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SA vs. FA w/ FTA

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CCCTB 4 EU?
SA vs. FA w/ FTA

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Abstract: Since its conception, some within the European Union have expressed concerns over the ability of multinationals to avoid taxation by undertaking transfer pricing to shift profits towards low tax locations. These concerns have been growing, leading to a renewed call for a common consolidated corporate tax base wherein profits are allocated to nations according to a formula rather than firms' internal prices. This paper analyzes the merits of such a shift in taxation. In particular, it is shown that, given tax rates, implementing formula apportionment can result in greater tax revenues and less intense tax competition particularly for lower trade barriers. However, this is not always the case and depends on parameter values, including those describing the extent of economic integration.

Key Words: Common Consolidated Tax Base; Vertical FDI; Formula Apportionment

JEL Codes: F24; F36; H25; H87

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1. Introduction

Since its inception, the European Union project has concerned itself with beggar thy neighbour policies in which one nation chooses a regulation that benefits itself relative to others. Initially, this concern focussed itself on trade policy and worked towards lowering the trade barriers existing between member states. The focus quickly shifted towards tax policy, including both how international tax differences affect the location of both multinationals' real activities and their declare profits. Regarding this latter point, a chief concern is that low tax rates in one member state result in transfer pricing in which firms shift profits to that location, lowering the tax base and revenues elsewhere. While some have called for tax harmonization to eliminate this fiscal externality, others have suggested a move towards a common consolidated corporate tax base (CCCTB) wherein firm profits are allocated to member states according to a formula that depends on factors such as sales, payroll, and investment. The claim is that doing so would eliminate the use of transfer pricing to manipulate tax bases. However, it is now well established that such a move can result in additional distortions as firms manipulate the factors used in the formula to shift profits towards low tax locations.[1] Thus, *a priori*, it is not clear what the effect of moving from the current practice of separate accounting (SA) towards formula apportionment (FA) would do to tax revenues. This paper contributes to the debate on the impacts of a move from the current practice of separate accounting to FA by considering a vertical multinational that operates in a setting with both taxes and tariffs. In particular, it is shown that declining trade barriers can increase the incentive to undertake transfer pricing, but that this need not always be the case, particularly for downstream tariffs. Nevertheless, under many parameterizations, tax revenues would increase from a shift to FA. This may then indicate that, in an era with declining

[1] Empirical evidence of such distortions are provided by Hines (2010), Riedel (2010), and Mintz and Smart (2004).

trade barriers, there is indeed a renewed need to consider such a change in international tax policy.

This focus on vertical FDI is in contrast to the existing literature in two ways. First, the bulk of the current research works with a horizontal model of FDI where the firm operates in different states in order to sell in those locations (Markusen, 1984). This is different from the vertical model in which the multinational carries out different activities in different countries, producing an intermediate in one which is then converted to a final good in the other (Helpman, 1984). Recent empirical work indicates that although market access driven FDI is a large part of overall FDI activity, vertical FDI is non-negligible.[2] This distinction between FDI motivations is more than just academic to the current issue, however, since the proposed formulas often include sales shares as a determinant of what proportion of profits must be declared in each location. With horizontal FDI, sales and employment shares mirror one another as the local employment is used to create the local sales. With vertical FDI, this is not true as employment in both locations is used for sales in both locations. Furthermore, just as the intermediate good is subject to tariffs in the downstream location (something considered by Schjelderup and Weichenrieder (1999)), final good exports to the upstream location are themselves liable to upstream tariffs. This again is important for the formula as upstream tariffs affect the benefits to upstream sales and therefore the sales share used in apportionment. Thus, with vertical FDI, the impact on transfer pricing and the tradeoffs under SA and FA for differing levels of integration is richer than that under horizontal FDI.

The existing literature uses one of two approaches towards modelling the firm structure of the multinational. The first is a horizontal model in which output is sold in the market where it

[2] See Davies (2008), Blonigen, et al. (2007), or Braconier, Norbäck, and Urban (2005) for evidence of vertical FDI.

is produced.[3] Models in this vein include Runkel and Schjelderup (2011), Nielsen, Raimondos-Møller, Schjelderup (2010), Riedel (2010), Riedel and Runkel (2006), and Eichner and Runkel (2008, 2011). Some of these models incorporate trade in headquarter services, that is, an input required for production in the subsidiary that acts as the conduit for transfer pricing. However, this input is modelled as a joint input as per Markusen (1984) the use of which does not impact output in the rest of the multinational. This approach has two key differences from the current paper. First, as output is sold locally, tariffs and transport costs on the finished product have no bearing on production or sales. This eliminates one avenue in which reduced trade barriers affect firm choices and thus the allocation of profits under FA. Second, it lacks the vertical aspect of FDI in which production in one portion of the firm depends on that elsewhere. This them eliminates another avenue for trade barriers to affect the relative activity levels across countries (and thus the incentive to shift profits).

The second thread of the literature builds from the model of Kant (1990) wherein the parent of multinational provides an input to its subsidiary who then undertakes all final goods sales. Examples of this include Eggert and Schjelderup (2005) and Nielsen, Raimondos-Møller, and Schjelderup (2003). These vertical FDI models, however, include neither transport costs or tariffs and thus cannot compare the two tax methods under falling trade barriers.[4] Additionally, Eggert and Schjelderup (2005) do not include sales in the apportionment formula. Nielsen, Raimondos-Møller, and Schjelderup (2003) do include sales in the formula, however, their

[3] It should be noted, however, that as the key point is that the output in one market does not affect revenues of the other. Thus, subsidiary output could be sold in many markets, just not in those the parent operates in.

[4] Kant (1990), Schjelderup and Sørgard (1997), Schjelderup and Weichenrieder (1999), and Bernard, Jensen, and Schott (2006) do include tariffs on the intermediate good but not sales of the final good. However, none of these consider FA. Haufler, Klemm, and Schjelderup (2008) consider a political economy model with SA with a vertical multinational and consider how changes in integration – modelled as the cost of doing business overseas – affects voting behaviour.

comparison of FA and SA is limited to the extent of transfer pricing and does not include tax revenues.

In the end, two major themes come out of the analysis. First, the extent of transfer pricing depends on costs, of which tariffs and transport costs form a part. The way in which these are related, however, depends on relative tax rates and which trade barriers are moving. In particular, since internal prices can be used to manipulate tariff as well as tax payments, under some constellations of parameters, a switch to FA can actually increase price manipulation. Second, a switch to FA can indeed increase tax revenues and limit the incentives to deviate from harmonized taxes. These benefits of FA are often highest when trade barriers are low. However, there do exist parameterizations where SA results in both higher revenues for some countries and less incentive to deviate from harmonized rates. Thus, whether or not FA achieves its touted goals depends critically on parameter values, including the degree of economic integration.

The paper proceeds as follows. Section 2 discusses the firm choices under the current practice of SA. In particular, it analyzes how these choices depend on both tariffs and taxes. Section 3 repeats this for FA. Section 4 then compares the two, with a particular eye on the extent of fiscal externalities and how these depend on tariffs. Section 5 concludes.

2. Separate Accounting

In this section, I present a stylized version of a vertical multinational.[5] The firm produces an intermediate good in the upstream country. The cost of producing i units of the intermediate is $d(i)$, which is increasing and convex. This is then shipped to the downstream location

[5] I take the location of the activities as given. These could be determined endogenously by allowing for cost differentials across locations. As this would necessitate the introduction of multiple factors of production, increasing the generality of the model but adding little to the intuition of the new results, I take the location of activities as given.

incurring a per unit transport cost γ_d and an ad valorem tariff τ_d. The intermediate is then used to produce a final good, where to produce a quantity Q the firm must incur a cost $c(Q,i)$ which is increasing and convex in the quantity of final good output, but non-increasing and concave in the amount of the intermediate used. This total final good output is then split between sales in the upstream (f_u) and downstream locations (f_d). There is no additional cost to sales in the downstream location, however, sales in the upstream location incur another shipping cost γ_u and face upstream tariffs τ_u. These final good outputs are sold according to local inverse demand schedules $P(f_d)$ and $P_u(f_u)$ for the upstream and downstream respectively. These are assumed decreasing and not too convex so that marginal revenue is strictly decreasing in output. I assume that markets are segmented so that resale between countries is prohibited.

In addition to choosing its production levels, the firm chooses an internal, transfer price for the intermediate good q. This can deviate from the governments' desired level of reported costs, however, there is a cost to doing so. This is given by $\phi(q, d(i))$. I assume that this is not tax deductible and that there is no dispute between the governments on the preferred reported internal price. Finally, the profit tax rate in the upstream location is t_u whereas that in downstream is t_d. Firm profits are then:

$$\begin{aligned}\pi = (1-t_d)\big((1-\tau_u)P_u(f_u)f_u + P(f_d)f_d - c(f_d+f_u,i) - \gamma_u f_u - (\gamma_d + q(1+\tau_d))i\big) \\ + (1-t_u)\big(qi - d(i)\big) - \phi\big(q, d(i)\big)\end{aligned} \tag{1}$$

This results in first order conditions for downstream and upstream sales of:

$$\frac{d\pi}{df_d} = (1-t_d)\big(P'(f_d)f_d + P(f_d) - c_1(f_d+f_u,i)\big) = 0 \tag{2}$$

and

$$\frac{d\pi}{df_u} = (1-t_d)\Big((1-\tau_u)P_u'(f_u)f_u + (1-\tau_u)P_u(f_u) - \gamma_u - c_1(f_d + f_u, i)\Big) = 0. \quad (3)$$

Note that these differ in two ways. First, demands can obviously differ between countries. Second, upstream sales incur both additional tariffs and transport costs. The first order condition for intermediate goods production is:

$$\frac{d\pi}{di} = (1-t_u)\big(q - d_1(i)\big) - (1-t_d)\Big(c_2(f_d + f_u, i) + \big(\gamma_d + q(1+\tau_d)\big)\Big) - \phi_2\big(q, d(i)\big)d_1(i) = 0 \quad (4)$$

which balances the upstream revenues earned by creation of the intermediate with the downstream costs (including the reduction in final goods production costs) and potential increases in the cost of transfer pricing. Finally, the firm's desired transfer price is driven by:

$$\frac{d\pi}{dq} = \big((1-t_u) - (1-t_d)(1+\tau_d)\big)i - \phi_1\big(q, d(i)\big) = 0. \quad (5)$$

The transfer price balances the reduction in tax payments – which includes both avoided profit taxes and avoided tariffs on the intermediate – against changes in the cost of misreporting.

In order to derive additional results, clarify the tradeoffs facing the firm, and facilitate comparisons to the FA case, I now make the following additional assumptions. First, I assume that one unit of the intermediate is required for each unit of the final good. Second, I assume that both the upstream and downstream cost functions are linear. Third, following the literature, I assume that the governments desire a reported transfer cost of αd where $\alpha > 1$ so that non-negative profits are reported upstream. This can be thought of as representing one standard of arms-length pricing in which a "normal" rate of return for the affiliate is the baseline for judging whether the internal price is too high or too low. In addition, I assume that the cost of

misrepresentation is $.5\phi\left(q-\alpha d\right)^2$ where ϕ is a positive scalar.[6] Thus, profits and the first order conditions become:

$$\begin{aligned}\pi = &\left(1-t_d\right)\left(\left(1-\tau_u\right)P\left(f_u\right)f_u + P\left(f_d\right)f_d - c\left(f_d+f_u\right) - \gamma_u f_u - \left(\gamma_d + q\left(1+\tau_d\right)\right)\left(f_d+f_u\right)\right) \\ &+\left(1-t_u\right)\left(q\left(f_d+f_u\right) - d\left(f_d+f_u\right)\right) - \frac{1}{2}\phi\left(q-\alpha d\right)^2\end{aligned} \tag{6}$$

$$\frac{d\pi}{df_d} = \left(1-t_d\right)\left(P_d + P_d{}'f_d + -c - \left(\gamma_d + q\left(1+\tau_d\right)\right)\right) + \left(1-t_u\right)\left(q-d\right) = 0 \tag{7}$$

$$\frac{d\pi}{df_u} = \left(1-t_d\right)\left(\left(1-\tau_u\right)\left(P_u + P_u{}'f_u\right) - c - \gamma_u - \gamma_d - q\left(1+\tau_d\right)\right) + \left(1-t_u\right)\left(q-d\right) = 0 \tag{8}$$

and

$$\frac{d\pi}{dq} = \left(\left(1-t_u\right) - \left(1-t_d\right)\left(1+\tau_d\right)\right)\left(f_d+f_u\right) - \phi\left(q-\alpha d\right) = 0\,. \tag{9}$$

As before, the choice of outputs balances marginal revenues (net of tariff payments for the upstream sales) with marginal costs. With equal tax rates, profit taxes net out of (7) and (8), leaving the transfer price only with a role in affecting tariff payments on intermediate goods shipments.

From (9), the firm's desired transfer price is:

$$q = \alpha d + \phi^{-1}\left(\left(1-t_u\right) - \left(1-t_d\right)\left(1+\tau_d\right)\right)\left(f_d+f_u\right). \tag{10}$$

Thus, whether or not the firm chooses to overstate its transfer price depends on the sign of:

$$\Omega = \left(1-t_u\right) - \left(1-t_d\right)\left(1+\tau_d\right).$$

When the upstream tax rate is larger than the downstream rate, $\Omega < 0$ and the firm wishes to understate its costs relative to the governments' target of αd. This is because setting a low internal price both lowers tariff payments on the intermediate and shifts profits to the low-tax

[6] This formulation of the costs of transfer pricing mirrors that used by Eichner and Runkel (2011) and Riedel and Runkel (2007) among others.

downstream country. When the upstream tax is sufficiently low relative to the downstream tax, $\Omega > 0$ and the firm will overstate the internal price. This is because, net of higher tariff payments, it behoves the firm to shift profits to the low-tax upstream country. These attempts to shift profits lie at the heart of the argument for a CCCTB in the hopes that by no longer allowing the firm to shift profits in this manner, that it will curb transfer pricing and minimize fiscal externalities. Similarly, as the downstream tariff falls (as occurred with the implementation of the European Union project), it is more likely that the firm will overstate costs.

It is important to recognize that this discussion is about the *direction* of misrepresentation, not its magnitude. A change in a tax rate or the downstream tariff not only affects Ω but also (potentially), total output. Note that since output can change in response to a change in the upstream tariff, this indicates that transfer pricing can as well. This can be seen in the second term of (10). As output rises, so does the benefit of misrepresentation. To determine the total effect of a change in taxes or tariffs, it is necessary to compute the following comparative statics. For simplicity, define:

$$\Delta = -\phi\left(1-t_d\right)^2\left(P_{11}f_d + 2P_1\right)\left(1-\tau_u\right)\left(P^*_{11}f_u + 2P^*_1\right)$$
$$-\left(1-t_d\right)\Omega^2\left(\left(P_{11}f_d + 2P_1\right) + \left(1-\tau_u\right)\left(P^*_{11}f_u + 2P^*_1\right)\right) < 0$$

by the second order conditions.

2.1 The Impact of Trade Barriers

Then, by fully differentiating (7) through (9), I can obtain the impact of the downstream tariff on the transfer price:

$$\frac{dq}{d\tau_d} =$$
$$\Delta^{-1}\left(1-t_d\right)^2\begin{pmatrix}\left(P_{11}f_d + 2P_1\right)\left(1-\tau_u\right)\left(P^*_{11}f_u + 2P^*_1\right)\left(1-t_d\right)\left(f_d + f_u\right)\\ -\Omega q\left(P_{11}f_d + 2P_1 + \left(1-\tau_u\right)\left(P^*_{11}f_u + 2P^*_1\right)\right)\end{pmatrix} \quad (11)$$

If $\Omega \geq 0$, implying that the firm wants to overstate the transfer price, then $\frac{dq}{d\tau_d} < 0$. Evidence of such an effect is found in data on US multinational exports by Bernard, Jensen, and Schott (2006). In this case, an increase in the downstream tariff acts as a cost, reducing output and the desire to overstate the transfer cost. In addition, the higher downstream tariff reinforces the desire to set a low internal price to minimize tariff payments. These then work together to lower the transfer price. On the other hand, when $\Omega < 0$, the effect is ambiguous. This is because reductions in output push the transfer price up towards αd while the higher tariff pushes it further below αd. Thus, the net impact is ambiguous.[7]

Turning to the upstream tariff, we see that:

$$\frac{dq}{d\tau_u} = \Delta^{-1}\left(1-t_d\right)\left(P_{11}f_d + 2P_1\right)\left(1-t_d\right)\left(P^*{}_1 f_u + P^*\right)\Omega \tag{12}$$

which has the opposite sign as Ω. Here, the transfer price does not directly depend on the upstream tariff. Nevertheless, a rise in the upstream tariff reduces upstream sales, lowering the desire to misrepresent the internal price. If $q > \alpha d$, implying that $\Omega > 0$, then a rise in the upstream tariff lowers the internal price and misrepresentation falls. If the firm is initially understating costs ($\Omega < 0$), then a rise in the upstream tariff reduces misrepresentation by increasing q. Since the existing literature does not consider vertical FDI, this effect has so far been overlooked. This is similar to the effects of the transport costs:

$$\frac{dq}{d\gamma_d} = -\left(1-t_d\right)^2 \Omega\Delta\left(\left(1-\tau_u\right)\left(P^*{}_{11}f_u + 2P^*{}_1\right) + \left(P_{11}f_d + 2P_1\right)\right) \tag{13}$$

and

[7] This ambiguity arises again in the FA case where, as discussed below, depending on parameters the transfer price can be rising or falling in the downstream tariff.

$$\frac{dq}{d\gamma_u} = -(1-t_d)^2\,\Omega\Delta\left(P_{11}f_d + 2P_1\right) \tag{14}$$

both of which also have the opposite sign of Ω. As with the upstream tariff, as the transfer price only depends on the volume of production, increases in these trade barriers reduce transfer pricing.

An important implication of it is that the creation of a free trade area, pushing both tariffs lower, has an ambiguous effect on transfer pricing. When the firm overstates costs, both tariff reductions encourage misrepresentation. When the firm understates costs, the decline in the upstream tariff exacerbates this overstatement. However, if the downstream tariff avoidance motivation dominates, then the downstream tariff reduction moves to reduce misrepresentation. As confirmed by simulations, the net effect does indeed depend on parameter values (including the initial tariff levels). In addition, as non-price dependent barriers fall (i.e. reductions in transport costs), this would increase transfer pricing. Thus, deepening EU integration may well have exacerbated the extent of transfer pricing because of the attendant expansion of output. It is also important to note that if FDI is bilateral with countries acting as both upstream and downstream locations, then the total impact becomes even more complicated.

2.2 The Impact of Taxes

Beginning with the upstream country:

$$\frac{dq}{dt_u} = \\ (1-t_d)\Delta^{-1}\begin{pmatrix}\left(P_{11}f_d + 2P_1\right)(1-t_d)(1-\tau_u)\left(P^*{}_{11}f_u + 2P^*{}_1\right)\left(f_d + f_u\right) \\ -\Omega\left(P_{11}f_d + 2P_1 + (1-\tau_u)P^*{}_{11}f_u + 2(1-\tau_u)P^*{}_1\right)(q-d)\end{pmatrix} \tag{15}$$

Assuming that $q > d$ so that reported upstream profits are never negative in equilibrium, this again depends on the sign of Ω, i.e. the direction of misrepresentation. For $\Omega = 0$, this is

negative, i.e. starting from no misrepresentation but then increasing the upstream tax results in the firm shifting profits downstream by underreporting the internal price. For $\Omega > 0$, i.e. where the firm is initially overstating costs, an increase in the upstream tax reduces the transfer price. This occurs for two reasons. First and most obviously, it reduces the firm's desire to shift profits upstream because of the decline in that country's tax advantage. Second, it results in a reduction in output. To see this, rewrite the first order conditions for downstream sales as:

$$MR_d = P_d + P_d' f_d = c + \gamma_d + \frac{(1-t_u)}{(1-t_d)} d - \frac{\Omega}{(1-t_d)} q = MC$$

and for upstream sales:

$$MR_u = (1-\tau_u)\left(P_u + P_u' f_u\right) = c + \gamma_d + \gamma_u + \frac{(1-t_u)}{(1-t_d)} d - \frac{\Omega}{(1-t_d)} q = MC + \gamma_u .$$

Since:

$$\frac{dMC}{dt_u} = \frac{1}{(1-t_d)}(q-d) - \frac{\Omega}{(1-t_d)}\frac{dq}{dt_u}$$

unless the increase in the upstream tax sufficiently increases the transfer price (which should not be the case when upstream taxes are high), then an increase in the upstream tax increase after-tax marginal costs, lowering output. This reduces the desire for misrepresentation. Thus, in the case of $\Omega > 0$, these work in the same direction and the transfer price falls, i.e. there is a reduction in overstating costs. Conversely, when $\Omega < 0$, an increase in the upstream tax increases the desire to shift profits downstream for a given profit, but reduces the desire to misrepresent costs due to a reduction in the volume of output due to rising after-tax marginal costs. This results in an ambiguous effect of the upstream tax on transfer pricing.

Turning to the downstream tax, we see that:

$$\frac{dq}{dt_d} =$$

$$\Delta^{-1}\left(1-t_d\right)\begin{pmatrix}\frac{\left(1-t_u\right)}{\left(1-t_d\right)}\left(q-d\right)\Omega\left(P_{11}f_d+2P_1+\left(1-\tau_u\right)\left(P^*_{11}f_u+2P^*_1\right)\right)\\-\left(1+\tau_d\right)\left(f_d+f_u\right)\left(P_{11}f_d+2P_1\right)\left(1-t_d\right)\left(1-\tau_u\right)\left(P^*_{11}f_u+2P^*_1\right)\end{pmatrix} \tag{16}$$

As before, there will be two effects, one arising from the desire to move profits given output (the second term) and the other from changes in the amount of output (the first term). As before, consider the change in the after-tax marginal cost:

$$\frac{dMC}{dt_d} = -\frac{\left(1-t_u\right)}{\left(1-t_d\right)^2}\left(q-d\right)-\left(1-t_d\right)^{-1}\Omega\frac{dq}{dt_d}$$

In opposition to the upstream tax, for small changes in the transfer price, an increase in the downstream tax lowers marginal costs and increases output and the magnitude of misrepresentation. When $\Omega > 0$, this implies an increase in q with the opposite effect when $\Omega < 0$. In either case, the second term says to shift profits upstream in response to an increase in the downstream tax. Thus, the net effect depends on the direction of misrepresentation. When the firm is initially overstating costs, a rise in the downstream tax increases the extent of misrepresentation and q rises. When $\Omega < 0$ the effect is ambiguous. Again, the ambiguity here is confirmed in simulations.

As a final point, note that by the changes in marginal costs equations, unusual movements in output are theoretically possible. For example, consider:

$$\frac{dMC}{dt_u} = \frac{1}{\left(1-t_d\right)}\left(q-d\right)-\frac{\Omega}{\left(1-t_d\right)}\frac{dq}{dt_u}$$

An increase in the upstream tax can result in a substantially large change in transfer pricing so that the after-tax marginal cost of production rises. As such, it is possible to find that marginal costs fall in response to tariff or tax hikes.

3. Formula Apportionment

In contrast to the SA situation, under FA, the firm does not declare separate profits subject to local taxation. Instead, worldwide profits are allocated to each jurisdiction according to a formula. Common elements of proposed formulas include payroll, capital investment, and sales. Since there is not capital investment in this model I set it aside. Thus, when κ is the weight in the formula applied to sales shares, this results in an effective tax rate, t^e, of:

$$\begin{aligned} t^e = t_d\left(\kappa\frac{P_d f_d}{P_d f_d + P_u f_u} + (1-\kappa)\frac{c(f_d + f_u, i)}{c(f_d + f_u, i) + d(i)}\right) \\ + t_u\left(\kappa\frac{P_u f_u}{P_d f_d + P_u f_u} + (1-\kappa)\frac{d(i)}{c(f_d + f_u, i) + d(i)}\right) \end{aligned} \tag{17}$$

i.e. a weighted average of the two countries' taxes. Note that these weights depend not just on the formula's weight κ, but on relative sales (which unsurprisingly depend on upstream tariffs) and production costs. This then results in an after-tax profit of:

$$\begin{aligned} \pi = (1-t^e)\left((1-\tau_u)P_u(f_u)f_u + P(f_d)f_d - c(f_d + f_u, i) - \gamma_u f_u - (\gamma_d + \tau_d q)i - d(i)\right) \\ -\phi(q, d(i)) \end{aligned} \tag{18}$$

Applying the assumptions used in the analysis of the SA case, this can be rewritten as:

$$\begin{aligned} \pi = (1-t^e)\left((1-\tau_u)P_u(f_u)f_u + P(f_d)f_d - (c + \gamma_d + \tau_d q + d)(f_d + f_u, i) - \gamma_u f_u\right) \\ -.5\phi(q - \alpha d)^2 \end{aligned} \tag{19}$$

where the effective tax is now simply:

$$t^e = t_d\left(\kappa\frac{P_d f_d}{P_d f_d + P_u f_u} + (1-\kappa)\frac{c}{c+d}\right) + t_u\left(\kappa\frac{P_u f_u}{P_d f_d + P_u f_u} + (1-\kappa)\frac{d}{c+d}\right)$$

It will be useful to define:

$$\Pi = Pf_d + (1-\tau_u)P_u f_u - (c + \gamma_d + d + \tau_d q)(f_d + f_u) - \gamma_u f_u$$

which is the pre-profit tax level of profits, excluding the non-deductible transfer price cost. This allows me to write the first order conditions as:

$$\frac{d\pi}{df_d} = \left(1-t^e\right)\left(P + P'f_d - \left(c+\gamma_d + d + \tau_d q\right)\right) + \Pi\left(t^* - t\right)\kappa\left(1 - \frac{Pf_d}{\left(Pf_d + P^* f_u\right)}\right)\frac{\left(P_1 f_d + P\right)}{Pf_d + P^* f_u} = 0 \quad (20)$$

$$\frac{d\pi}{df_u} = \left(1-t^e\right)\left(\left(1-\tau_u\right)\left(P^*{}_1 f_u + P^*\right) - \left(c+\gamma_d + d + \tau_d q\right) - \gamma_u\right) - \Pi\left(t^* - t\right)\kappa\frac{Pf_d}{\left(Pf_d + P^* f_u\right)}\frac{P^*{}_1 f_u + P^*}{\left(Pf_d + P^* f_u\right)} = 0$$

(21)

and

$$\frac{d\pi}{dq} = -\left(1-t^e\right)\tau_d\left(f_d + f_u\right) - \phi\left(q - \alpha d\right) = 0\,. \quad (22)$$

In the two output conditions, the first term represents the standard tradeoff between marginal revenue and marginal cost. As before, for the upstream sales, this includes the upstream tariff and additional shipping cost. The second term in each represents the shift in the weights between the two countries. As downstream sales rise, this shifts the sales ratio towards the downstream tax. For upstream sales, the reverse happens. Note that due to the assumption of Leontief production for the final good vis-a-vis the intermediate good, changes in output levels do not affect the payroll share of either country. This simplification is an added benefit of this assumption as it allows me to concentrate on how tariffs affect the relative sales shares and on the vertical nature of the firm.

When $t_d > t_u$, (20) and (21) indicate that, beginning where marginal revenue equals marginal cost for the two sales levels, there is an incentive to reduce downstream sales and increase upstream sales. When the downstream country has the lower tax, the reverse is true. This is because it shifts the weight in the effective tax formula towards the lower tax location.

This mirrors the results found elsewhere showing that FA can result in new distortions as firms attempt to play against the formula.

Using (22), the equilibrium transfer price will be:

$$q = \alpha d - \phi^{-1}\left(1 - t^{e}\right)\tau_{d}\left(f_{d} + f_{u}\right) \tag{23}$$

and, unlike the SA case, the firm will always understate the internal price for a positive downstream tariff. This is because, under FA, there is no benefit to misrepresenting the price in order to shift profits between locations. This is commonly taken to mean that transfer pricing is mitigated by FA. However, as is shown in the next section, this need not be the case, particularly when the desire to shift profits works counter to the desire to avoid tariffs. Nevertheless, this indicates that transfer pricing will persist as long as tariffs (or other transfer price-based barriers) are positive.

As before, how the firm choices move in tax and tariff space is generally ambiguous. Although there is no longer any ambiguity about the direction of misrepresentation, it again depends on both the downstream tariff and total output. Further, the complications introduced by changes in the effective tax rate make it impossible to find analytic comparative statics. Nevertheless, by using simulations, I am able to explore how transfer pricing depends on trade barriers and taxes. To this end, I must impose functional forms on my inverse demands. Specifically, I assume that both are linear where $P_{d}\left(f_{d}\right) = A - Bf_{d}$ and $P_{u}\left(f_{u}\right) = A_{u} - B_{u} f_{u}$. Table 1 lists the baseline parameter values for these simulations.

3.1 The Impact of Trade Barriers

Figure 1 illustrates the transfer price as a function of the downstream tariff. It does so for a downstream tax of .3 and three values of the upstream tax, .2, .3, and .4. From this, three things are seen. First, when the downstream tariff is zero, the transfer price equals the government's

target rate (which in these simulations is 20). Second, for positive downstream tariffs, higher upstream taxes result in a higher transfer prices, i.e. less misrepresentation. Although I do not illustrate it here, the same holds for changes in the downstream tax. In essence, increases in either profit tax increases the effective tax (although, due to the ability to manipulate the weights, the effect can be somewhat mitigated by shifting sales). The marginal benefit to misrepresentation is decreasing in the effective tax rate (since profits are taxed) but the marginal cost of misrepresentation does not depend directly on taxes. As a result, an increase in the effective tax results in less misrepresentation. Third, as the downstream tariff rises, the transfer price falls in order to minimize tariff payments. This latter result, however, is sensitive to parameter values. Increasing the upstream cost from 10 to 30 results in Figure 2.[8] Now the transfer price can be increasing in the downstream tariff for higher downstream tariffs. This is because output levels are lower with these higher costs. As such, the reduction in output effect dominates the benefit to avoiding downstream. This illustrates the ambiguous effects discussed above.[9]

Figure 3 illustrates the impact of the upstream tariff. Unlike the downstream tariff, the upstream one affects transfer pricing only via the volume of production. As such, as this tariff rises, output and the extent of misrepresentation fall.[10] Again, the higher are profit taxes, the higher is the transfer price. Putting this alongside the result for the downstream tariff results in ambiguous effects from tariff changes on transfer pricing under FA. Even ignoring the potential non-monotonicities in the downstream tariff, since reductions in low levels of τ_d can to reduce

[8] Note that as the upstream cost is higher, so too is the governments' desired transfer price (now equal to 90).
[9] It is worth recognizing that, as is easily verified via the envelope theorem, profits fall in the downstream tariff, regardless of the movement in transfer pricing.
[10] Note that here, because the downstream tariff is positive, the firm is setting a transfer price below the governments' preferred rate.

transfer pricing whereas reductions in τ_u tend to increase it, the net effect of instituting a free trade agreement clearly depends on parameter values.

Figures 4 and 5 illustrate what happens as downstream and upstream transport costs change. Similar to what was derived analytically for the SA case, increases in these trade barriers reduce transfer pricing as they lower output. Thus as was found there, as non-price trade barriers fall, misrepresentation increases.

Another impact of trade barriers, and one that will be central to the discussion in the next section, are their effects on the effective tax rate. This is illustrated in Figure 6. As the upstream tariff rises, the firm shifts output away from the upstream country and towards the downstream (in a relative sense as, due to reductions in underreporting the internal costs, higher tariffs drive up costs). This reduces the effective tax when the upstream location is the high tax one and increases the effective tax if it is the low tax location. Thus, the effect of the creation of a free trade area will have implications for effective tax rates depending on which country has relatively low taxes. Although it is more difficult to see, Figure 7 shows a comparable effect for increases in the downstream tariff. The reason for this smaller impact on the effective tax rate is that it only affects relative sales through the marginal cost of both locations.

Figures 8 and 9 repeat this exercise for the downstream and upstream transport costs. Although the impacts are small in magnitude, the impacts on the effective tax mirror those for changes in the tariffs.

3.2 The Impact of Taxes

Figure 10 shows the impact of taxes on the transfer price for given tariffs. As can be seen, an increase in either tax rate increases the internal price and lowers the extent of

misrepresentation. Since an increase in either rate lowers the after tax return to misrepresentation without affecting its cost, this reduces the degree of under-reporting.

Figure 11 shows the impact of taxes on the share of profits taxable downstream. As is expected, as the upstream tax rises, the firm shifts sales so that the portion of taxes apportioned to home taxation declines. As Figure 12 shows, however, the effective tax still increases (and under this parameterization, the increase is only slightly less than a linear one).

4. A Comparison of SA and Formula Apportionment

The above illustrates how firm choices move in the various government policies under a given system. This, however, is not at the true heart of the push towards a CCCTB. Instead, proponents hail the reductions in transfer pricing (and attendant increases in tax revenues) for given tax parameters. Such a move is also criticized by those who suggest that such a move can result in additional distortions and potential increases in tax competition. In this section, I compare the two systems, again with an eye towards how this comparison depends on trade barriers.

4.1 Transfer Pricing Under Separate Accounting versus Formula Apportionment

To begin with, Figure 7 compares the transfer price for SA and FA as it varies with the downstream tariff. The top panel is where the upstream tax is higher than the downstream tax and the bottom is where the upstream country is the low tax nation. Since there is only the tariff motivation to transfer price under SA, transfer prices (and all other variables) are the same under both methodologies for equal taxes and this case is omitted. When the upstream tax is lower than the downstream tax, SA results in a higher transfer price than does FA as the firm seeks to shift profits upstream. When the upstream tax is lower, the reverse is true. This does not mean,

however, that the extent of misrepresentation is always greater under SA. Recall that in these simulations, the government's desired transfer price is 20. When the upstream tax is lower, for low levels of the downstream tariff SA gives greater misrepresentation as the tax avoidance motive pushes the transfer price up. As the downstream tariff rises, the tariff avoidance motive takes on increasing importance. Because this works against the tax avoidance motive, it eventually leads to less misrepresentation under SA. Thus it is not always the case that a shift to FA results in less misrepresentation.

Figure 14 repeats this exercise but allows the upstream tariff to vary. As with Figure 13, the ranking of the transfer price across the two regimes depends on the ranking of profit taxes. Unlike that the downstream tariff, however, the extent of misrepresentation is always falling in the upstream tariff. This is because the rise in the upstream tariff reduces output and the benefit to misrepresentation leading to a transfer price approaches 20. Note that with SA a low upstream profit tax, this leads to a reduction in the transfer price. As before, however, when the upstream tax is higher, the extent of misrepresentation is lower under FA. However, when the upstream tax is higher, particularly for low values of the upstream tariff (where output is higher), the extent of misrepresentation is lower under SA. Again, this is due to the opposing effects of tax and downstream tariff avoidance. Although I do not show the figures here, changes in transport costs have impacts similar to changes in the upstream tariff (although the magnitude of the changes are smaller in line with the earlier results).

Combining these two tariff effects, a switch from SA to FA can raise or lower the extent of misrepresentation depending on the level of taxes and tariffs.

4.2 Tax Revenues under Separate Accounting versus Formula Apportionment

Although part of the debate has been on the ability of FA to limit transfer pricing, the reason for this focus is because of the effect of transfer pricing on tax revenues. In particular, high tax locations believe that if the tax motive for transfer pricing is eliminated via FA, that this will increase their tax revenues. In fact, however, whether or not this holds depends on parameter values, in particular on the preferred markup α. To formulate some intuition, consider a special case in which demands are identical, and taxes are equal, there are no tariffs, and there is no upstream transport cost ($\gamma_u = 0$). In this case, under both SA and FA, there is no incentive to transfer price and $q = \alpha d$. Furthermore, sales in each location are given by:

$$f_d = f_u = \frac{A - c - \gamma_d - d}{B}$$

and worldwide pre-tax profits under each method are:

$$\pi_d + \pi_u = \frac{\left(A - c - \gamma_d - d\right)^2}{B}.$$

What does differ between methods, however is the income allocated to each country for taxation. With SA, the preferred markup determines this resulting in an upstream tax revenues (R_u) of:

$$R_u = t_u 2(\alpha - 1) d\left(\frac{A - c - \gamma_d - d}{B}\right). \tag{24}$$

Under FA, the income allocated is determined by the formula, which in the special case means that half of worldwide profits are taxable in the upstream location, resulting in revenues of

$$R_u = \frac{\left(A - c - \gamma_d - d\right)^2}{2B}. \tag{25}$$

Comparing (24) and (25), whether a switch from SA to FA increases upstream depends on whether α is greater or less than $\frac{A - c - \gamma_d + 3d}{4}$. In addition, as the worldwide tax base is the same across cases, if upstream revenues rise, this implies downstream revenues, R_d, will fall.

Allowing for tariffs (which enter into revenues and affect sales and transfer pricing) and upstream transport costs complicates this comparison. Therefore I again use simulations to consider how changes in trade barriers impact the revenue comparison.

Figure 15 illustrates the difference in total revenues (including tariff revenues) under FA versus SA. In this case, the upstream country gains revenues from a switch from SA to FA but the downstream country loses revenues. The upstream's gains are greatest when it has the higher tax rate as FA reduces the shifting of profits away from it. The ranking of downstream losses, however, depend on the downstream tariff. When its tariff is small, a shift towards FA hurts downstream more when they are the low tax location as the elimination of transfer pricing allocates less income to them. When tariffs are higher, the reverse is true. Recall that when the upstream tax is high, under SA both the tax and tariff avoidance motives result in a lower transfer price. The elimination of the tax avoidance motive under FA results in a higher transfer price, increasing tariff revenues. When tariffs are large, this outweighs the loss in profit taxes as profits are reallocated. Thus, the impact of trade liberalization on the difference in downstream revenues across methods depends on the relative tax levels. The same holds for the upstream country, although there it is driven solely by the volume of production effect. As can be seen, declining downstream tariffs increases the revenue boost from FA when it is the high tax location but lowers it under SA. Again, this is because of the conflicting directions of the tax and tariff avoidance motives under SA when the upstream tax is lower.

Furthermore, as shown in the bottom panel, worldwide tax revenues can fall under FA when the upstream country is the low tax location and tariffs are high. This is because under SA, tax avoidance keeps the transfer price – and tariff revenues – higher. This, combined with the overall reduction in output results in lower worldwide tax takes. As tariffs fall, however, this

becomes less of a concern, suggesting that with transfers between governments, it may be possible for both countries to benefit from FA. For this to occur, however, taxes must differ (otherwise there is no transfer pricing motive under SA for FA to correct).

Figure 16 repeats this with a value of $\alpha = 3$, i.e. where the governments' desired transfer price is larger relative to upstream costs than in the baseline. Now we see that which country sees a boost in revenues depends very much on the constellation of taxes and tariffs. In fact, in line with the above special case, with a higher preferred markup the upstream country can lose by the switch to FA. Furthermore, as shown in the bottom panel, worldwide tax revenues can fall under FA when the upstream country is the low tax location and tariffs are high. This is because under SA, tax avoidance keeps the transfer price – and tariff revenues – higher. This, combined with the overall reduction in output results in lower worldwide tax takes. As tariffs fall, however, this becomes less of a concern, suggesting that with transfers between governments, it may be possible for both countries to benefit from FA. In addition, worldwide revenues can fall from shifting to FA when the downstream tariff is high and the upstream tax is lower.

Figure 17 repeats 15 for changes in the upstream tariff (for $\alpha = 2$). As before, switching from SA to FA benefits the upstream country's revenues at the expense of the downstream revenues with the largest changes in absolute values when the upstream tax is higher than the downstream tax. Also as before, this switch can reduce worldwide revenues. As the upstream tariff rises, these upstream gains, downstream losses, and worldwide revenue changes approach zero. This is because the higher upstream tariffs reduce output and the extent of transfer pricing, thereby decreasing the changes caused by the switch to FA. Figure 18 again considers changes in the upstream tariff, but uses the higher target price ($\alpha = 3$). As before, this alternative parameterization can result in a decline in revenues for the upstream location but an increase in

those for the downstream country. Here, however, we observe some interesting interplay between tariffs and taxes as for higher upstream tariff levels. In particular, note that the upstream tariff that maximizes the worldwide revenue increase when the upstream tax is lower minimizes the revenue boost when the upstream tax is higher.

Putting the above results together indicate that the revenue implications of moving from SA to FA is likely to depend on parameter values. Nevertheless, when target mark-ups are low and trade is relatively unhindered, the revenue benefits of moving to FA are generally positive for the upstream country, negative for the downstream country and ambiguous for the world, depending on relative taxes.

4.3 Tax Competition Under Separate Accounting versus Formula Apportionment

In addition to changing tax revenues, switching to FA has the potential to affect tax competition. There are two reasons for this. First, as noted above, changing tax methods leads to different transfer prices (and outputs and profits). As such, tax bases change altering the incentive to manipulate taxes. Second, under SA, the firm pays an effective tax rate. The extent to which this depends on a given nation's tax depends on the weights applied in the formula. When a country has a low weight, a change in its tax does little to impact the effective rate, in essence making profits inelastic to that country's tax rate giving it an incentive to raise its tax rate with little concerns about negative tax base effects. Alternatively, when a country's weight is high, it will be forced to internalize a large part of the effects of its choice. Unfortunately, unlike Nielsen, Raimondos-Møller, and Schjelderup (2010) who use a formula only depending on capital usage, I am unable to analytically compare the two systems analytically. Nevertheless in order to gain some insight into these effects, I now simulate the first order conditions for taxes for the upstream and downstream countries evaluated at a baseline harmonized rate of .3.

Figure 19 illustrates the change in downstream revenues with respect to a change in the downstream profit tax.[11] As can be seen, for both FA and SA, from this baseline, the downstream country can increase revenues by increasing its tax. In addition, the benefit from doing so is falling in the downstream tariff. This is because as tariffs rise, the profits and the tax base fall, reducing the benefit from increasing the downstream tax. Furthermore, the incentive to increase the tax is greater under SA. This suggests that a switch to FA would help limit tax competition. Figure 20, however, again raises the target markup to 3. Now, although it is still in the downstream country's interest to unilaterally raise its tax, this incentive is stronger under FA. The difference between these two figures again returns to the distribution of income under SA. When taxes are equal and the preferred markup is low, a greater share of income is allocated to downstream taxation than when α is high. As such, the greater tax base increases downstream's desire to unilaterally increase its profit tax.

Figure 21 considers the change in upstream revenues from a change in the upstream tax. This country also benefits from an increase in its tax rate with a greater benefit from smaller downstream tariffs. Unlike downstream country, the upstream incentive to deviate is greater under FA than SA. However in Figure 22 when $\alpha = 3$, comparable to the downstream country, the incentive to deviate is larger under SA. Again, the difference lies in the fact that higher preferred mark-ups allocate a bigger tax base to upstream under SA which increases its desire to unilaterally raise its tax.

These findings suggest that the likelihood of FA curbing tax competition depends on parameter values, including the degree of profit allocation taking place via the target markup. Nevertheless, it may well be the case that switching to FA discourages tax competition by one

[11] I am treating tariffs as an exogenous variable here in keeping with the notion that under a free trade agreement, their use is governed by external agreements.

country while encouraging it for the other. A secondary result is that as downstream tariffs fall, the incentive to deviate from harmonized taxes rises. Although not shown, this is also true for declines in upstream tariffs and transport costs. This suggests that increased integration may well make tax harmonization more difficult.[12]

5. Conclusion

This paper adds to the existing debate on the relative merits of FA and SA by considering vertical FDI. Although horizontal FDI is a major component of FDI activity, recognizing the vertical nature of investment is important for understanding potential impacts of policy changes because this highlights the role of trade barriers on final goods as well as intermediates as well as the role of sales in the apportionment rule.

This distinction points out two important facts. First, transfer pricing is not driven solely by tax differentials. Indeed tariffs (as well as other price based taxes) can lead to the manipulation of internal prices. As such, the degree of misrepresentation under SA and FA depends on taxes and tariffs. Second, the benefits in terms of tax revenue generation and tax competition reduction depend highly on parameter values. In particular, simulations find that these benefits can fall in trade barriers. This suggests that increased economic integration may well tip things in favour of FA instead of SA. This may well be a portion of the increased calls within the EU for such a regime shift.

As a final note, although the model utilizes tariffs as the second policy choice, they indicate that other policies, such as value added taxes, can have implications for both transfer pricing, tax revenues, and the overall choice of tax method. I leave this open for future research.

[12] Davies and Voget () and Redoano () both find evidence suggesting that tax competition is greater between EU members than between EU and non-EU countries, consistent with this result.

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Table 1: Baseline Parameter Values

Parameter	Description	Baseline Value
t_d	Downstream profit tax	.3
t_u	Upstream profit tax	.3
τ_d	Downstream tariff on intermediate good	.1
τ_u	Upstream tariff on final good	.1
A_d	Intercept for downstream inverse demand	100
B_d	Slope for downstream inverse demand	1
A_u	Intercept for upstream inverse demand	100
B_u	Slope for upstream inverse demand	1
κ	Weight of sales in effective tax formula	.5
c	Downstream per-unit cost of transforming intermediate to final good	10
d	Upstream cost of producing intermediate	10
γ_d	Per-unit shipping cost of intermediate good	.1
γ_u	Per-unit shipping cost of final good	.1
ϕ	Cost parameter in cost of transfer pricing	15
α	Extent above d governments want q	2

Figure 1: Transfer Pricing Under Formula Apportionment (Changes in τ_d)

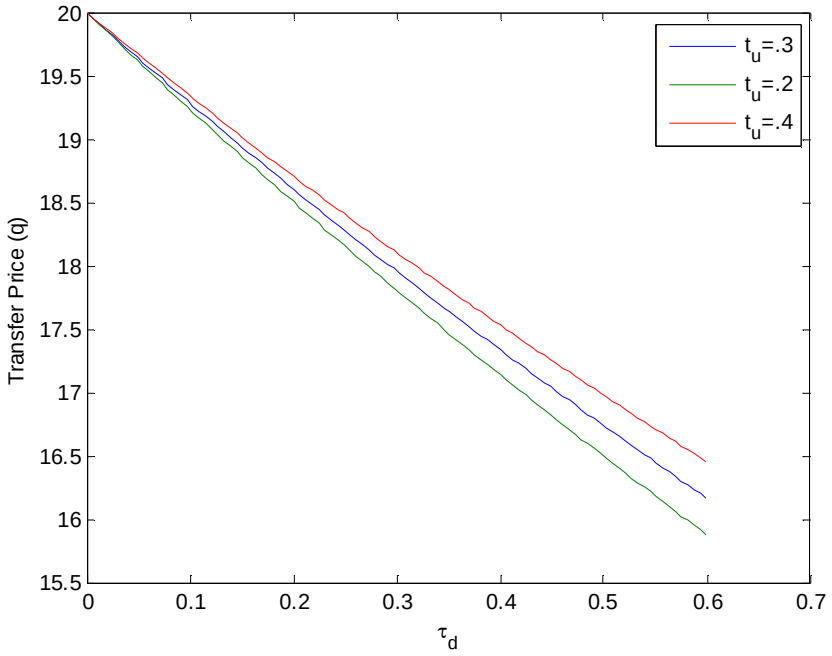


Figure 2: Transfer Pricing Under Formula Apportionment (Changes in τ_d, $c = 30$)

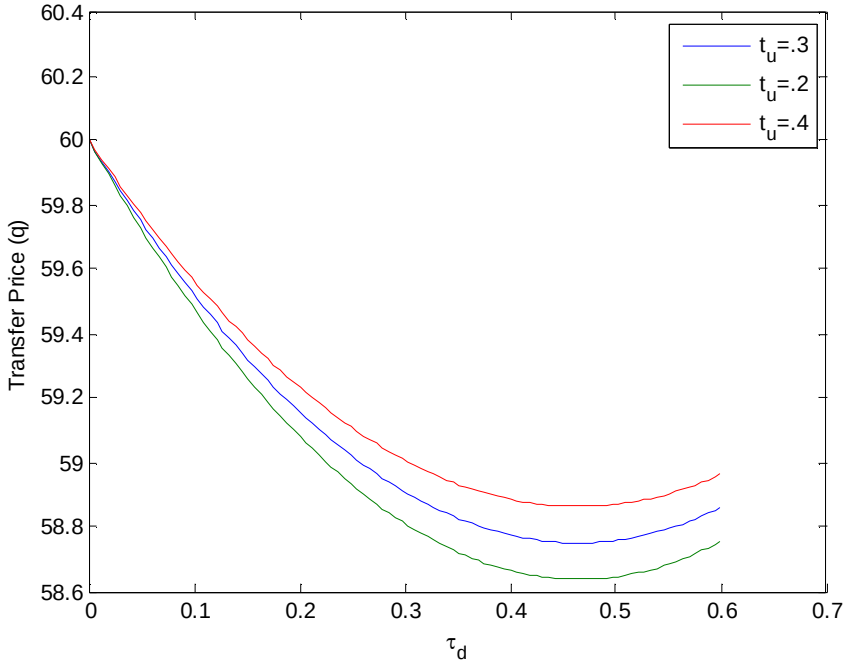


Figure 3: Transfer Pricing Under Formula Apportionment (Changes in τ_u)

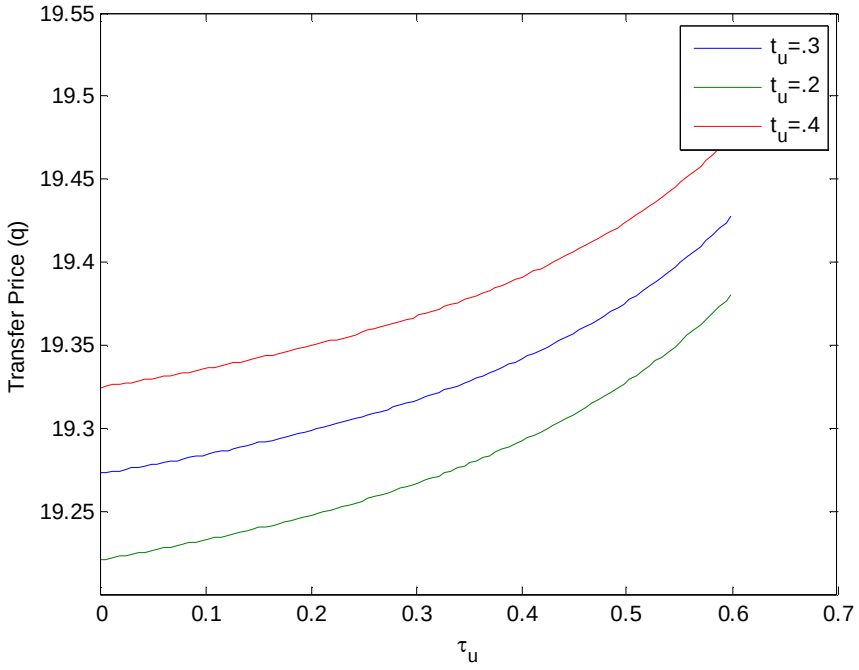


Figure 4: Transfer Pricing Under Formula Apportionment (Changes in γ_d)

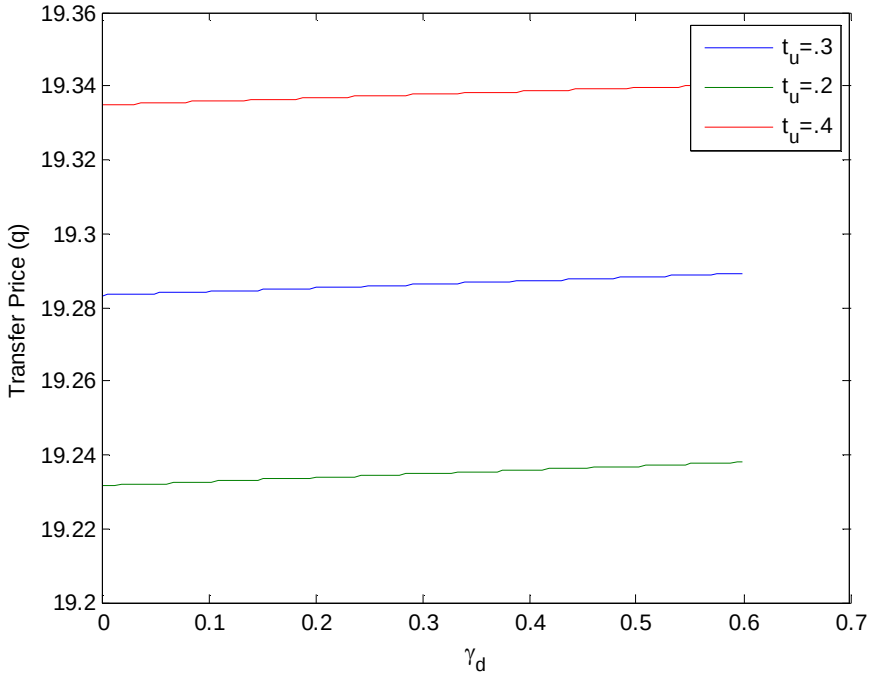


Figure 5: Transfer Pricing Under Formula Apportionment (Changes in γ_u)

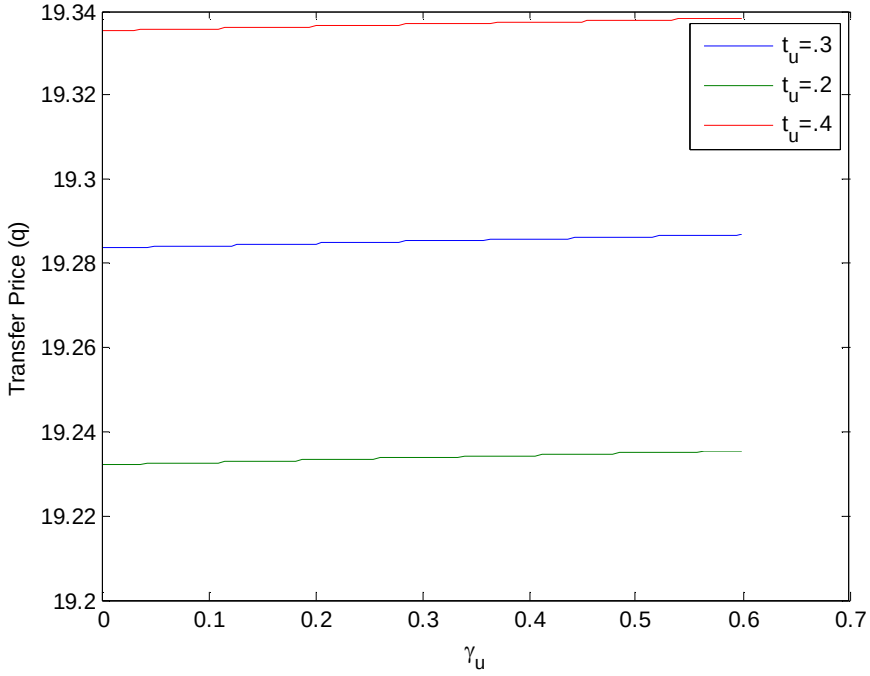


Figure 6: Effective Tax Under Formula Apportionment (Changes in τ_u)

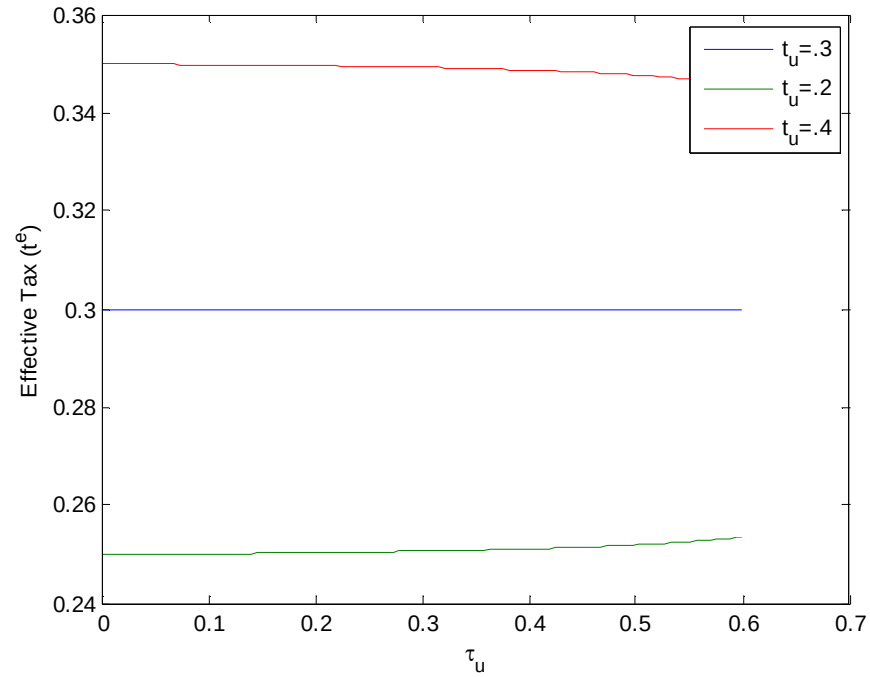


Figure 7: Effective Tax Under Formula Apportionment (Changes in τ_d)

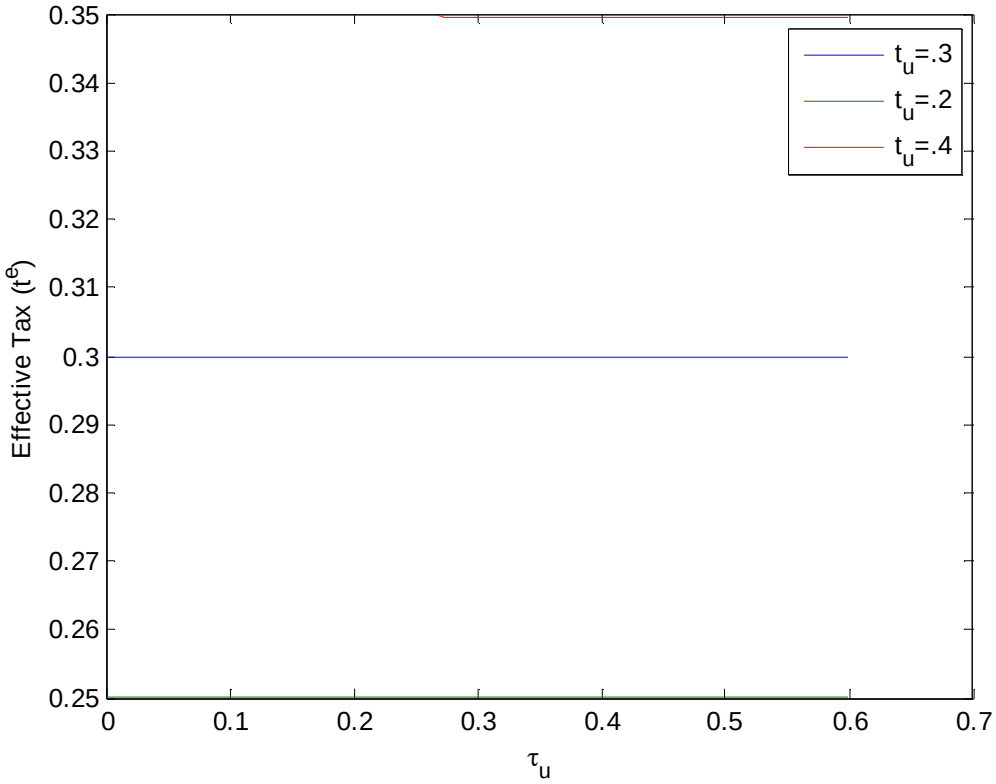


Figure 8: Effective Tax Under Formula Apportionment (Changes in γ_d)

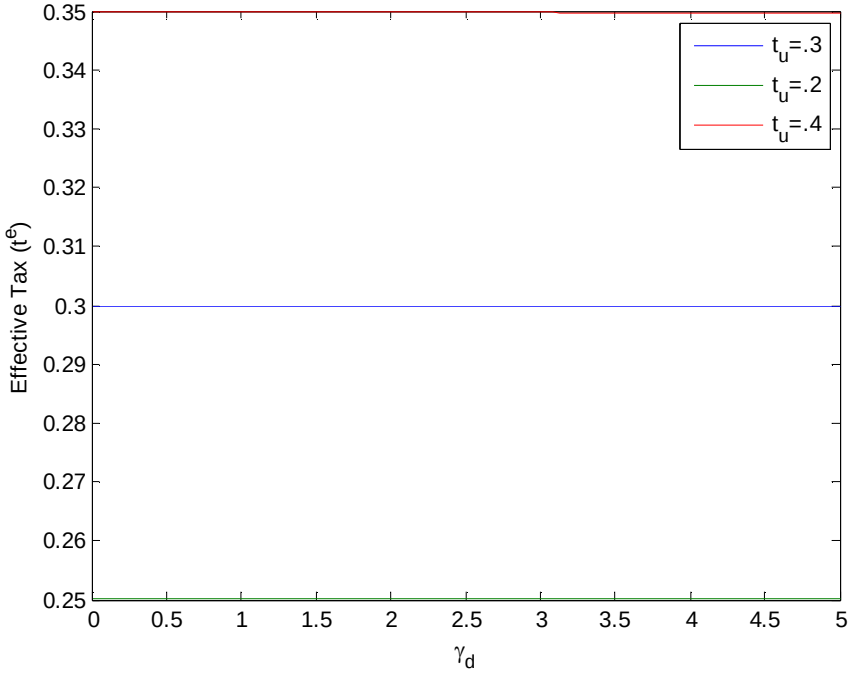


Figure 9: Effective Tax Under Formula Apportionment (Changes in γ_u)

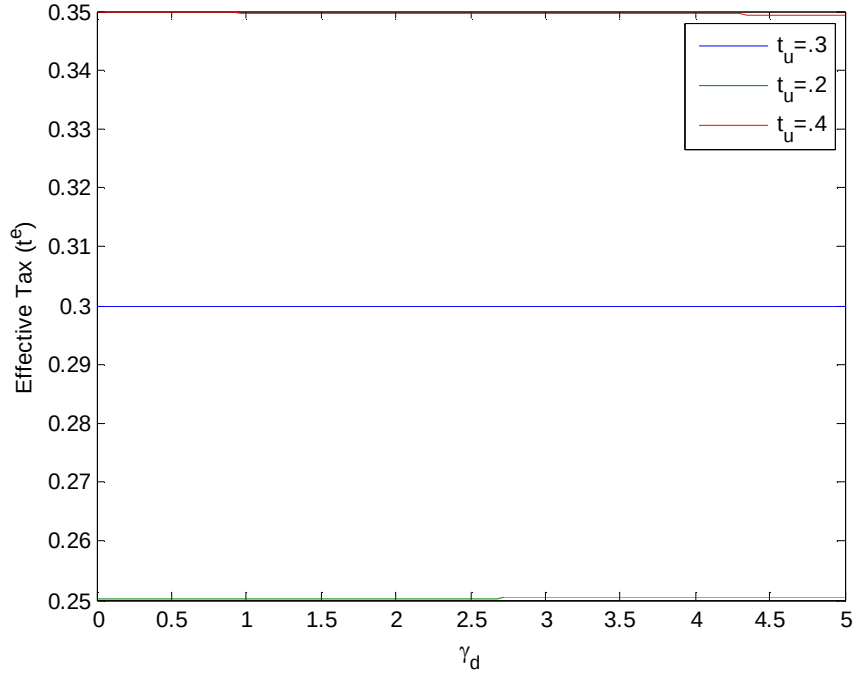


Figure 10: Transfer Pricing under Formula Apportionment (Changes in Taxes)

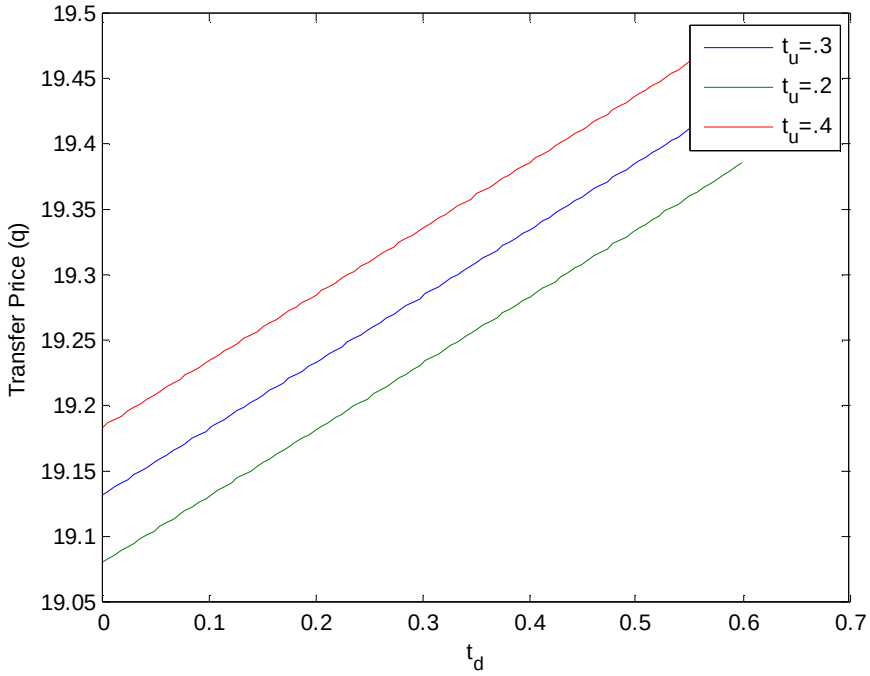


Figure 11: Share of Profits Taxable Downstream (Changes in Taxes)

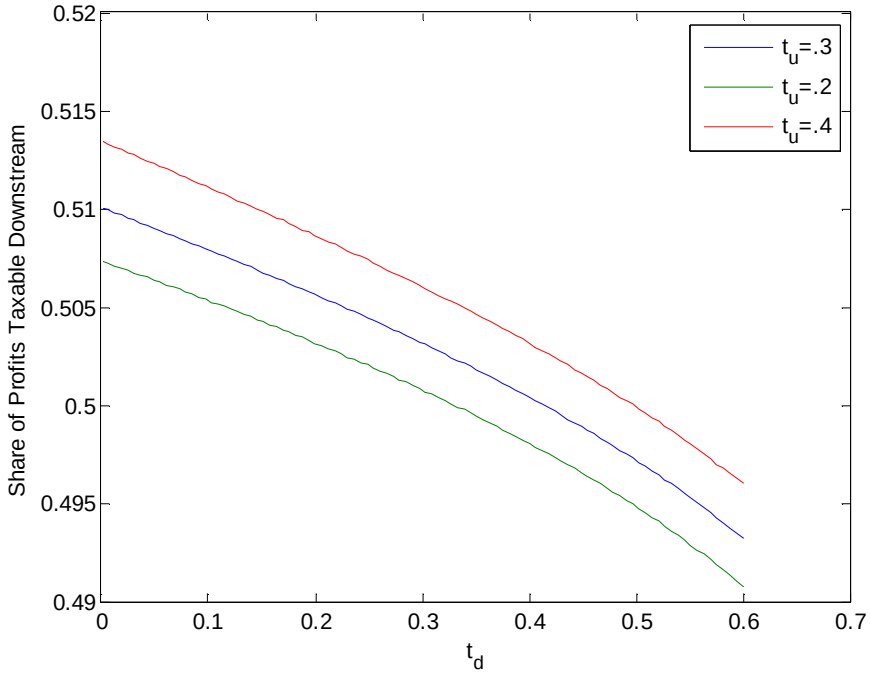


Figure 12: Effective Tax under Formula Apportionment (Changes in Taxes)

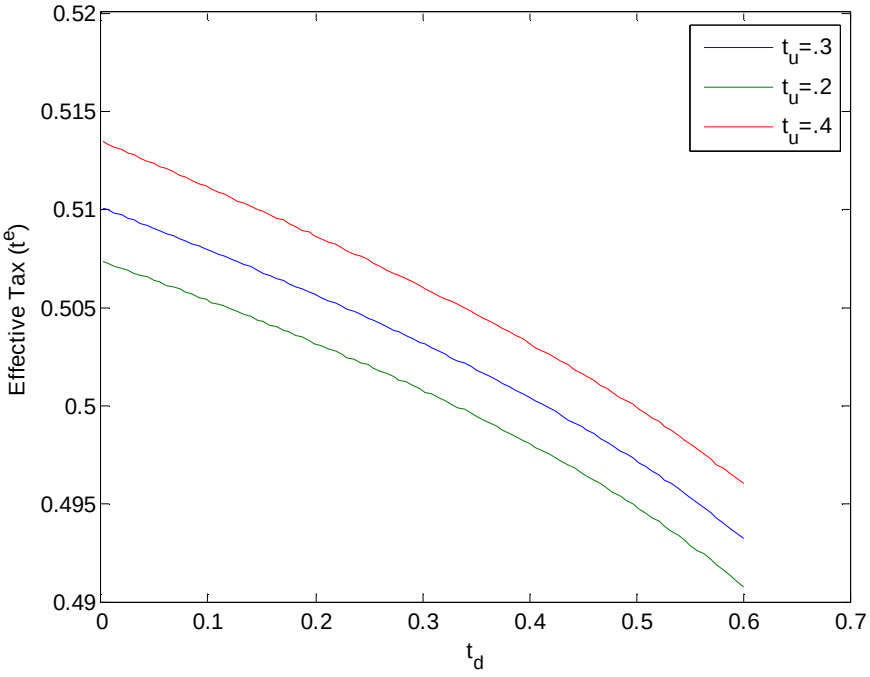


Figure 13: Transfer Pricing Under Separate Accounting and Formula Apportionment (Changes in τ_d)

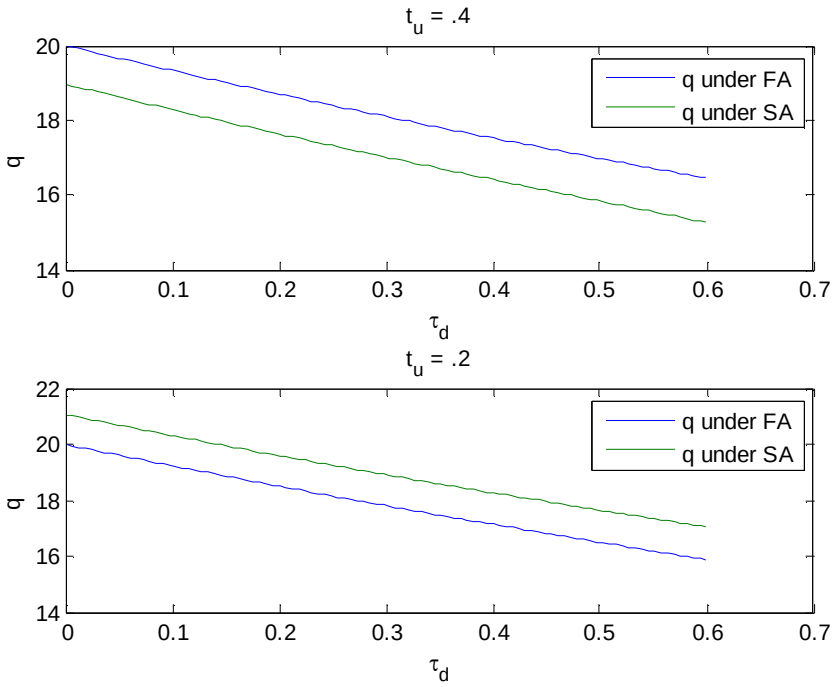


Figure 14: Transfer Pricing Under Separate Accounting and Formula Apportionment (Changes in τ_u)

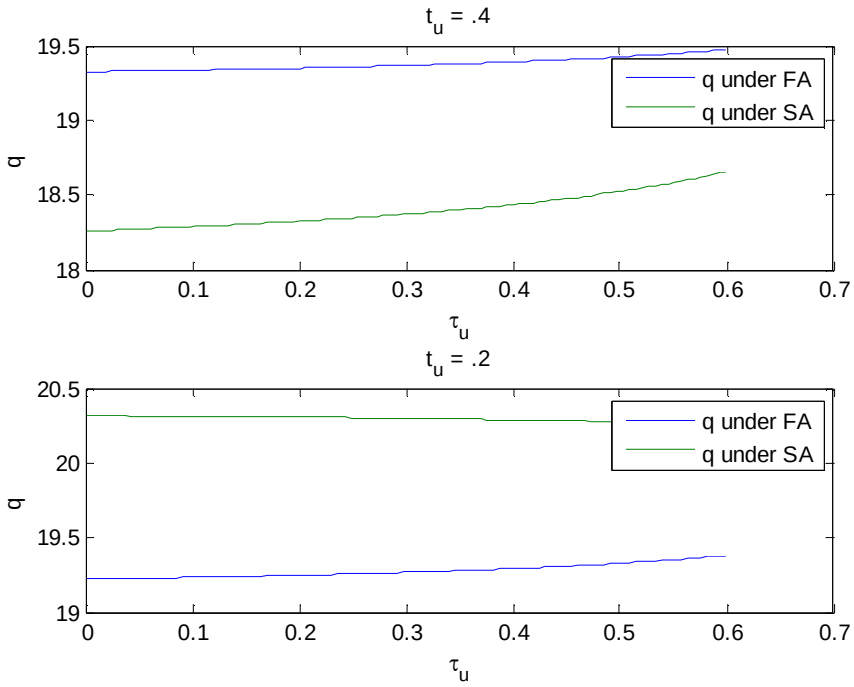


Figure 15: Revenue Difference (FA – SA) (Changes in τ_d)

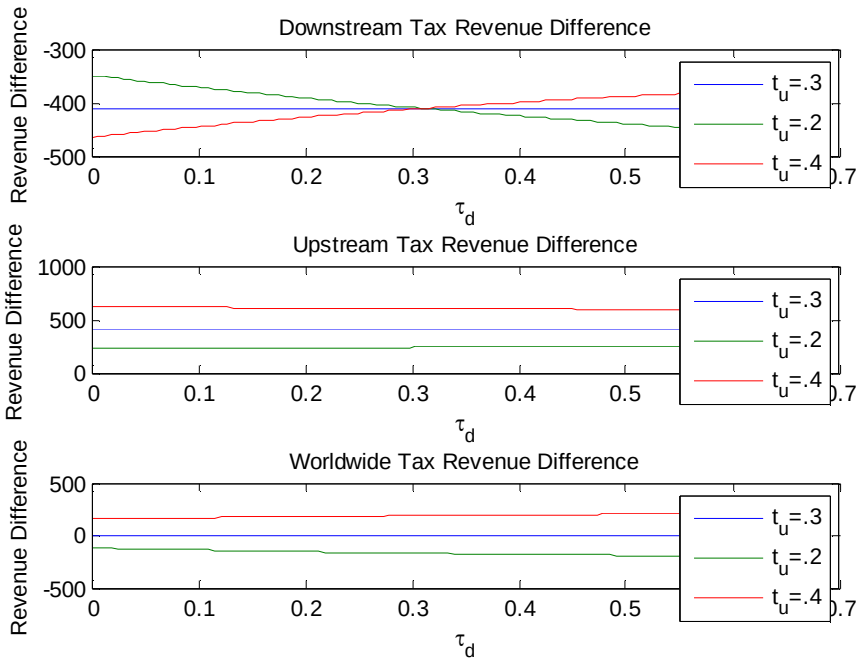


Figure 16: Revenue Difference (FA – SA) with $\alpha = 3$ (Changes in τ_d)

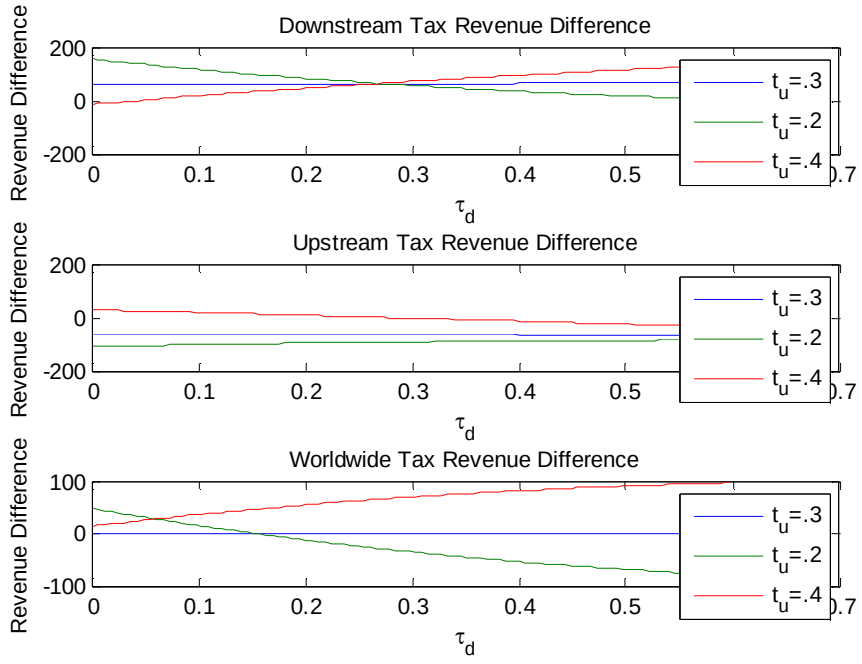


Figure 17: Revenue Difference (FA – SA) (Changes in τ_u)

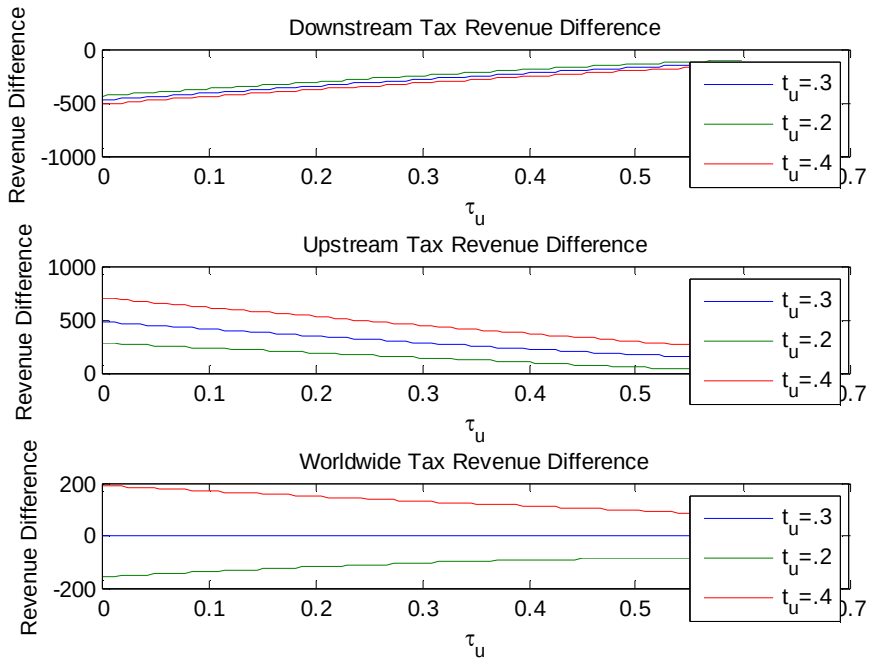


Figure 18: Revenue Difference (FA – SA) with $\alpha = 3$ (Changes in τ_u)

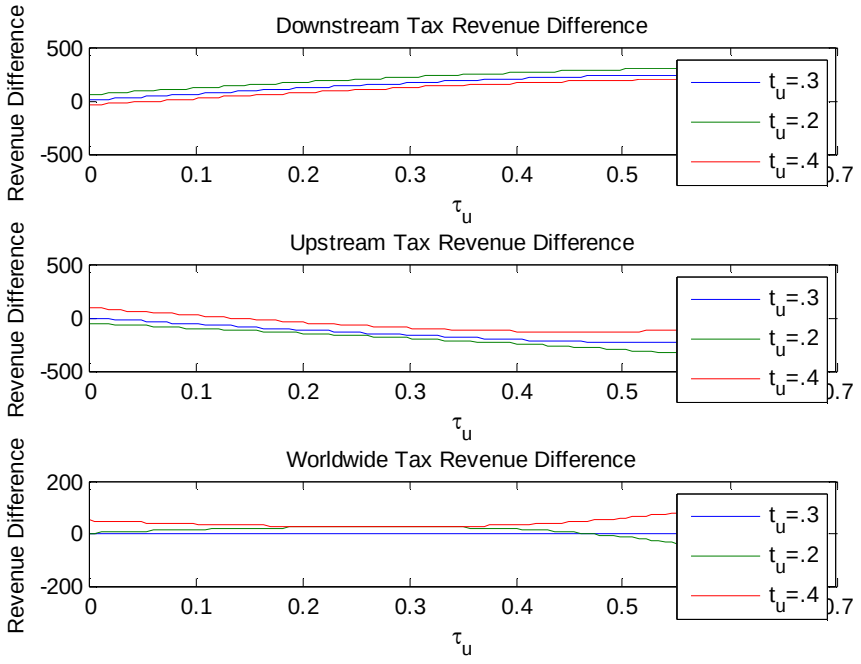


Figure 19: Downstream Tax FOCs (Changes in τ_d)

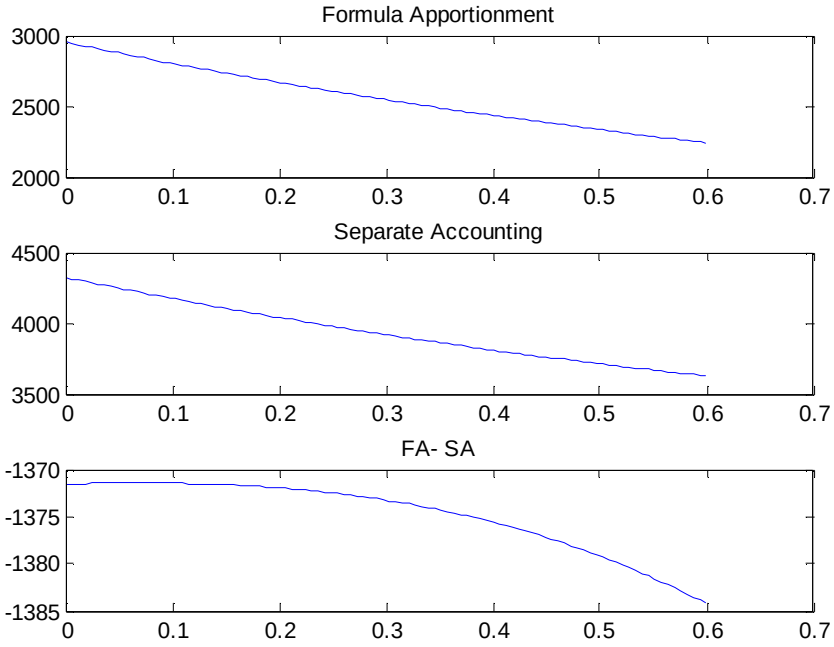


Figure 20: Downstream Tax FOCs with $\alpha = 3$ (Changes in τ_d)

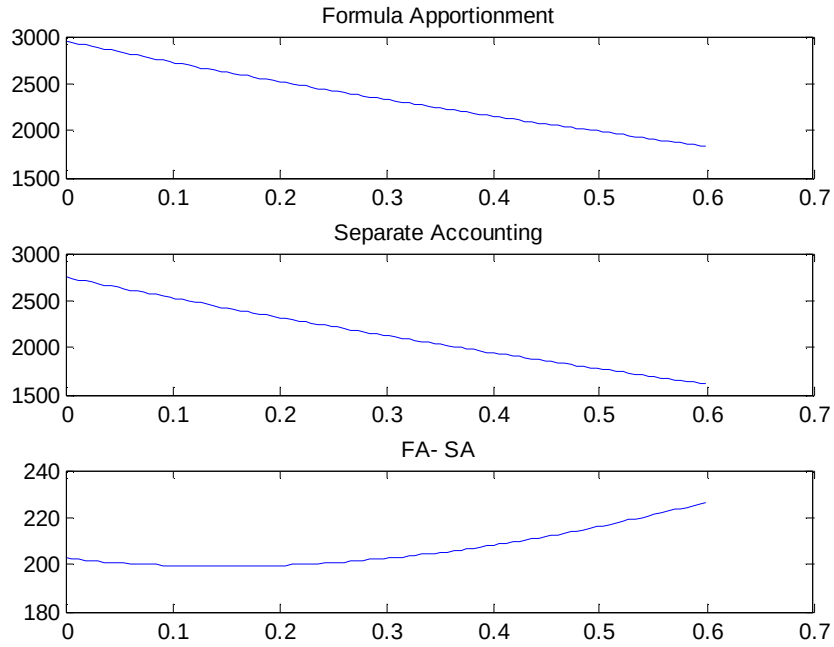


Figure 21: Upstream Tax FOCs (Changes in τ_d)

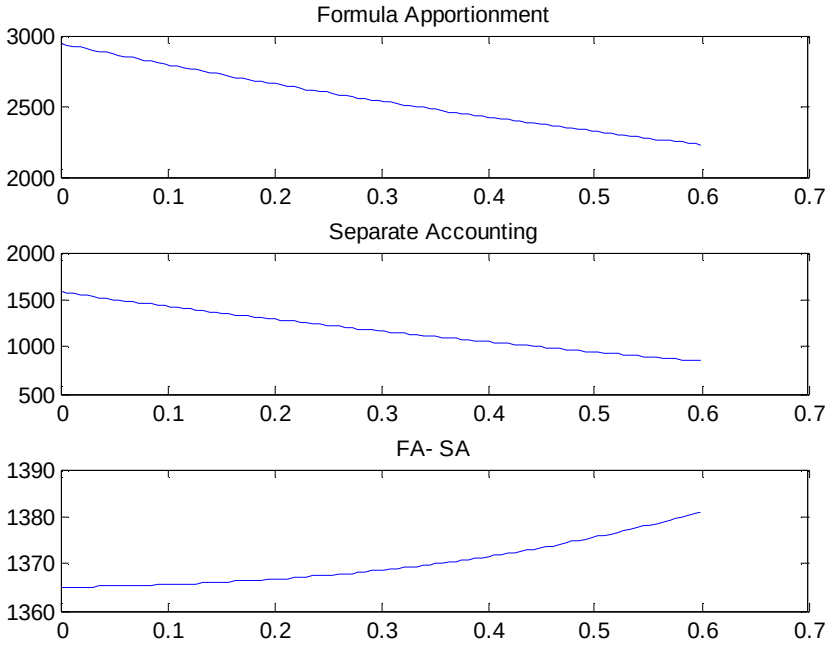
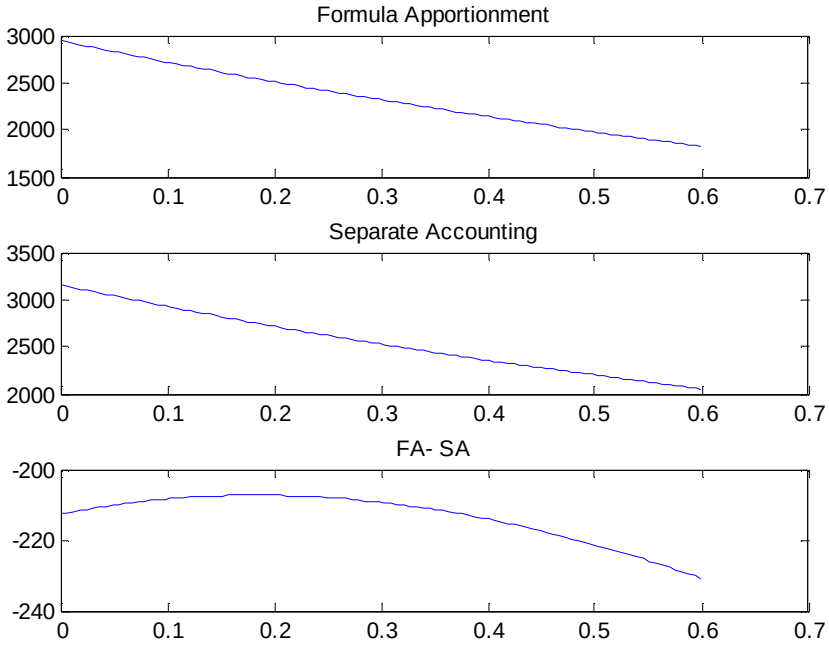


Figure 22: Upstream Tax FOCs with $\alpha = 3$ (Changes in τ_d)



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