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Multinationals and Tax Evasion: Estimating a Direct Channel for Income Shifting*

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Abstract

We estimate the importance of tax induced transfer pricing by Norwegian based multinational enterprises in the period 1999-2004. We find strong support for intra firm transfer pricing related to tax incentives. The incentive is estimated both at the parent firm level by including parent firm fixed effects, and at the affiliate level, by including affiliate firm fixed effects. Tax motivated manipulation of transfer prices are particularly strong for firms that use one of the big four international accounting firms, for big firms and for firms being controlled by domestic owners. Manipulation of transfer prices are more pronounced for larger differences in home and host country tax rates.

JEL.CLASS.NO: F23, H26, H87

KEYWORDS: Transfer pricing, Income shifting, Corporate tax rates

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1 Introduction

Transfer pricing is recognized as one of the biggest tax avoidance schemes for multinational firms. Through globalization, multinational firms can structure their operations in ways that gives them huge discretion in allocating cost to each country where it is localized and shift profit through intra firm trade. Transfer pricing is also big business for the big accounting firms. Allegedly, Ernst & Young alone employs over 900 professionals to sell transfer pricing schemes, and clients pay top accountancy firms up to £500,000 a time to invent tax-avoidance schemes. This is among the findings reported during a recent two-week long investigation by the Guardian, where they examined the accounts of the UK's biggest companies.¹ The reported findings in the investigation shows that British firms to a considerable extent shift profits out of the country and minimize UK tax by a series of sophisticated tax avoidance schemes.

This paper is an empirical investigation of how differences in national taxes affect prices and quantities that make up net intra firm trade flows among multinationals in Norway using a comprehensive firm level data set from the census of Norwegian based MNEs.² The data set comprises the value of all transactions, both inwards and outwards, between a parent MNE and each of it's affiliated firms abroad. In a first step we set up a theoretical model that predicts how net trade flows are affected by international taxation. We then test the theoretical predictions that follows from the model using micro level panel data of all Norwegian multinationals and their wholly controlled affiliates in the OECD area in the period 1999-2004. Our empirical approach has several advantages compared to the previous literature. One important difference is that we study the source of profit shifting itself, namely intrafirm trade flows, instead of relying on more indirect measures of profit shifting as is typical in this literature. Another particular feature of our analysis is that we are able to control for unobserved heterogeneity at the affiliate firm level as well as at the parent firm level. Hence, we are able to identify the within affiliate response to a tax rate change in the host country, as well as the within parent MNE response to tax rate differences across countries

¹<http://www.guardian.co.uk/business/series/tax-gap>

²A Norwegian based MNE is a Norwegian company, or a Norwegian affiliate of a foreign company, with one or more foreign affiliates.

where its affiliates are localized. Our analysis enable us to study whether international tax differentials seem to significantly influence transfer prices within multinational enterprises. That is, if the multinational enterprises in our study reallocate taxable income from countries with high tax rates to countries with low tax rates by underpricing goods sold *to* affiliates in low tax countries and overpricing goods sold *by* affiliates in low tax countries, and following the opposite pattern for transactions with affiliates in high tax countries. To the extent that MNE's have affiliates in countries with different tax rates we can identify whether these tax differentials significantly influence the MNE's transfer prices across it's affiliates by including MNE parent fixed effects, in addition to parent, affiliate and host country observables. On the other hand, to the extent that host country tax rates changes over time we can identify whether these tax changes significantly changes the MNE's transfer pricing towards the affiliates localized in these countries by including affiliate fixed effects in addition to observable controls.

Our study relates to a literature on transfer pricing that can be divided into three groups. The first group tries to verify transfer pricing indirectly by relying on statistical relationships to explain differences in pre-tax profits by foreign affiliates by differences in statutory corporate tax rates controlling for firm and country specifics. Recent studies that survey this literature are ??, ?, and ?.³ Profitability is only indirectly related to tax induced transfer pricing incentives. The relationship is even less clear when the parent MNE control affiliates in several countries, and especially when it's affiliates are located in countries where the statutory tax rate is both higher and lower than the home country tax rate. In such cases, the MNE may transfer income *to* the host country with low tax rate and *from* the host country with lower rates, and because the contribution to

³There are two studies on Norwegian data in this category. ? compare the profitability of Norwegian-owned and foreign-owned companies in manufacturing and trade in the years 1993 to 1996, and ? extends their study both in terms of the identification strategy and the time period that is covered. They both find that foreign-owned enterprises have a profit that is lower than Norwegian-owned enterprises. This is consistent with a net shifting of profits out of Norway by foreign-owned enterprises. Our analysis depart from the two earlier studies in two important ways. For one, whereas the population of MNEs in their study consist of Norwegian affiliates of foreign MNEs, the population of MNEs in the current study consist of the Norwegian parent MNE and their foreign affiliates in the OECD area. These two populations does only partly overlap. Moreover, including relationships outside the OECD area means that many more low tax countries are included in the earlier studies.

the MNE's home country profit is aggregated across all FDI activity we may fail to trace any activity of transfer pricing by investigating the MNEs profitability. The second group examines prices on traded goods. ? use product-level data from the trade statics and examines how prices on traded products are affected by differences in national tax rates. He finds that prices on internationally traded goods are sensitive to tax rate differentials across countries. ? investigates intra firm data on prices from the Bureau of Labor Statics in the US. She finds evidence for manipulated prices in order to save tax. The third group of papers study trade flows and whether they are affected by tax rate differentials. ? uses a panel data set on U.S. multinational firms operations. She finds that tax avoidance incentives are correlated with the pattern of U.S. international trade. ? uses Treasury tax return data to study location decisions, determinants of firm profitability as well as transfer pricing incentives related to intrafirm trade flows. He finds that intrafirm trade flows are larger between countries with large tax differentials and thus, that trade flows are positively correlated with tax avoidance incentives. ? uses micro level panel data of German affiliates in 31 countries during the period 1996-2003. He finds that the size of balance sheet items which reflects intra firm sales are negatively correlated with tax rate differentials across countries.

We find evidence for that multinational firms manipulate prices and quantities across time and across countries so that profit is shifted to low tax countries. In particular, using parent firm fixed effects to control for unobserved heterogeneity at the parent MNE level, our data show that the MNE adjust prices of intra firm trade across it's affiliates according to tax incentives for transfer pricing. Further, using affiliate fixed effects to control for unobserved heterogeneity at the bilateral parent-affiliate level, our data indicates that multinationals manipulate prices of intrafirm export and import in response to changes in the host country statutory tax rate. Large firms and firms with longer experience as a MNE, seem to do this more than small firms, and foreign owned affiliates in Norway seems to engage to an lesser extent in transfer pricing than firms with HQs in Norway. We also find clear support for that affiliates of multinational firms that use one of the four big international accounting firms shift more profit than firms that use domestic accountants.

Since the variables we observe and are estimating a response with respect to,

i.e., export- and import values, consist of a price and a quantity component it is not straightforward to predict what the anticipated sign of the coefficients is in the case of tax motivated transfer pricing. In order to make this clear we first present a simple theoretical model for transfer pricing in a multinational enterprise. This is done in Section ???. The rest of the paper is organized as follows. Section ??? explains the identification strategies, whereas Section ??? describes the data. Section ??? presents the empirical results and, finally, Section ??? give our conclusions.

2 A model of intercompany imports and exports and income shifting

In order to bring forward the incentives for how multinationals manipulate prices and quantities on intra firm transactions across countries we consider a multinational enterprise (MNE) that has a parent company in country i and subsidiaries in country $j = \{2, \dots, m\}$. The parent company exports x_{ij} at a price q_{ij} to its subsidiary located in country j , which sells the good to consumers in country j at a price p_j . Similarly, the affiliate in country j produces quantity x_{ji} that is sold to the parent company at a price q_{ji} . The parent company sells the imported product to domestic consumers at price p_i . The cost of production by the parent company and its affiliate are $k_i(x_{ij})$ and $k_j(x_{ji})$ and we shall assume that this is linear. In the continuation we shall use a shortcut for the derivative as follows $k'_i = \partial k_i / \partial x_{ij}$ (and similarly $k'_j = \partial k_j / \partial x_{ji}$). In order to simplify the analysis we shall also invoke the common assumption of monopoly in all markets in order to purely focus on tax incentives.

In order to prevent profit shifting, we assume that a transfer price that deviates from the true price of the good involves resource costs to each firm, which are a convex function of the difference between the declared price and true price (marginal cost of production). This assumption is standard in the transfer pricing literature and can be justified either by an increased probability of detection by national tax authorities, or as concealment costs related to the use of lawyers and accountants. We shall denote the concealment function by $c_i[q_{ij} - k'_i(x_{ij})]$,

and require it to possess the following properties

$$c_i(0) = c'_i(0) = 0, \quad \text{sign}(c'_i(\cdot)) = \text{sign}(q_{ij} - k'_i(x_{ij})), \quad c''_i(\cdot) > 0$$

In order to incorporate taxes and their effect on the transfer price, we need to specify the international tax principle in operation. It is generally accepted in international tax law that the source country has a first right to tax profits of all firms operating within its borders. Repatriated profits in the form of dividends are either subject to tax in the home country in which case most often a limited tax credit is given, or repatriated dividends are exempted altogether. The exemption method is widely used in OECD countries as well as the EU due to the Parent-Subsidiary Directive (90/435/EWG). In either case whether a limited tax credit applies or repatriated profits are exempt from domestic taxation, profits at home and abroad are taxed at different effective tax rates. It is for this reason that it is often argued that the source principle of taxation applies to corporate income (see Keen 1993, find right citation). Further, if a company shifts a dollar of income from one foreign country to another, holding investment and economic activity constant, the potential tax saving depends upon the difference in the statutory corporate tax rates, rather than in effective tax rates. With these specifications, global net profit of the multinational firm are

$$\Pi = (1 - \tau_i)\pi_i + \sum_{j=2}^m (1 - \tau_j)\pi_j, \quad (1)$$

We shall assume for ease of exposition that the exemption method is in place. The maximization problem of the firm can then be written out in full as

$$\begin{aligned} \Pi = \max_{x_{ij}, x_{ji}, q_{ij}, q_{ji}} & \left\{ (1 - \tau_i) \left[\sum_{j=2}^m (p_i(x_{ji})x_{ji} - q_{ji}x_{ji} + q_{ij}x_{ij} \right. \right. \\ & \left. \left. - k_i(x_{ij}) - c_i[q_{ij} - k'_i(x_{ij})]) \right] \right. \\ & \left. + \sum_{j=2}^m (1 - \tau_j) (p_j(x_{ij})x_{ij} - q_{ij}x_{ij} + q_{ji}x_{ji} - k_j(x_{ji}) - c_j[q_{ji} - k'_j(x_{ji})]) \right\} \end{aligned} \quad (2)$$

In what follows we shall limit our attention to the simple case of the parent

company and only one affiliate without any consequence for the qualitative insights we are about to derive.⁴ The first order conditions that follows from the maximization problem (??) can be written as:

$$\begin{aligned}
 (\tau_j - \tau_i) q_{ij} - (1 - \tau_i) k'_i(x_{ij}) + (1 - \tau_j) (p'_j(x_{ij})x_{ij} + p_j(x_{ij})) &= 0 & (x_{ij}) \\
 (\tau_j - \tau_i) x_{ij} - (1 - \tau_i) c'_i[q_{ij} - k'_i(x_{ij})] &= 0 & (q_{ij}) \\
 (\tau_i - \tau_j) q_{ji} - (1 - \tau_j) k'_j(x_{ji}) + (1 - \tau_i) (p'_i(x_{ji})x_{ji} + p_i(x_{ji})) &= 0 & (x_{ji}) \\
 (\tau_i - \tau_j) x_{ji} - (1 - \tau_j) c'_j[q_{ji} - k'_j(x_{ji})] &= 0 & (q_{ji})
 \end{aligned}$$

It can be seen from the first order conditions that if $\tau_i = \tau_j$, then $q_{ij} = k'_i$ (from $c'_i = 0$) and $q_{ji} = k'_j$ (from $c'_j = 0$) so the incentive to deviate from marginal cost pricing vanishes when taxes are equal. In general taxes are not equal and we can through comparative static analysis show that⁵

$$\begin{aligned}
 \forall(\tau_i, \tau_j) : & \quad \frac{dq_{ij}}{d\tau_i} < 0, & \quad \frac{dq_{ji}}{d\tau_i} > 0, \\
 \tau_i > \tau_j : & \quad \frac{dx_{ij}}{d\tau_i} > 0, & \quad \frac{dx_{ji}}{d\tau_i} > 0, \\
 \tau_i < \tau_j : & \quad \frac{dx_{ij}}{d\tau_i} < 0, & \quad \frac{dx_{ji}}{d\tau_i} < 0.
 \end{aligned} \tag{3}$$

Starting from $\tau_i > \tau_j$, equation (??) shows that a rise in τ_i makes it even more profitable to shift profit by a high transfer price from country i to country j . This is done by underinvoicing exports from the parent firm in country i and overinvoicing exports to country i . A lower export price from the parent firm leads the importing firm to expand its demand for good x_{ij} , whilst the profit shifting motive leads the affiliate in the high tax country to expand its import of good x_{ji} .

We now turn to analyze how taxes affect net trade flows. The net export value

⁴Only examining two firms does not affect the incentive to manipulate the price of imported and exported goods between country i and j , since the transfer price only depend on τ_i and τ_j , and thus, is independent of whether the parent company has one or several affiliates

⁵The full expressions are relegated to the Appendix.

NE of the parent firm in country i is exports (E) minus imports (M), that is

$$NE = E - M = q_{ij}x_{ij} - q_{ji}x_{ji}$$

Totally differentiating NE yields

$$\Delta NE = \underbrace{\left(\frac{\partial q_{ij}}{\partial \tau_i} x_{ij} + q_{ij} \frac{\partial x_{ij}}{\partial \tau_i} \right)}_{\Delta E = \text{change export value}} - \underbrace{\left(\frac{\partial q_{ji}}{\partial \tau_i} x_{ji} + q_{ji} \frac{\partial x_{ji}}{\partial \tau_i} \right)}_{\Delta M = \text{change import value}} \quad (4)$$

Using information from (??) in (??), it can be shown that

$$\begin{aligned} \tau_i > \tau_j : \quad \Delta NE &= \underbrace{\Delta E}_{-/+} - \underbrace{\Delta M}_{+} = \underbrace{\frac{\partial q_{ij}}{\partial \tau_i} x_{ij}}_{-} + \underbrace{q_{ij} \frac{\partial x_{ij}}{\partial \tau_i}}_{+} - \underbrace{\frac{\partial q_{ji}}{\partial \tau_i} x_{ji}}_{+} - \underbrace{q_{ji} \frac{\partial x_{ji}}{\partial \tau_i}}_{+} \\ \tau_i < \tau_j : \quad \Delta NE &= \underbrace{\Delta E}_{-} - \underbrace{\Delta M}_{+/-} = \underbrace{\frac{\partial q_{ij}}{\partial \tau_i} x_{ij}}_{-} + \underbrace{q_{ij} \frac{\partial x_{ij}}{\partial \tau_i}}_{-} - \underbrace{\frac{\partial q_{ji}}{\partial \tau_i} x_{ji}}_{+} - \underbrace{q_{ji} \frac{\partial x_{ji}}{\partial \tau_i}}_{-} \end{aligned}$$

When $\tau_i > \tau_j$ it is profitable for the multinational firm to shift profit from the parent firm located in country i to the affiliate located in country j . It can do this in two ways; either by underinvoicing exports from the parent firm thereby reducing the parents income or increasing its costs by overinvoicing imports from the affiliate in country j . As seen from equations (??) and (??), the profit shifting motive of the affiliate in country j is unambiguously positive so $\Delta M > 0$. This means that both the transfer price and the quantity exported rises following an increase in τ_i . This unambiguously brings down taxable profit by the parent firm in country i . In country i the parent firm lowers its transfer price in order to underinvoice its exports, but as the export price to the affiliate in country j falls, the affiliate in j demands more of the good since its profit margin rises as the import price falls. We shall call this the quantity effect; it may dominate the effect of a falling transfer price, and if this occurs, the export value of the parent firm rises. But in general this effect is ambiguous ($\Delta E \gtrless 0$). Taking into account the export and import effect together, the quantity effect is second order in nature and is expected to be dominated by the profit shifting motive of the multinational firm, leading to a fall in net exports ($\Delta NE < 0$). We may state this as follows:

Hypothesis 1 *When $\tau_i > \tau_j$, an increase in τ_i leads to an increase in the value of imports of the parent firm ($\Delta M > 0$) in order to shift profit to country j , while the effect on exports of the parent firm are ambiguous ($\Delta E \gtrless 0$). When the profit shifting motive dominates the quantity effect, the net export value falls ($\Delta NE < 0$).*

Hypothesis 2 *When $\tau_i < \tau_j$, an increase in τ_i leads to a fall in the value of exports of the parent firm ($\Delta E < 0$) since it has become more profitable to profit to country i , while the effect on imports of the parent firm are ambiguous ($\Delta M \gtrless 0$). When the profit shifting motive dominates the quantity effect, the net export value falls ($\Delta NE < 0$).*

It is straightforward to show the same type of results as in Hypothesis 1 and 2 for a change in τ_j , but with a reversal of the inequalities. More importantly, Hypothesis 1 and 2 show that the value of net export is *negatively correlated with tax rate differentials*; as the tax rate increases in one country, this affects the net value of exports (ΔNE) negatively.

3 Empirical specification

The purpose of the study is to examine multinational firms' responses to changes in the difference between the Norwegian corporate tax rate and corporate taxes in countries where it's affiliate is localized. The theoretical analysis predicted a negative monotonic relationship between net export from the parent firm's point of view and the difference in the two countries statutory tax rates. Further, the theoretical model predicted a positive bivariate relationship between the value of import and the difference between home and host country tax rates ($\tau_i - \tau_j$) when home country tax is the highest or the tax rate difference approaches zero. The relationship cannot be unequivocally established in cases when the home country tax rate is strictly lower. The opposite pattern is predicted for the bivariate relationship between the value of export and the difference between home and host country tax rates ($\tau_i - \tau_j$); when taxes are equal or the home country tax rate is strictly smaller the model predicts a negative relationship, whereas the relationship cannot be unequivocally established in cases when the host country

tax rate is strictly lower.

Taking these theoretical predictions into account, our empirical specifications will mainly focus how the difference between the statutory tax rate in the MNE's home and host country ($\tau_i - \tau_j$) affects intra firm net export, while controlling for observable firm, affiliate, and host country characteristics, as well as time- and sector specific trends on the difference between the statutory tax rate in the MNE's home and host country ($\tau_i - \tau_j$). Transfer pricing in multinational enterprises can be carried out both by applying different prices on intra firm trade towards its affiliates located in countries with different tax rates, and by changing prices on intrafirm trade when the tax rate differential between the home and the host country changes. Thus, to the extent that the multinational enterprises in our data controls affiliates in several countries with different corporate tax rates, we are able to identify the extent of within-MNE transfer pricing by controlling for (Norwegian) parent specific unobserved heterogeneity. We estimate the within firm response to tax rate differences across its locations by introducing parent-MNE fixed effects in our regressions. We then continue by estimating the response to tax rate changes by utilising host country tax rate changes that takes place between 1999 and 2004 by including affiliate level fixed effects. Figure ?? gives an illustration of the across- and within country tax rate variations the estimations rely on. In order to qualify the estimation results we perform several robustness checks.

3.1 Within MNE response to across affiliate tax rate differences

We estimate a model that specify a linear relationship between intra firm net export and the tax rate difference ($\tau_i - \tau_j$). The model is specified as follows

$$NE_{ikt} = \beta_0 + \beta_1(\tau_t^i - \tau_t^j) + X'_{it}\boldsymbol{\rho} + Y'_{kt}\boldsymbol{\varphi} + Z'_{jt}\boldsymbol{\delta} + \boldsymbol{\xi}_t + \mathbf{v}_s + \boldsymbol{\xi}_t \times \mathbf{v}_s + \alpha_i + \varepsilon_{ikt} \quad (5)$$

where NE_{ikt} is the value of net export from the parent firm i to the affiliate firm k , firm i is always localized in Norway. Further, X'_{it} is a vector of observable characteristics for firm i in year t , Y'_{kt} is a vector of observable characteristics for

the affiliate k in year t , Z'_{jt} is a vector of country characteristics for country j in year t , and ξ_t and v_s are year and sector dummies.⁶ Finally, α_i absorbs unobserved parent MNE fixed effects and ε_{ijt} is exogenous disturbance. Hence, β_1 predicts the change in the level of intra firm net export due to differences in the host country statutory tax rates relative to the home country statutory tax rate, and this is expected to be negative. Firm level control variables we will be using are age of the parent MNE, home country sales volume, home country sales volume squared, total assets parent MNE, and the ratio of debt to capital (leverage). In particular, the balance-sheet data enable us to identify the accounting firm used by the firm, and we use this information to construct a dummy variable to identify whether the firm uses one of the big four accounting firms.⁷ As control variable for the affiliate we use total assets from the affiliate balance-sheet, whereas we include population and GDP per capita as country controls. We also allows for heterogeneous responses across the population of firms in an saturated model that takes into account foreign versus domestic ownership of the parent MNE, the use of one of the big accounting firms, and firm size.

Fixed effects are introduced to control for time-invariant unobservable heterogeneity at the parent firm level. As an alternative to parent MNE fixed effects we could have introduced affiliate level fixed effects and estimate β solely from within country tax rate variation. However, to the extent that an MNE has established affiliates in countries with different statutory tax rates, this would remove useful information. If we were to control for fixed effects at the affiliate level we are ignoring that the same firm will set prices on intra firm trade differently across it's affiliates because of differences in tax rates, which is exactly the hypothesis we want to test. For firms with a single foreign affiliate we exploit information

⁶We use 7 or 41 sectors according to the one- and two digit level industry classification

⁷These are PriceWaterhouseCoopers, Deloitte Touche, Ernst & Young, and KPMG. A quick glance at their web pages suggests that they have a substantial focus on transfer pricing. For instance, Ernst & Young alone employs over 900 professionals to sell transfer pricing schemes according to a Guardian article, (<http://www.guardian.co.uk/commentisfree/2009/feb/11/taxavoidance-tax>). The Guardian examined the extent of tax avoidance by big business over two weeks in February 2009, see <http://www.guardian.co.uk/business/series/tax-gap> for a day-by-day overview of published articles on the theme. As stated in of the articles in the series "...armies of accountants are devoted to the job ["transfer pricing"] under such euphemistic initiatives as "tax efficient supply chain management".". For instance, a reference to a 2005 internal HMRC study indicating that 50% of the big four's tax fees came from "commercial tax planning" and "artificial avoidance schemes", indicates that the "big four" play an important role.

about how intra firm trade changes over time when the tax rate changes in the home or host country. For these firms it does not matter whether we include firm or affiliate fixed effects. For firms controlling several foreign affiliates we exploit information about how intra firm trade differs vis a vis affiliates paying different tax rates. By including firm fixed effects thus, tax motivated manipulation of transfer prices is identified from tax variations within affiliates, and also across affiliates but within the firm.

In order to limit the potential problem of heteroscedasticity in the fitted model caused by extremes in scale between large and small firms, we explore alternative transformations of the dependent trade variables, such as a log transformation (treating trade between -1 and 1 as zero) and different scale transformations, including trade scaled by home country sales and by total intra firm trade. It turns out that the qualitative results are robust to most transformations. We report some results for regressions on log transformed trade variables, but concentrate on results for regressions on untransformed variables. Finally, taking into account that the error term may be correlated over affiliates standard errors are clustered by affiliates. We also undertake several robustness checks of the results.

A potential weakness with this fixed effects specification is that the size of firms' FDI may be correlated with tax rate differentials, and that the size of intra firm trade is complementary to the FDI size. However, the data does not show any correlation between tax rate differentials and total assets in the affiliates; the semi elasticity of total assets with respect to tax rate differentials are small and insignificant. Still, if the investment decision is not significantly affected by tax rate differentials for the firms and the time span we are studying, the estimated model including parent firms fixed effects may still be insufficient in explaining the firms transfer pricing incentives. First, the centralized model where the headquarter maximizes global after tax profit by setting both transfer prices and quantities may not be the correct assumption, and strategic incentives may conflict with the tax incentives if quantity decisions are delegated to host country affiliates. Secondly, across country differences in statutory tax rates may not be a perfect estimate of the across country transfer pricing incentives. Next, trade values are also affected by exchange rates movements, which is an omitted

variable in our study. If all problems above are absent, it should not matter much whether we include parent or affiliate fixed effects in our model. However, the model specification in the following section estimate the MNEs response solely to tax rate differences over time and within each country where it's affiliate is localized.

3.2 Within affiliate response to within country tax rate changes

In order to obtain estimates of the within affiliate response to tax rate changes that takes place within countries we include affiliate fixed effects instead of parent fixed effects in ?? and estimate the following model:

$$NE_{ikt} = \beta_0 + \beta_1(\tau_t^i - \tau_t^j) + X'_{it}\boldsymbol{\rho} + Y'_{kt}\boldsymbol{\varphi} + Z'_{jt}\boldsymbol{\delta} + \boldsymbol{\xi}_t + \boldsymbol{v}_s + \boldsymbol{\xi}_t \times \boldsymbol{v}_s + \alpha_k + \varepsilon_{ikt} \quad (6)$$

The only difference between (??) and (??) is the inclusion of α_k instead of α_i . Apart for that, all variable definitions and controls are the same in the two models.

An alternative estimate of the reduction in net export following a tax rate reduction can be obtained by looking at the yearly changes in net export on all parent-affiliate relationships in the data. In a differences-in-differences framework we estimate the yearly change in net export on MNE-relations that experiences a tax change in the first year with the lower or higher tax rate relative to the yearly change in net export in any other typical year and for any other typical firm that do not experience a tax reduction. That is, we regress the yearly change in net export on the change in the host country statutory tax rate. Affiliates in countries where the tax rate changes are in the treatment group in the first year with the lower or higher tax rate and all other year-affiliate observations of yearly changes constitutes the control group.

The following equation is estimated:

$$NE_{ikt} - NE_{ikt-1} = \Delta NE_{ikt} = \Delta \xi_t + \mu_0 \Delta \tau_t^j + \Delta X'_{it}\boldsymbol{\rho}_0 + \Delta Y'_{kt}\boldsymbol{\varphi}_0 + \Delta Z'_{jt}\boldsymbol{\delta}_0 + \Delta \varepsilon_{ikt}, \quad (7)$$

where the Δ -prefix denote that the variable measure the change from one year to the next. The coefficient μ_0 is the estimated response with respect to net export at the mean firm to an increase in the host country tax rate of one percentage point relative to the yearly change in net export in any other year without any tax rate change in the host country.

Taking into account that the incentives to shift profit might be asymmetric with respect to the direction of the tax change, we allow for heterogeneous tax change responses by introducing two year-country specific dummies, U_t^j and D_t^j , for the positive and negative changes in the host country tax rate instead of using the level of the change ($\tau_t^i - \tau_t^j$) directly. Hence, U_t^j is equal to one if the tax rate in host country j is increased from year $t - 1$ to t , and zero otherwise, and D_t^j is equal to one if the tax rate in host country j is decreased from year $t - 1$ to t , and zero otherwise, if both dummies are equal to zero the host country tax rate is unchanged, i.e., it captures a change either to a “high tax state” or a “low tax state”, with the control group being all affiliate-year observation with no tax change taking place.

Instead of (??) we estimate:

$$NE_{ikt} - NE_{ikt-1} = \Delta NE_{ikt} = \Delta \xi_t + \mu_1 D_t^k + \mu_2 U_t^k + \Delta X'_{it} \boldsymbol{\varrho}_1 + \Delta Y'_{kt} \boldsymbol{\varphi}_1 + \Delta Z'_{jt} \boldsymbol{\delta}_1 + \Delta \varepsilon_{ikt}, \quad (8)$$

μ_1 is the response with respect to net export at the mean firm, pooled across all occurrences of host country tax rate increases (big and small), whereas μ_2 is the response with respect to net export at the mean firm, pooled across all occurrences of host country tax rate decreases (big and small), relative to the yearly change in net export in any other year or country without any tax rate change in the host country.

4 Data and variable definitions

Our data set contains balance-sheet data for the entire population of Norwegian firms for the years 1992-2004. The source for this register is the annual financial

account filings from the Norwegian Register of Company Accounts, made available by Dun & Bradstreet. Second, our data on intra firm transactions between MNE's localized in Norway and it's foreign affiliates is obtained from a register of outward FDI (called "Utenlandsoppgaven"). This register contains a micro level panel database of all Norwegian multinationals from 1990-2005. It contains information about the MNEs' owner shares in affiliates abroad, the country where the affiliate is localized and some balance-sheet information about the foreign affiliate. It also contains information about the book values of financial transactions between the parent MNE and it's affiliate from 1999 and onwards. Finally, the information about intra firm transactions shows the affiliates accounts for sales in both directions. The final source of information is the register of foreign owner shares in Norwegian firms (called "SIFON-regisert").⁸ All three sources can be linked together through an unique firm code. Hence, when the information from the accounting register is linked with the registers on inward and outward FDI we have comprehensive information about the Norwegian multinationals. All three data sources are administered by Statistics Norway. Since the intra firm trade variables are the variable of interest in our estimations we will be using observations in the time span 1999-2004. All monetary values are expressed in current 1000,- NOK. Finally, we include yearly statutory corporate tax rates, available from the Institute for Fiscal Studies, for each country included in the sample.⁹

The sample used is constructed by identifying foreign MNE objects (affiliates) in the OECD area in which a Norwegian firm is a majority owner (the direct or indirect owner share in the foreign object is at least 50%). It should be noted that although Norwegian multinationals have affiliated firms throughout the world, the OECD countries accounts for a vast part of the total volume of intra firm trade. The selection criteria takes into account that incentives for income shifting is affected different when affiliates are not wholly owned. Further, by including affiliates in the OECD area we ensure that all affiliates are subject to the same transfer pricing rules, and hopefully similar enforcement of these rules. In cases where a Norwegian multinational has more than one affiliate in the same country, these are nevertheless treated as one MNE relationship.

By combining the information about owner shares from the registers on outward

⁸? and ? both uses the registers on inward and outward FDI.

⁹<http://www.ifs.org.uk>.

and inward FDI, we distinguish between foreign and domestic controlled multinationals. In this respect we classify a MNE as a domestic controlled MNE if the foreign ownership share is less than 50%, and as a foreign controlled MNE otherwise. This defines the ownership variable used, which is a dummy for foreign control of MNE firm i in year t .¹⁰

The variables containing information about intra firm trade is constructed from the outward FDI register. From the trade variables defined by intra firm sale from MNE firm i in Norway to its affiliate k (E_{ik}) and by sales in the opposite direction (E_{ki}), we define net export by the parent MNE in Norway as $NE_{ikt} = E_{ikt} - E_{kit}$, for each year, subscript i always identify the parent MNE in Norway, and subscript k the its affiliate k . Our main task is to identify the impact of the difference in the statutory tax rate in Norway and country j , $(\tau_t^N - \tau_t^j)$, on intra firm export and import.

Control variables included in the regressions are age of the parent MNE firm in Norway, sales volume, capital stock in parent MNE, capital stock in foreign affiliate, and the ration of debt to capital (leverage). Further, firms are classified according to the industry they operate in (Mining and quarrying; Manufacturing; Electricity, gas and water supply; Construction; Wholesale, retail, hotels, restaurants; Transport and communication; Financial intermediation, real estate). Finally, the balance-sheet data enable us to identify the accounting firm used by the MNE, and we use this information to construct a dummy variable that is set equal to 1 if the MNE uses one of the big four accounting firms, and zero otherwise.¹¹

5 Descriptive statistics

Given the sample selection rules we have 10,992 observations over the period 1999-2004 on 3,082 bilateral relationships with non-missing information on intra

¹⁰Remember that the firm selection criteria we use is that it must have an ownership share of at least 50% in an operation abroad. Hence, we do not include the entire population of MNEs in Norway. ? provide a classification of foreign and domestic MNEs and foreign and domestic non-MNEs based on ownership, but not necessary control.

¹¹These are PriceWaterhouseCoopers, Deloitte Touche, Ernst & Young, and KPMG. A quick glance at their web pages suggests that they have a substantial focus on transfer pricing.

firm trade between a parent firm registered in Norway and affiliates in the OECD area where the owner share is at least 50%. These bilateral relationships involve 1,392 Norwegian parents. Of the 3,082 MNE relations, 652 are continuous relationships (exists all years, 3,912 observations), 1,184 are starting relationships (started during the time period and never closed, 4,167 observations), 551 relationships are closing (exists in 1999 but are closed and never started again, 1481 observations), while 695 relationships are switching status more than once (1432 observations). This is after we have dropped observations where observed home country sales is larger than mean of home country sales plus three times the standard deviation. Information on intra firm trade and firm level characteristics are complete for 7,772 of the above observations, and this is the regression sample used in the estimations. In the end we include 1,000 MNE firms and 2,374 bilateral relationships. Out of these, 571 are continuous relationships (2,882 obs), 890 and 435 are starting and closing firms respectively (2,919 and 1,980 observations), whereas 478 are switching status (891 observations). When it comes to intra firm trade, around 36% of the observations have positive observations for import, export or both, out of these around 15% has only positive import, and 46% has only positive export, while 39% has positive on both import and export. The statutory tax rate is larger in Norway than in the host country for 135 relationships (395 observations and 106 firms), lower in Norway than in the host country for 1,711 relationships (5,504 observations and 772 firms), and the tax rates are equal for 677 relationships (1,873 observations and 567 firms). Notice that the statutory tax rate for corporate taxation has been 28% throughout the period of analysis.

In the regression sample 487 firms has one single foreign affiliate in the OECD area with owner share of 50% (1,382 observations and 487 affiliates), 232 firms has two foreign affiliates (1,263 observations and 447 affiliates), 118 firms has three foreign affiliates (1,034 observations and 340 affiliates), and 163 firms has 4 or more affiliates (4,093 observations and 1,100 affiliates). This contributes to explain why we are interested in within firm across affiliates variation, and not only within affiliates variation.

Table ?? show some summary statistics for intra firm trade between the parent firm and it's foreign affiliates in the OECD area in the period 1999-2004 within the

selection criteria. The summary statistics is broken down by sector, by tax rate difference and by country. Except for Construction, there is significant amounts of intra firm trade within all sectors. Mining and quarrying and Manufacturing stand for a large proportion of intra firm export, but otherwise there are not very large differences between the sectors in terms of intra firm trade, less for import than for export. When it comes to intra firm trade broken down by intervals of tax differentials it is interesting to see that the value of export increases substantially when tax the differential is large, above 0.1 or below -0.1 percentage points, this can also be seen in Figure ?? . For intra firm import this is the case only for a large positive tax differential. Table ?? in the Appendix shows trade broken down by country. In Table ?? we present descriptive statistics both for firm and affiliate characteristics as well as for the trade variables in the data for the various regression samples we are using.

A preliminary test of transfer pricing being affected by tax changes can be obtained by comparing intra firm net export at the mean firm before and after the last period before the tax change.¹² To do this we pool all tax cuts that took place between 2000 and 2004 together, and examine intra firm trade on the MNE relations in the years before and after the last year with the higher tax. We are thus able to observe up to five periods after and up to 4 periods before the last year with the higher tax rate.¹³ We estimate the following equation:

$$NE_{ijt} = \gamma_0 + D'_p \gamma + \boldsymbol{\xi}_t + \mathbf{v}_s + \boldsymbol{\xi}_t \times \mathbf{v}_s + \alpha_{ij} + \varepsilon_{ijt}, \quad (9)$$

Where the vector $D'_p = (D_{t-4}, \dots, D_{t-1}, D_{t+1}, \dots, D_{t+5})$ are dummies for which period relative to the tax cut the observation is. The corresponding coefficients is the estimate for net export at the mean firm relative to period t , which is the last period with the higher tax rate. The model is estimated including affiliate fixed effects and year, sector and year-sector dummies on a balanced panel including only affiliates experiencing a tax cut. In this context we report the estimated

¹²Countries with tax cuts are Denmark (2001), Finland (2000), Island (2004), Belgium (2003), France (2000, 2001, 2002), Greece (2001, 2002), Ireland (2003), Italy (2001, 2003), Luxembourg (2002, 2004), Poland (2000, 2001, 2003), Portugal (2000, 2002, 2004), Germany (2001, 2003, 2004), Japan (2004), Czech Republic (2000, 2004), Australia (2000, 2001).

¹³When a country reduces the tax rate several times, we examine what happens before and after the first time the tax was reduced.

patterns when the estimation is weighted by the firms' home country sales. This is done to see if coefficients become more precise when we give more weight to larger firms that have a potentially less volatile trade pattern. It could also happen that the size of the coefficients changes if larger firms have larger size of intra firms trade and therefor larger scope for tax savings via transfer pricing. Estimation is done on a log transformation of intra firm net export in addition to the level of net export. To check whether it is likely that any systematic change in net export is due to changes within the parent or affiliate we perform the same regression on home country sales, total assets at the parent firm and at the affiliate, and leverage. The results of the panel regression based on equation ?? are shown in Table ?? in the Appendix. The patterns that emerges are qualitatively very similar whether we are using the plain level of net export, or the log of net export. For the non-weighted regressions the change in means are hardly significant, with two exceptions, although the value of net export seems to be decreasing after the reduction in the tax rates. When the regression is weighted by firm size (home country sales), estimates are more precise and coefficients becomes significantly larger. In particular, whereas we cannot see any clear trend before the tax rates were reduced, we observe a shift in the trend after the tax rate reduction took place. This is consistent with our theoretical predictions. Further, when we examine the pattern of changes in firm and affiliate controls before and after the tax rate change, the last four columns in Table ??, we see that firm size does not change significantly at all. This descriptive analysis indicates that intra firm trade changes in response to tax changes over time. Of course these results are only indicative and will now turn to the estimation result from the more formal analysis controlling for observed and unobserved confounding factors.

6 Regression results

The regression results for intra firm net export are reported in Table ?. Results are reported for OLS and the two FE regressions with parent- and affiliate fixed effects respectively, without controls and when controls as well as time and sector dummies and their interactions are included. The regression results for the linear specification give strong cross sectional support for transfer pricing in

an OLS framework, and these also carry over when we include parent firm fixed effects (which also contain cross sectional variation due to MNEs with multiple affiliates) and affiliate firm fixed effects. Regression of intra firm export and import are less striking, but they still give some support to our hypothesis. Results for intra firm export and import are reported in Table ?? and ?? in the Appendix. The estimated effects are not very sensitive to the inclusion of control variables, and they do not seem to change much when we include firm fixed effects either. However, when we include affiliate fixed effects instead of parent fixed effects, there is a sharp increase in estimated response to host country tax rate changes and the estimate almost doubles in magnitude. In terms of semi-elasticities, a one percentage point difference in the host country tax rates leads to a difference in net export of 12%, whereas a one percentage point increase in the host country tax rate leads to a change in net export of 23%. Elasticities are estimated at the means of all covariates and they are reported in Table ??.

A model with main effects only is a good approximation if the response in intra firm trade to tax differentials are similar across various subpopulations of firms. However, there are response to believe that the effect of tax differentials is different for different types of firms, e.g. MNE's under foreign versus domestic control or firms of different size. To allow for heterogeneous responses we estimate a saturated model with dummies that are interacted with tax rate differentials. In a saturated model we include a dummy for parent MNE size (equal to one if parent sale is above the median in terms of home country sales), a dummy for foreign control of the parent MNE (dummy equals 1 if the MNE is under foreign control), and a dummy for whether the MNE uses one of the big four accounting firms (dummy equals 1 if the MNE uses one of the big four accounting firms).¹⁴ Further, we interact these dummies with the tax difference to estimate the interaction terms.

The regression results for the three different specifications of the saturated model are reported in Table ?. Except for ownership, the interaction terms are signifi-

¹⁴About two third of the regression sample uses one of the big four accounting firms. This does not mean that as many as two third of the MNE's are using on of the big four accounting firms since many MNE's controls more than one foreign affiliate. On average, MNE's using one of the big four has 7.75 foreign affiliates, whereas the remaining MNE's has 5.85 foreign affiliates. Hence, the number of MNE's counted is lower than the number of observation when the dummy for big four is one.

cant in both fixed effects regressions. The interaction term with respect to use of a big accounting firm and size remains significant when we include firm fixed effects, whereas the the interaction term for foreign ownership is not longer significant. Notice that foreign controlled MNEs on average are *less* inclined to engage in transfer pricing since the coefficient of the interaction term is positive. Further, the tax motivated incentive for transfer pricing is not significant for MNEs *not* using one of the big four accounting firms, and for small firms. Again, it is perhaps more useful to evaluate the effects in terms of semi-elasticities, i.e., the percentage decrease in net export when the host country tax rate changes by one percentage point, estimated at the means for all covariates, see Table ???. The semi-elasticity is significant and of a non-negligible magnitude for domestic controlled firms, for firms using one of the big four accounting firms, and for big firms when parent fixed effects are included. When we include affiliate fixed effects instead of parent fixed the semi-elasticity for large firms are close to being significant at the 5% level. In the OLS regression the semi-elasticity vary from 13% to 16.6%. Adding parent fixed effects does not affect the semi-elasticity much, but when the model is estimated with affiliate fixed effects the semi-elasticities almost doubles in size, varying between 25% and 30%. Using the estimated elasticities we find that net export reduces by approximately 500 000,- NOK at the mean firm when the host country tax rate changes by one percentage point. At the mean among the big firms the change is more than 2 MNOK, and at the mean among firms using one of the big four accounting firms the change is just above 1.9 MNOK.

For the difference-in-difference approach, the typical pattern that emerges is that the effect of an increase in the host country statutory tax rate on intra firm net export is positive, i.e., intra firm net export is higher the first year in a high tax state, and lower the first year in a low tax state. Tables ??? and ??? report results based on regression of equation (??) and (??) respectively.

The differences-in-differences estimates for firms regardless of experience (the last row in Table ???) is almost identical to the estimates from the regressions above with affiliate fixed effects. The effects are both larger and more significant for firms that have survived longer, i.e., more experienced MNE-relations, for bigger firms and for firms that uses one of the big four accounting firms. These are firms that are more experienced in the dealing with the transfer pricing rules, which

are being guided by professionals, and where the scope for tax savings is large. The results in Table ?? reveal that the firms responses to a host country tax increase is both larger and more significant than the responses to host country tax decreases. One factor that may contribute to explain this pattern is that the trade levels and the variation in the trade levels are smaller with countries where the tax rate is decreased than with countries that increases the tax rate, see Table ?? in the Appendix for descriptives of the trade levels by direction of tax rate changes. On the other hand, the magnitude of the tax rate changes are much larger for tax rate reductions than for tax rate increases, which should in isolation give larger coefficient when we are using simple dummies for increases and decreases.

6.1 Specification and robustness tests

The results in section ?? might not be robust against sample selection changes, changes in control variables, or other changes of the specification for the regressions. In order to check the robustness of the results we have run a large number of alternative regressions with respect to intra firm trade. One set of regressions includes a bigger set, or a different set of control variables, which includes the tangibility of the parent MNE (intangible assets divided by total assets), the number of countries in which the MNE has at least one wholly owned affiliate (more than 50% owner share), market concentration by constructing the Herfindahl index on the basis of the concentration of sales volume at the 3- or 5-digit industry level. We also check whether the results changes if we include countries outside the OECD-area. The results reported in ?? are sustained in all the alternative regressions, and the parameter values does not seem to change substantially either.

In another set of regressions we scale intra firm trade by using the ratio of net export to sales, to the sum of import and export, to capital stock in parent MNE, or to capital stock in the foreign affiliate, as the dependent variable. The regression results for these alternative specifications are overall about the same, although some are less significant, but nevertheless, they give weak support for the results reported in section ??.

In order to examine whether the linear model of the relationship between the tax differentials and intra firm trade is appropriate, we also estimate a model that allows for nonlinearity in the response to the tax induced transfer pricing incentive. We then include dummies for different levels of positive and negative tax rate differences. The base line for comparison used is all relationships where there are no tax rate differences. Since there are by far fewer observations where the norwegian tax is the largest we pool these together and use one dummy for all instances of $(t_i - t_j) > 0$. Further, we use three dummies for small, medium and large negative tax rate differences, selecting the intervals such that the number of observations are as close as possible. From the theoretical predictions our expectations is then that the dummy coefficients are negative for positive tax rate differences, i.e., when the host country tax rate is lower than the home country tax rate we expect that the MNE transfer income abroad by underinvoicing sales to the host country affiliate and overinvoicing sales in the other direction. Hence, from the parent firm's point of view it charges less for goods it sells to the affiliate and pays more for goods it buys from the affiliate and net export is lower than when there is no difference in the two countries tax rates. For negative tax rate differences we expect the opposite behavior and consequently expect a positive dummy coefficient.

The regressions in Table ?? confirms these expectations for intra firm net export, the effects being larger and more precise for larger than for smaller tax rate differences. The R-squared values does not changes as compared to the linear specification, and the non-linear specification does not manage to explain more of the variation in in intra firm net export than the linear model. Here too, there is an asymmetry in the responsiveness to tax differences when the difference is positive and when it is negative. The dummy coefficients for small and negative tax difference are insignificant, and the dummy coefficient for all positive instances of positive tax differences is larger than the dummy coefficient for a considerable negative tax difference (in the parent fixed effects regression). If we pool all negative tax differences together as well, the dummy coefficient becomes insignificant. To check whether differences in the FDI investment, measured by total assets at the affiliate level, contribute to explain this asymmetry we ran the same regression for affiliate total assets, the argument being that intra firm trade is complementary to FDI size. This reveal that the size of the investment

is significantly lower in countries where the tax rate is lower than in Norway. The results when the regression is run on intra firm export and import separately are again less clear, but at large they seem to follow the predictions from the theoretical model. In particular, the dummies for intra firm export is positive for negative tax differentials only, and then they are significant as well. For intra firm import the dummy coefficient has the expected sign for positive tax differentials only.

7 Conclusion

Norway has a relatively low statutory corporate tax rate, which should give MNE's incentives to shift income in to Norway. The purpose of our study has been to examine multinational firm's response with respect to the possible manipulation of prices on intra firm trade to changes in the difference between the Norwegian corporate tax rate and corporate taxes in countries where it's affiliate is localized. In this paper, in line with some recent studies, we estimate the importance of profit shifting by relating firms actual transactions across countries to tax differences. This paper does, however, depart from the previous literature in several important aspects. First, whereas the previous literature rely on aggregated data (country level, firm level, trade data), we have detailed information on intra firm transactions. In addition, we also have detailed firm level data that enable us to control for observed parent level heterogeneity as well as unobserved heterogeneity at the single parent-affiliate relationship. Since we know the MNEs portfolio of foreign affiliates we are able to observe at the same time the MNEs pricing vis a vis high and low tax countries by controlling for parent fixed effects. To the extent that there are within MNE, but between countries. More precise estimates of the transfer pricing incentives are We find support for intra firm trade based on tax incentives at the firm level, the support is also stronger when tax incentives are stronger.

Table 1: Intra firm trade between parent firm in Norway and its affiliates in the OECD area 1999-2004. By sector and tax rate differences.

Sector	MNE relations ¹	Obs ²	Export (1000 NOK)		Import (1000 NOK)	
			Mean	SD	Mean	SD
Mining and quarrying	60	195	17,633	115,531	1,795	11,172
Manufacturing	656	2,471	14,203	68,956	4,192	39,516
Electricity, gas and water supply	33	118	5,151	35,066	4,706	36,072
Construction	12	38	351	729	191	785
Wholesale, retail, hotels, restaurants	402	1,446	9,665	56,509	3,797	33,030
Transport and communication	290	883	1,644	17,452	2,222	9,511
Financial intermediation, real estate	1629	5,841	4,189	70,633	5,063	191,496
Total	3082	10,992	7,191	66,586	4,394	141,433
Bilateral tax difference						
$(\tau^N - \tau^j) > 0.1$	54	161	19,352	155,218	23,085	140,826
$0.1 \geq (\tau^N - \tau^j) > 0.5$	79	131	1,834	4,400	3,851	20,793
$0.05 \geq (\tau^N - \tau^j) > 0.01$	50	191	5,582	24,153	5,810	38,361
$0.01 \geq (\tau^N - \tau^j) \geq -0.01$	1012	3,390	2,566	14,625	872	7,524
$-0.01 > (\tau^N - \tau^j) \geq (-0.05)$	906	2,928	4,751	24,432	1,408	12,845
$-0.05 > (\tau^N - \tau^j) \geq -0.1$	834	2,434	7,448	49,460	9,220	286,881
$(\tau^N - \tau^j) < -0.1$	679	1,757	19,287	143,108	7,654	93,148
Total	3614	10,992	7,191	66,586	4,394	141,433

¹) Number of year-MNE relations observations

²) Only observations with information on intra firm trade, and affiliates with at least 50% Norwegian ownership included. Some MNE relations are counted twice in the lower panel because of changes in the statutory tax rate within some countries.

Table 2: Summary statistics

	All affiliates			Affiliates in OECD area			Regression sample			Using Big Four		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Age MNE	16674	26.23	32.01	12487	24.67	29.88	7772	26.41	31.18	5508	26.74	31.61
Debt ratio	16516	0.39	4.25	12373	0.40	4.90	7772	0.32	0.37	5508	0.34	0.41
Sales revenue	16755	1,103,567	4,683,619	12547	983,436	4,332,884	7772	1,429,770	5,268,823	5508	1,648,855	6,016,889
Home CP	16755	121,550	1,124,320	12547	89,877	917,172	7772	123,973	1,040,171	5508	152,877	1,204,058
Host CP	14082	6,508	155,893	10992	5,972	166,921	7772	4,829	109,995	5508	6,041	123,163
Home capital	16521	5,619,688	26806776	12378	4,481,901	23919375	7772	5,628,979	25304927	5508	6,268,141	25849709
Host capital	14082	185,020	1,626,449	10992	204,671	1,813,393	7772	185,509	1,719,002	5508	210,728	1,877,136
Aff. per MNE	14082	6.96	8.49	10992	6.11	7.51	7772	7.09	8.26	5508	7.62	8.22
Tax difference	15912	-.02	.079	12547	-.04	.058	7772	-.042	.059	5508	-.044	.058
Export	14082	6,154	59,482	10992	7,191	66,586	7772	9,485	77,724	5508	11,055	90,804
Import	14082	3,839	125,807	10992	4,394	141,433	7772	3,935	57,841	5508	4,782	67,144

The variable "countries" stands for the number of countries the MNE has an affiliate in which it has at least 50% owner share

Table 3: Regression results intra firm net export, linear OLS og FE specification

	OLS			MNE fixed effects		Affiliate fixed effects	
	(1)	(2)	(3)	(4)	(5)	(6)	
$(\tau^N - \tau^i)$	-80.035*** (24,368)	-67.548** (27,444)	-70.043*** (15,754)	-63,771*** (17,903)	-111,503** (43,754)	-121,902** (49,459)	
Age MNE		0 (38)		-7,635 (6,373)		-15,084** (6,747)	
Sale MNE		0.003* (0.002)		0.004** (0.002)		0.004*** (0.002)	
(Sale MNE) ²		-0.000 (0.000)		-0.000** (0.000)		-0.000 (0.000)	
Total assets MNE		-0.000* (0.000)		0.001** (0.000)		0.001*** (0.000)	
Leverage		-749 (1,504)		-887 (3,439)		111 (3,568)	
Total assets affiliate		-0.002 (0.002)		-0.001*** (0.000)		-0.015*** (0.001)	
Population		1.789 (18.438)		8.832 (15.747)		-332.242 (481.930)	
GDP per capita		156.003 (96.692)		163.075 (149.290)		2,537.151 (2,438.272)	
Constant	2,183*** (762)	9,764 (28,520)	2,604** (1,016)	173,473 (151,840)	859 (1,990)	306,226* (163,395)	
R^2	0.005	0.038	0.003	0.010	0.001	0.033	
N	7772	7772	7772	7772	7772	7772	

Standard errors in parentheses. SE clustered by affiliate in OLS models.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Time, sector, and time specific sector dummies included in (2), (4), (6) and (8).

Table 4: OLS and Fixed Effects estimates for intra firm net export

	OLS regression			MNE fixed effects			Affiliate fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$(\tau^N - \tau^i)$	-78,452*** (30,244)	-13,992 (17,984)	-5,114 (15,411)	-69,630*** (18,763)	-14,146 (29,023)	6,174 (27,009)	-124,773** (51,051)	-83,543 (54,755)	-38,259 (62,426)
Foreign ownership (FO)	-513 (1,533)			5,923 (6,094)			3,522 (6,748)		
FO*Taxdiff	89,768** (35,412)			47,437 (46,223)			17,487 (77,678)		
Big Accounting firm (BA)		-1,943 (1,597)			-3,547 (4,119)			-3,152 (4,404)	
BA*Taxdiff		-80,700** (35,342)			-73,035** (33,580)			-77,304* (46,974)	
Size (above median)			2,387 (1,661)						-1,721 (5,545)
Size*Taxdiff			-117,128*** (41,335)						-134,308** (61,997)
Constant	9,933 (28,413)	10,274 (28,646)	27,812 (27,923)	177,721 (151,893)	176,721 (151,821)	167,127 (147,201)	308,765* (163,564)	308,344* (163,389)	181,539 (158,352)
N	0.039	0.039	0.020	0.010	0.011	0.011	0.033	0.033	0.031
R^2	7772	7772	7772	7772	7772	7772	7772	7772	7772

Standard errors in parentheses. SE clustered by affiliate in OLS models.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Controls and year- and industry dummies in all model specifications

Controls: Age parent firm, sales, sales squared, total assets parent MNE, total assets foreign affiliate, leverage, host country population and GDP/capita

Table 5: Semi-elasticities, OLS and FE specifications

	OLS		MNE fixed effects		Affiliate fixed effects	
	ey/dx	s.e.	ey/dx	s.e.	ey/dx	s.e.
Linear model	-12.56**	(4.767)	-11.90**	(3.751)	-23.10*	(9.930)
Ownership						
Domestic control	-13.24**	(4.682)	-14.32**	(4.989)	-25.36*	(11.748)
Foreign control	6.91	(17.244)	-2.53	(5.297)	-13.92	(14.257)
Accounting firm						
Not using B4	-3.29	(3.992)	-2.52	(5.381)	-16.37	(14.273)
Using B4	-16.62**	(6.060)	-16.99**	(6.158)	-30.91*	(13.360)
Firm size						
Small	-1.30	(4.795)	1.30	(6.902)	-11.58	(18.924)
Large	-15.49**	(5.461)	-16.15*	(7.211)	-26.36	(13.560)

Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Definition of firm size is above and below median with respect to home country sales.

Table 6: Effect of host country tax rate change on yearly change in net export.

Years with continuous existence	Difference-in-Difference estimate μ_0			
	All firm types	Using B4 ¹⁾	Big firms ²⁾	Big firms using B4
All years	341,424** (162,685)	429,063** (205,856)	471,730* (240,811)	652,403** (298,002)
N	1925	1501	1333	1075
5 years	207,223** (100,965)	260,151** (131,275)	313,944* (160,171)	393,745** (200,437)
N	3169	2410	1942	1611
4 years	142,884* (77,509)	193,352* (101,926)	225,359* (135,257)	303,715* (170,381)
N	4255	3228	2363	1947
3 years	121,660* (64,911)	170,102** (85,716)	186,447 (113,803)	266,157* (146,004)
N	5031	3825	2708	2219
2 years	109,093 (61,631)	153,145* (82,381)	177,143 (108,560)	253,450* (139,760)
N	5398	4084	2847	2324

Standard errors in parentheses. SE clustered by MNE-relation.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Time and sector dummies in all regressions

Controls: Age parent firm, sales, sales squared, capital parent MNE, capital foreign affiliate, debt to capital fraction, host country population and GDP/capita, all in first difference form

¹⁾B4 refers to the use of one of the big four accounting firms

²⁾A big firm is defined as a firm with home country sales within the top 25 percentile.

Table 7: Effect of host country tax rate change on yearly change in net export.

Years with continuous existence	Difference-in-Difference estimate μ_1 and μ_2			
	All firm types	Using B4 ¹⁾	Big firms ²⁾	Big firms using B4
<i>All years:</i>				
Increase	57,624*** (19,303)	71,050*** (23,616)	85,013*** (28,112)	99,277*** (33,104)
Decrease	-16,787* (8,996)	-18,646* (11,005)	-22,060* (12,770)	-24,883 (15,195)
N	1925	1501	1333	1075
<i>5 years:</i>				
Increase	41,774*** (12,672)	50,379*** (15,619)	62,141*** (19,750)	70,879*** (22,576)
Decrease	-10,361* (5,848)	-11,335 (7,311)	-15,541* (9,135)	-15,529 (10,633)
N	3169	2410	1942	1611
<i>4 years:</i>				
Increase	28,373*** (9,348)	34,577*** (11,608)	48,091*** (16,209)	53,915*** (18,630)
Decrease	-7,109 (4,465)	-8,064 (5,622)	-11,408 (7,660)	-12,148 (9,043)
N	4255	3228	2363	1947
<i>3 years:</i>				
Increase	23,879*** (7,925)	29,271*** (9,872)	42,289*** (14,258)	46,789*** (16,434)
Decrease	-6,260 (3,830)	-7,206 (4,807)	-10,473 (6,767)	-11,632 (8,044)
N	5031	3825	2708	2219
<i>2 years:</i>				
Increase	22,452*** (7,511)	28,112*** (9,577)	38,932*** (13,418)	43,817*** (15,615)
Decrease	-5,605 (3,637)	-6,973 (4,663)	-10,531 (6,466)	-11,823 (7,726)
N	5398	4084	2847	2324

Standard errors in parentheses. SE clustered by MNE-relation.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Time and sector dummies in all regressions

Controls: Age parent firm, sales, sales squared, capital parent MNE, capital foreign affiliate, debt to capital fraction, host country population and GDP/capita, all in first difference form

¹⁾B4 refers to the use of one of the big four accounting firms

²⁾A big firm is defined as a firm with home country sales within the top 25 percentile.

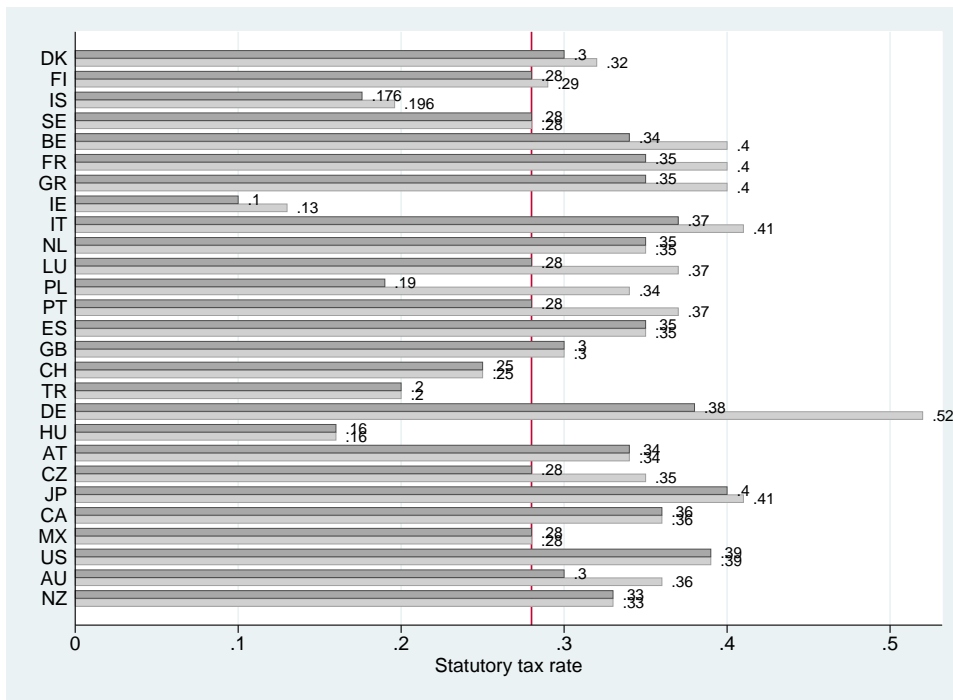


Figure 1: Statutory tax rates in the OECD area, max and min rates 1999-2004.

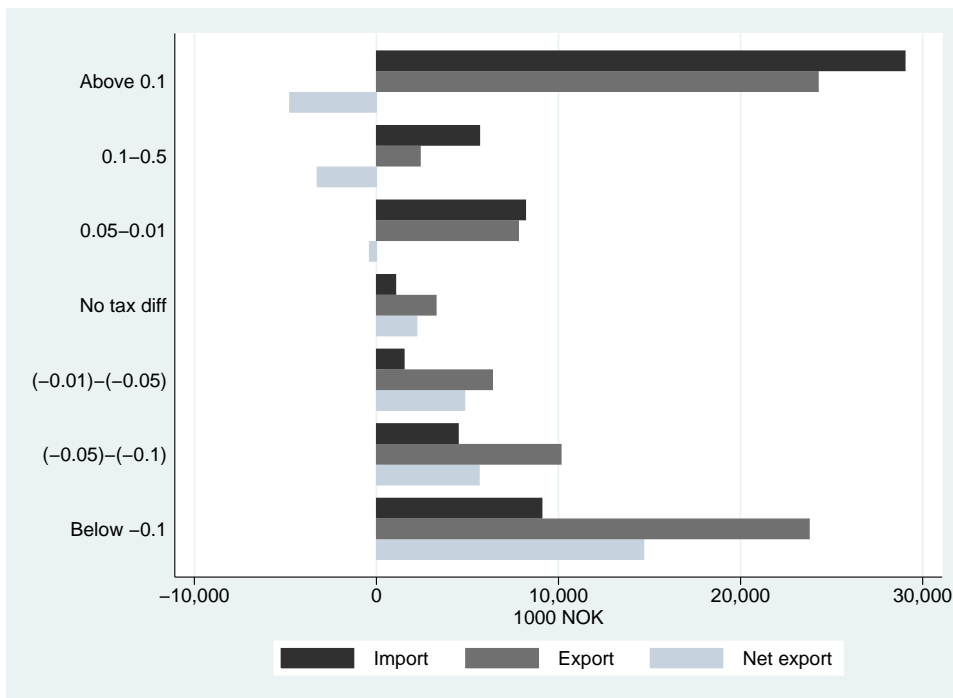


Figure 2: Intrafirm trade by tax rate differences, mean values.

Table A.1: Intra firm trade between parent firm in Norway and its affiliates in the OECD area 1999-2004, by country.

Country	Tax rate Min-Max	MNE relations ¹	Obs ²	Affiliates pr MNE ³ (mean)		Export (1000 NOK)		Import (1000 NOK)	
				MNE ³	pr	Pr year	Pr firm	Pr year	Pr firm
DK	30-32	392	1343	3.99		532,117	2,377	259,837	1,161
FI	28-29	162	578	6.01		271,807	2,822	93,740	973
IS	17.6-19,6	12	39	6.38		11,244	1,730	50,316	7,741
SE	28-28	707	2518	3.22		1,114,079	2,655	336,384	802
BE	34-40	66	208	9.81		245,619	7,085	2,350,801	67,812
FR	35-40	110	432	8.70		525,916	7,304	159,858	2,220
GR	35-40	14	52	19.69		51,824	5,980	25,032	2,888
IE	10-13	31	90	11.01		511,137	34,076	612,843	40,856
IT	37-41	44	179	13.06		928,372	31,119	66,331	2,223
NL	35-35	126	452	7.98		248,877	3,304	227,743	3,023
LU	28-37	24	82	2.66		102,472	7,498	3,351	245
PL	19-34	93	344	7.12		57,314	1,000	111,079	1,937
PT	28-37	32	128	11.37		121,678	5,704	28,051	1,315
ES	35-35	89	309	7.58		148,575	2,885	54,547	1,059
GB	30-30	364	1268	4.95		1,675,114	7,926	392,049	1,855
CH	25-25	50	191	10.29		177,694	5,582	184,950	5,810
TR	20-20	9	41	12.73		19,239	2,815	1,474	216
DE	38-52	220	810	6.34		2,873,304	21,284	1,459,302	10,810
HU	16-16	16	64	14.31		6,047	567	4,028	378
AT	34-34	26	103	13.49		368,030	21,439	4,561	266
CZ	28-35	30	107	10.23		25,604	1,436	2,376	133
JP	40-41	26	97	11.39		442,401	27,365	114,259	7,068
CA	36-36	77	307	8.20		135,200	2,642	142,876	2,792
MX	28-28	13	47	18.85		2,384	304	1,695	216
US	39-39	284	952	5.37		2,503,471	15,778	1,334,134	8,408
AU	30-36	55	212	10.06		66,637	1,886	27,049	766
NZ	33-33	10	39	18.62		8,344	1,284	1,129	174
Total		3082	10992	6.11		487,944	7,191	298,140	4,394

¹)Number of year-MNE relations observations in listed country

²)Only observations with information on intra firm trade, and affiliates with at least 50% Norwegian ownership included.

³)Number of MNE-relations in total across OECD, ownership > 50%.

Table A.2: Panel regression of intra firm net export and firm level control variables by period relative to last period before tax cut (period t), i.e., period $t + 1$ is the first period with lower tax rate. All regressions with affiliate fixed effects and year, industry and year-industry dummies and on a balanced panel (affiliates existing the entire time span 1999-2004).

	Net export		Log net export		Firm controls (FE)			
	FE	Weighted FE	FE	Weighted FE	Sales	Capital	Aff capital	Leverage
$t - 3$	6,574 (33,117)	20,978 (51,037)	0.025 (1.135)	2.372** (1.203)	-624,581 (404,865)	-809,768 (988,520)	-114,438 (163,479)	-0.105*** (0.040)
$t - 2$	10,824 (29,004)	8,372 (43,834)	-0.456 (0.994)	1.459 (1.033)	-204,607 (354,576)	-490,831 (865,733)	-55,309 (143,172)	-0.051 (0.035)
$t - 1$	3,091 (16,943)	-52,929* (29,808)	1.239** (0.581)	2.360*** (0.703)	27,718 (207,132)	717,080 (505,733)	-27,311 (83,637)	-0.034* (0.021)
$t + 1$	-11,273 (13,057)	-45,552** (23,130)	-0.846* (0.447)	-2.046*** (0.545)	98,682 (159,621)	312,452 (389,731)	38,284 (64,453)	-0.012 (0.016)
$t + 2$	-6,497 (15,590)	-80,999*** (26,386)	0.027 (0.534)	-1.795*** (0.622)	192,841 (190,586)	789,855* (465,336)	111,404 (76,956)	-0.004 (0.019)
$t + 3$	-17,028 (18,299)	-77,162** (33,730)	-0.074 (0.627)	-2.438*** (0.795)	194,242 (223,703)	240,555 (546,195)	107,123 (90,328)	-0.006 (0.022)
Constant	6,576 (14,418)	18,274 (26,243)	2.555*** (0.494)	-1.447** (0.619)	1,777,285*** (176,266)	5,265,070*** (430,371)	130,767* (71,173)	0.351*** (0.018)
N	1,148	1,148	1,148	1,148	1,148	1,148	1,148	1,148

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Weights used are mean of home country sales in the period 1999-2004.

Countries with tax cuts between 2000 and 2003: DK (2001), FI (2000), BE (2003), FR (2000, 2001, 2002), GR (2001, 2002), IE (2003), IT (2001, 2003), LU (2002, 2004), PL (2000, 2001, 2003), PT (2000, 2002, 2004), DE (2001, 2003, 2004), CZ (2000, 2004), AU (2000, 2001)

When tax rates are reduced several times within the time span, we use the first time of reduction.

Table A.3: Regression results intra firm export, linear OLS og FE specification

	OLS			MNE fixed effects		Affiliate fixed effects	
	(1)	(2)	(3)	(4)	(5)	(6)	
$(\tau^N - \tau^i)$	-34,053*** (8,335)	-14,677 (9,897)	-8,083* (4,299)	8,921* (4,986)	-2,529 (6,619)	2,788 (7,600)	
Age MNE		30.580* (15.821)		-392.625 (1,467.295)		-424.906 (1,004.785)	
Sale MNE		0.001*** (0.000)		-0.000 (0.000)		-0.000 (0.000)	
(Sale MNE) ²		-0.000*** (0.000)		0.000 (0.000)		0.000 (0.000)	
Total assets MNE		-0.000*** (0.000)		0.000 (0.000)		0.000 (0.000)	
Leverage		-597 (514)		161 (759)		407 (503)	
Total assets affiliate		0.000 (0.000)		0.000*** (0.000)		0.001*** (0.000)	
Population		12.615 (7.823)		19.595*** (3.725)		-219.453*** (71.098)	
GDP per capita		147* (78)		245*** (38)		-215 (382)	
Constant	3,437*** (468)	-11,331*** (3,349)	4,684*** (271)	8,013 (33,942)	4,951*** (336)	31,877 (23,873)	
R^2	0.010	0.068	0.001	0.027	0.000	0.024	
N	7313	7313	7313	7313	7313	7313	

Standard errors in parentheses. SE clustered by affiliate in OLS models.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Time, sector, and time specific sector dummies included in (2), (4), (6) and (8).

Table A.4: Regression results intra firm import, linear OLS og FE specification

	OLS		MNE fixed effects		Affiliate fixed effects	
	(1)	(2)	(3)	(4)	(5)	(6)
$(\tau^N - \tau^i)$	15,085 (9,711)	10,393 (11,108)	12,435* (7,188)	13,495* (7,716)	36,298** (16,760)	30,491* (18,377)
Age MNE		-2.522 (17.812)		-50.845 (2,256.581)		-877.977 (2,210.332)
Sale MNE		0.001* (0.001)		0.000 (0.000)		-0.000 (0.000)
(Sale MNE) ²		-0.000** (0.000)		-0.000 (0.000)		0.000 (0.000)
Total assets MNE		-0.000** (0.000)		0.000 (0.000)		-0.000 (0.000)
Leverage		1,705 (1,146)		-863 (1,572)		-452 (1,381)
Total assets affiliate		0.000 (0.000)		0.000 (0.000)		0.000 (0.000)
Population		6.215 (25.990)		7.527 (25.073)		16.663 (201.188)
GDP per capita		14 (81)		19 (48)		623 (638)
Constant	1,252*** (309)	-9,554 (5,960)	1,287*** (208)	2,048 (46,618)	971*** (272)	5,193 (44,902)
R^2	0.003	0.057	0.002	0.011	0.003	0.019
N	2263	2263	2263	2263	2263	2263

Standard errors in parentheses. SE clustered by affiliate in OLS models.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Time, sector, and time specific sector dummies included in (2), (4), (6) and (8).

Table A.5: Trade by direction of tax rate change

	N	Mean	s.d.	Min	Max	p90	p95
Net export							
Tax unchanged	6,845	5,111	52,535	-1,132,838	1,515,210	9,831	29,681
Tax increase	149	26,731	169,988	-32,160	1,702,830	17,027	50,591
Tax decrease	778	5,362	120,413	-2,627,512	1,312,546	11,952	30,460
Export							
Tax unchanged	6,845	8,214	47,506	0	1,581,472	12,974	34,124
Tax increase	149	51,090	427,373	0	5,080,954	20,869	50,591
Tax decrease	778	12,702	73,432	0	1,312,546	15,343	41,351
Import							
Tax unchanged	6,845	3,103	32,574	0	1,184,080	1,797	7,457
Tax increase	149	24,359	276,673	0	3,378,124	4,191	15,508
Tax decrease	778	7,340	97,136	0	2,627,513	6,477	16,929

Table A.6: Regression results nonlinear OLS and FE specification for net export and log of net export.

Dependent variable	Net export			Log of net export				
	OLS	FE	FE	OLS	FE	FE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$(\tau^N - \tau^j)$:								
$\tau^N - \tau^j > 0$	-5,054* (2,671)	-8,410** (3,383)	-11,189** (4,487)	-11,664*** (4,502)	-0.528 (0.445)	-0.540 (0.464)	-1.471*** (0.269)	-1.357*** (0.268)
$[-0.05, -0.01]$	1,894* (1,070)	1,776 (1,153)	1,289 (2,613)	1,139 (2,619)	0.440* (0.234)	0.554** (0.233)	0.122 (0.156)	0.126 (0.156)
$[-0.05, -0.1]$	3,213 (2,705)	878 (2,357)	-2,053 (2,929)	-2,266 (2,934)	0.924*** (0.271)	0.951*** (0.275)	-0.080 (0.175)	-0.043 (0.175)
< -0.1	12,249*** (3,861)	10,164*** (3,347)	9,208*** (3,199)	8,923*** (3,221)	1.403*** (0.312)	1.342*** (0.312)	0.723*** (0.192)	0.661*** (0.192)
Control variables	No	Yes	No	Yes	No	Yes	No	Yes
Year-, industry, year-industry dummies	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.005	0.037	0.004	0.011	0.012	0.050	0.010	0.027
N	7772	7772	7772	7772	7772	7772	7772	7772

Standard errors in parentheses. SE clustered by affiliate in OLS model.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Baseline reference is no tax rate difference.

Fixed effects at the parent firm level in FE models.

Controls: Age parent firm, sales, sales squared, total assets parent MNE, total assets foreign affiliate, leverage.

Table A.7: Regression results nonlinear OLS and FE specification for export and import.

Dependent variable	Export			Import				
	OLS	OLS	FE	OLS	OLS	FE		
$(\tau^N - \tau^j)$:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\tau^N - \tau^j > 0$	7,783 (7,490)	2,418 (7,392)	1,029 (5,168)	785 (5,187)	12,836 (9,470)	10,828 (9,559)	12,219*** (3,947)	12,449*** (3,949)
$[-0.05, -0.01]$	2,396** (1,129)	1,746 (1,205)	1,575 (3,010)	1,292 (3,018)	502 (355)	-30 (634)	286 (2,299)	153 (2,298)
$[-0.05, -0.1]$	6,737*** (2,106)	2,875 (1,754)	-280 (3,374)	-371 (3,380)	3,524* (1,863)	1,997 (1,578)	1,773 (2,577)	1,895 (2,574)
< -0.1	20,365*** (5,599)	17,707*** (5,204)	17,108*** (3,685)	17,651*** (3,711)	8,116** (3,454)	7,544** (3,416)	7,900*** (2,814)	8,728*** (2,826)
Control variables	No	Yes	No	Yes	No	Yes	No	Yes
Year-, industry, year-industry dummies	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.008	0.036	0.005	0.011	0.004	0.018	0.003	0.015
N	7772	7772	7772	7772	7772	7772	7772	7772

Standard errors in parentheses. SE clustered by affiliate in OLS model.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Baseline reference is no tax rate difference.

Fixed effects at the parent firm level in FE models.

Controls: Age parent firm, sales, sales squared, total assets parent MNE, total assets foreign affiliate, leverage.

A Sign of derivatives in equation ??

For $t_i = t_j$ we get from the first order conditions that

$$(p'_j x_{ij} + p_j) = k'_i \quad (\text{A.1})$$

$$c'_i = 0 \Rightarrow q_{ij} = k'_i \quad (\text{A.2})$$

$$(p'_i x_{ji} + p_i) = k'_j \quad (\text{A.3})$$

$$c'_j = 0 \Rightarrow q_{ji} = k'_j \quad (\text{A.4})$$

That is, the undistorted monopoly solutions.

If $t_i \neq t_j$:

From the second equation (q_{ij}) we know

$$(t_j - t_i) x_{ij} = (1 - t_i) c'_i \quad (\text{A.5})$$

Hence, if $t_j > t_i \Rightarrow q_{ij} > k'_i$ and the parent MNE will over invoice intra firm export from i to j . Since q_{ji} is set to satisfy $(t_i - t_j) x_{ji} = (1 - t_j) c'_j$ we must have that $c'_j < 0$, which is the case when $q_{ji} < k'_j$.

Then, from the first equation

$$(1 - t_j) (p'_j x_{ij} + p_j) = (1 - t_i) \left(k'_i - \frac{t_j - t_i}{1 - t_i} q_{ij} \right) \quad (\text{A.6})$$

Export quantity is set, not to satisfy marginal revenue equal marginal cost, but marginal cost subtracted by the term $(t_j - t_i) q_{ij}$. If $t_j > t_i$ this will be positive and quantity exported will be above the monopoly level (since adjusted marginal cost is lower than the true marginal cost). Since x_{ji} is set to satisfy $(1 - t_i) (p'_i x_{ji} + p_i) = (1 - t_i) \left(k'_j + \frac{t_j - t_i}{1 - t_j} q_{ji} \right)$ the opposite will be true for quantity imported from j to i .

If country i is the low tax country of the two, the firm has incentives to transfer profit from country i to j .

Differentiating the set of first order conditions with respect to t_i yields:

$$-q_{ij} + (t_j - t_i) \frac{dq_{ij}}{dt_i} + k'_i + (1 - t_j) (p''_j x_{ij} + 2p'_j) \frac{dx_{ij}}{dt_i} = 0 \quad (\text{A.7})$$

$$-x_{ij} + (t_j - t_i) \frac{dx_{ij}}{dt_i} + c'_i - (1 - t_i) c''_i \frac{dq_{ij}}{dt_i} = 0 \quad (\text{A.8})$$

$$q_{ji} + (t_i - t_j) \frac{dq_{ji}}{dt_i} - (p'_i x_{ji} + p_i) + (1 - t_i) (p''_i x_{ji} + 2p'_i) \frac{dx_{ji}}{dt_i} = 0 \quad (\text{A.9})$$

$$x_{ji} + (t_i - t_j) \frac{dx_{ji}}{dt_i} - (1 - t_j) c''_j \frac{dq_{ji}}{dt_i} = 0 \quad (\text{A.10})$$

which yields:

$$\frac{dq_{ij}}{dt_i} = \frac{(t_j - t_i) (q_{ij} - k'_i) - (1 - t_j) (x_{ij} - c'_i) (p''_j x_{ij} + 2p'_j)}{(t_j - t_i)^2 + c''_j (1 - t_j) (1 - t_i) (p''_i x_{ji} + 2p'_i)} < 0$$

$$\frac{dx_{ij}}{dt_i} = \frac{(t_j - t_i) (x_{ij} - c'_i) + c''_j (1 - t_i) (q_{ij} - k'_i)}{(t_j - t_i)^2 + c''_j (1 - t_j) (1 - t_i) (p''_i x_{ji} + 2p'_i)} \begin{matrix} \geq 0 \\ \leq 0 \end{matrix}$$

$$\frac{dq_{ji}}{dt_i} = -\frac{(t_j - t_i) (p_i + p'_i x_{ji} - q_{ji}) - x_{ji} (1 - t_i) (p''_i x_{ji} + 2p'_i)}{(t_j - t_i)^2 + c''_j (1 - t_j) (1 - t_i) (p''_i x_{ji} + 2p'_i)} > 0$$

$$\frac{dx_{ji}}{dt_i} = -\frac{(t_j - t_i) x_{ji} - c''_j (1 - t_j) (p_i + p'_i x_{ji} - q_{ji})}{(t_j - t_i)^2 + c''_j (1 - t_j) (1 - t_i) (p''_i x_{ji} + 2p'_i)} \begin{matrix} \geq 0 \\ \leq 0 \end{matrix}$$

From the second order condition for x_{ij} we know that the denominator must be negative. Hence, since $c''_j > 0$ we can also state that $(p''_i x_{ji} + 2p'_i) < 0$. Further, since $(t_j - t_i) (q_{ij} - k'_i) > 0$ and $(x_{ij} - c'_i) > 0$, we may now state that $(dq_{ij}/dt_i) < 0 \forall t_i, t_j$ whereas $(dx_{ij}/dt_i) > 0$ for $t_i > t_j$, and $(dx_{ij}/dt_i) < 0$ for $t_i < t_j$. It is also straightforward to establish that $(dq_{ji}/dt_i) > 0 \forall t_i, t_j$ whereas $(dx_{ji}/dt_i) > 0$ for $t_i > t_j$, and $(dx_{ji}/dt_i) < 0$ for $t_i < t_j$.

Effect on the value of intra firm export ($q_{ij}x_{ij}$) for negative tax rate difference $t_i < t_j$, i.e., home country tax rate is lower:

$$\frac{d(q_{ij}x_{ij})}{dt_i} = \frac{dq_{ij}}{dt_i} x_{ij} + \frac{dx_{ij}}{dt_i} q_{ij} < 0$$

$\begin{matrix} > 0 \\ < 0 \end{matrix}$
 $\begin{matrix} > 0 \\ < 0 \end{matrix}$

And for positive tax rate difference $t_i > t_j$:

$$\frac{d(q_{ij}x_{ij})}{dt_i} = \underbrace{\frac{dq_{ij}}{dt_i}}_{<0} x_{ij} + \underbrace{\frac{dx_{ij}}{dt_i}}_{>0} q_{ij} \geq 0$$

Effect on the value of intra firm import ($q_{ji}x_{ji}$) for $t_i < t_j$:

$$\frac{d(q_{ji}x_{ji})}{dt_i} = \underbrace{\frac{dq_{ji}}{dt_i}}_{>0} x_{ji} + \underbrace{\frac{dx_{ji}}{dt_i}}_{<0} q_{ji} \geq 0$$

And or $t_i > t_j$:

$$\frac{d(q_{ji}x_{ji})}{dt_i} = \underbrace{\frac{dq_{ji}}{dt_i}}_{>0} x_{ji} + \underbrace{\frac{dx_{ji}}{dt_i}}_{>0} q_{ji} > 0$$

Effect on intra firm net export, ($q_{ij}x_{ij} - q_{ji}x_{ji}$) for $t_i > t_j$:

$$\frac{d(q_{ij}x_{ij} - q_{ji}x_{ji})}{dt_i} = \underbrace{\frac{dq_{ij}}{dt_i}}_{neg} x_{ij} + \underbrace{\frac{dx_{ij}}{dt_i}}_{pos} q_{ij} - \underbrace{\frac{dq_{ji}}{dt_i}}_{pos} x_{ji} - \underbrace{\frac{dx_{ji}}{dt_i}}_{pos} q_{ji}$$

And for $t_i < t_j$:

$$\frac{d(q_{ij}x_{ij} - q_{ji}x_{ji})}{dt_i} = \underbrace{\frac{dq_{ij}}{dt_i}}_{neg} x_{ij} + \underbrace{\frac{dx_{ij}}{dt_i}}_{neg} q_{ij} - \underbrace{\frac{dq_{ji}}{dt_i}}_{pos} x_{ji} - \underbrace{\frac{dx_{ji}}{dt_i}}_{neg} q_{ji}$$

In both cases there are three negative and one positive term, and the likely effect is negative.

Similar comparative statics can be performed for marginal change in the host country tax rate, the signs are then reversed.

We estimate the importance of tax induced transfer pricing by Norwegian based multinational enterprises in the period 1999-2004. We find strong support for intra firm transfer pricing related to tax incentives. The incentive is estimated both at the parent firm level by including parent firm fixed effects, and at the affiliate level, by including affiliate firm fixed effects. Tax motivated manipulation of transfer prices are particularly strong for firms that use one of the big four international accounting firms, for big firms and for firms being controlled by domestic owners. Manipulation of transfer prices are more pronounced for larger differences in home and host country tax rates.

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