affiliates in which US multinationals owned less than 50% of the foreign corporation. This was especially true for corporations in low tax rate jurisdictions. Desai and Hines use the data from the benchmark surveys of affiliates of US multinationals from the BEA in 1982 and 1989, aggregated within each country; they use data for each year on 44 countries. Data is available for two groups of affiliates: majority-owned and those with between 10% and 50% ownership. They classify the latter as being “joint ventures”. Consistent with the prediction, they find that US participation in joint ventures fell sharply after 1986, particularly in low tax countries. Further, and consistent with the evidence of Grubert (1998), joint ventures in low tax countries used more debt and royalty payments after 1986, which is consistent with the higher tax costs of dividends payments.

Approximately 40% of all trade is intra-firm trade. For transactions with affiliates in low tax countries, there is an incentive to underprice US intrafirm exports and to overprice US intrafirm imports. For high tax countries the opposite is true. Clausing (2001) examines the evidence on this using aggregate BEA data on intrafirm trade flows between the US and 58 other countries between 1982 and 1994. She compares trade flows to measures of

the average tax rate in host countries. She finds that intrafirm trade patterns are consistent with transfer pricing motivation: a 10% higher local tax rate is associated with 4.4% higher parent company trade surpluses with local affiliates.

6.4. Transfer Pricing

All of the research described above gives only indirect evidence of profit-shifting. Even differences in profit between jurisdictions could be due to unobserved factors correlated with tax rates. However, two papers investigate transfer prices directly, thereby providing direct evidence of the extent to which companies manipulate intrafirm prices in the light of differences in tax rates.

Bernard and Weiner (1990) use firm-level data on oil imports, including the transfer price, in the US petroleum industry from the US Energy Information Administration between 1973 and 1984. They can distinguish between imports from a third party and from an affiliate, and therefore have access to reasonably good information on an “arms length price”; they also know the country of export and the tax rate of that country (although this is complicated by specific oil tax regimes in many countries). They find systematic differences between transfer and arms length prices for many exporting countries. However, the relationship between these differences and corporate tax rates is weak. They therefore do not find systematic evidence of manipulating transfer prices to reduce overall tax liabilities.

Swenson (2001b) uses data collected by the US Department of Census on the prices of over 9,000 US imports from Canada, France, Germany, Japan and the UK, during the period 1981 to 1988. These data do not allow any differentiation between intra-firm and arms length prices. To identify transfer pricing incentives, Swenson identifies differences in tax rates, and also allows for tariffs. She finds significant, but relatively small, effects

of tax rates on transfer prices, perhaps because the data include trade between unrelated parties.

More recently, however, Clausing (2003) has undertaken a study using monthly data from the International Price Program (IPP) of the US Bureau of Labor Statistics (BLS) on international trade prices for 1997, 1998 and 1999. Overall, she uses over 400,000 observations on prices of specific items. Importantly, she can differentiate between intrafirm trade and arms-length trade: just under 40% of the prices are intrafirm. She finds important differences in the behavior of intrafirm trade prices compared with arms-length trade. Differences are consistent with tax-motivated income shifting: US intrafirm trade with low tax countries exhibits lower export prices and higher import prices. More specifically, the central result is that a foreign tax rate 1% lower is associated with intrafirm export prices that are 0.94% lower and intrafirm import prices that are 0.64% higher. These results are highly significant statistically, and are found using both statutory rates and effective tax rates, and controlling for other influences on intrafirm trade.

7. Conclusions

This survey has covered a lot of ground, examining evidence of taxation on many aspects of locational decisions of multinational companies. In particular, it has surveyed empirical research on the influence of taxes on: discrete location choices; capital expenditure decisions of affiliates; the overall allocation of capital across countries; differences in the rates of profit across countries; financial and organisational form decisions, especially the use of debt and the form and size of income repatriated to the parent; and intrafirm transfer prices and trade.

It is tempting to conclude this part of the survey with some specific results – for example, an estimate of the quantitative effect of taxes on capital flows. Indeed, other surveys have

concluded in this way.³⁰ But any such result would be misleading. As is clear from this review, researchers have made a number of different choices in their work. Even within research on flows of capital, for example, there are many differences in the measures of capital flow and measures of tax rates used. There is no reason to suppose that the sensitivity of inward US FDI to the US statutory tax rate should be the same as the sensitivity of discrete location choices to the effective average tax rate, or the sensitivity of capital expenditure to the effective marginal tax rate. And within the range of studies on profit shifting, there are even more types of analysis to consider.

Further, many differences also arise even within each group of papers aiming to shed light on the same type of sensitivity; differences which it is not possible to cover in any detail in such a wide-ranging survey. At a basic level, data may vary across years and countries. At a more technical level, there are a host of issues of econometric methodology to be dealt with. For example, are endogenous variables instrumented, and if so, with what instruments? How is serial correlation dealt with? As a result of these differences, not every empirical estimate is equally valid.

However, some broad conclusions can be drawn. It is clear from this accumulated evidence that taxation does play a role in affecting the choices made by multinational companies. However, tax is not equally important in all decisions. For example, effective average tax rates tend to play a significant role in discrete location choices, and hence in the overall allocation of capital; but effective marginal tax rates are much less significant. Differences in statutory tax rates appear to play a significant role in the location of taxable income; there is evidence that such differences affect financial policy, the repatriation of income and transfer prices.

³⁰ De Mooij and Ederveen (2003) present a meta-analysis which in effect presents a more complex result.

The empirical literature surveyed here has developed rapidly over the last ten to fifteen years,³¹ from rather basic time series regressions on inward FDI to the US, to sophisticated studies involving very large datasets containing detailed information on parents and affiliates. The range of questions has also developed, and the understanding of the ways in which tax is likely to impact on behaviour has also developed. Much more detailed analysis is now being undertaken, and researchers have found innovative ways to identify the impact of taxation. However, much remains to be done. This more sophisticated work is still very new and in its infancy. The advent of microeconomic data is important in allowing researchers to study the decisions of multinational companies in more detail, and in giving them the opportunity to exploit, or control for, the many observed and unobserved differences across economic agents, and across countries.

³¹ An important part of this development is due to a series of papers commissioned by the NBER and reported in a series of edited books: many of the references in this paper come from these books. Other papers come from papers commissioned by the International Tax Policy Forum.

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Table 1 Location of firms and capital: relating measures of capital and tax rates

	EMTR	EATR	Average Tax Rate	Statutory tax rate or other measure
Time series and panel FDI	Slemrod (1990)		Hartman (1984) Boskin, Gale (1987) Newlon (1987) Young (1888) Murthy (1989)	Jun (1994) Billington (1999)
Bilateral FDI	Devereux, Freeman (95) Buettner (2002) Gorter, Parikh (2003) Bénassy Quéré et al (2005)	Bénassy Quéré et al (2005) Bellak, Leibrecht (2005)	Buettner (2002) Gorter, Parikh (2003) Bénassy Quéré et al (2005)	Wei (2000)
Aggregate cross-section allocation of assets of US multinationals, by country (or state) or industry			Grubert, Mutti (1991) Hines, Rice (1994) Swenson (1994) Mutti, Grubert (2004)	Wheeler, Mody (1992) Hines (1996)
Individual data on multinational companies		Devereux, Griffith (98)	Kemsley (1998) Stöwhase (2002)	
Individual cross-section allocation of assets of multinationals, by affiliate	Cummins, Hubbard (95)	Buettner, Ruf (2006)	Altshuler et al (2001) Grubert, Mutti (2000) Altshuler, Hubbard (2003)	Desai et al (2004b)

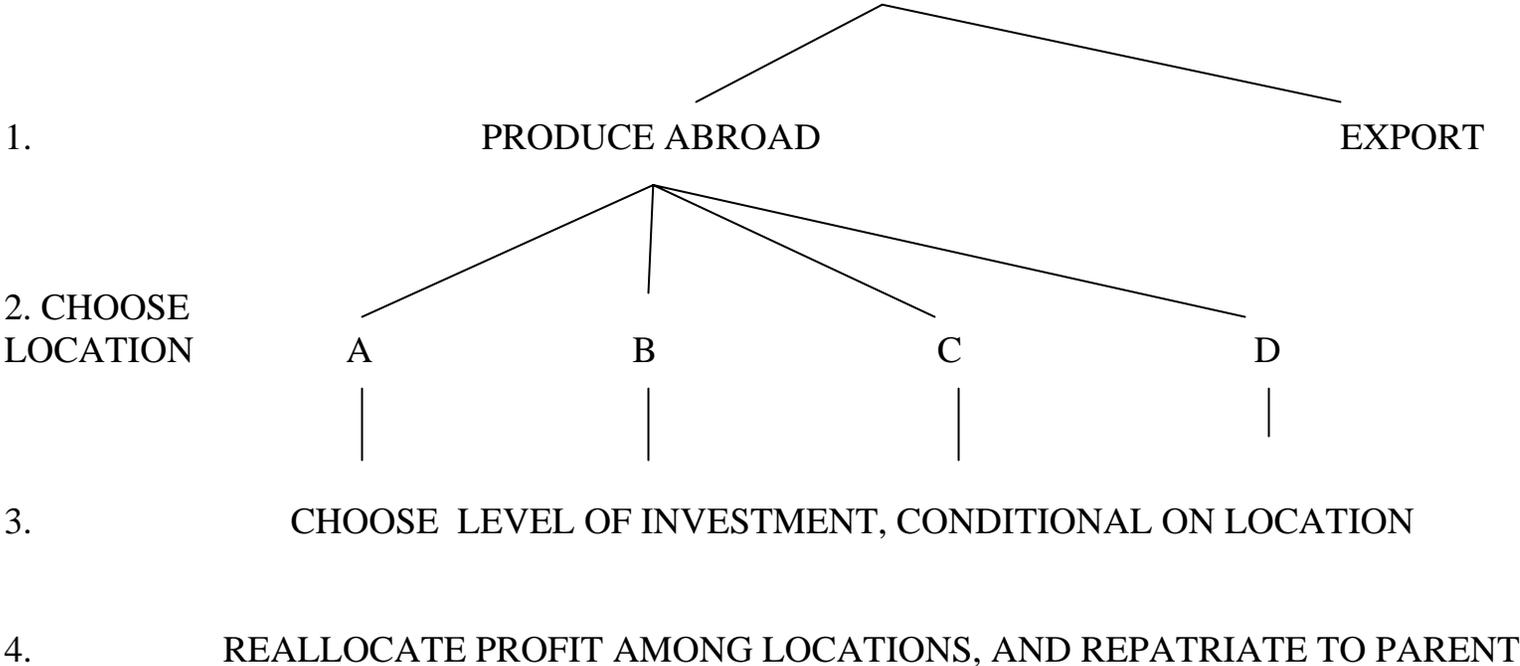
Notes.

EMTR: effective marginal tax rate or cost of capital, forward looking, based on tax rules; **EATR:** effective average tax rate, forward looking, based on tax rules; **Average tax rate:** backward looking, based on observed tax payments.

Table 2 Location of profit: relating direct and indirect tests of profit location and types of data

	Country / Industry value-added	Aggregate data on affiliates by country	Firm-level data	Affiliate level data
Indirect: comparisons of profitability	Bartelsman, Beetsma (2003)	Jenkins, Wright (1975) Grubert, Mutti (1991) Hines, Rice (1994)	Klassen et al (1993) Harris (1993) Harris et al (1993) Collins et al (1998) Demirgüç-Kunt, Huizinga (2001)	Grubert et al (1993) Huizinga, Laeven (2005)
Indirect: repatriation policy	Kopits (1972)	Kopits (1976)		Mutti (1981) Hines, Hubbard (1990) Altshuler, Newlon (1993) Altshuler et al (1995) Altshuler, Mintz (1995) Grubert (1998) Desai et al (2001) Altshuler, Grubert (2004) Desai et al (2006b)
Indirect: use of debt			Collins, Shackelford (1992) Froot, Hines (1995) Altshuler, Mintz (1995)	Desai et al (2004a)
Indirect: Legal form or choice of location		Desai, Hines (1999)	Stöwhase (2002)	Grubert, Slemrod (1998) Desai et al (2006a)
Indirect: patterns of trade				Clausing (2001)
Direct: observed prices				Swenson (2001b) Clausing (2003)

FIGURE 1: A DECISION TREE FOR MULTINATIONAL COMPANIES



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