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Abstract

This paper explores the efficiency distortions under two types of destination-based corporate cash-flow taxes. Auerbach and Devereux (2015) have shown that a sales-apportioned cash-flow tax will distort consumer prices; this paper shows that those distortions are generally quite small, and are limited solely to industries in which economic profits are earned, and consumption is already significantly distorted. This paper also shows that a border-adjusted cash-flow tax will distort consumption decisions that cross borders, such as travel, higher education, and retirement location. In addition, it would affect labor migration decisions, especially for migrants who plan either to migrate only temporarily, or to remit a substantial fraction of their earning back to their home country.

Keywords: International Corporate Taxation, Cash Flow Tax, Destination-Based Cash Flow Tax, Formula Apportionment

JEL Codes: H21, H25, H31, H32

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The corporate income tax distorts a broad range of economic decisions, and induces a variety of tax avoidance strategies. Increasingly, a destination-based corporate cash-flow taxation is being considered as a desirable alternative, one that would eliminate distortions in both marginal investment decisions and financing decisions (OECD 2007, Auerbach Devereux and Simpson 2010, Institute for Fiscal Studies 2011).

There are two types of destination-based taxes being widely discussed. One is sales-based formula apportionment, recommended by the European Commission (2001) for the E.U., and advocated by Avi-Yonah *et al.* (2009) for the U.S. and Eichner and Runkel (2008) for the E.U. The other is a border-adjusted cash flow tax, advocated by Auerbach (2010) and Auerbach and Holtz-Eakin (2016).

Auerbach and Devereux (2015) suggest that while both forms of destination-based cash flow taxes are neutral with respect to production decisions, only the border-adjusted cash flow tax is also neutral with respect to consumption decisions. Although they are correct that a sales-proportioned tax will distort some consumer prices, I show that the effect is quite small.

In addition, a broadened form of their model, that allows for both consumers and workers to move across borders, shows that their destination-based cash flow tax also creates consumption distortions which a sales-apportioned cash flow tax does not generate. Hence, from an efficiency perspective, it is not clear that the border-adjusted tax is superior, and indeed it is possible that the sales-apportioned version of a cash-flow tax may be the preferred alternative.

Section 1 presents a version of the Auerbach-Devereaux model, stripped down to its bare essentials. I replicate their results for the border-adjusted tax, but find no sales-apportioned consumption distortion. Section 2 shows why that occurred, and identifies the market conditions necessary for a sales-apportioned tax distortion. This section also demonstrates that those distortions will typically be very small in magnitude.

Section 3 then expands the model to allow for cross-border consumption, in forms such

as foreign travel, foreign education, retirement to a foreign country, and remittances to support family abroad, and labor mobility. It shows that a border-adjusted tax distorts both consumption decisions that cross borders, and labor migration decisions.

1 The ABD Model

The model in this section is a bare-bones version of the model developed by Bond and Devereux (2002) and Auerbach and Devereux (2015) (hereafter ABD). There are two countries, A and B, and two products, X_c and X_m. X_c is a commodity good, produced in both countries under perfect competition and constant returns to scale. X_m is produced by competitive multinational companies that take all prices as given. They also produce using a constant returns to scale technology, and earn no economic profits.[1] Trade between the two countries is frictionless; there are no transportation costs.

All production uses some resource Z, in fixed supply in both countries, the price of which is q. Z could be thought of as labor, or capital, or some optimal mix of labor and capital. Production merely transforms this resource into the final good, so for each firm, $x_{ij} = z_j$. Since neither tax distorts any production decision, any more complex production function would only add complexity without providing any additional insight.

Country A imposes a cash-flow tax at rate τ. Since there are no economic profits in this model, and trade is assumed to balance, the tax generates no revenues whatsoever. In both countries, consumer utility is $U(x_c, x_m)$.

1.1 The Border-Adjusted CFT

Under a border-adjusted cash-flow tax (BACFT) in country A, firms can deduct costs incurred in country A, but are taxed on all revenues in country A.[2] Hence the profits of a

[1] In Auerbach and Devereux (2015), this sector had decreasing returns to scale. I will discuss the implications of this difference in the next section.

[2] A border-adjusted tax is generally discussed as a replacement for the corporate income tax. However, if it were levied only on corporations, exports and imports by non-corporate entities would not face a tax, nor get a deduction. This would

competitive firm producing good c in both countries is

$$\pi = p_{cA}x_{cA}(1-\tau) + p_{cB}x_{cB} - q_A z_A(1-\tau) - q_B(x_{cA} + x_{cB} - z_A). \tag{1}$$

Competitive firms producing in A and selling in B would be at a distinct advantage, earning positive economic profits. As production in A expands, the price of Z_A is bid up; as production in B slumps, the price of Z_B falls; an equilibrium is finally attained when

$$\frac{p_{cA}}{p_{cB}} = \frac{q_A}{q_B} = \frac{1}{(1-\tau)}. \tag{2}$$

Thus, a new zero-profit competitive equilibrium is eventually attained.

In the multinational sector, a firm producing and selling in both countries would have the same profit function as in (1), with the subscripts changed from c to m. In the short run, it would be highly profitable for the firm to shift its production to A and its sales to B. In the long run, after the transition described above has taken place, and (2) has been attained for the multinational sector, the firm's sales would return back to the pretax balance. The firm might also return its production levels in the two countries to the pretax levels, but there is no obvious compelling reason for it to do so, and if we introduce any type of adjustment costs into the model, we are permanently left with more production by the multinational sector in country A, presumably offset by a shift in production in the commodity sector to country B. Otherwise, there are no consumer distortions in the model, since in both countries, $p_{cj} = p_{mj}$.

1.2 The Sales-Apportioned CFT

Under a sales-apportioned cash-flow tax (SACFT) in country A, corporations are taxed on all revenues in country A, but can deduct only a share of their costs, regardless of where those costs were incurred. For a firm in the commodity sector selling all its production in

put non-corporate exporters at a severe tax disadvantage, and non-corporate importers at a major advantage. Thus, it would be necessary to subject all businesses to these tax rules.

country A, regardless of its location, all revenues would be taxed and all costs deducted, so the tax has no effect on the zero-profit competitive equilibrium. Any firm selling all its production in country B, again regardless of its location, would be unaffected by the tax. Hence there would be no economic transition, no short-run shifting of production or sales, and no long-run change in the two countries' price levels.

In the multinational sector, profits of a firm producing and selling in both countries would be

$$\pi = p_{mA}x_{mA}(1-\tau) + p_{mB}x_{mB} - q(z_A + z_B)(1-\theta_A), \tag{3}$$

where θ_A is the revenue-weighted rate at which costs are deducted,

$$\theta_A = \frac{p_{mA}x_{mA}\tau}{p_{mA}x_{mA} + p_{mB}x_{mB}}. \tag{4}$$

Note that a change in sales changes the firm's θ_A:

$$\frac{d\theta_A}{dx_{mA}} = \frac{\tau p_{mA}p_{mB}x_{mB}}{(p_{mA}x_{mA} + p_{mB}x_{mB})^2}. \tag{5}$$

Therefore the first order condition for profit maximization with respect to x_{mA}, noting that $(z_A + z_B) = x_{mA} + x_{mB}$, is

$$\begin{aligned} \tfrac{d\pi}{dx_{mA}} &= p_{mA}(1-\tau) - q(1-\theta_A) + q(x_{mA}+x_{mB})\tfrac{\tau p_{mA}p_{mB}x_{mB}}{(p_{mA}x_{mA}+p_{mB}x_{mB})^2} \\ &= p_{mA}(1-\tau) - q(1-\tau) + q(p_{mA}-p_{mB})\tfrac{\tau p_{mB}x_{mB}^2}{(p_{mA}x_{mA}+p_{mB}x_{mB})^2} = 0, \end{aligned} \tag{6}$$

which is satisfied at $p_{mA} = p_{mB} = q$. So in this perfectly competitive, zero economic profits model, the sales-apportioned cash-flow tax, like its border-adjusted counterpart, creates no consumer distortions, but does so without any messy transition.

This is not the result that Auerbach and Devereux derived. To understand the difference, I will explore the potential distortions of a SACFT in more detail in the next section.

2 The Economic Distortions of a SACFT

Auerbach and Devereux found "an effective tax or subsidy on consumption" due to the SACFT; in the previous section, I found no such distortion. To understand why, consider the general case of a profit maximizing monopolist. Under a SACFT levied at rates τ_A and τ_B in the two countries, its after-tax profits will be

$$\pi = R_A(1-\tau_A) + R_B(1-\tau_B) - C_T(1-\theta), \tag{7}$$

where R_i is total revenues from sales in country i and C_T is the total cost of producing $q_A + q_B$, and now

$$\theta = \frac{R_A\tau_A + R_B\tau_B}{R_A + R_B}. \tag{8}$$

The change in θ with respect to revenue is now

$$\frac{d\theta}{dR_i} = \frac{(\tau_i - \tau_j)R_j}{(R_A + R_B)^2}, \tag{9}$$

so the firm's first order condition for profit maximization becomes

$$\frac{d\pi}{dR_i} = R_i'(1-\tau_i) - C_T'(1-\theta) + C_T\frac{R_i'(\tau_i - \tau_j)R_j}{(R_A + R_B)^2} = 0 \tag{10}$$

which after considerable manipulation reduces to

$$R_i' = C_T'\left[\frac{(R_A + R_B)(1-\theta)}{(R_A + R_B)(1-\theta) - \pi(\tau_i - \theta)}\right] \tag{11}$$

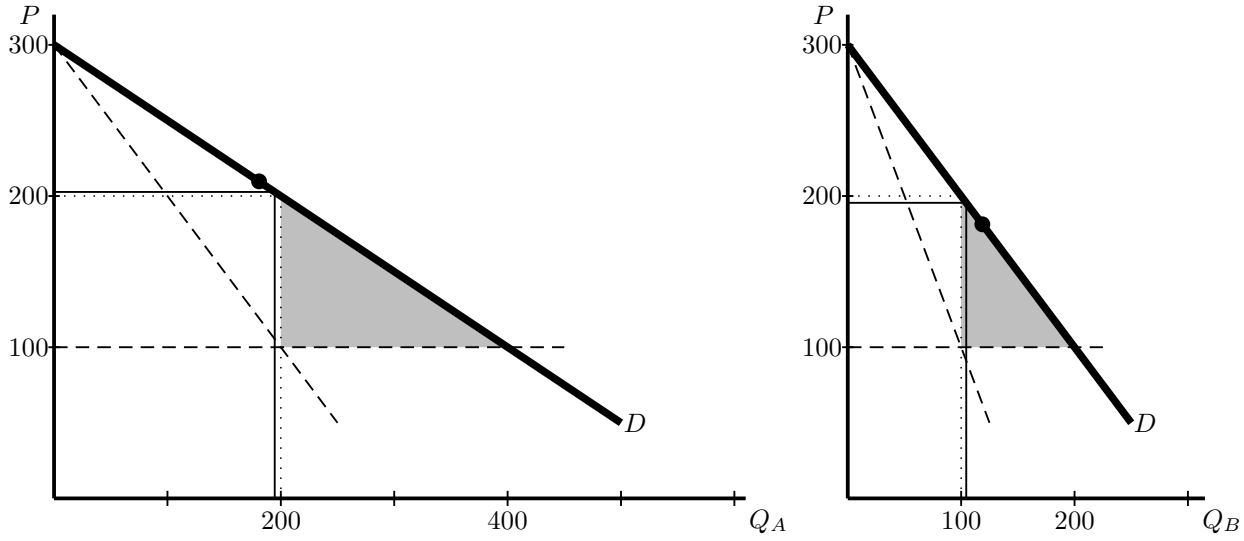
Economic efficiency requires the term in brackets to equal one. That condition will be satisfied if either (a) both countries levy the same tax rate, so $\tau_A = \theta = \tau_B$, or (b) that the firm earns zero economic profits. Hence when Auerbach and Devereux defined their multinational sector to have decreasing returns to scale and therefore economic profits, they found an economic distortion due to the SACFT; when I adopted a constant returns

to scale, zero economic profit model, I did not.[3]

Thus, while a SACFT will distort consumer markets that generate economic profits, it will have no effect on either purely competitive or monopolistic competitive markets, which represent a significant share of trade. Further it will leave the choice between a corporate or non-corporate form unaffected in these industries. However, a major fraction of trade is carried out by multinationals with some degree of market power, and (11) shows that those markets will be distorted by the SACFT.

To get a sense of the magnitude of that distortion, our monopolist faces the linear demand curves $P_A = 300 - .5Q_A$ and $P_B = 300 - Q_B$, and produces at constant marginal cost $C'_T = 100$, portrayed in Figure 1. The profit maximizing choices in the absence of taxation are $P = 200$, $Q_A = 200$, and $Q_B = 100$, indicated by the dotted lines in the figure. The total deadweight loss due to the firm's market power, shaded gray in the figure, is 15,000, and the firm's economic profit is 30,000.

Figure 1: Profit Maximizing Monopolist under SACFT



Suppose now that countries A and B impose SACFTs at $\tau_A = 40\%$ and $\tau_B = 20\%$. The profit maximizing conditions (11) for Q_A and Q_B are solved at approximately $P_A = 202.7$, $Q_A = 194.6$, $P_B = 195.5$, and $Q_B = 104.5$, indicated by the solid lines in the figure. The

[3]In their appendix equation (A.2), if π is set equal to zero, the equation reduces to $p_1^* h'(x_1^*) f_1(k^*, m^*) = 1$, which is the profit maximizing condition in the absence of taxation.

additional deadweight loss due to the tax differential is 17.33, on a combined tax revenue of 9941.4 (7896.6 in country A, 2044.8 in country B). Thus, while nonzero, the distortion associated with a SACFT would be limited solely to markets dominated by firms with substantial economic profits, and would be trivially small.

Figure 1 depicted a firm whose economic profits derived from the demand for its unique product. Auerbach and Devereux, in contrast, modeled multinational firms selling at a market-determined price, but generating profits due to an increasing marginal cost function. Imagine an industry with many firms, all of who have the cost function $C_i = Q_i^2/3$. If the market demand curves were the same as in Figure 1, the untaxed profit maximum would again be at $P = 200$, $Q_A = 200$, and $Q_B = 100$. The imposition of SACFTs at $\tau_A = 40\%$ and $\tau_B = 20\%$ would have led to a new equilibrium at roughly $P_A = 209.7$, $Q_A = 180.8$, $P_B = 181.3$ and $Q_B = 118.7$, indicated by the solid circles on the figure's demand curves.

However, that result is an upper bound on the distortion, since it assumes that all the firms are homogeneous, with identical increasing cost curves. The industry that the Auerbach-Devereux model best describes is the oil industry, where costs vary considerably between producers. Firms sell their product at a market determined price, but generate significant economic profits when they own relatively low-cost sources of oil. Since the distortion is proportionate to profits, we would expect high profit multinationals to shift their sales from A to B. However, lower profit firms would be willing to accept a smaller price differential, and if there are many marginal producers earning close to normal returns, any price differential would draw them entirely to the high-tax market. Indeed, in the absence of transportation costs, we could well have a separating equilibrium, with little to no price differential, but also little to no tax revenue in the higher tax rate country.

Overall, these results suggest that a SACFT would indeed result in a small but nonzero additional distortion of some consumer markets. If a BACFT, as ABD suggest, results in no economic distortions whatsoever, it would indeed appear to be the preferred option. The next section explores whether that is in fact the case.

3 Mobile Individuals

The model in Section 1 implicitly assumed that consumers are immobile. Goods are imported and exported, but the residents of A who earn their income in A stay put, consuming only goods produced in or imported into A. This is a normal, simplifying assumption that is also implicit to the ABD models, and usually an innocuous one. That it is not innocuous here should be apparent once it is relaxed.

Suppose there is a third good, X_f, that can be consumed either at home or abroad. Examples would include domestic/foreign travel, domestic/foreign higher education, domestic/foreign retirement consumption, and consumption financed through foreign remittances. I will assume that the industry is perfectly competitive, which is probably a reasonable approximation.

3.1 BACFT

Section 1 confirmed the basic ABD conclusion: that under a BACFT, the price levels in the two countries will adjust until

$$\frac{p_{iA}}{p_{iB}} = \phi, \tag{12}$$

where $\phi = 1/(1-\tau)$. Thus, after the transition following the imposition of the BACFT has completed, the prices of X_m, X_c, and X_f in country A will all be ϕ times their counterparts in country B.

Consider now a consumer in country B, with utility function $U(x_m, x_c, x_{fA}, x_{fB})$. That consumer now faces prices $\{p_{mB}, p_{cB}, \phi p_{fA}, p_{fB}\}$. The BACFT has distorted his or her consumption choices away from x_{fA}, even though, in this all-competitive model, the tax generates zero tax revenue. Similarly, the utility maximizing choices of consumers in county A have been distorted, with p_{fB} now only $1/\phi$ as large as its pretax level, relative to the other prices this consumer faces. Hence, we would expect a BACFT to generate significant substitution effects between foreign and domestic travel, foreign and domestic higher

education, and foreign and domestic retirement location decisions for the residents of both countries.

3.2 SACFT

Under a SACFT in country A, any corporations producing X_f would be taxed on their revenues in country A, but can deduct only the share of their costs associated with those revenues. Since the firms in this sector are almost always country-specific, and generate only normal returns, there would be almost no additional economic distortion due to the tax. An exception would be any mega-entertainment corporations like Disney, that generate economic profits in multiple locations worldwide. However, the previous sections suggest that any distortion generated by the SACFT in the behavior of these firms would be dwarfed by the impacts of the BACFT on these firms' sales.

3.3 Mobile Labor

Consumers are not the only ones who demonstrate at least some degree of mobility. Labor is also somewhat mobile, in many cases despite the best efforts of some countries to limit that mobility.

Consider an individual born in country B. Suppose first that he or she migrates to A permanently, and only earns and consumes in A thereafter. Under a SACFT, his or her wage rate and consumer prices will be mostly unchanged, so the migration choice is almost entirely unaffected by the tax. Under a BACFT, his or her nominal wage rate and consumer prices will all be ϕ times higher in A, but his or her real consumption will be unaffected by the tax.

Suppose however that the migration decision is only partial, or temporary: that the migrant plans either to return eventually to his or her home country B, or plans to support family members back home through financial remittances. Let α represent the share of income earned in A that would be consumed in A if migration occurs, with the remaining

$(1-\alpha)$ being taken or sent home to B. Again, under a SACFT, his or her wage rate and consumer prices will be mostly unchanged, so the migration choice is almost entirely unaffected by the tax. However now, under a BACFT, all of his or her nominal wages earned in A will be ϕ times higher, but only that fraction α of the consumption those wages purchase will be ϕ times higher. Thus, a BACFT would distort the migration decisions of workers located in B, increasing their incentive to cross the border. The opposite effect would happen with potential temporary migrants from A to B.

4 Conclusion

Auerbach and Devereux found that a SACFT would have a distortionary effect on consumer prices, but a BACFT would be neutral in both production and consumption decisions. My results show that those conclusions are incomplete. A SACFT does indeed distort consumer prices, but those distortions are generally quite small, and are limited solely to industries in which economic profits are earned, and consumption is already significantly distorted. Perfectly competitive or monopolistic competitive industries would be entirely unaffected by the tax.

My results also show that a BACFT is not without its own consumption distortions. Consumption decisions that cross borders, such as travel, higher education, and retirement location, would all be significantly distorted by the tax. In addition, labor migration decisions would be affected, especially for migrants who plan either to migrate only temporarily or to remit a substantial fraction of their earning back to their home country. Thus, the adoption of a BACFT would be expected to result in significant changes in all of these behaviors.

My results do not make clear which tax would be less distortionary overall. That calculus would involve weighing many small distortions from the one tax against fewer quite large distortions from the other; it is not obvious that sufficiently finely-detailed data for that

comparison exists. However, my results do make clear that the overly simple comparison provided by ABD is misleading. There maybe be an efficiency case to be made for the border-adjusted tax over its sales-apportioned counterpart, but it is not the slam dunk that the ABD results suggest.

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