Evaluating Neutrality Properties of Corporate Tax Reforms

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Abstract

We propose a methodology for assessing the neutrality of corporate tax reform proposals in an open economy. The methodology identifies variation in effective tax rates to assess the proximity of a tax system to capital export neutrality (CEN) and to market neutrality (MN, which holds if all potential competitors in a single market face the same effective tax rate). We apply the methodology to two reform options in the EU. Optional international loss consolidation would move the EU tax system away from both CEN and MN. The proposed common consolidated corporate tax base (CCCTB) has mixed effects which depend on the precise comparisons made.

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1 Introduction

This paper sets out a methodology for assessing the neutrality of corporation taxes in open economies. It focuses on international distortions to location, ownership and competition generated by differences in tax regimes between countries. The methodology compares the distribution of firm-specific effective tax rates in two dimensions. The first explores the extent to which location decisions of individual companies are likely to be affected by taxes. The second explores the extent to which competition between companies may be affected by taxes. The paper applies this methodology to compare existing corporation tax systems in the Europe Union with alternatives that have been proposed, including the Common Consolidated Corporate Tax Base (CCCTB).

The methodology developed here assesses the extent to which existing or potential corporation tax systems are consistent with two concepts of neutrality in an open economy. Such concepts of neutrality have a long history, dating back to Musgrave (1959). Traditionally, the debate has been about the relative merits of capital export neutrality (CEN) and capital import neutrality (see Richman, 1963). The more general notion of production efficiency usually implies a preference for CEN: this holds if decisions by investors as to where to locate their investments are not affected by taxes. More recently, Desai and Hines (2003) have pointed to the importance of a concept of capital ownership neutrality. The idea here is that if efficiency of production varies across potential owners, then an efficient tax system would also not distort ownership patterns. Beyond this, Devereux (2008) addresses the possibility that two firms that are not equally efficient nevertheless co-exist and compete in the same market. A more general neutrality concept, market neutrality (MN), which goes beyond the concept of Desai and Hines, is that tax should not distort the nature of the competition between firms. If two firms compete with each other in the same market, then MN would only hold if both firms face the same overall effective tax rates on their investment. Note that these two firms could produce in different countries, but export to the same third country.

The main contribution of the paper is to measure the extent to which existing and potential tax systems exhibit CEN and MN. Our broad approach is to consider the distribution of effective tax rates across alternative investment locations, and across potentially competing firms. To evaluate proximity to CEN, we calculate the effective tax rates for any single company facing the opportunity of investing in each of the 27 EU member states. We summarise the distribution of effective tax rates faced by that company by the standard deviation across the 27 effective tax rates. We take a smaller standard deviation indicate a greater proximity to CEN. We analyse the values of these standard deviations for a large number of companies, resident throughout the EU. To evaluate proximity to MN, we need to identify a representative tax rate for each company. We follow two routes, using the minimum and average across the 27 faced by each company. Allowing each company in the EU to serve the market in any member state implies that we need to compare these represen-

tative tax rates across all companies. We take a narrower distribution across companies as indicating closer proximity to MN. We discuss this approach in more detail in Section 2 below.

For each of these comparisons, we need measures of effective tax rates. We develop two measures based on the standard approach of considering a hypothetical investment project set out by Devereux and Griffith (1999): an effective average tax rate ($EATR$) and an effective marginal tax rate, the effect of which is summarised by the cost of capital (CoC). We follow Egger et al (2009) in measuring a company-specific effective tax rate, based on the company's existing asset mix, choice of finance and ownership pattern. We abstract from examining distortions to the allocation of capital between different assets, and the source of finance. We extend the measure to introduce uncertainty by allowing the possibility that the investment project may generate a loss.

We are not aware of any other paper which addresses these issues. The closest to the approach in this paper is that of Devereux and Pearson (1995), who analyse the impact of a number of potential tax harmonization scenarios on production efficiency. However, that approach is based on country-specific, rather than firm-specific, effective tax rates. It does not therefore reflect differences between companies located in the same country. Such differences may affect the assessment of CEN, but more importantly they have a direct implication for the assessment of MN. Egger and Loretz (2009) show that a uniform tax reform can have very different effects on effective tax rates across companies depending on, for example, their asset mix and their sources of finance. For some reforms, such as the CCCTB, such differences are exacerbated for multinational companies by different ownership patterns across countries. Further, the Devereux and Pearson approach does not allow for the hypothetical investment to generate a loss, and so is not able to consider the key element of loss consolidation considered in this paper.

We use this methodology to analyse and compare three different tax systems: (a) the actual system in 2008; (b) a system which allows (but does not require) companies within the same multinational group to offset losses against profits generated in the group in another country; and (c) the CCCTB proposal, which would oblige companies to consolidate all profits across the EU, and allocate them back to individual countries using an apportionment factor. The methodology for developing effective tax rates in each of these cases is described in more detail in Section 3.

Section 4 presents the company level data used in this paper. Section 5 presents the results, analysing the proximity of each of these tax systems to CEN and MN, and Section 6 concludes. The main results are as follows. The introduction of optional international loss consolidation would increase the variation in effective tax burdens, and would represent a move away from both CEN and MN. However, the effects of combining international loss consolidation with a common tax base and formula apportionment in the CCCTB are more subtle;

they depend on the precise comparisons made and the assumptions used. In our base case, the CCCTB would move the tax system slightly in the direction of CEN for $EATR$s, but away from CEN for CoCs. For MN, the results depend on whether the average or minimum measure of effective tax rate is used. Where the minimum rate is used, there is a significant movement towards MN, which reflects the fact that there would be fairly common minimum tax rates in the EU achievable by many companies. However, based on the average effective tax rates across locations, there is a small movement away from MN.

2 Neutrality concepts and production efficiency

This section sets out the broad approach of the paper. It begins with a brief summary of the literature investigating efficiency and neutrality properties of corporation taxes in an open economy, and identifies the two concepts of neutrality used in this paper. It then sets out the empirical approach used here to investigate how close existing and potential systems are to exhibiting these two forms of neutrality.

2.1 Conceptual framework

The starting point for any analysis of optimal tax systems is the Diamond and Mirrlees (1971) framework which demonstrated that, within a single country, it is optimal to preserve production efficiency. This holds when it is not possible to increase total output by reallocating inputs to different uses, and implies that the marginal pre-tax rate of return is the same on all investments. However, the Diamond-Mirrlees theorem relies on two critical assumptions: that there are no restrictions on the use of tax instruments available to the government, and that economic rent is fully taxed at 100% (or there is no economic rent).[1] Keen and Piekola (1996) analyse optimal tax rates between co-operating countries when economic rents exist but cannot be taxed at a rate of 100%. In this case, the optimal tax system depends on similar factors to those identified by Horst (1980); namely the elasticity of the supply of savings and the elasticity of the demand for capital in each jurisdiction. Keen and Piekola also show that the optimal tax structure depends on the rate at which economic rents are taxed.

A further caveat was introduced in an international context by Keen and Wildasin (2004). They point out that the Diamond-Mirrlees model does not directly apply in an international setting, since there is no longer a single government budget constraint, but each country has its own budget constraint. They analyse the case in which lump sum transfers between governments are ruled out, but where transfers can instead take place via trade taxes and subsidies. Under these circumstances, it may be the case that the optimal (Pareto-efficient) tax system does not generate production efficiency. However, as argued by Edwards (2005), if the aim is to generate a global optimum, it is not clear why governments should co-operate by adjusting their trade taxes, rather

[1] See Stiglitz and Dasgupta (1971).

than agreeing to lump-sum transfers. In the latter case, we are effectively returned to the Diamond-Mirrlees setting of a single budget constraint.

Although the global optimality of production efficiency is an important issue, we leave these caveats to one side and instead focus on the implications for the design of international taxes on profit of a requirement for production efficiency. We consider each country to be a small open economy, with access to international portfolio investment. Abstracting from risk, this implies that all companies are required to earn the same rate of return after source-based taxes on capital income. Specifically, if corporation taxes are source-based, but personal taxes are residence-based, then the post-corporation tax rate of return is fixed for any company. We also assume that companies can choose where to locate their investments, and can also supply third country markets through exporting.

In this setting, Devereux (2008) discusses the properties of international corporation tax systems that would generate production efficiency. It is clearly the case that if the post-tax rate of return is fixed and production efficiency requires the pre-tax rate of return to be the same on all possible investments, then production efficiency requires the effective tax wedge between pre- and post-tax rates of return to be the same for all possible investments. This requires the complete harmonisation of all source-based corporation taxes.

However, in this paper we split this requirement into two elements, which illuminate the nature of the proposed tax reforms. The first element is capital export neutrality (CEN) (applied to corporation tax): that is, any individual company must face the same effective tax rate on any investment, irrespective of the location of that investment. In the absence of CEN, taxes may induce a company to produce in a less efficient location.[2]

The second element we consider we refer to as market neutrality (MN). This is related to concepts of capital ownership neutrality (CON) of Devereux (1990) and Desai and Hines, (2003). The concept of MN is that the tax system should not favour one company over another company with which it competes. If this did not hold, then a less efficient company may have a competitive advantage over a more efficient company. This of course requires there to be differences in efficiency between companies, a point emphasised by Desai and Hines (2003) in developing their concept of CON, which is that the tax system should not prevent a more efficient owner acquiring an asset from a less efficient owner. If all assets were indeed owned by their most efficient owner, then distortion to competition would be irrelevant in this context. However, this is clearly not the case in practice: companies with different levels of efficiency do co-exist. If they do co-exist, then production efficiency requires the broader concept that

[2]In a setting without a distinction between portfolio and direct international investment, CEN can be sufficient to achieve production efficiency. However, with a fixed post-tax rate of return it is not a sufficient condition.

there is no distortion in the market, so that the competitive advantage of more efficient companies is not undermined. In the absence of international trade, the condition for the absence of any distortion in the market is equivalent to capital import neutrality (Richman, 1963): that all firms operating in a given jurisdiction should face the same effective tax rate. But with international trade, companies producing in different countries may nevertheless compete with each other in third countries. In that case, production efficiency requires that any company competing (or potentially competing) with any other in a given market must face the same effective tax rate; this is market neutrality.

Both CEN and MN are required for production efficiency. By investigating the proximity of the existing and hypothetical tax systems to each of these, we aim to identify the strengths and weaknesses of alternative tax systems.

2.2 Empirical measures

To assess proximity to CEN and MN, we estimate and use company-specific measures of effective tax rates for a large number of European firms when they potentially invest either at home or in any of the other 26 EU member states. We measure the extent to which tax systems meet the requirement of CEN by calculating the standard deviation of the distribution of these 27 effective tax rates for each individual company. We then consider the distribution of these standard deviations across all of the companies in our dataset. CEN holds in the case of a single company when its standard deviation is zero, and CEN would apply throughout the EU if all of these standard deviations were zero. More generally, we consider that a potential reform moves the overall system towards CEN if the distribution of standard deviations moves towards zero. We do not explicitly define a single measure to capture such a movement in the distribution of standard deviations. Instead, we present the distribution and consider its properties in the context of understanding the effects of the reform.

To consider how close existing and potential tax systems are to MN, we identify a single effective tax rate facing each company as it competes in any potential market. A difficulty is that we have 27 effective tax rates for each company, corresponding to investment in each EU member state. To analyse competition between companies, however, we need to summarise these into a single figure for each company. But we do not know which country a company will choose for the location of production to serve a particular market. We consider two possibilities. First, we assume that the company is equally likely to choose each member state, and we therefore take the average across the 27 effective tax rates. Second, we assume that the company chooses the most tax-efficient location for production; in this case we use the minimum effective tax rate for each company. To measure proximity to MN, we consider the variation in the distribution of these single tax rates across companies. If there were no variation at all, then the tax system would exhibit MN. More generally, we consider that a potential reform moves the overall system towards MN if the distribution of these single tax rates becomes narrower. As for CEN, we do

not summarise this in a single measure, but again present the distribution and interpret the effects of any particular reform.

One important issue in analysing both CEN and MN is whether the appropriate effective tax rate is an average or marginal rate. Devereux and Griffith (1998, 2003) point out that both of these could be relevant in determining the size of the capital stock owned by a company in each country. The effective average tax rate ($EATR$) is the relevant measure for the extensive investment margin: the discrete choice of where to locate a new activity. In the context of this analysis of this paper, this is the decision as to in which of the 27 EU member states to locate a new plant. Conditional on this choice, the intensive margin - the scale of investment in the chosen country - depends on the effective marginal tax rate ($EMTR$), or equivalently, the cost of capital (CoC).[3]

Both the $EATR$ and the CoC are relevant for assessing CEN and MN. We interpret CEN as implying more than simply that the extensive decision margin is unaffected by tax. Instead, we interpret it as indicating that the allocation of capital across countries is unaffected by tax; and as noted above, the allocation of capital should depend on both the $EATR$ and the CoC. Similarly, the impact of tax on the price charged by a participant in a market may depend both on where production takes place and the scale of investment: hence MN also depends on both the $EATR$ and the CoC. In principle, for any company, we could combine the $EATR$ and CoC into a single measure summarising the impact of tax on its contribution to the overall allocation of capital or competitiveness. However, to do so, it would be necessary to know the importance of each measure for each decision. In the absence of such information, we therefore consider each measure separately.

Another important issue is that we use company-specific effective tax rates. As described below, the effective tax rates are based on a hypothetical new investment undertaken by an existing company. We follow Egger et al (2009) in assuming that the nature of this new investment matches the existing features of the company in terms of its mix of assets and use of alternative sources of finance. That is, the new investment is comprised of different assets in the same proportion as the company already owns; and the debt-equity ratio used to finance the new investment is also the same as in the existing company. We do not allow the company to choose the nature of its investment in response to tax reliefs available in each potential host country.

Our estimates of company-specific tax rates are intended to reflect differences in the tax treatment of companies even within a single country, since companies have different characteristics. Given these different characteristics, it is possible that two companies resident in the same country face different tax incentives in choosing to locate either at home or in a foreign country. This

[3]These are equivalent in their effects if each company requires a given post-tax rate of return.

implies that the extent to which CEN holds may be different for the two companies, even though they are resident in the same country. Clearly, too, the concept of MN is based on there being differences across companies. While there may be many factors creating differences in efficiency between companies, it is possible that some of these differences are reflected in the factors that we are able to incorporate into our company-specific measures. To this extent, then variation in effective tax rates even within a country may reflect absence of MN.

A final issue arises in respect of modelling of one particular tax system - that based on formula apportionment, such as the CCCTB. In this case, profits in the new investment are consolidated with profits from existing capital, and an overall statutory tax rate applied to the aggregate profit. This overall tax rate is a weighted average of the rates in each of the countries in which a company operates, where the weights depend on the formula used. This raises the problem if identifying the appropriate weight to give the new hypothetical investment, which we discuss further below.

3 Effective tax rates under different systems

The measures of effective average and marginal tax rates used here build on the cost of capital approach of Jorgensen (1963) and Hall and Jorgensen (1967), which was further developed by King and Fullerton (1984) and by Devereux and Griffith (1999). In line with Egger et al (2009) we apply firm- and industry-specific weights to exploit firm heterogeneity. We also introduce uncertainty in the outcome to allow possible losses in the hypothetical investment project. A formal presentation is provided in Devereux and Loretz (2008a); here we summarise the approach.

3.1 The current system

We consider a one-period investment by a company which takes the same form as its existing operations in terms of capital structure and asset mix. We further assume that this investment is conducted through a new subsidiary in which an asset is purchased in period 0 and makes an uncertain return in period 1. We assume that there are two possible outcomes, one positive and one negative. In the good outcome, a high return is earned. In the bad outcome, a negative return is earned. Denoting the probability of the good outcome to be q, the rate of return in the good outcome to be g, and the rate of return in the bad outcome to be b, then the expected return is $p = qg + (1-q)b$. In the standard approach to estimating the cost of capital, for $q = 1$, the cost of capital is the break-even value of g which generates a NPV of zero. Given our assumption of an uncertain outcome, it is necessary to assume values for q and b, and then solve for the break-even value of g. In the standard approach for estimating the EATR, for $q = 1$, it is necessary to choose a specific value of g which generates

a positive NPV. In this case, it is necessary to assume values of q, g and b.[4]

The basic mechanics of the hypothetical investment are as follows. First consider the case in which the parent company establishes a new subsidiary at home. The subsidiary undertakes investment of 1 unit in period 0, financed partly by issuing new equity and partly by borrowing. The investment generates a stream of depreciation allowances over time, the value of which depends on the allowance rate permitted for the asset mix chosen by the firm and the tax rate, t. The investment generates a return in period 1 which, if positive, is subject to tax at rate t. If it is negative, it will generate a taxable loss, which we discuss below. Interest paid in period 1 on borrowing in period 0 generally receives relief at rate t. We hold the capital stock unaffected in all other periods.[5] There may be differences in effective tax rates across firms, even though firms are subject to the same tax law, due to variation in the asset mix used, and the amount of borrowing.

In general, if the subsidiary is in a foreign country, the approach is the same. However, the firm has additional options for financing, including lending by the parent. The interest paid on such debt would be deductible against corporation tax by the subsidiary, but may be subject to a withholding tax on payment to the parent, and the parent may be subject to tax on the interest received. Dividends paid by the subsidiary to the parent would also potentially be subject to withholding taxes and a further tax on receipt by the parent.

Because the subsidiary is new, the allowance received in period 0 creates an initial taxable loss. In the case of a domestic subsidiary we assume loss relief is allowed within the country, so that this loss can be set against taxable income in the parent company. Similarly for the domestic subsidiary, in the case of the bad outcome the taxable loss generated in period 1 is assumed to be set against the taxable income in the parent. However, under existing rules there is generally no international loss consolidation, which implies that any loss arising in the foreign subsidiary could not normally be set against the profits of the parent. If the parent has an existing subsidiary in the location of the new investment, then we assume that losses can be set against profits in that existing subsidiary. However, if this is not the case, then losses will generally have to be carried forward to set against future profits. In the case of the bad outcome in period 1, there will be no future profit, and so there is no relief for losses in the host country. However, after the losses are materialized, they may be offset against the existing profits in the parent company.[6] In general, the

[4] In general, we assume $q = 0.8$ and $b = -0.2$. For the $EATR$ calculations, we also assume $g = 0.3$, which implies that $p = 0.2$ as is commonly assumed.

[5] In the good outcome, this is achieved by a reduction in new investment which we assume would otherwise have taken place. In the bad outcome, it is achieved by the sale of the asset, as the the subsidiary is closed down. The distinction between these two approaches is relevant only to the tax position. In particular, if the asset is sold, there may be a balancing charge if the sale proceeds exceeds the value for tax purposes. In this summary we neglect the issues of inflation and changes in relative prices.

[6] Austria and Denmark already forms of international loss consolidation, which we abstract

lack of immediate loss relief tends to increase the effective tax burden. Again the firm-specific composition of the investment will partly determine the size of this effect.

3.2 With voluntary cross-border loss consolidation

Now consider how the effective tax burden would change if the firm could choose whether to consolidate the losses of the foreign subsidiary with the parent.[7] The effective tax burden for a new subsidiary in the home country will not be affected, since we assume that it is already possible to offset the losses under the current system and will generally be beneficial to do so unless there is an anticipated change in the tax rate. However, for an investment project abroad the firm now faces a decision. Immediate cross-border loss offset in period 0 provides a certain tax relief against the home country tax rate, t. If the losses are left in the subsidiary and carried forward into period 1 then in the case of a good outcome, they can be set of against income arising in period 1 at the foreign country tax rate, t^*. If $t^* < t$, then it is always beneficial to consolidate immediately. However, if t^* is sufficiently larger than t, then the gain from offsetting the loss at the higher tax rate may offset the cost of the delay of one period, and the risk that a bad outcome may occur. Compared to the current system, then, a system of voluntary loss consolidation may - or may not - permit a reduction in the tax burden.

3.3 With loss consolidation and formula apportionment

Finally consider a more major tax reform, namely the introduction of a Common Consolidated Corporate Tax Base (CCCTB).[8] This would entail harmonization of the definition of the corporate tax base across EU countries and also an obligatory system of consolidation and formula apportionment.[9] The harmonization of the depreciation allowances eliminates one form of variation arising from investing in different countries. In addition, there are no longer any tax consequences of financing the subsidiary through lending from the parent, since the cash flows net out in the consolidation process. Further, since

from for simplicity reasons. Further the loss treatment we describe here is in compliance with the ruling in the Marks & Spencer v. Her Majesty's Inspector of Taxes (ECJ Case C-446/03), demanding that losses can be used in the parent company if there is no possibility of carrying them forward in the subsidiary.

[7]There process of corporate tax harmonisation within the European Union has been slow and has faced considerable opposition from Member States. So the European Commission has adopted a strategy of stepwise reform proposals. Agúndez-García (2006) discusses international loss consolidation and various forms of formula apportionment. We take the stepwise approach literally and analyse first the introduction of voluntary loss consolidation and then the full CCCTB.

[8]This was initially considered in European Commission (2001), but has been developed over time and we focus mainly on the 2007 statement by the CCCTB working group.

[9]Specifically we use the following assumptions as discussed by the CCCTB Working Group (2007): Buildings are depreciated according to a straight line schedule over 40 years, plant and machinery according to a declining balance scheme at a rate of 20 percent, intangibles are written down straight line over 15 years and inventories are valuated according to a weighted average.

losses in the subsidiary are automatically consolidated with the parent, there is no longer a disadvantage from foreign investment arising through the existence of taxable losses in the subsidiary. The tax disadvantage created by possibility of the loss-making bad outcome in the foreign subsidiary is therefore avoided.

However, the apportionment of profits to individual countries based on an arbitrary formula raises a new issue. In particular, the tax rate faced by the company as a whole depends on where the apportionment factors are located. If some of the apportionment factors are located in the new subsidiary, then there is an important feedback effect, since the tax rate applied to existing taxable income changes as a result of the new investment. To understand this effect, suppose that a proportion λ of the apportionment factors are located in the new subsidiary, and a proportion $1-\lambda$ are located in the parent company. Then the overall tax rate is $\tau = \lambda t^* + (1-\lambda)t$. Now suppose that the taxable income of the parent is P and the taxable income of the subsidiary is S. Tax due in the subsidiary is τS. The feedback effect is the change in tax in the parent, $(\tau - t)P$. In general, then, to estimate the effect of introducing formula apportionment, it is necessary to know both λ, and the ratio of taxable income in the parent to taxable income in the subsidiary, P/S. A natural assumption to make, however, is that the ratio of taxable incomes is equal to the ratio of apportionment factors: $P/S = (1-\lambda)/\lambda$. This is consistent with the general approach used in the paper that the new investment is a proportional expansion of the existing company, so that for example, the asset mix is the same. Making this assumption, the two tax effects sum to t^*S: that is, only the tax rate in the subsidiary country (and taxable income in the subsidiary) is relevant for the new investment.[10] This also applies if the existing company is a group located in more than one country. We make this assumption in the empirical work below. However, for comparison, in section 5.3 we also consider the opposite case where the tax effects depend only on the parent company's tax rate (or more generally, the existing tax rate of the group). This occurs if $\lambda = 0$, so that no apportionment factors are located in the country of the new investment. In this case, the ratio of the taxable incomes becomes irrelevant and the sum of the tax effects is tS.

4 Data

We use the largest available set of firm level data, Orbis, provided by the Bureau van Dijk (BvD). We begin with information on financial data and ownership for around one million large companies over the years 2001 to 2007. As we use information at the firm level only for the weights used in the calculation of effective tax rates, we average the data over time and use only the cross-sectional variation. This sample, including non-European companies, is then

[10] More precisely in our model, this result applies only to investment financed by retained earnings. Allowing for the parent lending to the subsidiary is more complex, and reintroduces a small effect from the parent's tax rate, t. Also, in calculating the cost of capital, we solve for g in the new subsidiary, which may differ from the rate of profit in the parent.

used to identify the group structures. A company is treated as part of a group if the database reports a majority shareholder (more than 50% direct or indirect shareholding) that is within our sample, or if a company is considered to be part of a group if the database reports a global owner which itself has a BvD identification number.

In order to have comparable numbers in each country, we limit the number of companies we consider in each EU member state to 50,000 companies; this reduces the sample size in France, Italy and Spain. This leaves us with a sample of 366,383 companies for which all the necessary data is reported.[11] Of these, 85,197 companies are part of 16,537 corporate groups, of which 4,244 corporate groups operate in more than one European country. We combine these data within the groups to end up with 297,723 observations. Each of these observations is then attributed to the country of the parent company, unless the corporate owner is outside Europe. In these cases we treat the highest level owner in a European country as the parent. Table 1 summarises the country coverage and the relevant variables that are used for the weighting of the firm specific effective tax rates.

Table 1 about here

We consider investment in 5 different assets, shown in Table 1: buildings, machinery, land, inventories and intangibles. The relevant shares for each investment are a combination of firm specific information combined with industry specific information as provided by McKenzie et al (1998). Specifically we use information about tangible and intangible fixed assets and inventories from BvD and split the tangible assets further into buildings, machinery and land using size-industry specific weights. The firm specific weights are defined as a proportion of the sum of tangible and intangible fixed assets and inventories. For the share of debt finance we use the firm specific ratio of current and non-current liabilities to total assets.[12]

As already discussed, we use firm-specific ratios across these five assets, and assume that the existing asset mix of the firm is mirrored in the new investment. The table shows average values for each country. Across the whole of Europe, buildings and machinery both account for around 23% of total assets, and inventories account for around 36%. Finally, the table also shows the average leverage ratio in each country; though again we use firm-specific values below.

To calculate the applicable overall tax rate under a formula apportionment system, we need to find the appropriate weighted average for groups that already operate in more than one country. And for all companies, we need to find the

[11] We exclude observations with missing values for the relevant variables, and corporate groups that report more than 100% debt or report zero values for all three asset variables, stocks, tangibles and intangibles.

[12] For a more detailed description see Egger et al (2009).

overall tax rate after the new subsidiary is set up. For existing multinational groups, we weight the corporate tax rate in the countries in which the group operates with the shares of the apportionment factors employed there. As in Devereux and Loretz (2008), we use a composite apportionment factor with weights of one third for turnover, one third for total assets, one sixth for number of employees and one sixth for cost of employees.

5 Results

We analyse the dispersion of the tax burden under the current and the proposed tax systems. We first present some numerical results for the $EATR$s and a graphical presentation of these results. The results for the costs of capital are subsequently presented only in graphical form.[13] Finally we also discuss the importance of the location of apportionment factors under a formula apportionment system.

5.1 Effective Average Tax Rates

To get a first impression of the impact of the different tax systems it is useful to examine the overall dispersion of the tax burden across all companies. As stated above, we do so for three different scenarios: the current system (without the possibility of international loss offset); a system of voluntary international loss consolidation without formula apportionment; and a system with a common consolidated tax base and formula apportionment.

Figure 1 about here

Figure 1 shows histograms of the $EATR$s for these three scenarios. Each histogram shows the dispersion of more than 8 million effective tax rates as we calculate the potential tax burden for 297,723 companies investing in all 27 European countries. As in all the figures, the graphs are arranged as follows. The upper part of the figure displays the results for the current system, the middle part for the voluntary loss offset and the lower part for the formula apportionment system. Moving from the top downwards two main changes can be observed. First, moving from the existing system to optional loss consolidation, the distribution shifts to the left, indicating that allowing loss consolidation reduces $EATR$s. Further the middle part of Figure 1 shows that this reform would also significantly increase the dispersion of $EATR$s. Note that because the loss consolidation is assumed to be voluntary, the distribution only widens at the lower tail. The lower part of the figure indicates that the overall tax burden under a formula apportionment system is significantly reduced relative to both of the other two systems. In this case, the lower tail is less pronounced,

[13] More detailed results are available from the authors on request.

which reflects the fact that excessive tax savings due to loss consolidation are not possible under a formula apportionment system.

To assess the impact on the $EATR$s in the individual member states, Table 2 compares the average $EATR$s for a domestic investment, and for inbound and outbound foreign direct investment. For domestic investment the current system and the voluntary consolidation lead to the same outcome as it is already possible to consolidate domestic losses under the current system. Further, it is always beneficial to use losses immediately in a domestic subsidiary because the loss carry forward could only be used against the same tax rate in the future. Even under formula apportionment the tax burden for domestic investment changes little; this is partly due to the fact the majority of our sample are domestic firms, for which the tax rate remains unchanged. As a result the differences in the domestic $EATR$ across countries persist.

Comparing the domestic $EATR$ under the current system with that for either outbound or inbound investment it is evident that the lack of international loss consolidation yields a higher $EATR$ for international investment. This is clearly inconsistent with CEN since domestic investment receives more favourable tax treatment. While the average $EATR$ for domestic investment ranges between 7.7% for Bulgaria and 28.3% in Malta, the average $EATR$ for outbound investment ranges between 25.9% in Bulgaria and 40.5% in Malta. Similarly the average $EATR$ for inbound investment varies from 17.3% in Cyprus to 39.2% in Malta.

Table 2 about here

Moving to a system of voluntary loss consolidation without formula apportionment would over-correct the distortion between domestic and foreign investment, as foreign investment would receive more favourable treatment. On average, the reform would generate a lower $EATR$ of two percentage points relative to domestic investment, though this difference is very unevenly distributed. In fact outbound investment from high tax countries would face a significantly reduced tax burden (as subsidiaries in low tax countries could offset losses against the parent's high tax rate), while outbound investment from low tax countries would still face a high tax burden. Overall, the spread of the average $EATR$ for outbound investment is comparable to the current system, with values between 17.7% for Belgium and 29.7% for Malta. For inbound investment, the attractiveness of low tax rate countries is amplified. For countries with a combination of generous depreciation allowances and low statutory tax rates, for example Lithuania, the average $EATR$ for inbound investment would be very low. This leads to an extremely large differential between country averages for the $EATR$ for inbound investment, with values as low as 1.8% for

Lithuania and as high as 33.4% for Malta.

A switch to a formula apportionment system would reduce the differential in the $EATR$ between domestic investment and inbound investment. However, the $EATR$ still varies significantly across the different member states. Country averages range from as little as 7.8% for investment into Bulgaria or Cyprus to 28.2% for investment into Malta. However, for the outbound investment the dispersion is significantly reduced, with a lowest average $EATR$ of 17.3% in Italy and a highest average of 21.1% in Cyprus. As described above, we assume that the investment is proportional to the existing operations, which implies that the effective tax burden including the feedback effect is mostly determined by the host country tax rate. The discussion in subsection 5.3 shows an alternative scenario where there is no feedback effect and the effective tax burden only depends on the home country tax rate.

5.1.1 Capital Export Neutrality

To evaluate the proximity of a tax system to CEN we go beyond an analysis of country averages of $EATR$s to exploit firm level information. For an individual company CEN holds if an investment faces the same tax treatment regardless of where the investment takes place. This can be measured as the variation between the $EATR$s a single firm would face on investment across all possible country locations, including its home country. The lower this variation, the closer the overall tax regime is to exhibiting capital export neutrality. The first three columns of Table 3 summarise the standard deviation between the $EATR$s for each of the 297,723 firms under the three tax systems considered in the paper. Figure 2 shows the dispersion of these standard deviations across all firms.

Figure 2 about here

Table 3 about here

In the top part of Figure 2, showing the distribution of company standard deviations under the current system, a unusual distribution can be observed. In fact, there are three distributions within this histogram. Starting from the left, the first peak at a standard deviation of around 0.03 there are firms with their headquarter in countries with a credit system and a relatively high tax rate, like the United Kingdom, Greece or Malta.[14] The smaller second peak at

[14]Note that our results are based on the tax laws in the year 2008, hence the recent change to an exemption system in the United Kingdom is not taken into account.

a standard deviation of approximately 0.05 represents firms in a country with a credit system and a moderate tax rate, e.g. the Czech Republic or Poland. The large bulk of companies is located in either a country with an exemption system, or in a country with a relatively low corporate tax rate, which effectively exempts foreign income from home country tax for most outbound investment. These countries have a standard deviation of their $EATR$s between 0.06 and 0.1. These effects can also be seen clearly in the first column of Table 3. Therefore, under the current system, capital export neutrality is to some extent fulfilled for high tax credit countries, but less so for exemption countries.

The middle part of Figure 2 displays the distribution of standard deviations under voluntary loss consolidation. Compared to the current system, there is a widening in the right hand side of the distribution, and an increase in the average standard deviation. This represents a movement away from capital export neutrality, as the standard deviations are generally higher. There is also an increase in the spread of tax rates, which stems from the fact that parent companies in low tax countries will not gain significantly from loss consolidation, while those in high tax countries will benefit the most since losses made abroad can be offset against tax at the parent's high tax rate. Therefore, the firms that face a low domestic tax burden, will face relatively high tax burdens for outbound investment. At the same time firms with a relatively high domestic tax burden will have increased low tax opportunities. This results in a average standard deviation of 0.085, with values up to more than 0.2 for some firms. The three distinct peaks for the different combinations of double taxation and tax rate combinations are no longer apparent.

The lower part of Figure 2 presents the distribution of standard deviations under a formula apportionment system. The overall distribution is slightly further left than under the current system. However the two smaller peaks of the credit countries disappear which implies that the overall improvement in terms of capital export neutrality is only minor. This can also be seen in the third column in Table 3 with a slightly reduced overall standard deviation of 0.059.

5.1.2 Market Neutrality

As discussed above, to assess whether these tax reforms would represent a movement towards market neutrality we follow two approaches in identifying a single $EATR$ for each company. First, we assume that in supplying any given market, a company faces its average $EATR$ from investing in all 27 countries. By comparing the distribution of this average $EATR$ for each company, we can then identify the extent to which some companies gain a competitive advantage over others. The results of this approach are presented graphically in the upper row of Figure 3 and on a more detailed basis for each country in the middle three columns of Table 3.

Figure 3 about here

Alternatively, we assume that each company will invest in the location which generates the lowest $EATR$. In this case, market neutrality depends on the distribution of the minimum $EATR$ for each company, across all companies. The results from this second approach are presented graphically in the lower row of Figure 3 and for each country in the last three columns of Table 3.

The upper left of Figure 3 presents the distribution of the average $EATR$s across all companies under the current system without loss consolidation. Most of the firms face an average $EATR$ between 25% and 35% and both the upper and lower tail are relatively short. This implies that the current system performs reasonably well in terms of MN. The country averages in Table 3 strengthen this impression, as they vary only moderately between 25.2% in Bulgaria and 40.0% in Malta.

In comparison, the lower left part of Figure 3 depicts the distribution of the minimum $EATR$s for each company under the current system. Relative to the average $EATR$ in the upper row the distribution is shifted to the left and is more dispersed. This is also reflected in the country averages in Table 3 where the differences across countries are larger than for the average $EATR$s, ranging from 7.7% in Cyprus to 28.3% in Malta. Further comparing the minimum $EATR$s with those for domestic investment in Table 2 it can be seen that the values are identical for all credit countries. This reflects the fact that under a credit system with no consolidation of losses across borders, domestic investment is the tax optimal strategy.

Introducing a voluntary system of loss consolidation would decrease both the average and minimum $EATR$s but simultaneously increase their dispersion. From the upper middle part of Figure 3, it becomes evident that most of the increased variation in the average $EATR$s would be in the lower tail. This is due to the voluntary nature of this tax reform, which implies that firms would claim no immediate group relief if this would increase their effective tax burden. Hence, companies located in a high tax countries with an exemption system could on average benefit more from the loss consolidation. The fact that a high home country tax rate implies bigger tax savings through loss consolidation is also reflected in the country averages in Table 3. The high tax and exemption countries - Germany, Italy and Spain - become the home countries with the lowest averages, all below 20%. At the other end of the spectrum are the high tax and credit countries like Malta with 29.7% and the United Kingdom and Greece. This is due to the fact that credit countries can only benefit to a limited extent through claiming losses in lower-taxed subsidiaries against highly taxed home country profits, because the absence of loss carry forward increases the subsequent tax burden in the subsidiary. And in contrast to the exemption countries these taxable profits are also subject to the higher

tax rate of the home country upon repatriation. Further, low tax countries like Cyprus or Ireland also cannot benefit from loss consolidation and therefore face relatively large tax burdens. The increased dispersion of the average $EATR$s represents a movement away from MN (using this measure), as the dispersion across firms rises.

The lower middle part of Figure 3 displays the dispersion of the minimum $EATR$s under a voluntary loss consolidation system and even more strongly highlights the tax planning opportunities available under this system by relocating real investment. In this case, over half of the firms can direct the investment to a country where it faces a negative $EATR$. On the other hand some firms cannot benefit and face positive (minimum) $EATR$s of more than 30%. This increased dispersion of the minimum $EATR$s again represents a movement away from market neutrality. From the second last column in Table 3 it can be seen that on average the minimum $EATR$ is only 1.0%. High tax exemption countries like Spain, Italy, Germany and France gain most, while credit countries, like Malta, United Kingdom, Greece or the Czech Republic gain less from the new tax incentives.

Under the assumption that formula apportionment would be introduced as an obligatory measure, the distribution of the average $EATR$s would widen a little, as can be seen in the upper right part of Figure 3, indicating a small movement away from MN. However, compared to the current system, there is a significant decrease in the average $EATR$. This is also apparent in Table 3 where the country averages now vary from 17.5% in Italy to 20.6% in Cyprus.

However, the distribution of the minimum $EATR$s, depicted in the lower right of Figure 3, is much narrower than for average $EATR$s. In the last column in Table 3 it can be observed that the country averages of the minimum $EATR$s are very similar across countries. In contrast to a system of voluntary loss consolidation system without formula apportionment, no large tax benefits of loss consolidation exist (since it is not possible to offset a loss in a low tax rate country against a profit in a high tax rate country). Hence there are no negative minimum $EATR$s and the distribution in the lower right part of Figure 3 is substantially less dispersed than for the current system. Under our assumption that the allocation of apportionment factors is the same as the allocation of taxable profit, the $EATR$ is determined to a large extent by the tax rate in the country of the new subsidiary. Consequently it varies only a little within a given country, and the location of the minimum $EATR$ may be common amongst parents from different countries. On this measure then, there is a substantial movement towards MN. Interestingly, the peak of the distribution is also considerably below that for the current system, implying that firms face on average a substantially lower minimum $EATR$.

5.2 Cost of Capital

We also use our methodology to assess the cost of capital (CoC), a measure that indicates the effect of the tax on the incentive to undertake an additional marginal investment.[15] We consider the proximity of the European CoCs to CEN and MN following the same approach as for the $EATR$. Comparisons based on the cost of capital are arguably more consistent with optimal tax theory. The cost of capital is the relevant measure in the absence of economic rent, and discrete investment choices, in which production efficiency is held to be optimal. In fact, the comparisons based on the cost of capital are similar to those based on the $EATR$. We therefore present the results briefly and highlight where additional insight can be gained.

5.2.1 Capital Export Neutrality

As with the $EATR$ we consider the standard deviation for any individual company across the CoCs which it would face in each of the 27 possible investment locations: CEN holds for an individual firm if the standard deviation is zero. Figure 4(a) displays the distribution of these standard deviations for the three scenarios considered in this paper. Comparing the left hand side part of Figure 4(a) to the upper part of Figure 2 it can be seen that the three distinct peaks in the distribution for the $EATR$ under the current system are not present for the CoC, indicating that the double taxation system is less important for a marginal investment.

Figures 4 about here

Moving right in Figure 4(a) the same phenomena as for the $EATR$ can be observed for the CoC. Introducing a voluntary system of loss consolidation without formula apportionment tends to increase the standard deviation for a large proportion of the sample, and therefore represents a clear movement away from CEN. A formula apportionment system tends to correct some of this newly induced distortions, but is still further away from CEN than the current system. This occurs despite the fact that the harmonized tax base is more relevant for the cost of capital. The effect can be traced back to the fact that this reform harmonises the tax base, but not the tax rate. To the extent that countries have currently chosen a broad base/low rate combination or a narrow base/high rate combination, then harmonising only the tax base can lead to greater dispersion in the CoC.

[15] An alternative measure, the effective marginal tax rate, becomes meaningless in the case of negative cost of capital. Given that in our voluntary consolidation scenario negative costs of capital are easily possible and also observed, we only report results for the cost of capital.

5.2.2 Market Neutrality

To assess the degree to which market neutrality is achieved, we consider the distribution of the minimum cost of capital facing each company across its 27 possible investments. The distribution of this minimum cost of capital is shown in Figure 4(b), and is again in line with the findings for the $EATR$. The dispersion of tax burdens increases following the introduction of a system with voluntary loss consolidation. This is shown in the middle part of Figure 4(b), where the distribution is more dispersed and shifted even further to the left. Given our parameterisation (a real interest rate of 5 per cent), a CoC of 5 per cent translates into an effective marginal tax rate of zero. This implies that almost all firms have at least one location where they face a negative effective marginal tax rate.

Figure 5 about here

Like the case of the distribution of minimum $EATR$s, the formula apportionment system leads to a narrower dispersion of minimum CoCs, as shown in the right hand part of the Figure, although on average there is a rise in the minimum CoC.

5.3 The allocation of apportionment factors

In modelling the effects of the formula apportionment system, we have so far assumed that the allocation of apportionment factors is proportional to the allocation of taxable income between the existing group of companies and the new subsidiary. As noted above, this implies that it is primarily the statutory tax rate in the country of the new subsidiary, rather than in the country of the existing company, which determines the $EATR$ and CoC. As an alternative, we now briefly present the case in which the $EATR$ and the CoC depend only on the tax rate of the parent company, or existing group of companies. This would be the case if none of the factors in the apportionment formula were located in the country of the subsidiary.[16]

Since the tax base would be harmonised across countries, and in this case the overall tax rate is independent of the location of the subsidiary, then the $EATR$ and CoC are also independent of the country of the subsidiary. Consequently any given firm faces the same $EATR$ and CoC regardless where it invests. This implies that CEN is completely achieved.

Given that CEN is completely achieved, the minimum and average effective tax rate are the same for any individual firm. Hence, there is only one $EATR$

[16] In principle, the investment may be strategically adjusted to influence the overall statutory tax rate. However, we do not address this possibility here.

and one CoC for each company to consider in assessing the proximity to MN. Figure 5 presents this minimum/average $EATR$s of all the companies in our dataset. Comparing the distribution in Figure 5 to the two graphs on the right hand side in Figure 3 two features are evident. First, there is a significant shift to the right. This is partly due to the geographical breakdown of our sample, since the large number of companies in Italy, France, Spain and Germany translates, under these assumptions, into a overall higher $EATR$. Second the distribution is much more dispersed than in Figure 3, indicating that, under this alternative assumption, a formula apportionment system would represent a move away from MN. This is broadly the opposite result to our base case of a proportional new investment. While the persisting tax rate differentials between the member states led to a violation of CEN under the assumption of a proportional new investment, they imply a move away from MN under the assumption of unchanged apportionment factors.

6 Conclusion

This paper proposes a methodology for assessing whether corporation taxes in open economies are consistent with two forms of neutrality: capital export neutrality and market neutrality. We assess the extent to which location decisions of companies are likely to be affected by taxes by comparing the effective tax rates faced by individual companies investing in each of the 27 EU member states. We assess the extent to which competition between companies may be affected by taxes by comparing a representative effective tax rate for each company across a large number of companies in the EU. The paper applies this methodology to compare existing corporation tax systems in the Europe Union with two alternatives: optional international loss consolidation, and formula apportionment in the form of the proposed Common Consolidated Corporate Tax Base (CCCTB).

We show that the current system gives an advantage to domestic investment because of the lack of international consolidation. As a result, the current system does not meet the requirements for either capital export neutrality nor market neutrality. Introducing a system of voluntary consolidation would partly correct the distortion between domestic and international investment. However, such a tax reform would introduce other distortions, and in general would imply a move away from both forms of neutrality.

In contrast, a change to a formula apportionment system would have some desirable efficiency effects. First, the tax differential between domestic and international investment would be mitigated, and under most scenarios there would be a small improvement towards CEN. Also, in some cases, we find a significant improvement towards MN. However, the results are dependent on the assumptions made. In our base case, in which the activities of the new subsidiary are proportional to those of the existing company, then there is generally a movement towards MN. However, if instead apportionment factors

are not present in the new subsidiary, then CEN is achieved, but there is a movement away from MN.

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References

Agúndez-García, A.J., 2006. The delineation and apportionment of an EU consolidated tax base for multi-jurisdictional corporate income taxation: A review of issues and options, *European Commission Working Paper* 9/2006.

Commission of the European Community, 2001. *Towards an internal market without tax obstacles. A strategy for providing companies with a consolidated corporate tax base for their EU-wide activities*, COM (2001) 582 final, Brussels.

Common Consolidated Corporate Tax Base (CCCTB) Working Group 2007. CCCTB: possible elements of a technical outline, *CCCTB/WP/057*.

Desai, M. and J.R. Hines 2003. Evaluating international tax reform, *National Tax Journal* 56, 487-502.

Devereux, M.P., 1990. Capital Export Neutrality, Capital Import Neutrality, Capital Ownership Neutrality and all that, *Mimeo*, Institute for Fiscal Studies

Devereux, M.P., 2008. Taxing International Corporate Income: Economic Principles and Feasibility, *Oxford Review of Economic Policy* 24, 698-719.

Devereux, M.P. and R. Griffith, 1998. Taxes and the location of production: evidence from a panel of US multinationals, *Journal of Public Economics* 68.3, 335-367.

Devereux, M.P. and R. Griffith, 1999. The taxation of discrete investment choices, *IFS Working Paper* No. W98/16, London: Institute for Fiscal Studies.

Devereux, M.P. and R. Griffith, 2003. Evaluating tax policy for location decisions, *International Tax and Public Finance* 10, 107-126.

Devereux, M.P. and S. Loretz 2008. The Effects of EU Formula Apportionment on Corporate Tax Revenues, *Fiscal Studies* 29, No. 2, 1-33.

Devereux, M.P. and S. Loretz 2008a. Increased efficiency through consolidation and formula apportionment in the European Union, Oxford University Centre for Business Taxation Working Paper WP08/12

Devereux, M.P. and M. Pearson 1995. European tax harmonization and production efficiency, *European Economic Review* 39, 1657-1681.

Diamond, P. and J. Mirrlees 1971. Optimal Taxation and Public Production I: Production Efficiency, *American Economic Review*, 8-27.

Edwards, J.S.S. 2005. Gains from trade in government revenue and Pareto-efficient international taxation", *Topics in Economic Analysis and Policy* 5, 22.

Egger, P., Loretz, S., Pfaffermayr, M. and H. Winner 2009. Firm-specific Forward-looking Effective Tax Rates, *International Tax and Public Finance* 16, 850-870.

Egger, P. and S. Loretz 2009. Homogeneous Profit Tax Effects for Heterogenous Firms?, *The World Economy* forthcoming.

Hall, R.E. and D. Jorgensen, 1967. Tax policy and investment behavior, *American Economic Review* 57, 391-414.

Horst, T. 1980. A note on the optimal taxation of international investment income, *Quarterly Journal of Economics* 94, 793-8.

Jorgensen, D.W., 1963. Capital theory and investment behaviour, *American Economic Review* 53, 247-259.

Keen, M.J. and H. Piekola 1996. Simple Rules for the Optimal Taxation of International Capital Income, *Scandinavian Journal of Economics* 99, 447-461.

Keen, M.J. and D.E. Wildasin 2004. Pareto-efficient international taxation, *American Economic Review* 94, 259-275.

King, M.A. and D. Fullerton, 1984. *The taxation of income from capital*, Chicago: University of Chicago Press.

McKenzie, K.J., M. Mansour, and A. Brule, 1998. The calculation of marginal effective tax rates, *Technical Committee of Business Taxation Working Paper* 97-15.

Musgrave, R.A. 1959. Criteria for Foreign Tax Credit, *Tax and Operations Abroad*, Tax Institute Symposium, 1959.

Richman, P. 1963. *Taxation of Foreign Investment Income: An Economic Analysis* Baltimore: John Hopkins Press.

Stiglitz, Joseph E. and Dasgupta, P. 1971. Differential Taxation, Public Goods and Economic Efficiency, *Review of Economic Studies*, 38, 151-74.

Table 1: **Descriptive Statistics: Country coverage and average weights**

Country	**Observations**		**Tax rate**		**buildings**	**machinery**	**land**	**inventories**	**intangibles**	**leverage**
	all firms	**parents**	(τ_n)	(τ_i^{FA})	(θ_i^b)	(θ_i^m)	(θ_i^l)	(θ_i^s)	(θ_i^i)	(dB_i)
Austria	2,020	131	25.0%	25.4%	0.236	0.265	0.081	0.360	0.058	0.675
Belgium	12,515	274	33.0%	31.8%	0.255	0.250	0.103	0.340	0.051	0.679
Bulgaria	2,366	0	10.0%	n.a.	0.236	0.319	0.087	0.331	0.027	0.620
Cyprus	98	4	10.0%	20.9%	0.357	0.198	0.128	0.181	0.137	0.448
Czech Republic	8,394	4	21.0%	20.3%	0.241	0.308	0.113	0.316	0.023	0.552
Germany	22,848	670	29.5%	28.7%	0.244	0.233	0.096	0.378	0.049	0.679
Denmark	5,511	214	25.0%	26.3%	0.336	0.239	0.148	0.215	0.062	0.597
Spain	50,000	253	30.0%	29.8%	0.234	0.207	0.102	0.361	0.096	0.604
Estonia	1,278	7	21.0%	21.2%	0.305	0.260	0.130	0.285	0.020	0.560
Finland	6,400	115	26.0%	26.2%	0.238	0.254	0.092	0.334	0.083	0.551
France	50,000	610	33.3%	31.8%	0.206	0.178	0.086	0.388	0.141	0.628
United Kingdom	25,038	492	28.0%	28.4%	0.288	0.244	0.118	0.300	0.051	0.643
Greece	8,312	30	25.0%	22.8%	0.212	0.266	0.080	0.390	0.053	0.619
Hungary	5,046	5	16.0%	17.6%	0.229	0.311	0.100	0.328	0.033	0.581
Ireland	939	42	12.5%	25.0%	0.287	0.226	0.114	0.338	0.036	0.599
Italy	50,000	425	31.4%	30.3%	0.181	0.227	0.072	0.430	0.090	0.755
Lithuania	860	2	15.0%	17.2%	0.206	0.339	0.077	0.369	0.010	0.520
Luxembourg	565	54	29.6%	28.9%	0.229	0.233	0.084	0.359	0.095	0.648
Latvia	747	1	15.0%	18.8%	0.237	0.338	0.092	0.320	0.013	0.585
Malta	108	1	35.0%	28.6%	0.312	0.179	0.126	0.376	0.007	0.555
Netherlands	4,563	492	25.5%	28.8%	0.282	0.218	0.113	0.328	0.059	0.676
Poland	10,019	12	19.0%	20.1%	0.255	0.323	0.098	0.295	0.029	0.529
Portugal	7,668	44	25.0%	26.2%	0.211	0.285	0.081	0.384	0.038	0.696
Romania	5,442	0	16.0%	n.a.	0.241	0.369	0.088	0.287	0.016	0.625
Slovak Republic	2,515	4	19.0%	21.7%	0.261	0.311	0.129	0.279	0.020	0.553
Slovenia	1,842	3	22.0%	27.4%	0.238	0.380	0.084	0.268	0.030	0.558
Sweden	12,629	355	28.0%	27.7%	0.278	0.231	0.117	0.325	0.049	0.625
Europe	**297,723**	**4,244**	**28.5%**	**29.0%**	**0.232**	**0.235**	**0.095**	**0.361**	**0.078**	**0.645**

Notes: τ_n denotes the statutory corporate tax rates including local profit taxes. All tax law parameters are for 2008.
τ_i^{FA} denotes the applicable tax rates under a formula apportionment system. Only multinational companies included.

Table 2: **Summary of Results: Domestic and Bilateral *EATR*s for domestic, inbound and outbound investment**

	domestic investment		**outward FDI**			**inward FDI**		
country	**current system**	**formula apportionment**	**current system**	**voluntary consolidation**	**formula apportionment**	**current system**	**voluntary consolidation**	**formula apportionment**
Austria	18.9%	19.8%	26.4%	19.7%	18.3%	29.2%	22.2%	20.0%
Belgium	24.5%	26.9%	29.0%	17.7%	17.9%	37.3%	31.5%	27.4%
Bulgaria	7.7%	8.1%	25.9%	23.9%	19.2%	21.5%	10.3%	7.8%
Cyprus	8.7%	8.8%	26.7%	24.9%	21.1%	17.3%	8.4%	7.8%
Czech Republic	17.4%	17.7%	28.8%	23.7%	19.6%	26.1%	18.5%	16.8%
Germany	22.4%	23.3%	28.4%	19.6%	18.0%	33.5%	27.2%	23.8%
Denmark	19.6%	20.4%	26.6%	19.9%	18.8%	30.5%	20.2%	20.0%
Spain	23.8%	24.6%	27.1%	18.1%	18.8%	34.4%	28.1%	24.0%
Estonia	20.0%	17.5%	26.5%	21.5%	19.4%	28.5%	22.8%	16.8%
Finland	21.7%	21.8%	26.6%	19.5%	19.4%	31.3%	23.7%	20.8%
France	25.9%	27.2%	28.8%	17.8%	18.5%	37.5%	31.9%	26.8%
United Kingdom	22.3%	22.4%	33.1%	24.7%	18.4%	33.3%	26.1%	22.5%
Greece	19.0%	20.5%	31.2%	24.3%	19.0%	28.7%	21.4%	20.0%
Hungary	13.2%	13.2%	26.4%	23.0%	19.5%	22.2%	13.8%	12.7%
Ireland	10.0%	10.2%	26.0%	23.5%	19.4%	19.1%	10.0%	9.9%
Italy	20.6%	23.9%	29.2%	19.0%	17.3%	33.0%	27.1%	25.6%
Lithuania	12.1%	12.8%	26.6%	23.5%	20.2%	21.3%	1.8%	11.9%
Luxembourg	22.1%	23.7%	27.0%	17.9%	18.4%	33.4%	26.7%	23.8%
Latvia	11.6%	12.3%	26.5%	23.3%	19.4%	21.0%	6.8%	11.9%
Malta	28.3%	29.6%	40.5%	29.7%	19.1%	39.2%	33.4%	28.2%
Netherlands	19.1%	20.0%	26.5%	19.7%	18.2%	29.6%	22.4%	20.5%
Poland	15.9%	16.1%	27.9%	23.4%	19.9%	24.3%	16.2%	15.1%
Portugal	18.2%	19.5%	27.3%	20.5%	18.1%	29.1%	21.0%	20.1%
Romania	12.5%	12.9%	26.6%	23.1%	18.9%	29.3%	12.5%	12.7%
Slovak Republic	15.3%	15.9%	26.8%	22.4%	19.6%	24.1%	15.2%	15.1%
Slovenia	17.6%	18.4%	26.7%	21.0%	19.5%	26.6%	18.6%	17.6%
Sweden	22.3%	22.6%	27.0%	19.1%	18.6%	33.1%	25.7%	22.5%
Europe	**21.6%**	**22.9%**	**28.5%**	**19.9%**	**18.4%**	**28.5%**	**19.9%**	**18.4%**

Notes: The value for Europe refers to the weighted average and therefore is influenced by the country coverage.

Table 3: **Summary of Results: Standard deviation, average and minimum $EATR$s for the individual corporations**

	Standard deviation			**average $EATR$**			**minimum $EATR$**		
country	**current system**	**voluntary consolidation**	**formula apportionment**	**current system**	**voluntary consolidation**	**formula apportionment**	**current system**	**voluntary consolidation**	**formula apportionment**
Austria	0.074	0.093	0.058	26.1%	19.6%	18.4%	12.9%	1.9%	7.8%
Belgium	0.064	0.095	0.058	28.8%	17.9%	18.2%	16.1%	-4.3%	7.6%
Bulgaria	0.075	0.074	0.059	25.2%	23.3%	18.8%	7.7%	7.6%	8.1%
Cyprus	0.075	0.074	0.065	26.0%	24.3%	20.6%	8.8%	8.8%	8.8%
Czech Republic	0.049	0.059	0.062	28.4%	23.4%	19.5%	17.4%	12.7%	8.3%
Germany	0.066	0.090	0.058	28.2%	19.7%	18.2%	15.4%	0.5%	7.7%
Denmark	0.071	0.090	0.060	26.3%	19.9%	18.9%	12.7%	1.3%	8.1%
Spain	0.069	0.095	0.061	26.9%	18.3%	19.0%	13.4%	-3.1%	8.0%
Estonia	0.071	0.081	0.061	26.3%	21.5%	19.3%	12.3%	5.7%	8.3%
Finland	0.070	0.093	0.062	26.5%	19.6%	19.5%	12.7%	0.1%	8.3%
France	0.066	0.098	0.060	28.7%	18.1%	18.8%	15.6%	-5.8%	7.9%
United Kingdom	0.028	0.046	0.059	32.7%	24.6%	18.6%	22.3%	12.1%	7.9%
Greece	0.038	0.050	0.060	30.7%	24.1%	19.0%	19.0%	12.5%	8.1%
Hungary	0.072	0.075	0.061	25.9%	22.6%	19.2%	11.6%	7.7%	8.2%
Ireland	0.071	0.070	0.060	25.4%	23.0%	19.0%	10.0%	9.9%	8.2%
Italy	0.066	0.090	0.056	28.9%	19.1%	17.5%	16.2%	-1.5%	7.3%
Lithuania	0.078	0.079	0.063	26.0%	23.1%	19.9%	10.9%	7.1%	8.5%
Luxembourg	0.068	0.096	0.059	26.8%	18.1%	18.6%	13.7%	-3.0%	7.9%
Latvia	0.074	0.074	0.060	25.9%	22.9%	19.2%	10.8%	8.0%	8.2%
Malta	0.026	0.037	0.062	40.0%	29.7%	19.5%	28.3%	16.8%	8.1%
Netherlands	0.070	0.089	0.058	26.1%	19.6%	18.2%	13.3%	2.1%	7.8%
Poland	0.057	0.065	0.062	27.4%	23.2%	19.7%	15.9%	12.2%	8.4%
Portugal	0.070	0.085	0.058	26.9%	20.4%	18.1%	13.5%	3.0%	7.7%
Romania	0.066	0.068	0.059	26.1%	22.7%	18.7%	12.5%	11.8%	8.0%
Slovak Republic	0.073	0.080	0.061	26.3%	22.1%	19.5%	12.0%	6.7%	8.3%
Slovenia	0.073	0.090	0.061	26.3%	20.9%	19.5%	12.4%	4.3%	8.3%
Sweden	0.068	0.090	0.059	26.8%	19.2%	18.7%	13.3%	-0.3%	7.9%
Europe	**0.062**	**0.085**	**0.059**	**28.3%**	**20.0%**	**18.6%**	**15.4%**	**1.0%**	**7.8%**

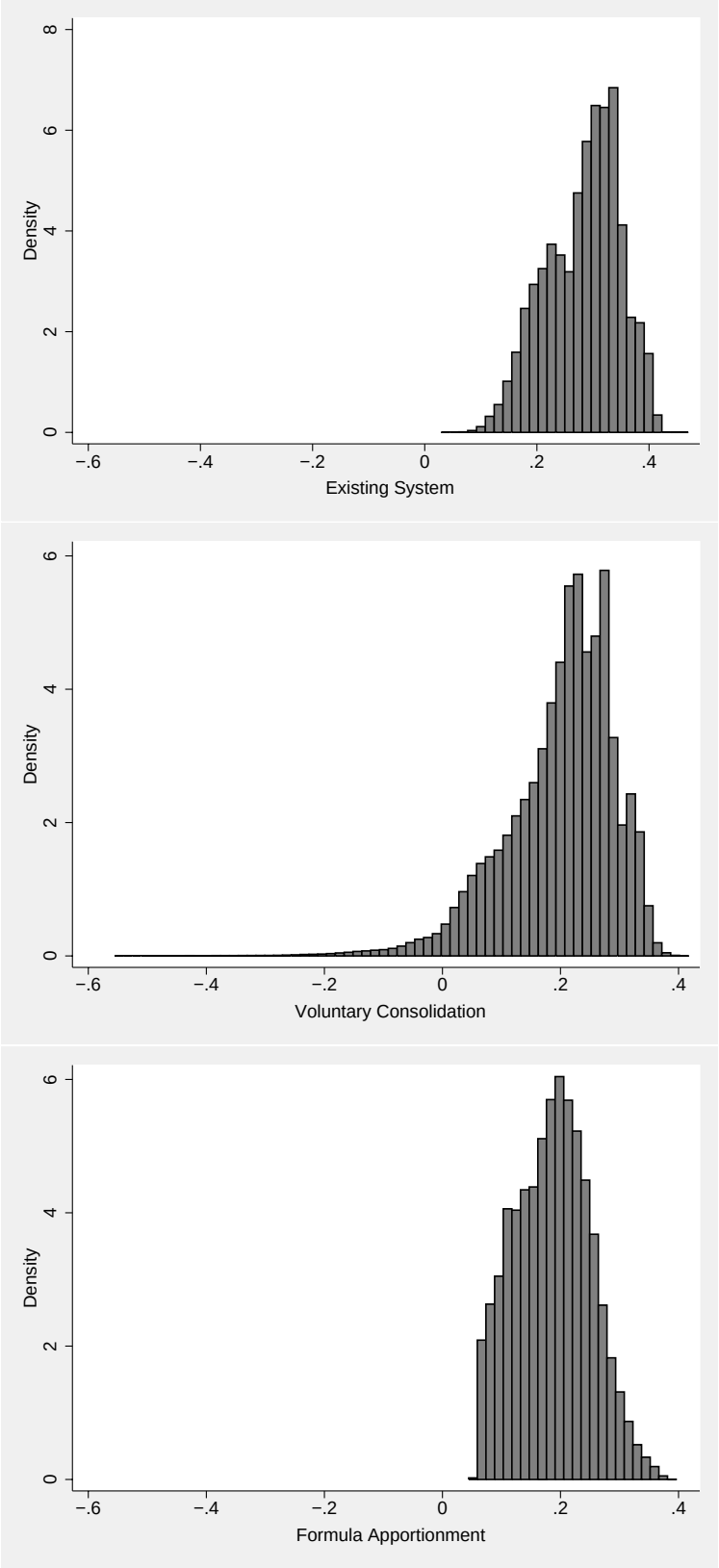


Figure 1: **Histograms of** $EATR$

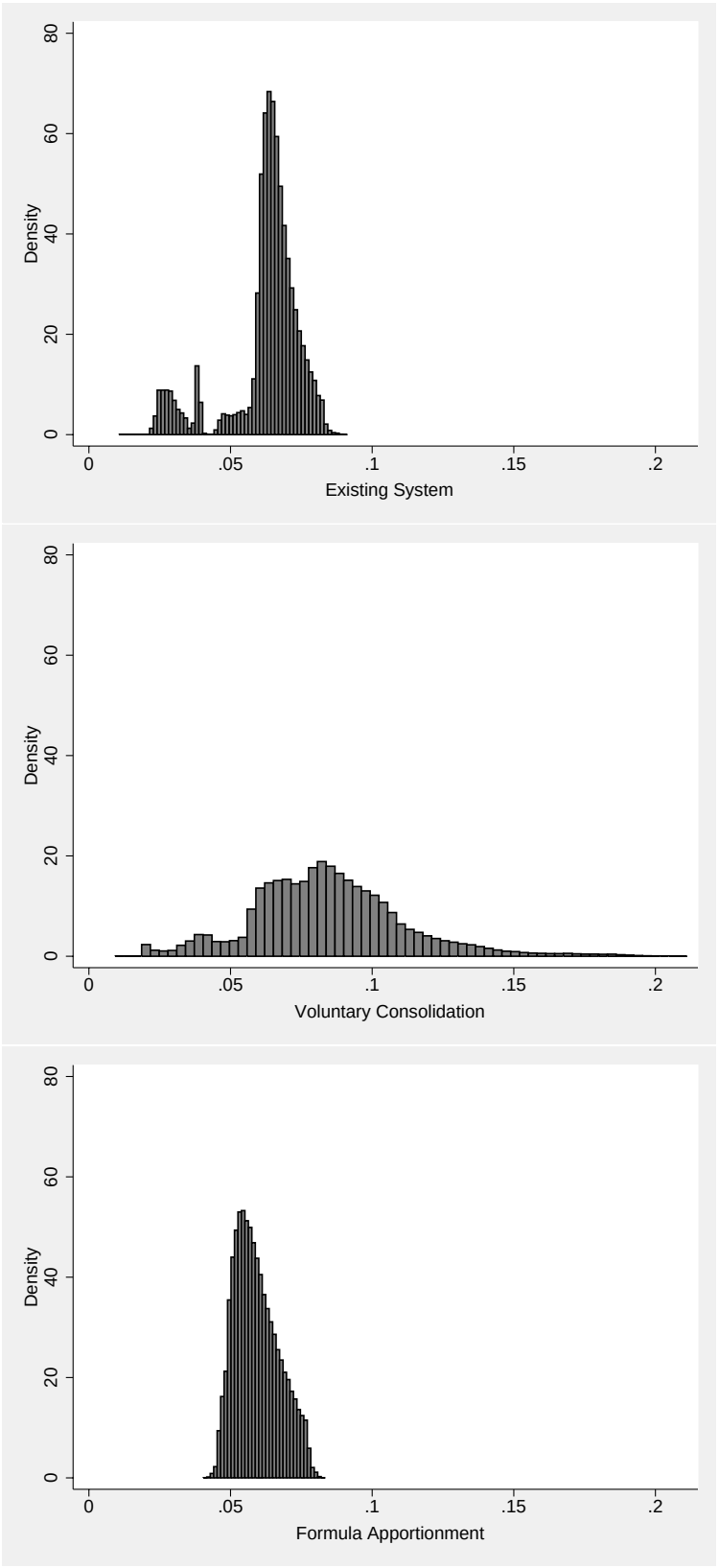


Figure 2: **Histograms of standard deviation of** $EATR$

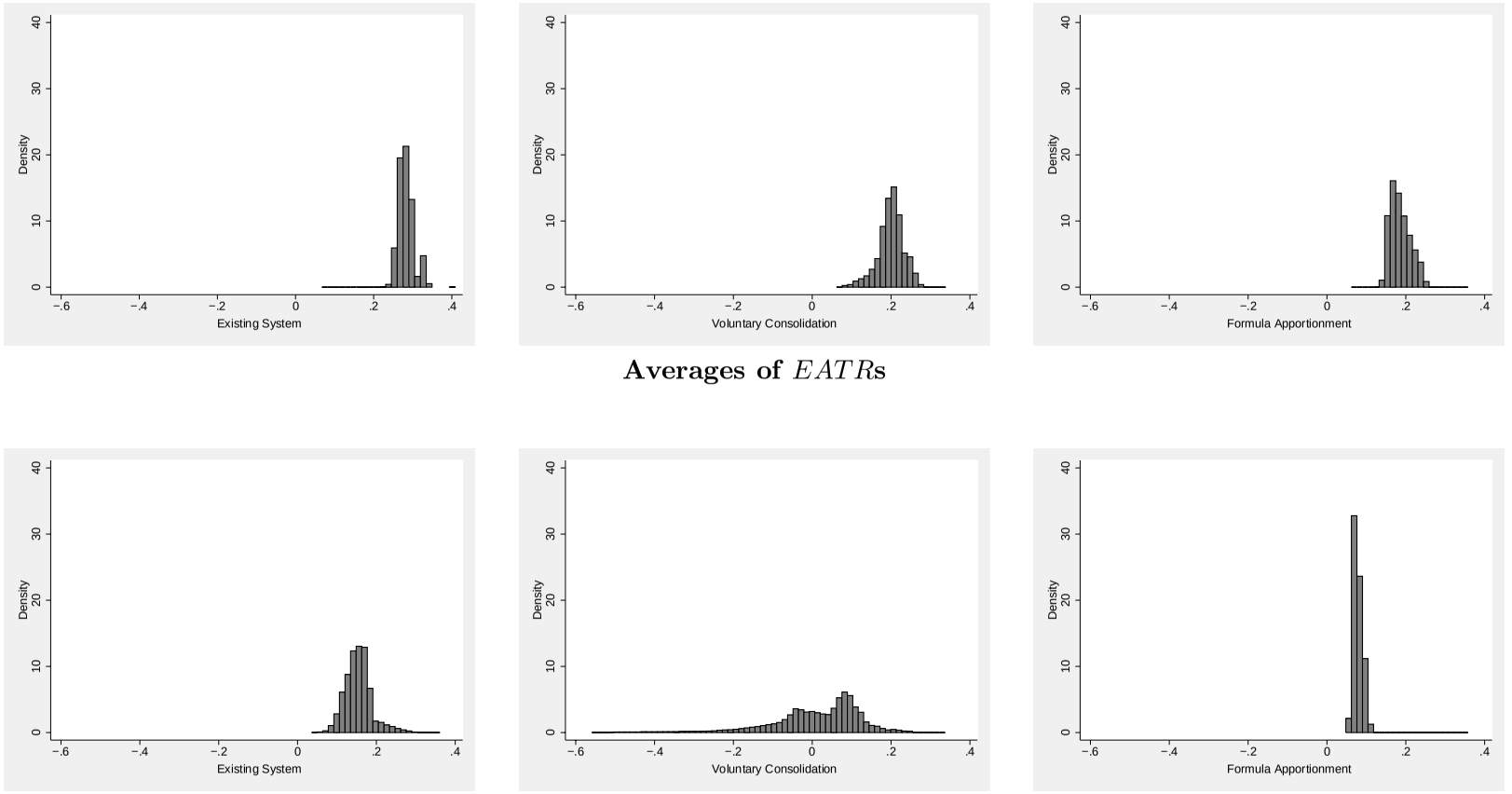
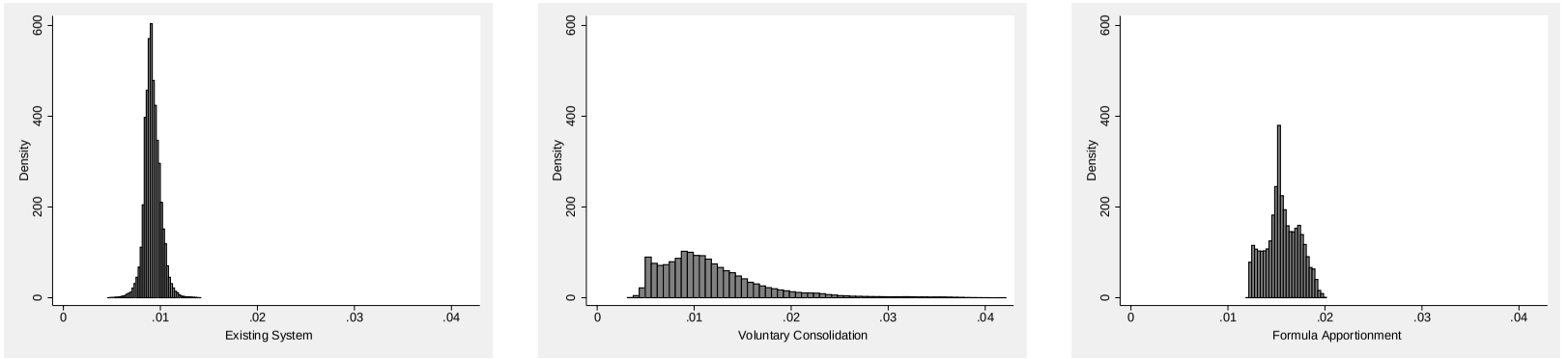
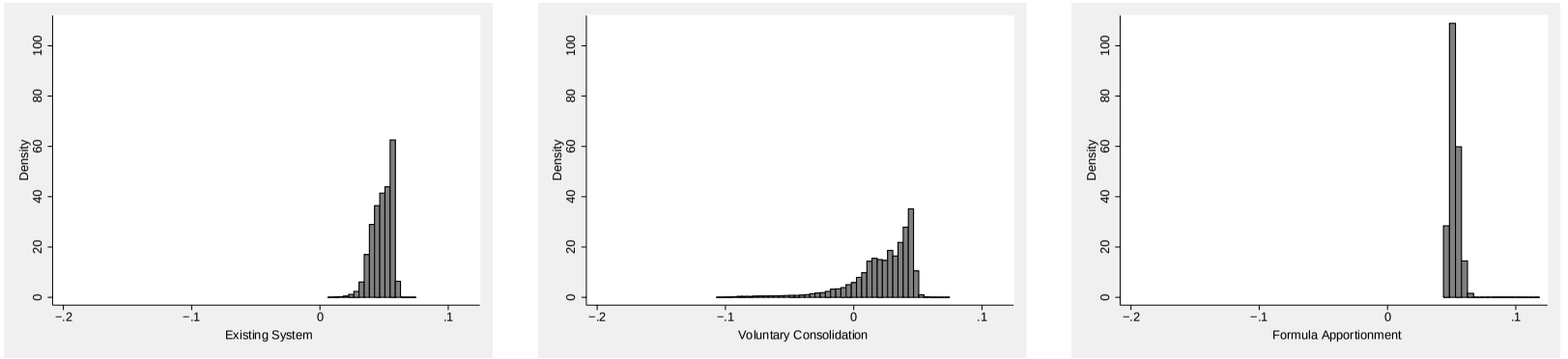


Figure 3: **Histograms of average and minimum** $EATR$



(a) **Histograms of standard deviation of** CoC



(b) **Histograms of minimum** CoC

Figure 4: Standard Deviation and Minimum of CoCs.

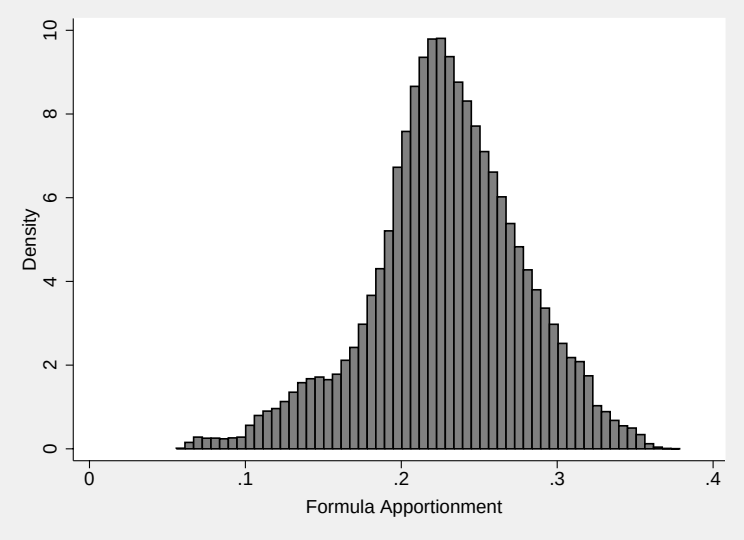


Figure 5: **Minimum and average EATR for the case** $\lambda = 0$

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