Regional Tax Differences and Multinational Profits in Europe

Alan Murphy*

Economic Analysis and Research Department
Central Bank and Financial Services Authority of Ireland
P.O. Box 559, Dame Street, Dublin 2, Ireland
http://www.centralbank.ie

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Abstract

This paper tests to what extent are corporate tax differentials motivating the reallocation of reported profits between EU parent multinationals and their European based affiliates. Hines and Rice (1994) report that a 1-percentage point reduction in corporation tax induces a 3% rise in reported profitability of European based affiliates of US parent multinationals.

When aggregated firm-level tax data are used and do not directly control for the parent-affiliate pair-wise trading environments, we obtain a semi-elasticity of -2.4 that is similar to previous research. But when we apply firm-level information on the total bundle of tax liabilities and control for the trading environment of each parent-affiliate pair we obtain a semi-elasticity of –0.25. This suggests that while corporation tax differences do affect reported profitability; the magnitude of this effect is lower than previously reported in studies using information from U.S. owned multinationals.
Non-Technical Summary

This paper tests to what extent are corporate tax differentials motivating the reallocation of reported profits between EU parent multinationals and their European based affiliates. Hines and Rice (1994) report that a 1-percentage point reduction in corporation tax induces a 3% rise in reported profitability of European based affiliates of US parent multinationals.

One issue highlighted by previous research is that a single measure of the tax rate cannot capture industry and firm specific tax deductions and other features of the tax system. In this paper we address this issue by using data containing information on the total bundle of corporate tax actually paid by each firm. This is important because we shown the actual tax rates paid by affiliates can vary widely across firms even within a unified tax regime. The second innovation is that, we use matched parent-affiliate data to control for the pair-wise trading environment. Allotting each trading pair its own pair-wise variable overcomes some information problems, one of which is that we do not know which variables are responsible for the heterogeneity bias in effective tax rates.

When we do not use the firm-level reported tax liabilities and directly control for the parent-affiliate pair-wise trading environments, we obtain a semi-elasticity of -2.4 that is similar to previous research. But when we apply the individual tax information and match each parent-affiliate pair we obtain a semi-elasticity of –0.25. This suggests that while corporation tax differences do affect reported profitability, the magnitude of this effect is lower than previously reported in studies using information from U.S. owned multinationals operating in Europe.

This finding is somewhat unanticipated, given the use of the actual reported tax liability faced by individual firms. One potential explanation is that relative to US owned multinationals operating in Europe, there is significantly less transfer pricing activity among European parent multinationals and their European based affiliates. This may be related to the type of FDI strategies used by European multinationals. On the one hand the investment may be horizontal in nature, where the multinational is
seeking market access or hoping to gain first mover advantage over its rivals. Alternatively, the investment may be of the vertical, whereby the firm seeks cost savings up and down the vertical chain of production. Investments between advanced economies are generally market seeking (horizontal) in nature and thus cost considerations (including taxes) are a lower priority. Evidence shows that approximately 75 percent of the FDI activity in Europe is accounted for by investments between the advanced European countries, which trade in similar goods.

In addition, European multinationals may have sunk cost issues in existing affiliate facilities. This might further diminish their ability to quickly alter the location of production in order to justify higher reported profits, especially when they face incremental corporation tax changes. Alternatively it might be that Hines and Rice (1994) get an aggregate effect, but on the wrong aggregated tax measure. This is supported by the fact that by aggregating our tax data we can approximate their results. Another potential difficulty with this type of model is that lowering tax rates can raise returns to capital in an economy or can be associated with higher profitability of firms for reasons that are unrelated to active profit management.
1. Introduction

This paper looks at how differences in corporation tax rates between European countries may influence the reported profitability of multinational firms. In particular we test how sensitive the reported profits of multinational affiliates based in Europe are to host country corporate tax rates. Figure 1 shows that in most OECD countries during the 1990’s headline corporate tax rates declined. While in Europe the association agreements of 1993 that led to the entry of 10 new member states in 2004 did not set off this tax competition, it may have intensified the already existing tax competition between EU members. Looking at Figure 1 it appears that after 2003 for OECD countries outside the EU, average tax rates have somewhat stabilized. But headline tax rates in the EU continued to fall from an average of 35 percent in 2000 to 31 percent by 2004. The European Commission has noted now that; “…the internal markets for goods, labour and capital are more integrated, the allocation of capital (economic activity and investments) is becoming more and more sensitive to differences in corporate taxation”.¹

The landscape of corporate tax liabilities is further complicated by the idiosyncratic and complex characteristics of each country’s corporate tax codes. One consequence of these incremental changes in tax rates and codes in Europe is that a firm’s corporate tax liability is imperfectly linked with its profitability and that the corporate tax system is not perfectly progressive. All this points to the fact that there is considerable heterogeneity both within and between EU member states in terms of corporate taxation rates.

Previous studies on how corporate tax influences pre-tax reported profitability generally relate the average profitability of affiliate firms to an average of the effective tax rate in a region. These studies have tended to find a very large sensitivity of reported profits to corporate tax. For instance, Hines and Rice (1994) estimated a semi-elasticity of reported affiliate profits with respect to corporate tax rates of –3.0. In such a case, an increase in the headline corporate tax rate from 10% to 11% in a

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¹ See the EU Commission website on Taxation and Customs Union: http://ec.europa.eu/taxation_customs
particular country would result in a 3% fall in reported pre-tax profitability of multinational affiliates.

The result obtained by Hines and Rice (1994) is based on aggregate tax data, which they acknowledge is a rather crude estimate:

“Of course, no single measure of the corporate income tax rate can accurately capture the precise differences in tax burdens corporations face in different countries. For one thing, the complexity of tax codes (including different provisions for tax deductions, depreciation rules, loss carry-forwards and carry-backs, and non-standard income concepts) precludes the possibility of distilling a well-defined tax rate for each country. In addition, a single tax rate cannot capture industry and firm specific tax holidays and other features”.

In this paper we are able to advance research on this issue in two related ways. Firstly, the paper incorporates more accurate tax rates, using data on the total bundle of tax paid by each multinational parent and its individual affiliates. This includes corporation, local and employment taxes that can be levied on the firm. Obviously using the data on the tax paid by individual firms is more relevant because what firms are interested in is the actual tax rate they face in a particular location. Secondly, we use controls for each individual parent-affiliate trading pair. This strategy is employed because we do not have perfect information on which variables are responsible for the heterogeneity bias in effective tax rates between firms, across sectors or within countries, so we simply allow each trading pair to have its own pair-wise variable [see Cheng and Wall (2004)].

Performing the analysis using firm-specific information on the complete bundle of taxes, and matched parent-affiliate data turns out to have a substantial impact on the magnitude of the corporate tax semi-elasticity. When the methodology of Hines and Rice is applied to the data, we obtain a semi-elasticity of -2.4 for reported affiliate profits with respect to corporate tax rates, which is similar to the -3.0 found by Hines and Rice. However, when analysis is done using firm-level tax information and controlling for the parent-affiliate relationship we obtain a semi-elasticity of -0.25. This would suggest that European multinationals and their affiliates are much less sensitive to tax changes in deciding where to report their profits than previously had
been thought. Consequently, it could be argued that the concern in some European countries about any potential negative effects arising from harmful corporate tax competition might be somewhat overstated.

This result is perhaps somewhat surprising, given the use of a more realistic tax liability faced by individual firms results in a much lower response to potential corporate tax changes. So why do the results obtained in this paper differ from previous estimates of the effect of tax on declared profits? One potential explanation is that relative to US owned affiliates operating in Europe, there is significantly less transfer pricing activity among European parent multinationals and their European based affiliates. The result may be linked to the issue of horizontal (market access – first mover advantage) versus vertical (cost considerations) FDI strategies. Investments between advanced economies are generally market seeking (horizontal) in nature and thus cost considerations (including taxes) are a lower priority. Evidence shows that approximately 75 percent of the FDI activity in Europe is accounted for by investments between advanced European countries. In addition, European multinationals may have sunk cost issues in existing affiliate facilities. This might further dampen their ability to quickly alter the location of production to justify higher reported profits, especially when they face incremental corporation tax changes.

Alternatively it might be that Hines and Rice (1994) get an aggregate effect, but on the wrong tax measure. This is supported by the fact that we can approximate their results aggregating our tax data. A potential problem with this type of model is that lowering tax rates can raise returns to capital in an economy or can be associated with higher profitability of firms for reasons that are unrelated to active profit management. One possible explanation for this is that lowering corporation tax may be correlated with other general equilibrium effects.

The structure of this paper is as follows; Section 2 looks at the data and summary statistics. Section 3 defines the effective tax rate measure, while Section 4 develops the model to be tested. Section 5 discusses the results and Section 6 is the conclusion.
2. Data and Summary Statistics

The dataset used for this analysis is “Amadeus” distributed by Bureau Van Dijk, which includes complete information from the Balance Sheets and Profit and Loss Statements of medium and large sized companies in Europe. Firms in the data set have to satisfy at least one of the following criteria:

- Number of employees greater than 100.
- Total assets exceeding 16 million US Dollars.
- Operating revenue exceeding 8 million US Dollars.

All multinationals from 1993 through 2001 for which unconsolidated accounts that were available separately for the parent and its foreign affiliates were retrieved. Only those firms for which the parent has a holding of 50 per cent or more were retained, so as to ensure that the parent multinational has effective control over the reporting actions of the foreign affiliate.

The availability of the data varies across countries, depending on the local accounting legislation. Table 1 shows the distribution of European foreign affiliates and EU parents in our panel by country. Where available, firms from all sectors are included and the primary industry for the individual plant is reported in the NACE classification system at the 4-digit level. We exclude financial firms in NACE categories 65 to 67 because the performance of these firms may be influenced by financial flows, which are potentially volatile and are not the subject of this analysis.

A parent firm may have multiple affiliates and in this sample the average number of affiliates each parent firm controls is three. We match each affiliate to its parent group. For example Volkswagen controls 18 affiliates in our data. There are 1,251 parent firms, and 4,304 affiliates of which 997 are located in Eastern Europe, which gives a total of about 50,000 observations over the 9-year period.

2.1 Sectoral Coverage

The OECD Measuring Globalisation database contains 9 broad industry categories, with information on both the number and employment levels of multinational affiliates in Europe. Using the Amadeus data we constructed a matching set for 7 of

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2 Irish Foreign Affiliates in the data are termed as true 'manufacturing' companies who face a headline corporate tax rate of 10% that will last until 2010.
the same broad industry categories for which we had information and conducted a correlation test of how representative our selected data is of the OECD measure of multinational activity in Europe. Using a rank correlation coefficient we obtained a correlation coefficient of 0.68 between our data and the Measuring Globalisation database, which suggests that the data in this analysis is reasonably representative of multinational activity in Europe.

One caveat concerning the conclusions in this paper is that results are based on the total bundle of taxes paid by the firm and not just taxable profits. The data contains a relatively fixed element (e.g. local taxes, which are generally related to plant size) and a more variable element (e.g. reported profitability). In addition, this dataset contains only a limited number of US-owned corporations and it is possible that the profit reporting behaviour of US-owned affiliates operating in Europe could be different from the patterns reported in this study.

3. Corporate Tax Data

Differences in the handling of tax allowances, exemptions, and exclusions mean that at company level, even when two affiliates of the same multinational parent are operating in the same country their tax liabilities can differ. Owing to the complexity of the potential tax obligations confronting the different affiliates, many studies examining the impact of corporate tax on profit reporting rely on an average effective tax rate measure (ETR) to reflect these differences. This effective tax rate measure is a rough proxy that distills the interaction of various tax rules on firm profitability.

Further evidence of the heterogenous nature of reported profitability and tax payments is provided in Figures 2-4, which show, by sector, the total tax payments relative to non-financial profits for affiliates. Germany and Ireland are used as examples, because Germany operates a relatively high corporate tax rate regime coupled with a set of complex tax codes. On the other hand Ireland is often cited as a country that operates a relatively low corporate tax regime coupled with a fairly flat tax system. While not reported, additional calculations show that on average similar within and across sectoral results hold for the other countries in this study.
Figure 2 shows the calculated effective tax rates for the highest and lowest deciles by sector in Germany. The large differences across sectors and between deciles are partly explained by the complexity of the German tax codes, which at times require up to 40,000 pages of documentation. One might expect that this was not the case for Ireland with a relatively flat tax system. But looking at Figures 3 and 4 we see clear differences between the tax liabilities of the highest and lowest deciles, both within and across sectors. In general, what this demonstrates is that tax rates vary widely across firms both across and even within sectors in the same unified tax regime.

Additional evidence on the importance of differences in effective tax rates within a unitary tax regime comes from a Belgium study by Vandenbussche and Tan (2005). They show that firms operating in Belgium face different levels of effective tax rates depending on either the sector or region in which they operate, or both. In addition, they report that while firm size and profitability show a significant statistical relationship to effective tax rates, relative to the other explanatory variables their magnitudes are small. So firms face a corporate tax system that is not perfectly progressive and in practice every firm faces a different corporate tax rate relative to their individual characteristics. In other words, there is an information gain in estimating the relationship between corporate tax and reported profitability at the parent-affiliate level of aggregation.

3.1 Calculating Corporate Taxes
There are several methods of calculating effective tax rates and the particular method selected depends on what relationship one is attempting to examine. Mendoza et al. (1994) developed a macro time-series approach for estimating effective capital income tax rates, which is the sum of personal capital and corporate income taxes divided by the total operating surplus of a country. Gorter et al. (2000) use OECD tax revenue and national accounts data to calculate Mendoza effective tax rates for several EU countries for the period 1990 to 1997. They show that France and Germany have relatively low effective tax rates, while Britain and Sweden are at the high end of their grouping. It appears that across time the rate remains quite stable except for the measured declines in Finland and Sweden. The problem with Mendoza’s effective tax rate measure is that the tax-authorities generally only report
tax revenue gathered by personal and corporate sources. Therefore, they do not uniquely identify tax revenue coming from capital income.

Micro-level studies aggregate firm-level information, usually they calculate a country’s effective tax rate as the corporation tax paid divided by pre tax profit for all firms. To overcome the problem of outliers, the median ratio within a country is used to compute the effective corporation tax rate (rather than the mean). There are significant differences between the macro approach and this micro approach. For example the macro methods refer to the complete capital taxation system not just corporation tax, whereas the micro level effective tax rate captures the country specific features of the tax base [see MARC, (1999), Gropp and Kostial, (2000)]. In Europe the big five (Britain, France, Germany, Italy and Sweden) have higher effective tax rates relative to smaller countries, however, effective corporation tax rates have tended to decline and somewhat converge over time.

The marginal effective tax rate is another method for calculating effective tax rates and is based upon country specific tax codes. Essentially, this measures the difference imposed by domestic tax (the percentage wedge) on pre and post tax required rates of return on investment projects near the margin [King and Fullerton, (1984)]. The King and Fullerton method is based on country level fiscal policy data and attempts to utilise this information set to capture the effect of fiscal policy changes on investment behaviour.

Unfortunately, the King and Fullerton marginal effective tax rate is very sensitive to changes in it’s underlying assumptions. Chennels and Griffith (1997) calculated the King and Fullerton marginal effective tax rates based on the return that individual shareholders require, which included personal and corporate taxation. France and especially Ireland appear to operate a low tax rate system compared to the other countries for which data is available. Interestingly, the King and Fullerton marginal effective tax rates seem quite low, when compared to either the macro or the micro estimates. One note of caution about these effective tax rate measures is that one can look at trends over the medium to long run with some confidence, while annual comparisons between countries and sectors appear problematic.
3.2 Effective Tax Rates

The firm level annual average $ETR$ used for this study is derived from annual audited company accounts. In the literature [e.g. Vandenbussche and Tan (2005)] a common formulation for a firm level annual average effective tax rate is the ratio of Tax Paid ($T_i$) over Profit before tax ($I_i$):

\[
ETR = \frac{\text{tax paid}}{\text{pre-tax profits}}
\]

In principle, at the end of the tax period a firm calculates its Taxable Income ($TI$), which it then multiplies by the Statutory Tax Rate ($t$), which gives the firm’s actual tax liability for that year. We refer to this as the amount of Tax Payable ($T$), which the firm is required to remit to the tax gathering authority:

\[
T = TI \times t
\]

In the firm-level data used in this study, taxable income is not reported. However, our company accounts data contains information on the total bundle of Tax Paid and Profits Before Tax. One can obtain a measure for Tax Preferences ($TP_i$) by calculating the difference between Profit Before Tax ($I_i$) and Taxable Income ($TI_i$):

\[
TP_i = I_i - TI_i \text{ or } TI_i = I_i - TP_i
\]

To obtain a firm level measure of the Effective Tax Rate it is necessary to control for the fact that Tax Preferences contain both transitory and permanent differences between accounting profit and taxable income. If we substitute Taxable Income ($TI_i$) into (1) this provides a measure of the effective tax rate, which is used in this analysis:

\[
ETR_i = \frac{(I_i - TP_i) \times (t)}{I_i} = (1 - \frac{TP_i}{I_i}) \times (t)
\]

4. Empirical Framework

In estimating the sensitivity of reported profits to changes in corporate tax rates the empirical framework adopted is similar to Hines and Rice (1994), where differences
in reported profitability are explained by differences in regional effective corporate
tax rates. One of the control variables is assets, which is a proxy for firm size and a
second is unit wage costs to control for labour productivity differences. GDP per
capita is used to control for the country specific trading environment of the affiliate.
The model is outlined in equation (5):

\[
\ln \pi_{it} = \beta_0 + \beta_1 \ln EFT_{it} + \beta_2 \ln AST_{it} + \beta_3 \ln COMP_{it} + \beta_4 \ln GDP_{it} + \varepsilon_{it}
\]

Where the log of the affiliates pre-tax non-financial profits \((\ln NFP_{it})\) is the dependent
variable. The main explanatory variables are \((\ln EFT_{it})\) which is the annual average
effective tax rate of the affiliate, \((\ln AST_{it})\) is the log of assets (plant, property and
equipment), \((\ln COMP_{it})\) is the log of per unit wage costs and \((\ln GDP_{it})\) is the log of
per capita GDP (we use a purchasing power of parity adjusted measure of per capita
GDP).

4.1 Specification Without Fixed Effects

The first set of results adopts the Hines and Rice (1994) methodology, which
employed country-level aggregate data on US multinationals and their foreign
affiliates. The model assumed that a representative US multinational parent firm
controlled all the foreign affiliates in the data. In the first set of estimates we assume a
similar setup with a representative EU parent multinational controlling all the
affiliates, with the profit and effective tax measures similarly aggregated.

In this specification \((\pi_j)\) is a country’s annual average profitability measure and \((\bar{x}_j)\)
is the country annual average effective tax rate, which is substituted into the \((EFT_{ib})\)
variable:

\[
(6) \sum_{i=1}^{n} \pi_j = \alpha_0 + \beta_1 \bar{x}_j + \varepsilon_j
\]

In the second specification it is again assumed that a representative EU parent
multinational controls all the affiliates in one sector, with the profit and effective tax
measures aggregated to sector level. The results are based on within country sector
level average reported affiliate profits \((\bar{\pi}_{si})\) and within country sector level average
affiliate effective tax rates ($\bar{x}_{si}$), which is again substituted into the ($EFT_{si}$) variable for each sector:

\begin{equation}
\sum_{i=1}^{n} \pi_{si} = \alpha_{0} + \beta_{1} \bar{x}_{si} + \varepsilon_{i}
\end{equation}

The remaining estimates are based on within country firm level reported profits ($\pi_{asi}$) and within country firm level effective tax rates ($\bar{x}_{asi}$) and are based on individual parent and affiliate level annual unconsolidated account data, which is again substituted into the ($EFT_{asi}$) variable for each individual firm:

\begin{equation}
\pi_{asi} = \alpha_{0} + \beta_{1} x_{asi} + \varepsilon_{i}
\end{equation}

4.2 Pair-wise Fixed Effects

Many models tend to use the relative corporate tax rate as one of the prime-determining factors for the reported profitability of a multinational affiliate in a particular location. So empirical tests looking at the correlation between corporation tax rates and affiliate profits have to control for both the country-specific tax environment of the affiliate and the affiliates trading relationship with the multinational parent.

The problem is that taxes are one of several correlated factors affecting profitability, for example, proximity to large wealthy markets and the relative abundance of physical infrastructure are two of these. This is one reason why some studies, in other contexts, have used pair-wise fixed effects techniques to estimate a range of trading relationships and how borders can affect trade. More generally, pair-wise fixed effects models can control for unobserved or mis-specified factors that may concurrently explain, for example, the flows or interactions between trading partners.

Wall (2001) used fixed effects models to estimate the effects of borders on trade. Glick and Rose (2001) applied a fixed effects model to estimate the trade effects of currency unions. This paper follows Glick and Rose (2001), using only one fixed effect for each parent and affiliate pair. The pair-wise fixed effects model is shown in (9):
(9) \( \ln NFP_{at} = \beta_{ap} + \beta_{t} + \beta_{1} \ln EFT_{at} + \beta_{2} \ln AST_{at} + \beta_{3} \ln COMP_{at} + \beta_{4} \ln GDP_{it} + \epsilon_{apt} \)

It employs \((\beta_{ap})\) and \((\beta_{t})\) to control for the unobservable elements in the affiliate and parent environment, to control for time-constant determinants of total assets, time effects, quality of local management and general unobservable firm level heterogeneity. We also include time \((t)\), sector \((s)\) and unemployment \((u)\) controls and report robust standard errors. Robust standard errors are used to control for the situation where a parent firm has multiple affiliates either across Europe, in one host country or both.\(^3\)

5. Main Results

In Table 2, columns 1 and 2 report results based on affiliate profitability and country average effective tax rates. The results in columns 3 and 4 are based on averages of sector level reported profits and sector average effective tax rates. While the results in columns 5 and 6 are based on the matched individual parent and affiliate level annual unconsolidated account data.

Applying the Hines and Rice method to our data at the country level we obtain a semi-elasticity of –2.41 for the tax variable. The magnitude of this corporate tax co-efficient is broadly similar to the results in the previous literature. Grubert and Mutti (2000) use tax return data for 500 U.S. multinationals and show that a lower tax rate that increases after-tax return by 1 per cent is associated with additional (real) capital investment of 3 per cent.

In columns 3 and 4 the same regression is run replacing average profits with firm level profit and replacing the average effective tax rate with an average sector effective tax rate. Using these sector measures the magnitude of the tax co-efficient declines to –1.46. This is similar to Altshuler et al (2001) who looked at US manufacturing firms in 58 countries and found the elasticity of (real) capital investment.

\(^3\) The subscripts \((a)\) represents the affiliate and \((p)\) the parent company; \((i)\) identifies the country; \((t)\) is the time operator and \((s)\) is the NACE Clio sector, while \(\beta_{1,2,3,4}\) are the parameters to be estimated and \(\epsilon_{apt}\) is a white noise error term.
investment to after tax rates of return to be approximately -1.5 for 1984 and close to -3.0 for 1992. A further study by Desai et al (2002) looked at the sensitivity of foreign direct investment undertaken by US multinationals to the host country tax in Asia, Europe and Latin America. They report particularly strong effects within Europe where a 10 percentage point increase in corporate tax rate is associated with a 7.7 per cent reduction in FDI and 1.7 per cent lower returns on assets.

Looking at the firm level regression results in the final two columns we obtain a tax co-efficient of −0.25 and −0.24 respectively. Our initial set of results suggests that for the firm, the relevant tax rate is the actual rate paid and not the average tax rate for that sector or country. It also shows that what is important to multinationals is the actual tax rates paid by affiliates, which can vary across firms within the same sector, even in a unified tax regime of a country. These results using data based on the tax rate actually paid by affiliates suggest that the estimates based on aggregated data could potentially be out by as much as a factor of 10.

The log of plant, property and equipment (which is a proxy for firm size) and the log of compensation, are, as predicted, positively related to the dependent variable. Log of GDP per capita is positively related to firm profits, indicating that it captures elements of market size and wealth that concurrently influence profit.

Looking at Table 3, columns 1 and 2 give the fixed effects results, while columns 3 and 4 show the pair-wise fixed effects results. As previously discussed, the estimates also contain country and sector identifiers as additional control variables. Once more we report a negative co-efficient for the effective tax rates for the entire sample. The other explanatory variables are again all positively related to the dependent variable. The main point worth noting is that employing pair-wise fixed effects along with the additional control variables, have reduced the magnitude of the tax co-efficient to circa −0.10. Interestingly, the co-efficient for plant, property and equipment (or firm size) is similar to our earlier results.

**5.1 Sector and Regional Results**

Turning to the results contained in Table 4, which splits the sample into manufacturing and services using matched parent and affiliate information. Columns
(1) and (2) give the results for affiliates located in the EU-15, while columns (3) and (4) give results for Eastern European affiliate firms, both for manufacturing and non-manufacturing respectively. When the sample is split, we see that for the EU the results remain approximately unchanged, but for the Eastern European affiliates the magnitude of the tax co-efficient is smaller. Overall, the results in column (1) at -0.28 and column (3) at -0.07 suggest that some active profit management is taking place. The other possibility is that taxes have a much smaller effect than previously estimated for the manufacturing sector in both the EU 15 and especially Eastern Europe.

Interestingly, the results for Eastern European affiliates are well below what Gorter and Parikh (2000) report for Portugal just prior to entry into the EU. The tax co-efficient for affiliate firms operating in non-manufacturing sectors is not significant and therefore not different from zero. Our results indicate that, during the period of this study, corporation tax did affect individual affiliate profit, but the magnitude of this effect is considerably below that previously reported. Gorter and Parikh (2000) for example give co-efficients of -4.6 and -2.3 for France and Germany respectively.

Affiliate assets are positive for each sector in both regions. However, the co-efficients are only statistically significant for affiliate manufacturing. One possible explanation for this is that physical assets are more important for manufacturing. If one takes affiliate assets as a proxy for firm size we can see that, on average, EU affiliates are larger (in terms of capital investment) than their Eastern European counterparts.

An alternative explanation for these differing results for the Eastern European region and the EU-15 is that production techniques are not the same. This could be a result of the central planning system formerly operating in the Eastern European region. Central planners focused on economies of scale and therefore the average size of a manufacturing facility tended to be large (especially in terms of numbers employed) by Western European standards. Product development, R&D and innovation lagged behind Western Europe across a broad range of goods and services. As part of industrial and general development strategy these large firms were often placed in less developed areas.
Much of the FDI activity into the Eastern Europe during the period of this study was of the merger and acquisition variety (see Roland, 2000). Therefore, it is likely in the early years of this study that production techniques lagged those in EU affiliates. This is reflected in the low skill activities that Eastern European CEE affiliates are often engaged in, such as assembly operations in the car, white good and latterly computer industries.

Aggregate data shows that a large proportion of the economy in the EU-15 is in the service sector, whereas in the CEE the service sector, while expanding rapidly during the 1990s, was much smaller. This result tends to confirm the hypothesis that, where a European multinational is already operating in manufacturing, they appear to employ active profit management techniques to minimise their exposure to group wide corporate tax liabilities.

5.2 Robustness Tests

As estimated, the profit model ignores the fact that some EU countries operate a tax credit system (for example the UK and Italy), while others use the tax exemption system. A tax credit system is used by tax authorities in conjunction with bi-lateral tax agreements to top-up the domestic tax liabilities of firms repatriating profits earned abroad. A firm whose foreign affiliate pays their tax liabilities in the affiliate country faces a top-up tax at home if these net profits (after tax) are repatriated. To control for these differences we estimate the elasticity for tax-exempt countries, conditional on a zero-elasticity for affiliate tax credit countries [see: Slemrod (1990) and Hines (1996)].

Table 5 gives manufacturing sector results for the effect of corporate tax on reported net (pre-tax) profit. We look at three regions in Europe: (1) EU low tax region; (2) EU high tax region and (3) the Eastern European regions. Looking at the size effect (log of affiliate assets) we see that on average EU low tax region affiliates are smaller than those in EU high tax or Eastern European regions respectively. The interaction effect is negative and statistically significant for the EU estimations. In column (1) we see results for the EU low tax region with a co-efficient of -0.37, while the estimated

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4 The high corporate tax countries in this section are Belgium, France and Germany, and the low corporate tax countries are Ireland, Portugal and Spain.
semi-elasticity for the EU high tax region in column (2) is -0.29, Gorter and Parikh (2000) report -1.00 and -1.50 for Austria and Denmark respectively. Hines (1996), reports an elasticity of -10.00 for European tax-exempt countries. In column (3) gives the results for Eastern Europe showing the interaction effect, which is not statistically significant at -0.07.

6. Conclusion

This paper tested whether corporate tax differentials are driving the reallocation of reported profits between EU parent multinationals and their European based affiliates. Studies looking at the profitability of multinational affiliates in Europe have tended to find a large sensitivity of reported profits to differences in regional corporate tax rates. For instance Hines and Rice (1994) using US parent multinational data report that a 1-percentage point reduction in corporation tax induces a 3% rise in reported profitability of a European based affiliate.

Previous research has also highlighted a set of problems associated with estimates based on country average effective corporate tax rates. One concern is that a single measure of the tax rate cannot capture industry and firm specific tax holidays and other features of the tax system. Another issue that arises when estimating the effect of corporate tax on reported profits is that a low tax environment may be associated with other general equilibrium effects, which may simultaneously influence firm-level profitability.

This paper addresses these issues; firstly, by using data containing information on the total bundle of tax actually paid by each firm. This is important because as we have shown the actual tax rates paid by affiliates can vary widely across firms even within a unified tax regime. Secondly, we use matched parent and affiliate unconsolidated account data to control for the trading environment of each parent-affiliate pair. Using matched parent and affiliate data and allotting each trading pair its own pair-wise variable overcomes an information problem, in that we do not know which variables are responsible for the heterogeneity bias in effective tax rates, both across and within sectors, and more generally within countries.
When we do not directly control for the parent-affiliate specific tax and trading environments, we obtain a semi-elasticity of -2.4 that is similar to previous research. But when we apply the individual tax information and match each parent-affiliate pair we obtain a semi-elasticity of –0.25. This suggests that in Europe some profit reallocation effects are taking place in all affiliates regardless of location and sector of activity. Looking more closely at the estimates in this paper they appear to show that profit reallocation occurs mainly between parent firms and their affiliates that are operating in the manufacturing sector. On average, these estimates suggest that while corporation tax differences do affect reported profitability; the magnitude of this effect is lower than previously reported in studies using information from U.S. owned multinationals.
Bibliography


Table 1: Distribution of Multinational Firms by Country and Activity, 1993-2001

<table>
<thead>
<tr>
<th>Country</th>
<th>Frequency of affiliate firms</th>
<th>Frequency of parent firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>131 (3.01)</td>
<td>49 (3.92)</td>
</tr>
<tr>
<td>Belgium</td>
<td>304 (7.01)</td>
<td>81 (6.47)</td>
</tr>
<tr>
<td>Denmark</td>
<td>98 (2.27)</td>
<td>45 (3.60)</td>
</tr>
<tr>
<td>Finland</td>
<td>39 (0.09)</td>
<td>21 (1.67)</td>
</tr>
<tr>
<td>France</td>
<td>451 (10.48)</td>
<td>187 (14.95)</td>
</tr>
<tr>
<td>Germany</td>
<td>485 (11.27)</td>
<td>232 (18.54)</td>
</tr>
<tr>
<td>Greece</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ireland</td>
<td>103 (2.39)</td>
<td>27 (2.16)</td>
</tr>
<tr>
<td>Italy</td>
<td>276 (6.41)</td>
<td>78 (6.25)</td>
</tr>
<tr>
<td>Luxemburg</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Netherlands</td>
<td>324 (7.52)</td>
<td>161 (12.87)</td>
</tr>
<tr>
<td>Portugal</td>
<td>93 (2.16)</td>
<td>-</td>
</tr>
<tr>
<td>Spain</td>
<td>282 (6.55)</td>
<td>18 (1.44)</td>
</tr>
<tr>
<td>Sweden</td>
<td>153 (3.55)</td>
<td>134 (10.71)</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>568 (13.20)</td>
<td>182 (14.55)</td>
</tr>
<tr>
<td>Central &amp; Eastern</td>
<td>997 (23.16)</td>
<td>-</td>
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<tr>
<td>Europe</td>
<td>4,304</td>
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Sector Distribution of parent and affiliate firms

<table>
<thead>
<tr>
<th>Affiliate firm</th>
<th>Manufacturing</th>
<th>Non-manufacturing</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent firm</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>51.27</td>
<td>30.43</td>
<td>18.30</td>
</tr>
<tr>
<td>Non-manufacturing</td>
<td>23.11</td>
<td>56.93</td>
<td>19.96</td>
</tr>
</tbody>
</table>

Note: The foreign affiliate column lists the number of foreign controlled affiliate firms operating in that country. The European parent column lists the number of parent multinationals in the dataset by their home country.

Source: Amadeus and own calculations.
Figure 1: Mean Corporate Tax Rates: 1993 - 2007

Source: European Commission.
Figure 2: German Effective Tax Rates - 2001
Highest and Lowest Deciles

Source: Amadeus and own calculations.
The Irish data has been extended to include 2002 and 2003 for Figures 2 and 3. It shows data for true 'manufacturing' companies who face a headline corporate tax rate of 10% which will last until 2010; for other companies it lasted only until the end of 2000. A company which did not qualify as a true 'manufacturing' company paid the declining rate of mainstream corporation tax from 2001 until the final 12.5% rate agreed between the Irish Government and the EU came into effect in 2003.
Figure 4: Irish Effective Tax Rates (Manufacturing) - 2003
Highest and Lowest Deciles

Source: Amadeus and own calculations.
Table 2: the effect of corporate tax rates on the location of non-financial profit

Dependent variable: log pre-tax non-financial profits

<table>
<thead>
<tr>
<th>Method</th>
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<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
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<td>-2.12**</td>
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<td></td>
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<td>(0.66)</td>
<td>(0.065)</td>
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<td>-0.24**</td>
</tr>
<tr>
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<td>(0.007)</td>
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<td>0.40*</td>
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<td>0.44***</td>
<td>0.42***</td>
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<td>(0.004)</td>
<td>(0.004)</td>
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<tr>
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<td>0.41****</td>
<td></td>
<td></td>
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<td>0.29*</td>
</tr>
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<td>(0.014)</td>
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<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(0.10)</td>
<td>0.17**</td>
</tr>
<tr>
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<td>(0.049)</td>
<td>-</td>
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<td></td>
<td></td>
<td>0.15**</td>
</tr>
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<td></td>
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<tr>
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</tr>
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Notes: (i) *** 1% significance level, ** & * significant at 5% and 10% confidence level.
Table 3: the effect of corporate tax rates on the location of non-financial profit

Dependent variable: log pre-tax non-financial profits

<table>
<thead>
<tr>
<th></th>
<th>Firm Level Fixed Effects</th>
<th>Parent &amp; Affiliate Pair-wise Fixed Effects</th>
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<tr>
<td></td>
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<td>-0.28***</td>
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<td>(0.008)</td>
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<td>(0.019)</td>
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<td>Log GDP per capita</td>
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<td>(0.07)</td>
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<td>Y</td>
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<tr>
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<td>2.52</td>
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<tr>
<td></td>
<td>(0.30)</td>
<td>(0.089)</td>
</tr>
<tr>
<td>R-Squared</td>
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<td>0.34</td>
</tr>
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<td>3801</td>
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Notes: (i) *** 1% significance level, ** & * significant at 5% and 10% confidence level.
Table 4: Fixed Effects Estimates

Tax Effects on European Sector Level Results for Profit Shifting

Dependent variable: log pre-tax non-financial profits

<table>
<thead>
<tr>
<th></th>
<th>EU Manufacturing</th>
<th>EU Services</th>
<th>Eastern Europe Manufacturing</th>
<th>Eastern Europe Services</th>
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<tbody>
<tr>
<td>Tax</td>
<td>-0.28***</td>
<td>-0.15</td>
<td>-0.07**</td>
<td>-0.02</td>
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<tr>
<td></td>
<td>(0.032)</td>
<td>(0.16)</td>
<td>(0.033)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Log Plant property &amp; equipment</td>
<td>0.72***</td>
<td>0.40</td>
<td>0.41**</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.29)</td>
<td>(0.052)</td>
<td>(0.20)</td>
</tr>
<tr>
<td>Log Compensation</td>
<td>0.21***</td>
<td>0.15</td>
<td>0.07**</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.16)</td>
<td>(0.033)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Log GDP per capita</td>
<td>0.29**</td>
<td>0.28</td>
<td>0.12</td>
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</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.007)</td>
<td>(0.053)</td>
<td>(0.053)</td>
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<td>Sector Effects</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>R-Squared</td>
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<td>0.23</td>
<td>0.26</td>
<td>0.19</td>
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<tr>
<td>Number of Firms</td>
<td>2241</td>
<td>1563</td>
<td>419</td>
<td>78</td>
</tr>
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</table>

Notes: (i) *** indicates 1%, ** 5% and * 10% significance levels. (ii) Robust standard errors in brackets.
Table 5: the effect of corporate tax rates on the location of non-financial profit

**Dependent variable: log pre-tax non-financial profits**

<table>
<thead>
<tr>
<th></th>
<th>Conditional on a zero-elasticity for tax credit countries</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>(1) EU Low Tax</td>
</tr>
<tr>
<td>Tax</td>
<td>-0.16* (0.076)</td>
</tr>
<tr>
<td>Log Plant property &amp; equipment</td>
<td>0.40** (0.065)</td>
</tr>
<tr>
<td>Log Compensation</td>
<td>0.36** (0.014)</td>
</tr>
<tr>
<td>Log GDP per capita</td>
<td>0.28 (0.042)</td>
</tr>
<tr>
<td>Location Controls</td>
<td>Y</td>
</tr>
<tr>
<td>Sector Controls</td>
<td>Y</td>
</tr>
<tr>
<td>Constant</td>
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<td>R-Squared</td>
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<td>Number of Firms</td>
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</table>

Notes: (i) *** indicates 1%, ** 5% and * 10% significance levels. (ii) Robust standard errors in brackets. (iii) The corporate low tax counties are Ireland, Portugal and Spain. (iv) High corporate tax countries are Belgium, France and Germany. (v) All East European Countries.
Appendix

It is possible that a MNE earning pre-tax profits $p_i$ in country $(i)$ may adjust those reported profits. Consider a parent MNE that has the ability to allocate an additional $\psi_i$ in profits to the affiliate in location $(i)$. To facilitate these actions the parent firm may have to:

- Undertake inefficient intra-firm trade.
- Establish additional facilities at the affiliate location.
- Employ additional staff at the affiliate location.
- Incur additional accounting, insurance and legal costs.

This process is likely to be costly, Hines and Rice (1994) theorise that the marginal cost of shifting profits to a new location is minimal at first, but rises in proportion to the $\frac{\psi}{p_i}$ ratio. If we permit $\alpha$ to denote this factor of proportionality, then the total cost of adjusting affiliate location reported profits equals $\frac{\alpha\psi_i^2}{2p_i}$. Therefore, the reported profitability of affiliate $i$, $\Pi_i$, is:

\begin{equation}
\Pi_i = p_i + \psi_i - \frac{\alpha\psi_i^2}{2p_i}
\end{equation}

If a foreign affiliate under reports profit and transfers it to another location it must be the case that $\psi_i < 0$. The assumption here is that transferring profits in any direction incurs costs within the multinational group, because doing so requires costly actions. In addition, the MNE is constrained to have the sum of $\psi_i$ non-positive, as by definition undertaking intra-firm transfers cannot create extra pre-tax profits for the group.

Consider, for example, the actions of a MNE firm that selects its profit transfers to maximise foreign affiliate after-tax returns (R), assuming as fixed profits generated by its factors ($p_i$):

\begin{equation}
R \equiv \sum_{i=1}^{n} (1 - \tau_i) \pi_i = \sum_{i=1}^{n} (1 - \tau_i) \left[ p_i + \psi_i - \frac{\alpha\psi_i^2}{2p_i} \right],
\end{equation}
Subject to:

\( \sum_{i=1}^{n} \psi_i = 0 \).

The first order condition of the maximisation problem with \( \lambda \) being the Lagrange multiplier corresponding to the constraint in (3a) is:

\[
(4a) \quad (1 - \tau_i) \left[ 1 - \alpha \left( \frac{\psi_i}{p_i} \right) \right] = \lambda ,
\]

Thus, for profit transfers \( (\psi_i) \) it is implied by (4a) that:

\[
(5a) \quad \psi_i = p_i \left[ \frac{1 - \tau_i - \lambda}{\alpha (1 - \tau_i)} \right].
\]

Combining (5a) and (2a) we attain:

\[
(6a) \quad \pi_i = p_i \left[ 1 + \frac{1}{2\alpha} - \frac{\lambda^2}{2\alpha (1 - \tau_i)^2} \right].
\]

This equation indicates that reported profitability \( (\pi_i) \) is a function of pre-tax profits \( (p_i) \) and the domestic tax rate. Transforming the term on the right hand side of equation (6a) into a linear function of the tax rates considerably eases the estimation problem. Therefore take a first-order Taylor expansion of (6a) in \( \tau_i \), around the point at which \( \tau_i = (1 - \lambda) \), giving the Profit Shifting Equation:

\[
(7a) \quad \pi_i = p_i - p_i \left[ \frac{\tau_i - (1 - \lambda)}{\alpha \lambda} \right].
\]

Consequentially, it must be the case that; reported profitability given by the MNE, exceeds earned profits in low tax locations, and is lower than actual earned profits in high tax locations.

The Lagrange multiplier \( \lambda \) captures the marginal cost of transferring profits between locations. Alternatively, one may view the Lagrange multiplier \( \lambda \) as the marginal country tax rate at which firms have no incentive to either transfer in (or out) locally generated profits. One may evaluate the value of earning an additional Euro of pre-tax profits \( (p_i) \) in location \( (i) \) by reference to the envelope theorem and assuming that \( (w_i) \) is not very responsive to changes in profit.

Therefore, equation (2a) indicates the value of additional profitability and assuming that the MNE has easy access to capital on world markets and it allocates any given
stock of capital optimally, such that \((\tilde{K})\) is allocated to maximize (2a). The. Subject to following constraint:

\[(8a) \sum_{i=1}^{n} K_i \leq \tilde{K}.
\]

Hence, the first-order condition for this maximisation problem is:

\[(9a) \frac{dp_i}{dK_i} (1-\tau_i) \left[ 1 + \frac{\alpha \psi_i^2}{2 p_i^2} \right] = \mu , \]

In which \((\mu)\) for every location is a constant. It reflects the value of relaxing the resource constraint in (8a) by one unit. Employing (5a) gives us:

\[(10a) \frac{dp_i}{dK_i} (1-\pi_i) \left[ 1 + \frac{(1-\tau_i - \lambda)^2}{2\alpha (1-\tau_i)^2} \right] = \mu . \]

Equation (10a) captures the MNEs ability to transfer profits between locations when doing so facilitates profitable reporting of taxable income. Thus (10a) captures the additional value of earning profits in low-tax countries. Taking a first-order Taylor expansion of (10a) in \(\tau_i\), around the point at which \(\tau_i = (1-\lambda)\) gives:

\[(11a) \frac{dp_i}{dK_i} (1-\tau_i) = \mu . \]

Consider the following production function to evaluate the investment behaviour that is implied by (11a):

\[(12a) p_i = \theta_i K_i^\gamma . \]

Where;\(\theta_i\) is the country-specific vector of observable attributes including for example GDP or GNP, unemployment rates and openness to trade, and the parameter \(\gamma\) reflects the curvature of the production function. By differentiating both sides with respect to \(K_i\), subject to (11a), and rearranging our terms, we obtain:

\[(13a) K_i^{1-\gamma} = \frac{(1-\pi_i) \theta_i \gamma}{\mu} . \]

By taking logs of both sides and using, a Taylor approximation that

\[(14a) \ln(1-\tau_i) \approx -\frac{\tau_i}{\lambda} . \]

This implies the following Investment Allocation Equation:

\[(15a) \ln(K_i) \approx \beta_0 - \beta_1 \tau_i \]
Thus (16a); \( \beta_0 = \frac{[\ln(\theta, \gamma) - \ln(\mu)]}{(1 - \gamma)} \)

and (17a) \( \beta_1 = \frac{1}{\hat{\lambda}(1 - \gamma)} \).