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HOW DOES FIRM HETEROGENEITY AFFECT INTERNATIONAL TAX POLICY?

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Firms - even in a narrowly defined sector - differ vastly in their size and productivity (Bernard, Jensen, Redding and Schott 2007). A firm at the 90th percentile of the productivity distribution produces almost twice as much output with the same inputs as a firm at the 10th percentile of the productivity distribution (Syverson 2011). This empirically observed heterogeneity has become a core element of recent theoretical and empirical research in many sub-disciplines of economics, such as the international trade literature (based on the seminal theoretical contribution by Melitz 2003). Clearly, the heterogeneity of firms is also relevant to the proper and well-targeted design of international corporate tax policy. Nevertheless, the existing theoretical literature on international corporate taxation has largely been confined to settings where all firms are identical.

In this contribution we report on the still relatively small strand of theoretical research that incorporates firm heterogeneity into models of tax policy towards mobile, multinational firms. The issues addressed by this strand of research are both positive and normative. The positive questions are whether firm heterogeneity can help to explain the tax reforms that we have observed in recent decades, and whether it can contribute to our understanding of firms' reactions to tax policy. From a normative perspective, firm heterogeneity raises the question of whether firms with different levels of productivity should be taxed differently under an optimized corporate tax scheme, and what this differentiation should look like.

Implications for positive international tax theory

International competition for foreign direct investment

We first turn to the implications of firm heterogeneity for positive international tax theory. Table 1 compares statutory and effective corporate tax rates in 20 OECD countries in 1990 and 2014 and contrasts this with the development of corporate tax revenue. A first, and puzzling, observation is that corporate profit tax revenue has risen in the majority of OECD countries, even though tax rates have been sharply reduced simultaneously. This suggests an increase in the corporate tax base that is caused by a combination of rising profitability in the corporate sector and an increase in the number of incorporated firms (see Auerbach, Devereux and Simpson 2010 for further discussion). But with a larger corporate tax base, standard optimal tax theory would predict that tax rates should rise, rather than fall.

A second observation from Table 1 is that effective tax rates, which include changes in the corporate tax base, have fallen by less than statutory corporate tax rates. This suggests that the corporate tax base has been broadened along with the reduction in the statutory tax rate.² One explanation for this pattern of tax reforms is that countries compete primarily for the allocation of accounting profits in multinational enterprises (MNEs), and these are driven primarily by the statutory tax rate (Devereux, Lockwood and Redoano 2008). At the same time, countries broaden their tax bases to increase tax revenue at a margin that does not affect the profit allocation of MNEs.

Related to this, a third observation (not shown in Table 1) is that firms located in low-tax countries have a systematically higher profitability than firms located in countries with higher taxes (Hines 1999; Becker, Fuest and Riedel 2012). This runs counter to a basic tax arbitrage argument, which would predict that pre-tax profits should be higher in high-tax countries, in order for after-tax profits to equalize in a world of international capital mobility. The conventional explanation for this



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² Similar reforms have also been enacted in less developed countries (Klemm and van Parys 2012).

Table 1

Corporate taxation in 20 OECD countries						
	Statutory tax rate ^{a)} (in %)		Effective average tax rate ^{b)} (in %)		CIT (Capital income tax) revenue (% of GDP)	
	1990	2014	1990	2014	1990	2012
Australia	39	30	35	27	4.0	5.2
Austria	39	25	29 ^{d)}	22	1.4	2.2
Belgium	41	34	33 ^{d)}	28	2.0	3.0
Canada	28	15	39 ^{e)}	23	2.5	2.9
Denmark	40	25	30 ^{d)}	22	1.7	3.0
Finland	50	20	35 ^{c)}	18	1.9	2.1
France	37	38	31	32	2.2	2.5
Germany	60	31	49	27	1.7	1.8
Ireland	10	13	9 ^{d)}	11	1.6	2.3
Italy	46	30	38	24	3.7	2.8
Japan	50	38	43	34	6.4	3.7
Netherlands	35	25	30 ^{c)}	19	3.0	1.9
New Zealand	33 ^{c)}	28	30 ^{e)}	26	2.4	4.7
Norway	51	27	25 ^{c)}	25	3.7	10.5
Portugal	40	30	33 ^{f)}	25	2.1	2.7
Spain	40	35	34 ^{e)}	34	2.8	2.0
Sweden	52	22	26 ^{c)}	19	1.5	2.6
Switzerland	31	21	23 ^{d)}	17	1.7	2.8
United Kingdom	35	23	31	21	3.4	2.7
United States	40	40	35 ^{e)}	35	2.4	2.5
unweighted average	39.9	27.5	31.9	24.5	2.6	3.2

^{a)} including local taxes; ^{b)} see CBT Corporate Tax Ranking 2012, Appendix A for details of calculation; ^{c)} 1992; ^{d)} 1994; ^{e)} 1996; ^{f)} 1998; ^{g)} 1999

Source: Oxford University Centre for Business Taxation (2015), OECD (2014).

observation is that differences in the profitability of affiliates of a multinational group reflect profit shifting behavior from high-tax to low-tax countries. The question is, however, whether international profit shifting is the only explanation for both the observed tax-rate-cut-cum-base-broadening reforms and the higher profitability of firms in low-tax countries.

To address these issues, Davies and Eckel (2010) and Haufler and Stähler (2013) analyze two-country models of tax competition for internationally mobile firms that differ in their productivity. In equilibrium, the larger country chooses the higher tax rate.³ While this pattern

³ In these models, only an asymmetric tax equilibrium can exist. In particular, Haufler and Stähler (2013) show that a Nash equilibrium in taxes can exist in models with mobile, heterogeneous firms only when countries are sufficiently different with respect to their underlying market characteristics, such as country size. Intuitively, in cases where countries are very similar, each country will try to marginally underbid its neighbor in order to attract all the high-profitability firms. This “destabilizing” incentive will stop only when the equilibrium tax differential is so large that an underbidding strategy is too costly for the (large) high-tax country.

of tax differentiation is already known from models with homogeneous firms, the new feature arising from firm heterogeneity lies in the sorting of firms according to their productivity level. This sorting occurs because production costs are deductible from the corporate tax base; this deduction is more valuable in high-tax countries, and it is more valuable for firms with high production costs, i.e. low productivity. Therefore, in the location equilibrium, low productivity firms locate in the larger market, which has the higher marginal return to capital in equilibrium, but also the higher tax rate. By contrast, highly productive firms self-select into the small, low-tax country, because, for these highly profitable firms, the low tax rate overcompensates for the effect of the smaller market size. Therefore, the stylized fact that high-profitability firms tend to cluster in low-tax countries can be explained from the sorting of heterogeneous firms in a tax competition equilibrium, even in the absence of profit shifting.

A further result in models of tax competition with heterogeneous firms is that a simultaneous market expansion in both countries that increases corporate tax bases can lead to a fall in the corporate tax rate of both countries (Haufler and Stähler 2013, Proposition 4). This surprising result is obtained because an increase in market size (and hence profit opportunities) implies that firms react more sensitively to the existing international tax differential. As a result, some of the firms that originally locate in the large, high-tax country will move to the small, low-tax country following the market expansion. Hence, the pivotal firm (which is just indifferent between the two locations) changes, and it will be characterized by lower costs and hence higher profits in the new equilibrium. This makes the pivotal firm (still) more sensitive to any given tax differential and aggravates the tax competition between countries that compete for internationally mobile firms. In equilibrium, the increased elasticity of corporate tax bases dominates the higher level of tax bases from the perspective of both countries, thus causing equilibrium tax rates to fall.

As Table 1 has also shown, while tax rates have fallen, tax bases have been broadened in many countries. To explain this pattern of tax-rate-cut-cum-base-broadening reforms, Baldwin and Okubo (2009) and Bauer, Davies and Haufler (2014) endogenize the corporate tax base in models with firm heterogeneity and trade. The latter authors start from a trade model with product differentiation and imperfect competition. At the margin, countries have an incentive to subsidize capital by granting a tax allowance in excess of the true cost of capital. Trade integration then leads to higher effective tax rates on capital, and thus to a broadening of the corporate tax base. This is due to two effects. First, reduced trade costs imply that more foreign goods and fewer domestic goods are consumed in equilibrium. This, in turn, implies that subsidies to increase domestic production become less effective as economic integration proceeds, and hence the optimal policy is to reduce these subsidies. This effect is also present in models with homogeneous firms. However, in a model with firm heterogeneity there is a second reason for governments to increase effective tax rates on domestic firms: this policy replaces low-productivity domestic producers with high-productivity producers from abroad. Thus the aggregate costs of supplying domestic consumers with the differentiated good fall when the domestic corporate tax base is broadened. Therefore, firm heterogeneity provides a rationale for the broadening of domestic tax bases that goes beyond the mere collection of higher corporate tax revenues.

In conjunction with the results of Haufler and Stähler (2013), these findings match the combination of rising corporate tax revenue, broadened tax bases and sharply reduced corporate tax rates that has characterized corporate tax policy in OECD countries over the last decades (see Table 1). These stylized facts can therefore be explained solely by the competition for foreign direct investment when firm heterogeneity is incorporated into the analysis. The studies thus offer a complementary explanation to the tax competition for profit shifting in multinational firms, on which a large part of the existing literature has focused.

Profit shifting by multinational firms

Firm heterogeneity also has implications for the profit-shifting opportunities of multinational firms. Bauer and Langenmayr (2013) analyze profit taxation under the ruling arm's length principle in the presence of heterogeneous firms. The arm's length principle states that for tax purposes, transactions between different subsidiaries of multinational corporations have to be treated as if they had taken place between independent parties. In other words, the "price" for internal transactions has to be the same as the price observed in the market for the same input.

This presumes that there are no fundamental differences between transactions within a multinational firm and among independent firms. Otherwise, the implied price for taxation is not correct. However, the international trade literature has shown that integrated, multinational firms are much more productive than domestic firms. In fact, it is this higher productivity that allows these firms to incur internationalization costs and to become multinationals in the first place. They can thus produce the input at a lower cost than the price at which it sells on the market. In addition, market prices include a mark-up that arises from the bargaining between the firm and the independent supplier. As a subsidiary within a multinational firm has less bargaining power than an independent supplier, this mark-up also implies that market prices are higher than input prices within the firm.

Bauer and Langenmayr (2013) model the decision of the firm between outsourcing and integrating the production of the input and analyze the consequences of this decision for the effective tax burden of the firm. They show that if the integrated firm uses the observed market price to value intra-firm transactions for tax purposes (as the tax law requires it to do), it pays less tax in its home country and more in the location where

it produces the input – but the latter is potentially a strategically chosen low-tax jurisdiction. As a result, the integrated, multinational company pays less tax than a comparable domestic firm that obtains inputs from an independent supplier abroad. Thus, including the productivity differences between multinational and domestic enterprises explains why multinational firms pay less tax (relative to their profits) than purely domestic companies, even when the multinational firms do not strategically influence transfer prices to minimize their tax burden. This result contributes to explaining the empirical evidence: Egger, Eggert and Winner (2010), for example, estimate that in European high-tax countries, subsidiaries of multinational corporations pay on average 32-57 percent less tax than similar domestically-owned firms.

Of course, the low tax burden of multinational firms can also arise because these firms shift profits abroad on purpose. Desai, Foley and Hines (2006) have shown that larger (and thus highly productive) firms are more likely to do so. Krautheim and Schmidt-Eisenlohr (2011) set up a model that reflects this empirical observation. They then study the competition in tax rates between a large country and a tax haven. As firms cannot produce in the tax haven, the two countries compete only for the firms' profits. In this model, a higher degree of firm heterogeneity increases the intensity of tax competition. More heterogeneity implies that there are more highly productive firms. As these firms react more strongly to tax rate differentials than low productivity firms, the large country has to lower its tax rate by a more significant amount. Nevertheless, a larger share of its tax base is shifted to the tax haven when firms are more heterogeneous. Thus, the existence of tax havens is more harmful for countries with a high level of firm heterogeneity.

Langenmayr (2015) proposes a similar model where governments can enact specific policies to limit profit shifting activities, such as thin capitalization rules or regulations on transfer prices. However, as these regulations can only focus on the means to shift profits, not on profit shifting itself, they impose costs also on firms that do not actively shift profits. Such policies can thus force low-productivity firms to exit the market. The resulting lower competition makes the remaining firms more profitable and induces them to shift even more profits abroad. Thus, because of firm heterogeneity, regulations to limit profit shifting may be self-defeating if they impose a large compliance burden on all firms.

Implications for normative international tax theory

As the discussion above has shown, the effective tax burdens differ among firms with different productivity levels. One core issue in the research on firms with heterogeneous productivity is therefore whether optimal government policies should discriminate between firms with different productivity – and if so, in which direction. This question is taken up in Langenmayr, Haufler and Bauer (2015). To simplify the analysis, the model incorporates firms with only two productivity levels, high and low. Consistent with empirical and theoretical results from the new trade theory, the high productivity firms will also be the large firms in equilibrium.

In the model, the government has two tax instruments at its disposal, the statutory tax rate and a tax base parameter. While the statutory tax rate is constrained to be the same for all firms, the tax base parameter, and hence the effective tax rate, can vary. Such discriminatory effects arise, for example, from thin capitalization rules that limit the deduction of interest payments from the corporate tax base. In many countries, thin capitalization rules allow the full deduction of interest paid up to some absolute threshold value (see Table 2). Other things being equal, such tax codes imply that the deductibility of interest is higher, and the effective tax rate is therefore lower, for smaller firms. On the other hand, large firms have been empirically shown to reduce their tax base more aggressively through corporate tax noncompliance. To the extent that these transactions are not audited rigorously, tax policy can thus also discriminate in favor of larger and more productive firms.

The statutory tax rate that the government sets in this model is determined endogenously in the competition with a tax haven. In equilibrium, the statutory tax rate is thus high when the cost of shifting profits to the tax haven is high (and tax competition is accordingly weak). The optimally differentiated tax base policy depends critically on the degree of international tax competition. When tax competition is weak and optimal profit tax rates are high, favoring high-productivity firms is the optimal policy. When tax competition is aggressive and profit taxes are low, however, the optimal tax policy reverses and favors low-productivity firms.

The reason for this switch in the pattern of optimal tax differentiation is that tax policy pursues two conflicting goals. On the one hand, the government seeks to increase tax revenues by broadening the tax base of high-

Table 2

Thin capitalization rules in EU-15 countries			
Country	Scheme	Threshold	Introduced in
Austria	<i>No thin capitalization rule</i>		
Belgium	Thin capitalization rule, debt-to-equity ratio 5:1		2012
Denmark	Interest cap, 80% of profits	Interest > kr. 21.3m	2007
Finland	Interest cap, 30% of EBITDA ^{a)}	Interest > € 0.5m	2014
France	Thin capitalization rule, int. debt-to-equity ratio 1.5:1	Interest > € 0.15m	2007
Germany	Interest cap, 30% EBITDA	Interest > € 3m	2008
Greece	Interest cap, 25% EBITDA	Interest > € 1m	2014
Ireland	<i>No thin capitalization rule</i>		
Italy	Interest cap, 30% EBITDA		2008
Luxembourg	<i>No thin capitalization rule</i>		
Netherlands	Restriction of interest deduction	Interest > € 0.75m	2013
Portugal	Interest cap, 30% EBITDA	Interest > € 3m	2013
Spain	Interest cap, 30% EBITDA	Interest > € 1m	2012
Sweden	<i>No thin capitalization rule, some rules on deductibility of internal debt</i>		
United Kingdom	Worldwide debt cap	Large groups (EU definition)	2010
^{a)} Earnings before interests, taxes, depreciation and amortization Notes: Limitation on interest deductibility in EU-15 countries. The year in the last column refers to the introduction or the last substantial change in the rules regarding interest deductibility.			
Source: Langenmayr, Haufler and Bauer (2015).			

ly productive and partly foreign-owned multinational firms. On the other hand, tax policy can increase the total productivity of the domestic economy by favoring the highly productive firms. This second objective will dominate when the government can capture a sufficiently large share of aggregate profits by means of a high profit tax rate. As profit tax rates fall due to tax competition, the first motive of raising more tax revenues from highly profitable firms by broadening their tax base becomes increasingly important.

The analysis thus predicts a fall in the tax advantages of large, productive enterprises as a result of economic integration and more aggressive corporate tax competition. This explains why many countries have countered the fall in statutory corporate tax rates over the last three decades by more serious attempts to increase the corporate tax base of the most productive firms. The German corporate tax reform of 2008, which is explicitly aimed at increasing the effective taxation of the largest (and most productive) multinational firms, is a typical example of such policies. Many other countries have also recently introduced measures aimed at limiting the tax advantages of large and highly profitable firms. A typical example is the proliferation of thin capitalization rules, shown above in Table 2. The model

thus gives an explanation for why these measures were aimed at large firms.

In summary, firm heterogeneity has important implications for both positive and normative tax theory. It contributes to an understanding of the observed patterns of corporate tax reforms and to explaining both the aggressive reduction of statutory tax rates and the comparatively low tax payments of multinational firms. This more detailed explanation of the forces shaping international tax competition is, in turn, important to shaping tax policy in the face of major productivity differences within the corporate sector.

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