Formula Apportionment: Is it better than the current system and are there better alternatives?

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FORMULA APPORTIONMENT: IS IT BETTER THAN THE CURRENT SYSTEM AND ARE THERE BETTER ALTERNATIVES?

Abstract

This analysis of formula apportionment compared to the current system is based on the observation that income shifting has two sources, intangible income and debt. The analysis also recognizes that a major goal of the transfer pricing or income allocation system is to preserve the tax neutrality between arm's length and related party transactions and between multinational and single jurisdiction companies. It therefore develops a model that highlights these features. Both separate accounts (SA) and formula apportionment (FA) distort behavior but along different margins. Under SA, companies have an incentive to shift high-tech activities and to manipulate transfer prices. Under FA, companies do not manipulate transfer prices but they have an incentive to shift routine activities abroad and to change the degree to which they depend on outside suppliers. Simulations based on the model indicate that FA has no clear advantage over SA even when the model assumes that an unrealistically large amount of resources are devoted to tax planning under SA. Furthermore, straightforward changes could be made in SA that would result in substantial improvements without resorting to full-fledged FA. We also examine the complicating role of financial assets under FA and how ongoing R&D is implicitly allocated. The conceptual basis for the conventional formulas are discussed, particularly ones based on sales. Finally, a static, no behavioral change, estimate of the effect of FA on the tax liabilities of US multinational corporations is presented for 1996 and 2004. The static estimate for 2004 suggests a potentially large revenue gain, but the simulations show that tax revenues under FA and SA are similar when behavioral responses are taken into account.

INTRODUCTION

The growing integration of the world economy, the difficulties in calculating arm's length prices for inter-company transactions and the increased opportunities for income shifting that result have motivated a greater interest in formula apportionment as the solution to the conundrum of how to tax the cross-border income of multinational corporations (MNCs). The evidence suggests that profitability disparities between high and low tax countries have been increasing (Grubert and Altshuler 2008). Under formula apportionment, intercompany transactions are ignored and the share of consolidated worldwide income allocated to a jurisdiction depends on the share of worldwide measurable factors such as capital, payrolls and sales that are located there. The European Union is currently considering whether to adopt a 'Common Consolidated Base' within the EU.[1] And Avi-Yonah and Clausing (2007) among others have recentl hat the United States implement formula apportionment.

Any evaluation of formula apportic o start with an analysis of the sources of income shifting, which it is, after all, designed to eliminate. Grubert (2003) indicates that for U.S. MNCs the shifting of R&D derived intangible income and the location of debt account for virtually all of the profitability disparity between operations in high- and low-tax countries. In particular, the shifting of income from intangibles assets like patents and trademarks to low-tax countries is a major source of profitability differences across high- and low-tax countries. In this paper, we argue that formula apportionment is not equipped to deal effectively with either source of income shifting. For debt there is a much better and simpler alternative to formula apportionment. And if the MNC company earns large rents, formula apportionment may lead to more distortions than the current system.

A comparison of formula apportionment (FA) and separate accounts (SA) must also start with an evaluation of the economic basis for using the 'arm's length' principle to set transfer prices for transactions between related parties. Why would the arm's length principle

[1] See Martens-Weiner (2006) for an extensive discussion of interest in business income tax reform in the EU and the issues that member countries would have to confront if they were to adopt a formulary apportionment system with a common consolidated tax base.

be optimal if there were no uncertainty about what transfer prices should be and they were costless to compute? Most studies either ignore or misstate the efficiency properties of arm's length prices in a world of costless information. To evaluate efficiency properties of a transfer price or income splitting system, it is necessary to clarify the decision margins that will be impacted. *Choosing a method is an issue of matching policy instruments with decision margins.* The role of the transfer pricing system must be considered as a component of a larger system in which specific policy instruments are assigned to the decision margins they can most directly address.

The purpose of a transfer price or income division system is *not* to offset the effect of differing country tax rates on investment.[2] A country chooses its corporate tax rate based on the level of personal tax rates, the size of government expenditures and the competition it faces from other jurisdictions, among many other factors. The transfer price system is only relevant in this context to the extent that pricing distortions interfere with the choice of a corporate tax rate. The transfer price-income division system is too indirect and unpredictable to play much of a role in the choice of a corporate tax rate. If policy makers are concerned that the country is losing investment because of a high corporate tax rate, they can lower the rate or offer incentives to new investors.

The decision margins that the transfer price or income division system is directly matched with are the choice between arm's length and related party transactions, and between exporting and production abroad. Tax neutrality between MNCs and single jurisdiction companies, which should be a goal of any system, requires that neither margin be distorted. If the MNC can shift intangible income to a low-tax affiliate, then the MNC has an incentive to transact with its affiliate even if it is less efficient than an unrelated party in the same market. Similarly, charging a high-tax affiliate more than the arm's length price favors transacting with the affiliate over the arm's length competitor who is fully subject to the high tax rate.

Therefore any analysis of a transfer price or income splitting system must consider the possibility of transactions with unrelated parties as well as the choice between exporting

[2] McLure (2007) seems to consider only this distortion.

and producing abroad. In the case of valuable intangibles, the important choice is between licensing a related party or an unrelated party abroad. Under FA, transactions with unrelated parties involving routine goods also become important because the activities that remain in-house enter into the allocation formula.

Tax planning under either SA or FA can therefore cause two types of welfare losses, each of which must be included in a complete analysis. The most obvious is the revenue loss which will force the government to rely on more distorting taxes. In addition, opportunities for income shifting alter the effective tax rate on investments by *related* companies in high- and low-tax countries. This distorts the choice between transactions with related and unrelated companies, the choice of investment location, and also discriminates against stand-alone local companies. The effective tax rate distortion may also, as mentioned above, force the government to alter its mix of various types of income and consumption taxes.

This paper has several goals. One is to illustrate the type of model that is required to make a complete analysis of which system is preferable. We also speculate whether it is possible to devise a system that combines the advantages of SA and FA without their respective shortcomings. The relationship between certain aspects of SA and FA are also discussed, in particular the treatment of ongoing R&D and cost sharing agreements. These considerations, and in particular the recognition of the importance of intangible income and debt in the location of income under SA, motivates an examination of several aspects of FA and its alternatives.

Incentives for Income Shifting under FA and SA

It would appear that FA eliminates incentives for tax planning because intercompany payments do not enter into the calculation. That this is incorrect has been clear at least since Gordon and Wilson (1986). Gordon and Wilson concentrate on the effect of FA on the gross-up in the pre-tax rate of return in the high-tax jurisdiction required for the company to break even. Under FA, the company has an incentive to spread this excess return to a low-tax state by merging with companies in the low-tax state.

We emphasize the importance of excess returns attributable to intangible assets like patents. For many MNCs these intangible returns can far exceed the 'normal' returns to capital. We present a model highlighting the importance of intangible excess returns that has a richer range of responses than in Gordon and Wilson (1986) or in more recent work by Nielson, Raimondos-Møller and Schjelderup (2006). We model a typical firm that has both high-tech and low-tech lines of business each of which can be located in several jurisdictions. In contrast to the current SA system, under FA the firm can shift income to the low-tax jurisdiction by locating the routine low-tech stage there. The company can also either outsource routine activities and components or 'insource' them by producing in-house what they can purchase from unrelated parties. Accordingly, companies have an incentive to make large behavioral adjustments under both systems, but along different margins. A simulation model is helpful in evaluating the two systems. We develop and present results from a simulation that allows us to make a comparison of SA and FA.

The Problem of Financial Assets and Earnings in Nonfinancial Companies

One of the advantages of FA may also be a source of one of its major weaknesses. Under FA, income allocation is based on real variables like tangible capital and payrolls. Income therefore cannot be shifted to tax havens in which there is no real business activity. But that leaves the question of what to do with financial assets and earnings, particularly in nonfinancial companies with a significant financial business. We address these issues in the context of our simple model.

Static Revenue Estimates

We evaluate the revenue consequences of multilateral adoption of FA on U.S. based MNCs using the Treasury tax files for 1996 and 2004 in combination with data provided by the Bureau of Economic Analysis (BEA) of the U.S. Commerce Department. In the process we compare the static (no behavioral response) revenue gain from FA with the effect of repealing deferral, which is another reform option that addresses the problem of income shifting. We present estimates of the revenue gain to the U.S. Treasury and compare these estimates to the change in revenue paid to foreign governments. These should in no way be interpreted as official Treasury estimates.

For U.S. companies in nonpetroleum manufacturing we estimate a static (no behavioral response) revenue gain to the U.S. Treasury of $23.7 billion under FA and a loss of revenues by foreign governments of $14.7 billion for 2004. The revenue gain can enhance efficiency to the extent that it permits a general lowering of tax rates. At the same time, this gain could be offset by increased efficiency losses associated with a change in the mix of revenue sources. Also, our simulations indicate that FA is unlikely to raise much revenue after behavioral changes are taken into account.

Can the Positive Aspects of FA be Achieved More Simply within the Current System?

One of the possible sources of revenue and efficiency gain from FA is the (implicit) reallocation of debt as a result of the formula. As noted at the beginning, the allocation of debt is one of the two major sources of income shifting under the current system. But that can easily be addressed without resorting to full-fledged FA. For example, assigning debt based on total assets in each location, including financial assets, would be an easy step and superior to the indirect allocation that occurs within the formula. The assignment would simply require that all components of the worldwide company have the same debt-asset ratio. In this calculation, intercompany assets, like equity in related parties, do not count. Similarly, only

debt incurred with third parties is allocated.[3] The interest on the debt would only be deductible in the country to which it is allocated.[4] This contrasts with the implicit assignment of debt based on sales, payrolls or tangible capital under FA, none of which are as good indicators of how much an affiliate could borrow. The system for allocating debt should, like the transfer pricing system in general, attempt to preserve tax neutrality between MNCs and local national companies.

MNCs ability to shift income, reflected in the income shifting function in our model, is not technologically determined but depends upon the particular regulatory and enforcement regime in place. One indication of the tightness of the current regime is the extent to which income is located in 'pure' tax havens without any real operations. This phenomenon has grown substantially for US MNCs since the implementation of the 'check the box' rules in 1997. These rules allow companies to avoid the CFC rules and strip income from high-tax countries to tax havens. Altshuler and Grubert (2005) have estimated that by 2002 'check the box' had allowed U.S. companies to reduce their foreign tax burdens by 15 percent.

The 'check the box' rules also may have promoted greater shifting of income out of the United States. [5] In non-oil manufacturing, for example, the share of total income earned abroad by U.S. MNCs increased from 54.6 percent in 1996 to 70.3 percent in 2004. Furthermore, this growth in the share of foreign income was not attributable mainly to the more rapid growth of sales abroad. The profit margin on sales abroad (the ratio of foreign income to sales) increased by 20 percent over this period while at the same time the profit margin on domestic sales declined substantially. While the focus of our revenue estimates is on the most recent data available, 2004, we also present estimates of the revenue gains from the adoption of FA for 1996. These estimates suggest that the 'check the box' rules introduced

[3] If a subsidiary has a branch in another country, there may be a question as to where the entity's financial assets are located for the purposes of the debt allocation. They should be in the country in which the income from the financial assets is reported.
[4] This is similar to the 'worldwide fungibility' system for interest allocation that is scheduled to go into effect in 2009. But it would affect all companies, not just those with excess foreign tax credits, because it would not work through the foreign tax credit calculation.
[5] The U.S. Treasury proposed to limit the application of 'check the box' in 1998, but the proposal never went into effect.

in 1997 may have had a significant effect on the share of worldwide income located abroad. Besides a reexamination of these 1997 regulations another option for controlling income shifting that seems worth studying is a requirement for a minimal level of real capital or employment in a jurisdiction before any income could be located there.

Sales Based Formulas

Many of the states in the United States use a formula based exclusively on sales. Avi-Yonah and Clausing (2007), among others, have proposed using sales as a basis for taxing cross-border income. Is there any conceptual basis for these formulas? Presumably there is a reason for countries to choose an income tax instead of relying entirely on consumption taxes. But sales based formulas seem to import consumption concepts into the corporate income tax. What is the relationship between a sales based formula and a destination basis consumption tax which appears similar? Is it free from investment distortions? We discuss these questions in this paper.

Alternative Formulas

In view of the critical role of 'super' profits because of intangible assets and the use of debt to shift income, it makes sense to ask whether there are formulas other than the traditional ones based on capital, payrolls and sales that reduce the type of income manipulation under SA without the distortions under FA discussed above. The assignment of debt based on assets, as in the current U.S. rules for calculating allowable foreign tax credits, is a possibility. We consider a version of the 'residual profit split' allocation for the intangible based excess returns to capital. Under this allocation interest paid to unrelated parties would first be added back to consolidated worldwide income. A 'normal' riskless return could then be assigned to each location based on total assets. (Assets could include capitalized R&D performed in the location.) Then a fixed percentage, say 50 percent, of the worldwide excess return is assigned to the parent on the grounds that it is likely to be the main source of superior returns. The remaining excess return could be apportioned using a formula. This kind

of procedure would drain most of the pool of the excess income that creates the distorting behavior outlined above. Adding capital in a low-tax location only earns the 'normal' return plus a share of the reduced pool of excess returns. The final taxable income in each location would be determined by assigning worldwide interest expense to each location based on assets.

Assigning an arbitrary percentage of the excess return to the home country of course creates an incentive for expatriation or 'inversion'. There are now restrictions on inversions in the Internal Revenue Code. The main issue would be acquisitions of U.S. MNCs by foreign companies based in low tax locations. This would require a toll charge for the transfer of valuable intangibles abroad, as in the present Section 367 of the Internal Revenue Code.

Problems of Implementation

FA seems much simpler than SA and seems to require much less detailed information. However, a variety of implementation issues do arise. First, what businesses are to be included in the worldwide combination? Some states in the United States use FA only for separate corporations, not any combination of related corporations under common ownership (see Martens-Weiner 1999 for useful background on how the U.S. states implement formula apportionment). Canada uses that system as well for its provinces. As a result, the system becomes elective because it is sensitive to the pattern of incorporation that the controlling company chooses.

The important choice of FA systems is between a "unitary" system and a "common consolidated base". In the former, an attempt is made to separate businesses within the consolidated group that have no effective relationship with each other. But dividing overhead expenses like interest between the different unitary businesses is not straightforward. The Common Consolidated Base system escapes this problem by combining various types of financial and nonfinancial businesses together. However, it spreads the effect of large profits in one line of business to all other lines.

Roadmap

The remainder of this paper addresses many of the considerations outlined above. Exploring implementation issues is beyond the scope of the current paper and is left for future work on the topic. As mentioned above, one goal of the paper is to determine whether FA is better than the current system. In the second section, we start by examining incentives under FA and SA using a simple theoretical model. We then discuss the results of a simulation that allows us to compare different aspects of SA and FA. We also posit how the model could be extended to incorporate investment in financial assets (and the location of the assets) as well as cost sharing agreements and licensing for R&D. We discuss revenue implications of adopting two alternatives to the current system in the third section. These alternatives are FA based on tangible capital and a repeal of deferral. In the fourth section we consider sales based allocations. We draw conclusions from our work in the final section.

INCENTIVES UNDER FA AND SA

FA and SA encourage MNCs to make adjustments along different margins. Although we focus on FA formulas based on the location of tangible capital, we do discuss the implications of sales based apportionment because it introduces a destination concept in contrast to capital and payrolls. The arm's length SA system encourages MNCs to locate highly profitable products in low-tax countries and to engage in planning that permits more shifting of income to the low-tax location by underpaying royalties to the parent. These opportunities distort the choice of location for investment and also the decision of whether to license profitable technologies to unrelated parties.

Under FA, companies also have an incentive to locate more high profitable operations in low-tax locations to attract more of the excess return, but further 'financial' planning in the form of transfer price manipulation and the location of debt provides no additional benefit. On the other hand, FA encourages the companies to reduce their activities in high-tax locations even if they are not shifted abroad. For example, MNCs can 'outsource' the production of low-tech components and routine services to reduce apportionment of income to the high-tax

location. This provides no benefit in arm's length income SA allocations for highly profitable products. Similarly, firms have an incentive to 'insource' routine activities in low-tax locations. Also, and probably more important, it is no longer necessary to locate the high-tech stage of production in a low-tax jurisdiction to locate excess returns there under FA because routine assembly and packaging can do as well in attracting more of the excess return.

Thus, one fundamental difference between FA and SA is aggregation. Under SA, companies can 'cherry pick' among their products and move only the most profitable to low-tax locations. Under FA, the excess returns from very profitable products are spread over a much larger capital base. A dollar of investment in a low-tax location will attract a smaller percentage of total excess returns. This would seem to favor FA in that the efficiency loss depends on the square of the tax discrepancy. On the other hand, this larger base of capital is now eligible for being shifted abroad to attract the excess return. As we will see, under FA the company has a wider range of adjustments it can make, and furthermore these additional adjustments involve routine or low-tech products and services which can be more easily shifted in or out of the company or from one location to another.

A Simple Model

These considerations can be illustrated in a simple model. The purpose is to clarify the differing responses by companies to tax differentials under FA and SA. We assume that, as is typical for U.S. MNCs, the company has a valuable intangible that permits it to earn substantial supernormal returns. The company produces a product for the worldwide market and faces a demand curve, *P(Q)*, reflecting its market power. We assume that the monopolist can not price discriminate. There are two stages of production, a high-tech stage and a routine component or services stage. For simplicity we assume that tangible capital is the only factor of production and that the formula is based purely on capital shares.

The final product, *Q*, is therefore a function of two separable functions, one for the advanced stage, $H(\cdot)$ and one for the routine stage, $R(\cdot)$. Thus $Q = Q(H(\cdot), R(\cdot))$. We

assume, realistically, that there is low substitutability between these two upper level functions. The output of the high-tech stage is a function of high-tech capital at home, K_1^H, and similar capital in the foreign country, K_2^H so that $H = H(K_1^H, K_2^H)$.[6] Production in the routine stage is a function of four types of capital: capital at home in the company's own operation KR_1^I, capital used by domestic suppliers of routine goods and services KR_1^O, capital in the company's own operations abroad KR_2^I, and finally capital used by suppliers abroad KR_2^O.[7] Production in the routine stage at home is a function of routine capital at home $R_1 = R(KR_1^I, KR_1^O)$, production in the routine stage abroad is a function of routine capital abroad $R_2 = R(KR_2^I, KR_2^O)$ and total routine production is a nested function $R = R(R_1, R_2)$. It seems reasonable to assume that the elasticity of substitution between the various types of routine capital is greater than between the two types of advanced capital. That is, it is easier to move routine operations abroad and 'insource' or outsource routine operations than to move advanced operations abroad.

Note that our model differs from those in the literature by allowing for two kinds of capital (high-tech and routine) along with the possibility of outsourcing productions (see, for example, Eggert and Schjelderup 2005 and Nielson, Raimondos-Møller and Schjelderup 2003 and 2006). In addition, we assume a pre-existing intangible that earns rent which seems most relevant for a study of income shifting. The goal is to capture most of the significant margins distorted in the FA versus SA choice.

The company maximizes after-tax rents under both SA and FA. The difference is in how tax liability in each country is determined. Under SA, we assume that the issue is how to divide the rent or excess return. We assume that under SA some of the supernormal returns can only be shifted to the low-tax foreign location but only if high-tech production takes place there. In other words, the MNC must actually produce the super drug or microprocessor

[6] We assume appropriate convexity to avoid boundary or specialization problems.
[7] Outsourced capital does not refer to leased capital. The U.S. states multiply the lease payment by a factor for the purpose of the formula.

abroad to shift some of the intangible income abroad. The 'normal' return on the tangible capital is given to the country in which it is located. We let country 1 be the high-tax country and denote its corporate tax rate t_1. Country 2, the low-tax country, has corporate tax rate t_2 (where $t_1 > t_2$). Our interest is in considering cases in which there are large statutory rate differentials.

The share, *S*, of the rent allocated to the low-tax country depends on the amount of high-tech capital in each location and a third factor, K^M, the amount of capital devoted to tax planning. An increase in high-tech capital in the low-tax location K_2^H will increase the share of rent located there $\left[\left(\frac{\partial S}{\partial K_2^H} \geq 0\right) \text{ and } \left(\frac{\partial S}{\partial K_1^H} < 0\right)\right]$. Initially an increase in K^M enhances the benefits of having more capital in the low-tax country. But *S*, the share of rent shifted, cannot exceed one, so that if K^M is very productive an increase in K^M may make it unnecessary to shift much capital to the low-tax location. That is K^M and K_2^H become substitutes not complements.[8] Note that the shifting function itself depends on government policy. For example, the United States implicitly lowered the cost of income shifting in 1997 with the enactment of the 'check the box' rules.

Under FA, tax planning to manipulate transfer prices is of no use. As we will see, what does matter is the amount of aggregate <u>in-house</u> capital in each location relative to total in-house capital. Furthermore, the division of profits applies to all capital returns including the normal return to high-tech capital.

After-tax Economic Profits

Total pre-tax rents or economic profits, E_{SA}, under separate accounts are:

$$E_{SA} = P(Q)Q - C_{SA}(\cdot)$$

where

[8] In the simulations, we use a bounded exponential to embody these features.

$$C_{SA}(\cdot) = \left(K_1^H + KR_1^I + KR_1^O + K^M\right)\left(\frac{r}{1-t_1}\right) + \left(K_2^H + KR_2^I + KR_2^O\right)\left(\frac{r}{1-t_2}\right).$$

The required return on capital is *r* and $C_{SA}(\cdot)$ are the costs under SA for the MNC. They are the pre-tax returns required to pay the suppliers of capital. We assume that only high-tech production in the low-tax location can justify locating some of the rent in that location. Therefore, the tax liabilities on these rents, T_{SA}, are:

$$T_{SA} = E_{SA}S(K_1^H, K_2^H, K^M)t_2 + E_{SA}(1-S(K_1^H, K_2^H, K^M))t_1.$$

where $S = S(K_1^H, K_2^H, K^M)$ denotes the portion of pre-tax economic profits shifted abroad ($0 \le S \le 1$).

Under FA, the *S* function does not appear in the profit function nor does the cost of K^M. The calculation of tax liabilities starts with total pre-tax revenues, $P(Q)Q$ minus costs on outsourced capital. This return is divided between the two jurisdictions based on the ratios of total in-house capital. The share allocated to country 1, α, is:

$$\alpha = \frac{K_1^H + KR_1^I}{K_1^H + KR_1^I + K_2^H + KR_2^I}$$

After-tax economic profits under FA, E_{FA}, are:

$$P(Q)Q - C_{in} - C_{out} - \left(P(Q)Q - C_{out}\right)(\alpha t_1 + (1-\alpha)t_2)$$

where $C_{in} = r(K_1^H + K_2^H + KR_1^I + KR_2^I)$ are costs for in-house capital and

$C_{out} = r\left(\frac{KR_1^O}{(1-t_1)} + \frac{KR_2^O}{(1-t_2)}\right)$ denotes costs for outsourced capital.

Before proceeding to the maximum after-tax profit conditions, we note the decision margins that come into play in shifting income under the two systems. Under SA, the company can, for given worldwide production, decide where to locate high-tech capital. The location of capital needed for routine production does not justify a larger share of the rents. The company also decides on the level of resources to devote to tax planning with transfer prices.

The company also chooses where to locate high-tech capital under FA. But manipulating transfer prices plays no role. The company does have three additional margins to shift more pre-tax income to the low-tax location, however. Locating more of the routine operation in the low-tax location now does attract more of the profits. Outsourcing more of the home-based routine operations gets them off the high-tax books. By creating more margins to manipulate, FA provides increased opportunities for shifting income. In addition, one might reasonably expect that it is easier to reallocate routine activities than more advanced operations.

Optimizing Conditions

We now proceed to characterize the optimizing conditions for capital investment. For simplicity, we use a constant elasticity demand function in our derivations: $P = aQ^{1/\varepsilon}$ where ε denotes the price elasticity of demand. We use this same parameterization in our simulations.

The maximization problem for the MNC under SA is:

$$\max E_{SA}(1-St_2-(1-S)t_1) \text{ over } \{K_1^H, K_2^H, KR_1^I, KR_2^I, KR_1^O, KR_2^O, K^M\}.$$

The first-order conditions are as follows:

(1) $$\frac{\partial Q}{\partial K_i^H} = \left(\frac{r}{1-t_i}\right)\frac{1}{aQ^{1/\varepsilon}\left(1+\frac{1}{\varepsilon}\right)} - \left(\frac{E_{SA}\frac{\partial S}{\partial K_i^H}(t_1-t_2)}{1-t_{SA}}\right)\frac{1}{aQ^{1/\varepsilon}\left(1+\frac{1}{\varepsilon}\right)} \qquad \text{for i=1,2}$$

(2) $$\frac{\partial Q}{\partial KR_i^I} = \frac{\partial Q}{\partial KR_i^O} = \left(\frac{r}{1-t_i}\right)\left(\frac{1}{aQ^{1/\varepsilon}\left(1+\frac{1}{\varepsilon}\right)}\right) \qquad \text{for i=1,2}$$

(3) $$\frac{\partial \pi_{SA}}{\partial K^M} = 0 \Rightarrow \frac{\partial S}{\partial K^M} = \frac{\frac{r}{1-t_1}(1-t_{SA})}{E_{SA}(t_1-t_2)}$$

where $t_{SA} = (1-S)t_1 + St_2$.

We can draw some straightforward observations from these first-order conditions. These observations are similar to previous findings in the literature. Regarding optimal investment in high-tech capital under SA, recall that $\frac{\partial S}{\partial K_1^H} < 0$ and $\frac{\partial S}{\partial K_2^H} \geq 0$. Thus the marginal cost of high-tech investment is lower in the low-tax country relative to the high-tax country. This is because the high-tax investment enables the shifting of income from high- to low-tax locations. The extent to which the marginal cost of high-tech investment in the low-tax country is lowered (and the marginal cost of investment in the high-tax country is increased) depends on the level of excess returns, the shifting function, and, importantly, the difference in tax rates across locations. Note that the extent that investment in high-tech capital in the low-tax country decreases the cost of capital there depends on the investment the company has made in K^M. Equation 3 shows that the optimal amount of capital invested in tax planning, K^M, depends on the level of excess returns and the tax differential. Finally note that the choice between in-sourcing and outsourcing routine capital is not distorted under SA. This result will not hold, as we will see, in the case of FA.

The maximization problem for the MNC under FA is:

$$\max E_{FA} - \left(P(Q)Q - C_{out}\right)(\alpha t_1 + (1-\alpha)t_2) \text{ over } \{K_1^H, K_2^H, KR_1^I, KR_2^I, KR_1^O, KR_2^O\}$$

where pre-tax earnings are $E_{FA} = P(Q)Q - C_{in} - C_{out}$. The first-order conditions for investment are:

$$(4) \qquad \frac{\partial Q}{\partial K_1^H} = \frac{\partial Q}{\partial KR_1^I} = \frac{r}{(1-t_{FA})aQ^{1/\varepsilon}\left(1+\frac{1}{\varepsilon}\right)} + \left(\frac{(1-\alpha)\left(t_1 - t_2\right)Q}{\left(1-t_{FA}\right)\hat{K}\left(1+\frac{1}{\varepsilon}\right)}\right)$$

$$(5) \qquad \frac{\partial Q}{\partial K_2^H} = \frac{\partial Q}{\partial KR_2^I} = \frac{r}{(1-t_{FA})aQ^{1/\varepsilon}\left(1+\frac{1}{\varepsilon}\right)} - \left(\frac{\alpha\left(t_1 - t_2\right)Q}{\left(1-t_{FA}\right)\hat{K}\left(1+\frac{1}{\varepsilon}\right)}\right)$$

(6) $$\frac{\partial Q}{\partial KR_i^O} = \left(\frac{r}{1-t_i}\right)\frac{1}{aQ^{1/\varepsilon}\left(1+\frac{1}{\varepsilon}\right)}$$

where $t_{FA} = \alpha t_1 + (1-\alpha)t_2$ and $\hat{K} = K_1^H + K_2^H + KR_1^I + KR_2^I$.

Again, some straightforward observations can be drawn from the optimal investment conditions. First note that the marginal cost of high-tech capital and in-house routine capital in each location is the same under FA. Furthermore, the choice between in-sourcing and outsourcing is distorted. High-tech capital and routine in-house capital in the low-tax location have lower marginal costs than the same capital placed in the high-tax location (compare equations 4 and 5). This, of course, is due to the symmetric treatment of high-tech and in-house capital in the formula.

Before discussing the simulations, we can make some more qualitative statements. First, interactions between the various types of capital can be important. That is in fact one of the motivations for the simulations. For example, outsourcing routine activities in the high-tax location is particularly valuable because it shrinks the denominator in the allocation formula and enhances the benefits of shifting capital from the high-tax to the low-tax location. Also, an observation from simply inspecting the allocation formula is that the marginal benefits of shifting capital from the high-tax location to the low-tax location declines very slowly. The denominator only changes to the extent that the inefficiency caused by the shift requires total capital to increase for a given level of output. In contrast, under SA the marginal benefits of shifting high-tech capital to the low-tax location would decline very rapidly if profit shifting is very easy.

Note that at this stage the model does not represent the ability to license the high-tech product to unrelated parties. One way to introduce licensing that we plan to explore in the future is by separating the production of routine and high-tech goods as different business lines. Only the high-tech good has some monopoly power and earns excess returns. The routine good is in a competitive market. Part of high-tech production could be produced by an arm's length licensee. (The high-tech production is split between related and unrelated parties

because they each have rising marginal costs --- we would assume no integration benefits). The arm's length licensee is willing to pay all of its excess profits as a royalty because it has no valuable intangible asset of its own to contribute. The parent would therefore maximize total (combined) after-tax profits to get the division between arm's length and related party production. This extension to the model will allow us to explore the choice between licensing a related or unrelated party abroad under FA and SA.

The model could also easily be adapted to a sales based formula. The MNC would have different lines of business or types of products. Like many high-tech businesses, the MNC will have some very profitable products along with many projects earning just normal profits. Under FA it therefore has the incentive to dispense with the product lines earning just normal profits in the high-tax country by selling the operations to local companies, for example. Similarly, in low-tax countries the MNC would acquire companies and the purchase price would offer the company a normal market return. It would even be willing to take an economic loss on these acquisitions because of the additional share of the worldwide supernormal return it could attract.

Simulations

Simulations are useful in evaluating SA and FA in a world with large tax differences. As we consider lower and lower tax rates abroad, the relative significance of various distortions may change. For example, the benefits of devoting additional resources to income shifting under SA declines rapidly as the share of economic income shifted gets very high. In contrast, the marginal benefits of shifting capital from the high-tax country to the low-tax country under FA declines very slowly because the denominator in the allocation ratio remains unchanged.

We simulate the implications of the model described above and present results in a series of tables discussed below. Table 1 presents the functional forms and parameters used in the simulations. As indicated above, worldwide production is a function of high-tech and routine capital at home and abroad. Worldwide high-tech capital, which is a CES function of high-tech capital in each location, is not very substitutable with routine capital. Routine

capital is a function of nested CES functions, made up of composite routine capital in each location which in turn is a function of in-house and outsourced capital in the location. In our base case, we assume a hierarchy of substitutability, with an elasticity of substitution of -1 between the high-tech capitals, -2 between the routine composites in each location, and -3 between in-house and outsourced capital in each location. The elasticity of demand for the final product, indicating the company's market power attributable to its valuable intangible, is -2.0 in the base case, making for an excess return equal to 100 percent of the normal return.

The shifting function, giving the share of the company's monopoly rent that is shifted to the host country under SA, is a bounded exponential depending on K^M, the resources devoted to financial manipulation, and the share of high-tech capital located abroad. The bounded exponential is chosen, in part, because the share of rents shifted abroad cannot exceed one. The power in the exponential is the product of K^M and the capital share because they, at least initially, are complementary; the ability to shift income to the low-tax location increases as more high-tech capital is located there. The parameters are calibrated so that about 4 percent of total capital is devoted to K^M when there is a large difference in tax rates and most of the rent is shifted. We assume that if K^M is zero and there is no shifting, all of the rent is paid to the parent in the form of royalties because that is where the intangible was created.

In each of the scenarios with the differing elasticities in the tables, we present three columns. Column one gives the results for a no-shifting equilibrium under SA, column two presents the shifting equilibrium and column three has the FA equilibrium. The response by the companies under SA and FA will be compared with the column one non-shifting equilibrium at the same tax rates because, as noted above, we want to separate the 'normal' effect of tax differences on location from the added consequences of incentives to shift income under SA and FA. In each case, we start with tax rates equal to 35 percent in both countries and then proceed to present the simulations for tax rates of 25 percent and 10 percent in the low-tax foreign location. To give a complete picture, the tables present the

amount and location of the various types of capital, the marginal effective tax rates on this capital, each country's tax revenue, economic profits, the share of economic profits shifted, and final selling prices.

Table 2 presents simulation results for the base case. These results show that FA seems to have more dramatic effects than SA on the allocation of capital, tax revenue and marginal effective tax rates. This is true even for high-tech capital which is the basic source of shifting under SA. Comparing SA and FA when the host country has a tax rate of 10 percent, for example, high-tech capital at home is about 5 percent lower under FA than SA and is about 5 percent higher in the host country. The distortion in routine capital used in-house under FA is particularly striking. (It hardly changes from the no-shifting case under SA). In-house capital declines by 28 percent at home and increases by 38 percent in the low-tax host country. As expected, the use of outsourced capital moves in the opposite direction, although more modestly, so the change in the ratio of in-house to outsourced capital in each location under FA is very large.

The marginal effective tax rates on the various types of capital mirror the large changes in the location of capital under FA. In all cases, even high-tech capital, the marginal effective tax rates in the new equilibrium deviate more from the country statutory rates under FA. For example, when the host country has a 10 percent tax rate, the marginal effective tax rate on high-tech capital at home is 42 percent under SA versus 46 percent under FA. In the low-tax location, it is zero under SA and a negative 4 percent under FA.

Somewhat offsetting the large change in the location of capital under FA is the use of shifting resources K^M under SA. When the foreign tax rate is 10 percent, this amounts to 4 percent of total capital. Tax revenues and economic profits (rents) under SA and FA are consistent with the responses of capital and the location of production. Economic profits and tax revenues are just slightly greater under FA and SA even when 4 percent of capital is devoted to tax planning under SA and 91 percent of economic profits are shifted to the low-tax location. But the outcomes are very close, particularly when contrasted with the no-shifting equilibrium.

Table 3 reduces the substitutability between the various types of routine capital to see if there are dramatic changes in the results. The elasticity of substitution between the routine composites in the two locations is now -1 instead of -2, and the elasticity of substitution between in-house and out-sourced capital in a location is -2 instead of -3. The changes in routine capital under FA are somewhat smaller, as one might expect. But the general pattern of the results is similar to the previous table. In the case of the 10 percent foreign tax rate, there are still very large changes in the location of routine capital under FA, such as the 31 percent increase in the use of in-house routine capital abroad and a 24 percent reduction at home. Furthermore, while there is less shifting of routine capital, more of the response under FA is diverted to high-tech capital. This is particularly notable in the marginal effective tax rate on high tech capital abroad, which is now -8 percent.

Table 4 returns to the elasticities of substitution in the base case but changes the product demand elasticity to 1.5 from 2.0, increasing the profit margin on costs to 200 percent from 100 percent. The increased economic rents increase the incentive to shift income under both systems, but the impact, if anything, seems larger under FA. For example, routine in-house capital increases by 55 percent abroad when the host country has a 10 percent tax rate, compared to 38 percent in the base case. (There is of course little change under SA because the use of routine capital is not distorted.) The percentage shift of high-tech capital under FA compared to SA is also greater than in the base case. (The absolute difference in marginal effective tax rates is slightly larger under FA.) Thus it appears that increasing profit margins cause greater distortions to both routine and high-tech capital under FA compared to SA. On the other hand, the greater profit margins increase the investment in K^M under SA to 7 percent of total costs so the overall picture does not seem much changed.

We do not explicitly make welfare estimates for the home country in the tables but we provide most of the ingredients for doing so, i.e., the change in rents, government revenues, prices and output. We also give the marginal effective tax rate for each type of capital in each country as an indication of the distortions caused by each system. What is

missing is the marginal value of government revenues which must, of course, be above a dollar. Otherwise, an increased ability of companies to shift income would be welfare improving. As noted earlier, the role of the transfer pricing system, whether SA or FA, is not to offset the 'normal' (not price distorted) effect of the differences in corporate tax rates among countries. (That is why, in the simulation tables, we first present the normal effect of the corporate tax with no income shifting.) Any deviation from this pattern under SA or FA because of income shifting responses should result in a welfare loss.

We could in principle estimate the marginal value of government funds from a full model itself. If a rational government chooses a certain corporate tax rate, it must be that at that point the marginal benefits of the dollar are equal to the extra tax paid by the private sector plus the additional welfare losses cause by the tax. But, in any case, the changes in home country revenues and company rents are very close in magnitude under FA and SA, particularly when compared to revenues and rents in the no shifting case. Furthermore this seeming equivalence is in a model in which an unrealistically large amount of resources are devoted to shifting under SA and more than 90 percent of rents are shifted when the host country has a tax rate of 10 percent.

There seems to have been little analysis of the relative merits of variations on the traditional formulas. Table 5 reports the simulations for one simple alternative. The intent is to drain the amount of excess profits from intangibles from the pool of income being allocated by the formula. First, a normal (grossed up) rate of return on the tangible assets in each location is imputed to that location. Then 50 percent of the excess economic profits that remain are allocated to the parent on the grounds that it is the source of the superior technology. The final 50 percent is allocated by the formula, in this case based on the location of the tangible capital.

Comparing the last two columns in Table 5, we can see that this simple alternative substantially reduces the distortions produced by standard FA. The location of capital gets much closer to the no-shifting SA case. For example, the amount of in-house routine capital abroad is about 15 percent lower than under the standard formula when the foreign tax rate is

10 percent. Home country tax revenues go up almost 75 percent and by much more than the reduction in company rents. So it is clearly welfare improving from the point of view of the home country. This simple example illustrates the possibility that there may be some middle ground between FA and SA that is better than either. As mentioned above, assigning debt under the current system on the basis of the location of assets is another example of a move in this direction.

These simulations indicate that, even when we assume a great amount of shifting under the current system, FA does not seem to have any notable advantage over SA. FA causes a greater widening in the disparities in marginal effective tax rates that result from tax differentials across countries. A greater amount of capital moves to low-tax locations. This is true even for high-tech capital which is the vehicle for income shifting under SA. To be sure, SA does motivate expenditures on the financial manipulation of intercompany prices, which have no use under FA. (We assume that there are no planning costs under FA in spite of the valuation and other issues discussed in the paper.) Finally, the simulations indicate that increasing the profit or varying the substitutability parameters did not seem to have a major impact on the relative performance of SA and FA.

The Similarity between Income from Financial Assets and Income from Intangible Assets under FA

For the purposes of the formula allocation the U.S. states generally distinguish between 'passive income', which is allocated to the state in which the parent company is incorporated, and 'business income', which is part of the consolidated pool subject to the normal formula. The exception is traditional stand alone banks that have their own formulas based on the number of loans and transactions, etc. The passive versus business income distinction obviously raises issues of classification. In any case, many nonfinancial corporations have significant financial operations. Their financial income is included in the consolidated pool of income to be apportioned but the formula is based exclusively on 'real' variables like tangible capital and payrolls. Financial assets do not enter in. The financial

income therefore plays the same role as supernormal intangible income in causing companies to reallocate real activities in order to reduce worldwide tax liabilities.

Tangible assets in the form of inventories and property, plant and equipment account for only a minority of total assets even in nonfinancial businesses. The U.S. Commerce Department's Bureau of Economic Analysis (BEA) data reveals that, in 2004, inventories and net property, plant and equipment were 25.6 percent of the total assets of parents in manufacturing. This share is calculated after netting equity in foreign affiliates from total assets. Foreign affiliates of these manufacturing parents have an even smaller share, 20.6 percent of total assets, after netting equity in other foreign affiliates, in the form of tangible assets.

The effect of financial income in distorting real decisions under FA contrasts with its role in the current system which provides much fewer opportunities for income shifting other than excess intangible income. Purely passive financial income is currently included in the parent's taxable income under the CFC rules. Furthermore, a significant amount of active financial income is subject to 'global dealing' rules which are effectively formulas tailor made for the financial sector.

The ratio of net worldwide net income to total plant, equipment and inventories shows the combined effect of excess intangible returns and the exclusive use of 'real' variables in the formula. Combining the BEA data with information from tax returns of U.S. MNCs available from the Treasury Department shows that in 2004 the ratio of net worldwide pre-tax income to tangible capital in manufacturing was 22.6 percent.[9] In pharmaceuticals and computers, two industries with very profitable companies, the ratio was 39.2 percent. Profitability relative to tangible assets of this magnitude provides a strong incentive for companies to readjust their activities to locate more of their excess profits in a low-tax location.

[9] As explained further in the next section we combine data from the BEA and the Treasury Department in our calculations since they have complementary strengths.

The Location of the Financial Business under FA

Many major nonfinancial companies have significant financial businesses. Since financial assets do not enter into the allocation formula, the location of the financial business seems independent of tax considerations if only tangible capital counts. But our earlier discussion of welfare considerations indicates that is actually an undesirable outcome. The effective tax rate on the financial operation in the high-tax country will be too low because it will in part reflect the tangible capital in the low-tax location. The MNC's financial business will therefore have an advantage over independent financial companies. Conversely, the MNC's financial business in the low-tax location will have a tax rate that is too high.

Current R&D under FA Compared to the Present System

The model assumes an existing intangible asset that allows the company to earn excess returns. It does not include the mechanism by which the intangible is created, which is presumably through prior R&D. But we can relate how current R&D is treated under FA with cost sharing agreements under SA. Under FA, R&D is deductible against worldwide income. The R&D then contributes to the future pool of income which is divided among affiliates based on the activities of the company at that time. It therefore looks like a cost sharing agreement under current practice in which the various components of a worldwide company contribute to the cost of a R&D program and then have the rights to use the technology eventually developed. But it is a cost sharing agreement which gives company planners great opportunities for exploiting a formula.

The major issue in cost sharing agreements is the 'buy in', the amount that new participants, that is the foreign affiliates, have to pay to compensate the parent company for its past R&D that the new project builds on. The implementation of FA effectively results in a cost sharing agreement without a 'buy in'. A new low-tax affiliate can benefit from the prior R&D without paying for it, which of course increases the benefits of a low-tax location. FA

also gives the parent company the incentive to delay establishing a low-tax subsidiary until a very promising technology has been developed because it can thereby deduct the cost of the project against highly taxed income. The low-tax subsidiary can also start small, paying a small amount of a promising research project, and then expand its production greatly after the product has been developed.

Capitalizing R&D and including it in the asset base would not solve the 'buy in' problem. (Capitalizing R&D presumably means that there is no current expensing for R&D.) The large successful high-tech companies are the winners in the R&D race and earn supernormal returns on both their past and current R&D projects. The losers in the race can presumably deduct their ‘dry hole’ costs against domestic taxable income earned on their other products. Capitalizing could also create the additional distortion by causing companies to shift routine development and testing to low-tax locations.

REVENUE

The estimates in this section are based both on the surveys of MNCs published by the Bureau of Economic Analysis (BEA) in the U.S. Commerce department and on the U.S. Treasury corporate tax files for 2004 (the most recent year available). The corporate tax files include the basic corporate tax return, the Form 1120, the Form 1118 in which companies report their foreign income and calculate their foreign tax credit, and the Form 5471, which is filed for each controlled foreign corporation (CFC) of a US parent MNC. The Form 5471 provides each CFC’s balance sheet and income statement, its foreign income taxes paid and various intercompany transactions. It is necessary to use both BEA and Treasury data because they have complementary strengths. For example, the parent balance sheet in Treasury Form 1120 is difficult to use because, unlike in the BEA data, the split between foreign and domestic assets is not provided.

Static Estimates

The estimates provided here are 'static' ones before any behavioral responses are taken into account. These estimates are in no way official Treasury revenue estimates. More realistic estimates would require the addition of behavioral responses of the type discussed elsewhere in this paper. We focus on nonfinancial parents because banks and other financial intermediaries present special problems. The standard formulas are based exclusively on 'real' variables like tangible capital and payrolls and therefore are not well suited for financial businesses.

The estimate of the U.S. static revenue gain from U.S. based MNCs as a result of FA starts with the companies' worldwide consolidated taxable income before corporate tax. This is the same starting point as the estimate for the repeal of deferral and is based on the Treasury tax files. Consolidated worldwide taxable income before corporate tax includes both income that is retained abroad under current law, and therefore not subject to current U.S. tax, and the income that does appear on the U.S. return. For repealing deferral, the revenue estimate then calculates the amount of foreign taxes that can be credited against the tentative U.S. tax liability on this worldwide income. In implementing FA, the worldwide consolidated base is split between the United States and foreign governments based on the formula. In each case, the net revenue gain compared to the revenue under current law is calculated.

We assume that the allocation formula under FA is based exclusively on the amount of real capital in each jurisdiction derived from the net plant and equipment plus inventories figures from the BEA tables for 2004. We use information from the BEA tables that classify affiliate data based on the industry of the parent. Using this classification is important because any income in a tax haven holding company controlled by a nonfinancial parent in manufacturing, for example, is included in worldwide income for the purpose of the formula allocation.

We start with manufacturing parents. The Treasury tax data for 2004 indicates that worldwide taxable income of U.S. parent companies in manufacturing was $444 billion. The share of worldwide net property, plant, equipment and inventories in affiliates abroad is .408. Using this ratio to apportion worldwide income results in a net gain of $29.9 billion to the

U.S. Treasury. This contrasts with a static gain of $17.4 billion as a result of repealing deferral. For all nonfinancial parents, the gain is $55.3 billion from FA and $28.5 billion from repealing deferral.

The higher revenue paid to the U.S. Treasury from FA compared to the repeal of deferral indicates that the tax credits granted against the worldwide income base under repeal are more important than the share of the worldwide base attributed to foreign governments under FA. In part this is due to the high foreign taxes paid by integrated oil companies, which are included in manufacturing. If oil companies are taken out of manufacturing, the comparison is much closer, an increase in U.S. revenue of $23.7 billion under FA and $17.4 under the repeal of deferral.

Furthermore, the U.S. companies will pay less to foreign governments under FA, by $14.7 billion in nonpetroleum manufacturing. The companies' average effective foreign tax rate goes up by about 5 percentage points but that is more than offset by the shrinkage of the total pool of foreign income. The net overall cost of FA to the companies is therefore much smaller than the net cost of repealing deferral. This simply reflects the fact that under the repeal of deferral, the effective worldwide tax rate is at least 35 percent while under FA the share allocated to foreign jurisdictions is taxed at about a 25 percent rate.

In these static estimates using 2004 data, repealing deferral raises about 40 percent less than FA. But as we have seen, companies have many opportunities for reducing the impact of FA. In contrast, these opportunities are limited if deferral is repealed because all worldwide income is in the U.S. tax base.

Interestingly, the comparable estimates for 1996 indicate a much smaller revenue gain from the adoption of FA. The static gain from manufacturing parents would have been $10 billion, which compares with the hypothetical gain in 2004 of $29.9 billion above. Furthermore, the three fold increase in the revenue from formula apportionment is not explained by the increased worldwide income of manufacturing parents over the period. Worldwide income only increased by 52 percent. These estimates for 1996 and 2004 are

consistent with the possibility that the 'check the box' rules introduced in 1997 had a significant effect on the share of worldwide income located abroad.

SALES BASED FORMULAS

Many U.S. states have adopted a sales only formula for apportionment. Putting sales in the formula seems to adopt a destination based concept, unlike payrolls and capital that are more consistent with origin based taxation. A sales based formula raises three issues: its conceptual basis as an income tax, its effect on sales and investment location, and its difficulty in enforcement.

A sales based formula may appear to be similar to a VAT or other destination based consumption taxes. Under very special circumstances it can be a destination basis *income* tax, which is far different. For example, in the special case in which all companies in a country have pre-tax corporate profits that are the same percentage of final sales (including the profits of suppliers of components), sales based formula apportionment is the equivalent of a destination basis income tax. But any departure from this extreme assumption will lead to a trade distortion. The tax saving by the exporter has to be the same as the tax paid by an importer to avoid any trade distortion.

As mentioned above, many states in the United States now use a sales only formula. Perhaps state policy makers think that they can 'export' the tax by taxing local sales of out of state companies. Or perhaps they think it acts as an export incentive for their own companies. Both, of course, cannot be true. The outcome depends on what happens to the terms of trade. If the tax on imports exceeds the tax on exports, a large state might benefit from its monopsony power by forcing down the price of imports.

Furthermore, in contrast to a destination based consumption tax, the use of a sales based formula to tax worldwide income distorts investment and sales behavior. With rents, the MNC will want to have higher sales in the low-tax location even if they have negative pre-tax profits on the margin. Similarly they will cut back on sales in the high-tax country. The pool of income to be split under FA always causes the trouble. Even without rents,

investors in the high-tax location have the incentive to export to a low-tax location and leave the proceeds abroad where they can accumulate returns at a low tax rate until they want to consume. The firm can effectively generate consumption tax treatment of savings under an income tax.

Grubert and Altshuler (2008) point out that income taxes and consumption taxes have fundamental differences that make it difficult to apply consumption tax rules to an income tax. In particular, income taxes require accruals and capitalizations while tax liabilities under a consumption tax are based purely on current transactions. As Grubert and Altshuler demonstrate, a sales based income tax can become a subsidy for investing in imported capital goods.

A sales based formula seems to have an advantage over the current system in that there are likely to be fewer unrelated party sales in a tax haven. But can the destination of sales easily be traced? A highly profitable company could just sell to an unrelated distributor in a low-tax country that earns a normal return. VAT systems apparently have great problems identifying real exports because of 'carrousel fraud' (see Keen and Smith 2006). With a sales based formula, the problem of identifying the actual destination of sales would be much more difficult since it would be necessary to know to which country the goods were shipped and not just whether they were exported.

The possibilities for avoiding taxes under a sales based FA regime could easily be illustrated in a three country model. Most large markets for U.S. based goods are in high-tax countries in Europe and Asia. But there are small low-tax countries like Ireland and Hong Kong in which independent distributors can be located. The model would therefore have two high-tax countries and one low-tax country. The high profit U.S. company could export to the other high-tax country directly, it could have an affiliate that produces and sells in the high-tax market or, wherever production occurs, it could sell to an independent distributor in the low-tax location which then resells in all markets. (It could also have a production affiliate in the low-tax country that could also use the independent distributor.) The independent distributor in the low-tax country just earns a normal return. Its tax liabilities on sales to any

market would not reflect any of the U.S. manufacturer's excess economic profits. There would therefore be a clear tax incentive to divert transactions through independent resellers.[10]

The sales based formula would, therefore, seem to provide great opportunities for restructuring the MNC's operations. Even if it sold its goods to an unrelated distributor in a low- tax country, it could presumably still maintain a marketing operation in the high-tax country without incurring a local liability as long as it did not take title to the goods. This would parallel the restructuring MNCs are now engaged in under the current system.[11]

CONCLUDING REMARKS

This paper reports results from an analysis of the benefits of FA relative to the current SA system that starts from the observation that the two most significant sources of income shifting are intangible income and debt. We also recognize that a major goal of the transfer pricing or income allocation system is to preserve the tax neutrality between arms length and related party transactions and between multinational and single jurisdiction companies. We present a simple model that highlights all of these features. We show that both SA and FA distort behavior but along different margins. Under SA, companies have an incentive to shift high-tech activities and to manipulate transfer prices. Under FA, companies do not manipulate transfer prices but they have an incentive to shift routine activities abroad and to change the degree to which they depend on outside suppliers.

The simulations of our simple model indicate that the current SA system causes fewer distortions than FA. FA causes a greater widening in the disparities in marginal effective tax rates that result from tax differentials across countries. As a result, more capital moves to low-tax locations under FA. This is true even for high-tech capital which is the vehicle for income shifting under SA. While SA induces expenditures on financial manipulation of intercompany

[10] John Wilson has independently come to a similar conclusion in an unpublished note using a somewhat different model. His model has a high-tech intermediate stage and a routine assembly stage earning a normal return. The two stages are not produced by a single integrated firm because the assembly stage is always outsourced to an independent firm in the low-tax country. It then exports the final product back to the high-tax location.

[11] It is our understanding that the new structures being used by MNC leave a minimal cost plus return in the high-tax locations.

prices which have no use under FA, this does not give any decisive advantage to FA even when we assume that these planning expenditures are very large and almost all of economic profits are shifted to the low-tax location.

We also examine the complicating role of financial assets under FA and how ongoing R&D is implicitly allocated. Formulas different from the conventional ones are also discussed, for example, first dealing with debt separately and allocating it based on total assets. The conceptual basis for the conventional formulas are discussed, particularly ones based on sales. Finally the effect of FA on the tax liabilities of US MNCs is estimated for 1996 and 2004.

Our analysis can be extended in a number of directions. For example, the model could take into account the possibility of licensing production that generates excess returns to third parties. The question is how FA and SA affect the choice between licensing a related or unrelated party abroad. Importantly, the model could also be extended to analyze how decision margins are impacted under sales based formulas. In addition, it would be interesting to explore whether the positive aspects of FA can be achieved within the current system. Finally, implementation problems deserve careful consideration.

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Table 1
Parameterization of Model

	Base case	Reduced substitutability between routine capital	Increased economic rents
	Elasticity of substitution		
Output $Q=\left(\frac{1}{2}H^{-4}+\frac{1}{2}R^{-4}\right)^{-1/4}$	-.2	-.2	-.2
High-tech capital $H=\left(K_1^H\right)^{1/2}\left(K_2^H\right)^{1/2}$	-1	-1	-1
Routine capital $R=\left(\frac{1}{2}(KR_1)^{\alpha}+\frac{1}{2}(KR_2)^{\alpha}\right)^{1/\alpha}$	-2	-1	-2
Routine capital at home $KR_1=\left(\frac{1}{2}(KR_1^O)^{\rho}+\frac{1}{2}(KR_1^I)^{\rho}\right)^{1/\rho}$	-3	-2	-3
Routine capital abroad $KR_2=\left(\frac{1}{2}(KR_2^O)^{\rho}+\frac{1}{2}(KR_2^I)^{\rho}\right)^{1/\rho}$	-3	-2	-3
	Price elasticity of demand		
Demand $P=(1/800)Q^{1/\varepsilon}$	-2.0	-2.0	-1.5
Shifting function $S=1-e^{-.04(Share)K^M}$ where $Share=\frac{K_2^H}{K_1^H+K_2^H}$			

Table 2
Optimal Capital Stocks and Marginal Effective Tax Rates Under Separate Accounts and Formulary Apportionment
Base Case Simulations

	Tax in host country=35%			Tax in host country=25%			Tax in host country=10%		
	Separate accounts		Formulary	Separate accounts		Formulary	Separate accounts		Formulary
	No shifting	Shifting	apportionment	No shifting	Shifting	apportionment	No shifting	Shifting	apportionment
High-tech capital									
Home	259.85	259.85	259.85	279.94	252.62	253.21	310.40	275.55	263.12
Host	259.85	259.85	259.85	323.01	354.98	353.44	429.78	478.80	503.21
Shifting capital	0.00	0.00		0.00	66.17		0.00	96.17	
Routine outsourced capital									
Home	226.21	226.21	226.21	225.83	225.11	235.51	224.26	223.30	238.36
Host	226.21	226.21	226.21	300.67	299.71	285.32	429.94	428.11	390.10
Routine insourced capital									
Home	226.21	226.21	226.21	225.83	225.11	172.29	224.26	223.30	138.16
Host	226.21	226.21	226.21	300.67	299.71	369.51	429.94	428.11	595.82
Marginal effective tax rates									
High-tech capital									
Home	0.35	0.35	0.35	0.35	0.41	0.41	0.35	0.42	0.46
Host	0.35	0.35	0.35	0.25	0.18	0.18	0.10	0.00	-0.04
Routine outsourced capital									
Home	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Host	0.35	0.35	0.35	0.25	0.25	0.25	0.10	0.10	0.10
Routine insourced capital									
Home	0.35	0.35	0.35	0.35	0.35	0.41	0.35	0.35	0.46
Host	0.35	0.35	0.35	0.25	0.25	0.18	0.10	0.10	-0.04

See continuation of table on next page.

Table 2 (continued)
Shifting, Tax Revenues and Rents under Separate Accounts and Formulary Apportionment
Base Case Simulations

	Tax in host country=35%			**Tax in host country=25%**			**Tax in host country=10%**		
	Separate accounts			Separate accounts			Separate accounts		
	No shifting	Shifting	Formulary apportionment	No shifting	Shifting	Formulary apportionment	No shifting	Shifting	Formulary apportionment
Profit shifting under Separate Accounts									
Share of high-tech capital in host	0.50	0.50	0.50	0.54	0.58	0.58	0.58	0.63	0.66
Percentage of rents shifted	---	0.00	---	---	0.79	---	---	0.91	---
Cost of shifting (K^M/total capital)	---	0.00	---	---	0.04	---	---	0.04	---
Profit split under Formula Apportionment									
Percent of profits allocated abroad	---	---	0.50	---	---	0.37	---	---	0.27
Tax revenue									
Home	115.06	115.06	76.71	121.92	58.20	64.09	131.88	51.51	54.04
Host	38.35	38.35	76.71	30.81	76.12	71.90	14.33	37.17	36.58
Rents	142.46	142.46	142.46	153.27	164.10	167.80	169.03	214.85	216.69
Price	1.83	1.83	1.83	1.70	1.70	1.70	1.54	1.54	1.54
Quantity	240.16	240.16	240.16	278.01	277.02	276.97	338.13	336.54	338.25

See table 1 for parameters used in simulations.

Table 3
Optimal Capital Stocks and Marginal Effective Tax Rates Under Separate Accounts and Formulary Apportionment
Reduced Substitutability Between Various Types of Routine Capital

	Tax in host country=35%			Tax in host country=25%			Tax in host country=10%		
	Separate accounts		Formulary	Separate accounts		Formulary	Separate accounts		Formulary
	No shifting	Shifting	apportionment	No shifting	Shifting	apportionment	No shifting	Shifting	apportionment
High-tech capital									
Home	259.85	259.85	259.85	279.12	251.84	252.58	305.77	271.11	256.32
Host	259.85	259.85	259.85	322.07	353.99	354.73	423.37	472.14	508.75
Shifting capital	0.00	0.00		0.00	66.10		0.00	95.79	
Routine outsourced capital									
Home	226.21	226.21	226.21	242.99	242.22	254.83	266.18	265.04	290.41
Host	226.21	226.21	226.21	280.38	279.48	266.55	368.56	366.98	335.87
Routine insourced capital									
Home	226.21	226.21	226.21	242.99	242.22	208.48	266.18	265.04	202.32
Host	226.21	226.21	226.21	280.38	279.48	323.06	368.56	366.98	480.82
Marginal effective tax rates									
High-tech capital									
Home	0.35	0.35	0.35	0.35	0.41	0.41	0.35	0.42	0.46
Host	0.35	0.35	0.35	0.25	0.18	0.17	0.10	0.00	-0.08
Routine outsourced capital									
Home	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Host	0.35	0.35	0.35	0.25	0.25	0.25	0.10	0.10	0.10
Routine insourced capital									
Home	0.35	0.35	0.35	0.35	0.35	0.41	0.35	0.35	0.46
Host	0.35	0.35	0.35	0.25	0.25	0.17	0.10	0.10	-0.08

In these simulations the substitutability between the various types of routine capital is reduced. The elasticity between routine capital in the two locations is -1 instead of -2 and the elasticity of substitution between in-sourced and out-sourced capital in the two locations is -2 instead of -3. All other parameters are the same (see Table 1).

Table 3 (continued)
Shifting, Tax Revenues and Rents under Separate Accounts and Formulary Apportionment
Reduced Substitutability Between Various Types of Routine Capital

	Tax in host country=35%			**Tax in host country=25%**			**Tax in host country=10%**		
	Separate accounts			Separate accounts			Separate accounts		
	No shifting	Shifting	Formulary apportionment	No shifting	Shifting	Formulary apportionment	No shifting	Shifting	Formulary apportionment
Profit shifting under Separate Accounts									
Share of high-tech capital in host	0.50	0.50	0.50	0.54	0.58	0.58	0.58	0.64	0.66
Percentage of rents shifted	---	0.00	---	---	0.79	---	---	0.91	---
Cost of shifting (K^M/total capital)	---	0.00	---	---	0.04	---	---	0.05	---
Profit split under Formula Apportionment									
Percent of profits allocated abroad	---	---	0.50	---	---	0.40	---	---	0.32
Tax revenue									
Home	115.06	115.06	76.71	123.59	59.99	69.80	135.39	55.74	63.84
Host	38.35	38.35	76.71	29.43	74.65	67.77	12.89	35.53	33.45
Rents	142.46	142.46	142.46	153.02	163.83	166.92	167.63	212.96	212.13
Price	1.83	1.83	1.83	1.70	1.70	1.70	1.55	1.55	1.55
Quantity	240.16	240.16	240.16	277.11	276.12	276.73	332.53	330.94	333.94

In these simulations the substitutability between the various types of routine capital is reduced. The elasticity between routine capital in the two locations is -1 instead of -2 and the elasticity of substitution between in-sourced and out-sourced capital in the two locations is -2 instead of -3. All other parameters are the same (see Table 1).

Table 4
Optimal Capital Stocks and Marginal Effective Tax Rates Under Separate Accounts and Formulary Apportionment
Increased Economic Profits

	Tax in host country=35%			Tax in host country=25%			Tax in host country=10%		
	Separate accounts		Formulary apportionment	Separate accounts		Formulary apportionment	Separate accounts		Formulary apportionment
	No shifting	Shifting		No shifting	Shifting		No shifting	Shifting	
High-tech capital									
Home	191.09	191.09	191.09	198.47	168.48	161.24	209.55	174.82	147.96
Host	191.09	191.09	191.09	229.00	265.40	267.08	290.14	340.96	366.62
Shifting capital	0.00	0.00		0.00	79.23		0.00	105.38	
Routine outsourced capital									
Home	166.35	166.35	166.35	160.11	159.19	173.46	151.39	150.34	167.96
Host	166.35	166.35	166.35	213.16	211.94	194.08	290.25	288.22	246.98
Routine insourced capital									
Home	166.35	166.35	166.35	160.11	159.19	89.81	151.39	150.34	53.39
Host	166.35	166.35	166.35	213.16	211.94	297.29	290.25	288.22	449.92
Marginal effective tax rates									
High-tech capital									
Home	0.35	0.35	0.35	0.35	0.45	0.48	0.35	0.46	0.56
Host	0.35	0.35	0.35	0.25	0.13	0.14	0.10	-0.05	-0.10
Routine outsourced capital									
Home	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Host	0.35	0.35	0.35	0.25	0.25	0.25	0.10	0.10	0.10
Routine insourced capital									
Home	0.35	0.35	0.35	0.35	0.35	0.48	0.35	0.35	0.56
Host	0.35	0.35	0.35	0.25	0.25	0.14	0.10	0.10	-0.10

In these simulations the demand elasticity for the output of the company is changed from -2 to -1.5. All other parameters are the same (see Table 1).

Table 4 (continued)
Shifting, Tax Revenues and Rents under Separate Accounts and Formulary Apportionment
Increased Economic Profits

	Tax in host country=35%			**Tax in host country=25%**			**Tax in host country=10%**		
	Separate accounts			Separate accounts			Separate accounts		
	No shifting	Shifting	Formulary apportionment	No shifting	Shifting	Formulary apportionment	No shifting	Shifting	Formulary apportionment
Profit shifting under Separate Accounts									
Share of high-tech capital in host	0.50	0.50	0.50	0.54	0.61	0.62	0.58	0.66	0.71
Percentage of rents shifted	---	0.00	---	---	0.86	---	---	0.94	---
Cost of shifting (K^M/total capital)	---	0.00	---	---	0.06	---	---	0.07	---
Profit split under Formula Apportionment									
Percent of profits allocated abroad	---	---	0.50	---	---	0.31	---	---	0.20
Tax revenue									
Home	141.02	141.02	84.61	144.95	46.67	57.32	150.48	38.48	41.28
Host	28.20	28.20	84.61	21.84	91.77	83.51	9.67	41.53	40.09
Rents	209.52	209.52	209.52	217.32	236.44	238.69	228.23	295.42	294.22
Price	2.74	2.74	2.74	2.54	2.56	2.58	2.31	2.32	2.38
Quantity	176.61	176.61	176.61	197.10	195.79	192.77	228.27	226.44	218.27

In these simulations the demand elasticity for the output of the company is changed from -2 to -1.5. All other parameters are the same (see Table 1).

Table 5
Optimal Capital Stocks and Marginal Effective Tax Rates Under An Alternative Formulary Apportionment Formula

	Tax in host country=.35			Tax in host country=.25			Tax in host country=.10		
	SA with no shifting	FA	Allocate 1/2 of rents using FA	SA with no shifting	FA	Allocate 1/2 of rents using FA	SA with no shifting	FA	Allocate 1/2 of rents using FA
High-tech capital									
Home	259.85	259.85	259.85	279.94	253.21	264.65	310.40	263.12	274.04
Host	259.85	259.85	259.85	323.01	353.44	339.07	429.78	503.21	471.52
Routine outsourced capital									
Home	226.21	226.21	226.21	225.83	235.51	231.39	224.26	238.36	234.59
Host	226.21	226.21	226.21	300.67	285.32	292.42	429.94	390.10	404.39
Routine insourced capital									
Home	226.21	226.21	226.21	225.83	172.29	194.82	224.26	138.16	158.81
Host	226.21	226.21	226.21	300.67	369.51	337.09	429.94	595.82	525.30
Marginal effective tax rates									
High-tech capital									
Home	0.35	0.35	0.35	0.35	0.41	0.38	0.35	0.46	0.41
Host	0.35	0.35	0.35	0.25	0.18	0.22	0.10	-0.04	0.03
Routine outsourced capital									
Home	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Host	0.35	0.35	0.35	0.25	0.25	0.25	0.10	0.10	0.10
Routine insourced capital									
Home	0.35	0.35	0.35	0.35	0.41	0.38	0.35	0.46	0.41
Host	0.35	0.35	0.35	0.25	0.18	0.22	0.10	-0.04	0.03

See table 1 for parameters used in simulations. See text for explanation.

Table 5 (continued)
Shifting, Tax Revenues and Rents under an Alternative Formulary Apportionment Formula
Base Case Simulations

	Tax in host country=35%			Tax in host country=25%			Tax in host country=10%		
	SA with no shifting	FA	Allocate 1/2 of rents using FA	SA with no shifting	FA	Allocate 1/2 of rents using FA	SA with no shifting	FA	Allocate 1/2 of rents using FA
Tax revenue									
Home	115.06	76.71	95.88	121.92	64.09	95.07	131.88	54.04	94.84
Host	38.35	76.71	57.53	30.81	71.90	49.81	14.33	36.58	24.58
Rents	142.46	142.46	142.46	153.27	167.80	160.04	169.03	216.69	190.46
Price	1.83	1.83	1.83	1.70	1.70	1.70	1.54	1.54	1.55
Quantity	240.16	240.16	240.16	278.01	276.97	277.14	338.13	338.25	333.78

See table 1 for parameters used in simulations. See text for explanation.

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