What Do We Know About Base Erosion and Profit Shifting? A Review of the Empirical Literature

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Abstract

The issue of tax-motivated income shifting within multinational firms has attracted increasing global attention in recent years. It is of central importance to many current policy debates, including those related to recent initiatives by the OECD on base erosion and profit shifting (BEPS) and to proposals for US tax reform in a territorial direction. This paper provides a survey of the empirical literature on tax-motivated income-shifting within multinational firms. Its emphasis is on clarifying what is known about the magnitude of BEPS. It begins by outlining a simple conceptual framework that helps to clarify aspects of governments' responses to the BEPS phenomenon and the potential role of the OECD initiative. The paper then discusses different empirical approaches to identifying income-shifting, describes existing data sources, and summarizes the findings of the empirical literature. A major theme that emerges from this survey is that in the more recent empirical literature, which uses new and richer sources of data, the estimated magnitude of BEPS is typically much smaller than that found in earlier studies. The paper seeks to provide a framework within which to conceptualize this magnitude and its implications for policy. It concludes by highlighting the importance of existing legal and economic frictions as constraints on BEPS, and discussing possible ways in which future research might model these frictions more precisely.

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1) Introduction

The arcane world of international taxation, and in particular the taxation of multinational corporations (MNCs), has recently gained an unprecedented level of political salience and public attention.[1] An important aspect of these developments has been the OECD's initiative on "base erosion and profit shifting" (BEPS). Following their meeting in Los Cabos, Mexico in June 2012, the G-20 leaders issued a communiqué declaring that: "We reiterate the need to prevent base erosion and profit shifting and we will follow with attention the ongoing work of the OECD [Organization for Economic Cooperation and Development] in this area."[2] This was followed by a major OECD report in February 2013 (OECD, 2013a) and subsequently by an action plan in July 2013 (OECD, 2013b). The BEPS issue is also highly relevant to current proposals in the United States that envisage combining tax reform in a territorial direction with provisions to limit base erosion.

In analyzing these initiatives and proposals, an important consideration is the magnitude of tax-motivated income shifting by MNCs (i.e. the magnitude of BEPS). This paper provides a survey of the empirical literature on tax-motivated income-shifting within multinational firms. Its emphasis is on describing what is known about the magnitude of BEPS, and on interpreting the implications of these findings. It begins, however, by outlining a simple conceptual framework that helps to clarify aspects of governments' responses to the BEPS phenomenon and the potential role of the OECD initiative.

The paper then discusses the empirical approaches that have been used to identify income-shifting. The emphasis is on the dominant approach within the economics literature on income shifting, which dates back to Hines and Rice (1994), and which we refer to as the "Hines-Rice" approach. However, other approaches within economics and accounting are also surveyed, including methods recently proposed by Dharmapala and Riedel (2013), based on identifying exogenous shocks to the income of parent firms, and by Dyreng and Markle (2013). The paper also describes existing data sources, documenting the shift from aggregate country-

[1] This has been exemplified by, for instance, the hearings held by the Public Accounts Committee of the House of Commons – see e.g. M. Gilleard "Google Hauled Before UK PAC Again, But International Tax Framework Cited as Real Villain" *International Tax* Review, May 21, 2013, available at: http://www.internationaltaxreview.com/Article/3208706/Google-hauled-before-UK-PAC-again-but-international-tax-framework-cited-as-real-villain.html

[2] See the full text of the G-20 communiqué at: http://www.telegraph.co.uk/finance/g20-summit/9343250/G20-Summit-communique-full-text.html

level datasets to firm-level microdata that has greatly enhanced the credibility of estimates of BEPS.

The primary aim of the paper is to summarize the findings of the empirical literature, especially with regard to the magnitude of BEPS. A major theme that emerges from this survey is that in the more recent empirical literature, which uses new and richer sources of data, the estimated magnitude of BEPS is typically much smaller than that found in earlier studies. For instance, early studies in the 1990's found estimates that correspond to a tax sensitivity of reported income that is about three times larger than currently accepted estimates. A representative consensus estimate from the literature, based on a meta-regression study by Heckemeyer and Overesch (2013), is a semi-elasticity of reported income with respect to the tax rate differential across countries of 0.8. This entails that a 10 percentage point increase in the tax rate difference between an affiliate and its parent (for instance, because the tax rate in the affiliate's country falls from 35% to 25%) would increase the pretax income reported by the affiliate by 8% (for example, from $100,000 to $108,000).[3]

The paper also surveys the existing evidence (or in some cases the lack thereof) with regard to five specific issues relating to BEPS that have attracted considerable attention in recent policy debates and in academic discourse. The first of these issues is the relative magnitude of profit shifting from parents to foreign affiliates as opposed to profit shifting among foreign affiliates. The second is the role of intellectual property and intangible assets in BEPS, and the related (but more general) question of how income shifting interacts with the location of real economic activity across jurisdictions. The third is the impact on income shifting of the existence of territorial versus worldwide tax systems in the residence country of the parent. The fourth is the issue of whether income shifting has increased in recent years, and the final issue relates to the consequences of income shifting for tax revenue.

Finally, the paper seeks to provide a framework within which to conceptualize the magnitude of BEPS and its implications, in particular whether the estimated magnitude (while clearly smaller than that found in early studies) should be viewed as being "large" or "small" for policy purposes. It contrasts the findings of the empirical literature with a widespread policy discourse which points to descriptive statistics regarding the fraction of net income reported by

[3] The alternative Dharmapala and Riedel (2013) approach provides an estimate that 2% of the (unexpected) income of the parent is shifted to low-tax affiliates, as discussed in Section 4 below.

MNCs in tax havens as indicating *ipso facto* that BEPS is large in magnitude and importance. It suggests how these two parallel discourses might be reconciled, and what types of evidences may be pertinent in achieving greater consensus on these issues.

The paper concludes by emphasizing the importance of existing legal and economic frictions as constraints on BEPS. It suggests that one potential approach to understanding these frictions is for future research to try to better model the costs of tax planning (in particular, the idea that tax planning involves fixed costs) to explain the apparent heterogeneity among firms in their tax planning behavior. Such future research may shed new light on the role of these frictions, and on their implications for the efficiency of the current international tax regime and various proposed reforms.

The paper proceeds as follows. Section 2 introduces a simple conceptual framework to understand the BEPS phenomenon and the recent OECD initiative. Section 3 discusses the various conceptual approaches taken within the empirical literature that seeks to measure BEPS. Section 4 describes the findings of this literature. Section 5 provides an interpretation of the implications of these findings, while Section 6 concludes.

2) A Simple Conceptual Framework for the BEPS Phenomenon and Initiative

The central focus of this paper is on reviewing the empirical findings of the scholarly literature on BEPS and discussing the implications of these findings. Before proceeding to this task, however, it may be helpful to situate this discussion within the context of the recent BEPS initiative. Thus, this section develops a simple conceptual framework that can help understand aspects of the BEPS initiative and the types of circumstances that appear to implicitly underlie the claims that have been made as part of this initiative.

The BEPS initiative raises a number of conceptual issues. The most fundamental of these are the questions of *why* and *for whom* BEPS constitutes a problem. The G-20 communiqué noted above takes as essentially self-evident the "need to prevent BEPS." Yet, national governments (especially of MNC residence countries but also those of source countries) have available a wide variety of legal instruments to reduce or prevent BEPS. If the "need to prevent BEPS" is so pressing, some explanation is required as to why governments have not unilaterally taken more extensive steps in this direction. The OECD's (2013a, b) answer is that BEPS arises primarily because of inconsistencies between the tax laws of different jurisdictions These

inconsistencies create (largely unintended) opportunities for firms to reduce tax liabilities. This characterization can be viewed as a variant of the classic "double nontaxation" problem that has long exercised the minds of international tax scholars. This perspective certainly captures a significant element of the BEPS phenomenon, but arguably it underemphasizes the role of governments' incentives in the area of the taxation of multinationals, in favor of stressing the limitations of governments' technical and legal capacities.

With regard to the question of *for whom* BEPS is a problem, the OECD (2013a) of course points to governments and to other taxpayers. It also claims that MNCs themselves may be harmed by BEPS (for instance, if there are reputational costs to tax avoidance). It is worth noting, however, that the impact on other taxpayers of greater tax burdens on MNCs depends in part on the incidence of the corporate tax – i.e. whether workers bear a substantial share of the burden. However, this is the subject of an ongoing debate in the empirical literature (e.g. Arulampalam, Devereux and Maffini, 2012) that is unlikely to be resolved within the timeframe of the BEPS action plan. It is also unclear why MNCs would fail to internalize purely private costs of tax planning, such as reputational losses.

The OECD's (2013b) proposed solutions focus on various forms of multilateral coordination and cooperation. Implicitly, it takes the view that multilateral cooperation can make countries collectively better off. In assessing this perspective, it is helpful to seek to understand more precisely the circumstances in which multilateral cooperation can enhance countries' welfare. Thus, this section presents a relatively simple example that illustrates some circumstances in which this may hold. However, it emphasizes countries' incentives to maximize national welfare, rather than unintentional interactions between different countries' tax laws.

Assume a world with four countries. Two of these - countries A and B - are residence countries for MNCs, and also serve as source countries for MNC operations. One of the counties (country C) is a pure source country, while he fourth is a tax haven (H). However, only the governments of countries A and B, and the MNCs resident in those countries, are assumed to make strategic choices; countries C and H play a passive role. There are two assets located in country A (denoted a1 and a2), and two assets located in country B (denoted b1 and b2). In addition, there are two MNCs – Firm A (resident in country A) and Firm B (resident in country B); residence is assumed to be fixed.

Firm A can generate $50 of (pretax) profits by owning both a1 and b1, while Firm B can generate $50 of (pretax) profits by owning both a2 and b2. Each asset generates zero profit if owned by any other owner. These assumptions reflect the ownership effects on productivity that are heavily emphasized in the general literature on MNCs, and that have been introduced into the literature on international taxation by Desai and Hines (2003). There is a supply of assets in C that (for the same cost of acquisition as each of a1, a2, b1 and b2) generate pretax profits of $45 each; assume these are domestically owned by country C firms as the default scenario. There are no "real" assets located in H, but H can be used (if the relevant tax laws permit) to shift income from any of the other jurisdictions, at a cost of $2 (incurred for each affiliate that shifts income out).

Assume that A, B and C all have a (fixed) corporate tax rate of 20% and have territorial tax systems that exempt active foreign income, while H has a zero tax rate. A natural characterization of national welfare for countries A and B in this framework is that it is the sum of the after-tax profits of the resident MNC and tax revenue from all sources (the government may care about its resident MNC because its ownership is primarily by domestic shareholders, consistent with the familiar "home bias" in equity holdings). For example:

National welfare of country A = After-tax profit of Firm A + Tax revenue of country A

The policy choices available to governments in this example are very simple – residence countries (A and B) can impose controlled foreign corporation (CFC) rules that pertain to their resident MNCs, while source countries (A, B and C) can impose earnings stripping (ES) rules on local affiliates (including parents' domestic operations). The impact of these policies is described below.

First, consider a scenario in which there are no CFC rules or ES rules. An efficient pattern of ownership will prevail, where Firm A owns a1 and b1 and generates $100 of pretax profit, while Firm B owns a2 and b2 and generates $100 of pretax profit. Each affiliate shifts all income out to H (e.g. by injecting equity into its H affiliate, which then lends the money to the A and B affiliates). Firm A's after-tax profit is $96 ($100 minus the $2 cost of profit-shifting at each affiliate), as is Firm B's after-tax profit (see Table 1).

In this scenario, no country has an incentive to unilaterally impose either an ES rule or a CFC rule. To see this for CFC rules, suppose country A introduces a CFC rule unilaterally. This entails that country A taxes interest income earned by Firm A in its H affiliate. Firm A will no

longer shift income, so it generates $100 of pretax profit, incurs zero tax planning costs, and pays tax of $10 to A and $10 to B (note that ownership patterns are not distorted because the after-tax returns to assets in different countries are proportional to the pretax returns). Country A's payoff from introducing a CFC rule unilaterally is $90 (the sum of the after-tax profit of Firm A ($80) and the $10 in revenue. Comparing this to the $96 from not doing so (see Table 1), it is clear that countries do not have any incentive to unilaterally introduce CFC rules. Note also that country B's payoff goes up to $106 (the after-tax profit of Firm B is still $96, while country B now receives $10 of revenue from Firm A's affiliate in country B).[4]

Intuitively, the problem is that by unilaterally imposing a CFC rule, country A is in effect transferring revenue to a foreign treasury (thereby reducing national welfare), without any offsetting increase in the revenue it derives from the local affiliates of foreign MNCs. Importantly, the CFC rule does not result in revenue for the residence country, as the firm prefers to forego tax planning and pay tax to the foreign treasury.

Suppose that countries A and B find some mechanism by which to cooperate, and that both countries simultaneously impose CFC rules of the type described above. Then, ownership patterns will be efficient. Firm A will earn $100 of pretax profit, incur zero tax planning costs, and pay $10 tax to each of countries A and B. Firm B will do likewise. Thus:

Country A's payoff = Firm A's after-tax payoff (80) + Revenue (10 + 10) = 100

Country B's payoff = Firm B's after-tax payoff (80) + Revenue (10 + 10) = 100

As shown in Table 1, both countries are better off if they can each commit to introducing a CFC rule.

This conclusion may seem in tension with the longstanding notion that countries seeking to maximize national welfare should encourage their resident MNCs to avoid foreign taxes, as

[4] The reasoning for why unilaterally introducing an ES rule is not in each country's interest is more complex, though intuitively straightforward. Suppose country A were to unilaterally impose an ES rule that is sufficiently strong to preclude all earning stripping (e.g. the denial of deductibility for interest payments to the H affiliate). This affects all affiliates (the owners of a1 and a2) located in country A. If Firm A continues to own a1 and b1, then it will earn $48 after-tax (as before) from b1. However, it will not be able to shift earnings out of a1, and so its after-tax profit = $40 (paying $10 tax to country A, but incurring no tax planning cost). Instead, if it were to buy an asset in country C, it would earn $45 pretax, incur $2 in tax planning costs, and strip all income to H – i.e. its after-tax profit = $43, so this is what it will do. Note that Firm A will then only have a notional presence in its country of residence (A) but we allow this as a possibility. Similarly, Firm B will buy an asset in country C instead of buying asset b1 in country A, earn $45 pretax, incur $2 in tax planning costs, and shift all income to H – i.e. its after-tax profit = $43. Note that this is an inefficient pattern of ownership (from a global perspective), but this is not crucial, as countries are assumed to care about national welfare. Country A's payoff from unilaterally introducing an ES rule is $91 (the after-tax profit of Firm A (48 + 43) plus revenue of zero). Comparing this to a payoff of $96 from not doing so, it is clear that, countries do not have any incentive to unilaterally introduce ES rules.

tax payments to foreign governments reduce national welfare. Indeed, Shaviro (2011) has recently developed a critique of the foreign tax credit in US tax law, partly on the grounds that it disincentivizes US MNCs' avoidance of foreign taxes. However, these views can be reconciled by noting that the key difference here is that multilateral cooperation entails that the CFC rules imposed here generate revenue from the local affiliates of foreign MNCs at the same time that they entail higher tax payments by resident MNCs to foreign governments. Thus, this simple example takes explicit account of the reality that most large economies are *both* residence and source countries. Multilateral adoption of CFC rules transfers money from your own MNCs to foreign treasuries, but also from foreign-owned MNCs to your treasury (in the example, these balance out exactly, with the savings in tax planning costs generating a global surplus from the reform). This can be viewed as an example of Shaviro's (2006) general argument that global welfare norms may sometimes promote national welfare if adopted multilaterally.

Could the "good" outcome in Table 1 be replicated using (source-based) ES rules rather than (residence-based) CFC rules? In this example, this would be possible, but would require that country C is also part of the multilateral agreement. Thus, it would require broader international cooperation. In addition, it is possible that source-based solutions may be more prone to unintended interactions across jurisdictions. In any event, the OECD (2013b) appears to favor a combination of residence-based and source-based solutions. In a recent discussion of the BEPS issue, Fuest *et al*. (2013) point to difficulties with extensions of residence taxation and instead argue for extending source-based taxation to reduce BEPS, in particular through withholding taxes.

This example, of course, is purely illustrative, and a number of important caveats are in order. First, this example is intended not as a description of reality, but as an illustration of a set of circumstances that would explain the BEPS phenomenon and the current BEPS initiative in a coherent way. Whether or not the real world corresponds to the assumptions required to render multilateral cooperation beneficial remains very much an open question. An alternative perspective on BEPS is that it may be optimal for governments to permit BEPS activities as a way of differentially taxing firms that are more and less mobile or tax-sensitive, where this characteristic is unobservable to governments (see Hines (2007) and Dharmapala (2008) for discussions of this possibility, and Hong and Smart (2010) for a formal theoretical model).

Within this perspective, it is less clear than in the example above whether there would be substantial gains from multilateral cooperation.

3) Conceptual Approaches used in the Empirical Literature

The primary approach to the empirical estimation of BEPS in the economic literature is directly derived from the early pioneering research on multinational income-shifting, notably Hines and Rice (1994) and Grubert and Mutti (1991). These important and widely-cited studies established a conceptual framework that continues to be highly influential. However, the early studies were subject to significant limitations in terms of the data that was then available. For instance, Hines and Rice (1994) and Grubert and Mutti (1991) both used aggregate (country-level) data in cross-sectional regression analyses. The available data has improved considerably, enabling the use of a much more extensive set of controls for both observable and unobservable determinants of income reported in different jurisdictions.

The basic premise of Hines and Rice (1994) is that the observed pretax income of an affiliate represents the sum of "true" income and "shifted" income (where the latter can of course be either positive or negative for any particular affiliate). True income is generated by the affiliate using capital and labor inputs. Thus, measures of the capital and labor inputs used by the affiliate (such as fixed tangible assets and employment compensation, respectively) are included in the analysis, to predict the counterfactual "true" level of income. Shifted income is determined by the tax incentive to move income in or out of the affiliate. In the simplest scenario, this would be the tax rate difference between the parent and the affiliate. However, more complex versions take account of the overall pattern of tax rates faced by all the affiliates of the MNC (e.g. Huizinga and Laeven, 2008). Income reported by a low-tax affiliate that cannot be accounted for by the affiliate's own labor and capital inputs is attributed to income-shifting.

This approach (which we will refer to as the "Hines-Rice" approach) can be represented by the following equation:

$$\log \pi_i = \beta_0 + \beta_1 \tau_i + \beta_2 \log K_i + \beta_3 \log L_i + \mathbf{X}_i \gamma + \varepsilon_i \qquad (1)$$

Here, π_i represents the profits of multinational affiliate i. The typical specification in the literature is log-linear – i.e. the natural logarithm of the affiliate's pretax profit is modeled as a linear function of the tax rate differential. Because of this, it is customary in this literature to

omit loss-making affiliates (i.e. those with negative income) from the sample.[5] The tax variable τ_i represents the tax incentive to shift profits into or out of affiliate *i*. Typically, this would be the tax rate difference between the parent and the affiliate, although more complex versions measure the tax rate difference with an appropriately defined average of tax rates faced by all the affiliates of the MNC. The coefficient of interest is β_1, which reflects the extent to which the multinational shifts profits into or out of affiliate *i*. Affiliate *i*'s capital inputs are represented by K_i (e.g. fixed tangible assets) and its labor inputs by L_i (e.g. employment compensation). $\mathbf{X}_i$ is a vector of additional affiliate-level controls, ε_i is the error term, and β_0 is a constant.

Hines and Rice (1994) estimated a model similar to that in Equation (1). However, their data was aggregated up to the country level (i.e. represented the aggregate profit, capital and labor inputs etc. of all US affiliates in a given country). This data was obtained from the Bureau of Economic Analysis (BEA) of the US Department of Commerce, which collects data on the foreign activities of US firms by means of surveys that these firms are required to complete. The forms that firms are required to complete vary depending on factors such as the year, the size of the parent and affiliate, and the parent's ownership stake. The most extensive data are collected in benchmark years, such as 1982 (used by Hines and Rice (1994)), 1999 and 2004.

Data at the aggregate country and year level are made publicly available by the BEA.[6] Individual firms' responses to the BEA surveys are confidential. Nonetheless, researchers have been able to obtain access to the affiliate-level data under certain conditions. The latter dataset, which captures financial and operating information for both the parent companies and foreign affiliates of U.S. multinationals, has proved important for academic research on various aspects of US multinationals' responses to international taxation (e.g. Desai, Foley and Hines, 2003, 2004, 2006; Dharmapala, Foley and Forbes, 2011).[7] Another confidential dataset that is in many ways analogous to the affiliate-level BEA data is collected by the German central bank (*Deutsche Bundesbank*) on the foreign affiliates of German-based multinational firms, and on the German affiliates of non-German multinational firms. This micro-level dataset on direct

[5] Note that it is possible to include negative observations using a simple rescaling of the variables (see e.g. Dharmapala and Riedel (2013)). However, incentives for BEPS activity are typically attenuated for loss-making firms due to tax law asymmetries such as limitations on loss offsets.

[6] See the BEA website at www.bea.gov.

[7] Another confidential source of data on US MNCs is from tax returns; these have been used in the literature by researchers with access to this information (e.g. Grubert, 2003, 2012).

investment is referred to as the MiDi (*Mikrodaten Direktinvestitionen*) dataset, and has also been used extensively in recent academic research (e.g. Weichenrieder, 2009; Buettner *et al*, 2012).

The increasing availability of affiliate-level datasets such as these has enabled researchers to move from aggregate country-level analysis to a more micro-level analysis of the behavior of individual multinational affiliates. The primary advantage of such data is the increased ability to control for potential confounding factors in the estimation of the presence and magnitude of BEPS. This trend has been reinforced by the creation and increased availability in recent years of commercial databases of firms that provide unconsolidated (i.e. affiliate-level rather than consolidated worldwide MNC-level) financial and ownership information for multinational affiliates. The most prominent of these databases in international tax research have been the Orbis and Amadeus databases, both produced by the Bureau van Dijk. Orbis is a global database that now provides information on about 100 million individual firms (including multinational affiliates). It has been used, for instance, by Markle (2012). Amadeus is focused on Europe, providing financial and ownership data on 1.6 million European business entities; it has been used, for instance, by Huizinga and Leuven (2008), Dischinger (2010) and Dharmapala and Riedel (2013).[8] In contrast, the primary database of financial statement information on US firms – Compustat – reports consolidated (i.e. worldwide) financial information that pertains to the multinational group in its entirety (although some geographic segment data is also available).

Because these affiliate-level datasets are longitudinal – i.e. report information on the same affiliates over multiple years – they have also enabled researchers to use panel data techniques that provide more credible estimates of BEPS. With panel data, we can modify Equation (1) as follows:

$$\log \pi_{it} = \beta_1 \tau_{it} + \beta_2 \log K_{it} + \beta_3 \log L_{it} + \mathbf{X}_{it}\gamma + \mu_i + \delta_t + \varepsilon_{it} \qquad (2)$$

Here, π_{it} represents the profits of multinational affiliate *i* in year *t*, and the other variables can be reinterpreted in analogous fashion. The new terms μ_i and δ_t represent an affiliate fixed effect (which controls for the unobserved characteristics of affiliate *i* that do not change over time) and

[8] While these affiliate-level datasets are extremely useful for research on international tax issues, they have some drawbacks. For instance, Orbis and Amadeus report ownership information only for the final year of their data. This creates the possibility of misclassification of ownership structures (i.e. of which affiliates belong to which parents in years prior to the final year). Budd, Koenings and Slaughter (2005) argue that under reasonable assumptions, such misclassification would primarily create a bias against finding significant results. Another important point to bear in mind is that these datasets report financial statement information rather than tax return information. This distinction is important, though its significance is somewhat mitigated in countries with a high degree of book-tax conformity.

a year fixed effect (which controls for unobserved common changes in the profitability of all affiliates in a given year), respectively.

Note that that tax incentive variable τ_{it} is now the tax incentive for profit shifting to or from affiliate *i* in year *t*. Changes in the tax differential between affiliate *i* and its parent (or other affiliates in its group more broadly) are typically generated by tax reforms in either affiliate *i*'s country or in the country of the parent or the group's other affiliates. Thus, they are unlikely to be attributable directly to the affiliate's own behavior or choices. However, a remaining concern with the approach in Equation (2) is the possibility that changes in a country's corporate tax rate that change τ_{it} may be correlated with other changes in policy or the economic environment that also independently affect affiliate *i*'s profits. It is feasible to add country-by-year fixed effects to Equation (2) to absorb any unobserved common change in profitability, for instance, to all multinational affiliates located in Estonia in 2008 (although this is rarely implemented in practice). If τ_{it} is measured as the tax rate difference between affiliate *i* and its parent, it is not possible to include country-pair-year fixed effects (which would absorb any unobserved common change in profitability, for instance, to all German-owned affiliates located in Estonia in 2008).[9]

The preceding discussion summarizes the primary approach used in the economic literature on BEPS. There are, in addition, some other approaches that have been implemented. For instance, a quite distinct tradition in the tax accounting literature uses consolidated data from Compustat on the worldwide operations of US firms to analyze BEPS (e.g. Collins, Kemsley and Lang, 1998)). As Compustat does not provide detailed information on each foreign affiliate, the objective is to test whether US-based MNCs shift income from the US to their foreign affiliates (considered as a whole). The basic method is to regress the ratio of foreign pretax income to foreign sales on measures of the foreign tax rate (FTR; interpreted as a measure of the strength of the incentive to shift income abroad). The FTR is weighted by the distribution of the firm's activities across jurisdictions, based on its current mix of operations. The regression controls for the ratio of worldwide income to worldwide sales, and the unit of observation is a (US-based) MNC in a given year. Klassen and Laplante (2012) is an important recent example of this approach, analyzing a panel of US firms with foreign income over 1988-2009.

[9] If the tax incentive variable uses the tax rates uses information on the tax rates faced by all of the group's affiliates, then it may be possible to control for country-pair-year fixed effects, but extensive variation in the tax rates of third countries would be required.

The premise of this approach is that accounting rates of return would be equalized across US and foreign operations in the absence of income shifting; differences in accounting rates of return that are related to FTR are interpreted as being attributable to income shifting. While it has the advantage of being implementable with the widely-available Compustat database and directly addresses important and policy-relevant questions about income shifting out of the US, there are significant empirical challenges that confront this approach. The amount of income shifted and the mix of operations that give rise to the FTR measure are all endogenous choices of the firm. In contrast to the estimation of Equation (2) with unconsolidated affiliate-level data, it is not possible to use changes in local tax rates as a source of arguably exogenous variation. Klassen and Laplante (2012) seek to address these challenges by using an instrumental variables (IV) strategy based on lagged FTR.

A novel development of this approach from the accounting literature is represented by Dyreng and Markle (2013). Their method of estimating income shifting is based on the premise that the allocation of a US-based MNC's sales between US customers and foreign customers is relatively nonmanipulable, given the fixed location of final consumers. Based on this premise, they argue that it is possible to directly estimate the direction and extent of income shifting by analyzing differences between the location of US MNCs' sales and the location of their reported earnings. This approach does not require imposing the assumption that accounting rates of return would be equalized across US and foreign operations in the absence of income shifting. However, it relies heavily on the premise that the location of sales is nonmanipulable and that it is not influenced by income-shifting strategies.

Dharmapala and Riedel (2013) also propose a new approach to measuring BEPS that departs in significant respects from the Hines-Rice approach. In the thought experiment underlying the test in Equation (2), the tax rate differential between country *i* and the parent country (or the various other countries in which the MNC operates) changes for exogenous reasons; the coefficient β_1 captures the sensitivity of profits reported by affiliate *i* to this change. An alternative thought experiment that also has the potential to illuminate the magnitude of BEPS is to imagine that a dollar were to exogenously appear, like manna from heaven, in affiliate *i*'s parent. Given some structure of profit shifting that is already in place, it would then follow that some fraction of this dollar would be shifted to affiliates facing a lower tax rate than the parent. If affiliate *i* is low-tax, then it would be expected that some fraction of this dollar

would ultimately be reported among affiliate *i*'s profits. This would not apply, however, to affiliates facing a higher tax rate than that of the parent. Thus, high-tax affiliates serve as a control group in this approach, to take account of nontax reasons – such as risk-sharing within the MNC, or the operation of internal capital markets – that increases in the parent's income may be reflected in the reported income of its affiliates.

A challenge facing this approach is to isolate a source of exogenous changes to the income of the parent firm ("income shocks"). Dharmapala and Riedel (2013) adapt an approach developed in a different context by Bertrand, Mehta and Mullainathan (2002), and construct an expected earnings shock variable based on the earnings of firms that operate in the same industry and the same country as the parent firm. This provides a measure of the parents' exogenous income before taxes and before profit shifting activities. Dharmapala and Riedel (2013) use the Amadeus dataset described above. The sample – which consists of over 18,000 observations on approximately 4800 multinational affiliates over the period 1995–2005 – is restricted to affiliates that operate in a different industry and country from their parent firms, so that the earnings shocks experienced by the parents do not directly impact the affiliates.

The basic specification estimated in Dharmapala and Riedel (2013) is:

$$\log \pi_{it} = \beta_1 \log \widehat{\pi_{it}} + \beta_2 (d_{it} * \log \widehat{\pi_{it}}) + \mathbf{X}_{it}\gamma + \mu_i + \delta_t + \varepsilon_{it} \qquad (3)$$

Here, $\widehat{\pi_{it}}$ is the "income shock" experienced by affiliate *i*'s parent in year *t* (computed using the approach outlined above). The indicator variable d_{it}= 1 if affiliate *i* faces a lower tax rate than its parent, and is 0 otherwise. The coefficient of interest here is β_2, which represents the extent to which an income shock to the parent is reflected in the pretax income of a low-tax affiliate, relative to the extent to which it is reflected in the pretax income of a high-tax affiliate of the same parent. The other variables are as defined previously, with $\mathbf{X}_{it}$ including various controls (including assets and, in some specifications, the tax rate). In essence, the empirical strategy here is to compare the differential impact among low-tax and high-tax affiliates of a common shock to the same parent, controlling for other factors that may affect affiliates' reported profits. This approach also readily allows for the inclusion of country-pair-year fixed effects, which absorb any unobserved common change in profitability, for instance, to all German-owned affiliates located in Estonia in 2008.

4) An Overview of the Findings of the Empirical Literature

4.1) The Magnitude of BEPS

Having described the conceptual foundations of the various approaches used in the empirical literature, we now turn to a summary of the findings, focusing on the magnitude of the estimated extent of BEPS. For this purpose, the coefficient β_1 in Equations (1) and (2) has a particularly straightforward economic interpretation. Recall that specifications of this type regress the log of pretax income (π_{it}) on a measure of the tax incentive for BEPS (τ_{it}). If the analysis were to regress the level rather than the log of pretax income on τ, then the estimated coefficient would be interpreted as the effect of a 1 unit change in τ (typically, a change of 1 percentage point in the tax differential) on pretax income (measured in dollars, euros, or other monetary units). However, as the dependent variable is the log of pretax income, the coefficient β_1 represents what is known as the "semi-elasticity" of pretax income with respect to τ.

The semi-elasticity represents the percentage change in pretax income associated with a 1 percentage point change in τ. For instance, an estimate that β_1 = 0.8 would imply that a 10 percentage point increase in the tax rate differential between affiliate *i* and its parent (for instance, because the tax rate in affiliate *i*'s country falls from 35% to 25% while the tax rate in the parent's country remains unchanged) would increase the pretax income reported by affiliate *i* by 8% (for example, from $100,000 to $108,000). Note that the precise interpretation depends on the definition of τ (which can represent the affiliate's tax differential *vis-à-vis* its parent, or a more complex measure of its tax rate relative to the rates faced by other affiliates within the same multinational group).[10] It is also important to note is that the semi-elasticity varies for different values of τ. Typically, the reported semi-elasticity is evaluated at the sample mean. For instance, if the mean tax rate in the data were 35%, then the semi-elasticity that is reported in the literature and that we discuss below pertains to small changes in τ around the mean value of 35%. The reported semi-elasticity cannot necessarily be extrapolated to changes in τ that are large, or that take as their starting point values of τ that are far from the mean.

[10] When the tax incentive is measured as a tax rate difference (whether between the affiliate and its parent or between the affiliate and all other affiliates), β_1 would be expected to be positive in sign (i.e. a larger tax differential is associated with higher reported income). If the tax incentive were to be measured as the affiliate's local tax rate (as in some studies), β_1 would be expected to be negative in sign (i.e. a lower local tax rate is associated with higher reported income).

A convenient starting point for our description of the findings of the BEPS literature is Huizinga and Laeven (2008). They use cross-sectional firm-level data for 1999 on European firms from the Amadeus database (described in Section 3 above) to estimate a regression analogous to that in Equation (1). They compute a measure of τ that takes account of the tax rates faced by all of the multinational group's affiliates. Using this approach, they estimate both an overall semi-elasticity of BEPS across Europe, and also a set of BEPS estimates for each country (representing the extent of profit shifting out of that country by affiliates located there) in their dataset. The overall estimate of the semi-elasticity is 1.31 (i.e. a 10 percentage point increase in the tax incentive to shift income to affiliate *i* is associated with a 13.1% increase in the income reported by affiliate *i*).

An illustrative example of their country-specific BEPS estimates is the following. Austria has a tax rate of 34%, which is close to the mean tax rate in their sample, and the semi-elasticity for income shifting out of Austria is estimated to be 1.07. The lowest-tax country in the sample is Hungary (with a tax rate of 18%). Thus, it can be inferred that approximately 17% of income generated in Austria by multinational groups with Hungarian affiliates is shifted to Hungary (this is obtained by multiplying the tax rate differential between the two countries of 16 percentage points by the semi-elasticity of 1.07 for Austria, and is subject to the caveat that using the semi-elasticity in relation to large tax rate changes or differences may be misleading). This example of the two halves of the erstwhile Habsburg Dual Monarchy serves to illustrate the relatively large effects found by Huizinga and Laeven (2008).

The magnitude of the effect in Huizinga and Laeven (2008) is substantially smaller than those estimated in earlier studies using aggregate country-level data.[11] This suggests that controlling for unobserved country-specific and industry-specific factors that may affect reported pretax income (as Huizinga and Leuven (2008) are able to do) substantially lowers the estimate of BEPS. Moreover, the literature since then has used panel data from Amadeus and elsewhere to estimate regressions similar to Equation (2). These allow researchers to go further and control for unobserved affiliate-specific characteristics that may affect reported pretax income.

[11] For example, Hines and Rice (1994) report a number of different estimates using different approaches. However, a representative estimate using ordinary least squares (OLS) is a semi-elasticity of 2.25 (see Table II, Column 2, p. 163, where the coefficient is reported as negative because the tax variable is the local tax rate rather than a tax differential). Moreover, Heckemeyer and Overesch (2013) report that many other early studies using country-level data found even larger magnitudes.

The estimates of BEPS using panel data and affiliate fixed effects are considerably smaller than those found by Huizinga and Leuven (2008). Dischinger (2010) uses Amadeus data on a panel of European affiliates over the period 1995-2005 to estimate a model that resembles Equation (2). He finds a semi-elasticity of 0.7 – i.e. a 10 percentage point increase in the tax rate differential between an affiliate and its parent is associated with a 7% increase in profits reported by that affiliate. This is an overall estimate; for profit shifting between parents and their lower-tax affiliates, the Amadeus data implies a lower semi-elasticity of about 0.5 (see Dischinger, Knoll and Riedel (2013), as discussed below). Lohse and Riedel (2013) use a more recent panel of Amadeus data (over 1999-2009) and find a semi-elasticity of about 0.4 – i.e. a 10 percentage point increase in the tax rate differential between an affiliate and its parent is associated with a 4% increase in profits reported by that affiliate.

There are a large number of other studies that use various approaches and datasets to obtain estimates of BEPS. Heckemeyer and Overesch (2013) collected 238 estimated semi-elasticities from 25 separate academic studies of profit shifting. They use this meta-dataset to conduct what is known as a "meta-regression." This involves regressing the semi-elasticities on various identifiable characteristics of the dataset (e.g. whether it is cross-sectional or longitudinal) and of the empirical approach (e.g. whether firm fixed effects are included). The meta-regression approach enables them to pinpoint the specific characteristics of different studies that are responsible for the widely varying magnitudes of the estimates. Not surprisingly, in view of our discussion so far, the innovations introduced in the more recent studies (such as the use of panel data and affiliate fixed effects) are strongly associated with smaller estimated magnitudes of BEPS.

Heckemeyer and Overesch (2013) also use the meta-regression approach to identify a "consensus" estimate from this extensive literature. This turns out to be a semi-elasticity of approximately 0.8, when controlling for the various potential sources of bias. As described above, this would imply that a 10 percentage point decrease in the tax rate faced by affiliate *i* (for instance, from 35% to 25%) would increase the pretax income reported by affiliate *i* by 8% (for example, from $100,000 to $108,000). Thus, although the meta-sample assembled by Heckemeyer and Overesch (2013) includes many of the early studies that used aggregate country-level data and found very large effects, the consensus estimate of the literature as a whole is much closer to the smaller effects that have been estimated by recent studies. We will

use this 0.8 semi-elasticity for illustrative purposes to summarize the current consensus that emerges from the literature that uses the general approach encapsulated in Equations (1) and (2). However, it should be borne in mind that, as discussed above, the latest estimates using the most current data are considerably smaller than this consensus estimate.

Research using the German MiDi dataset (which includes information on both foreign affiliates of German-based multinational firms and German affiliates of foreign multinationals) has also used a similar approach. Weichenrieder (2009) uses both types of data to analyze profit shifting into and out of Germany, using a panel of affiliates over the period 1996-2003. In particular, he studies the impact of foreign home-country tax rates on the return on assets (ROA) reported by German affiliates of foreign multinationals. An increase in a foreign parent's home country tax rate of 10 percentage points (e.g. from 25% to 35%) entails an increase in the ROA of its German affiliates of about half a percentage point (e.g. from about 5.5%, the approximate mean in the sample, to about 6%). This is a magnitude that is broadly comparable to the consensus estimate discussed above, but is only of borderline statistical significance. There is no statistically significant overall evidence of profit shifting by German multinationals towards their foreign affiliates, although there is some evidence that the extent of profit shifting may be greater for the subset of affiliates that are wholly owned by their German parents.

Buettner *et al*. (2012) use the MiDi data on foreign affiliates of German-based multinationals, in particular a panel of affiliates over the 1996-2004 period, to analyze the effects of tax rates and rules on the use of debt by multinational affiliates. They find a modest impact of tax rates on the use of inter-affiliate debt. A 10 percentage point increase in the local statutory tax rate (e.g. from 25% to 35%) is associated with an 8% increase (around the sample mean) in an affiliate's ratio of internal debt to total capital. The mean debt ratio in this sample is 0.28, so this corresponds to an increase from a debt ratio of 0.28 to one of 0.30. Moreover, the income shifting associated with this change would be even smaller, as the semi-elasticity of the debt ratio would have to be scaled by the interest rate to determine the amount of income shifted *via* the increase in internal debt. The effect found by Buettner *et al*. (2012) is somewhat smaller (though not dramatically so) than that reported by Desai, Foley and Hines (2004): using the confidential firm-level BEA dataset, they find a corresponding semi-elasticity of 10% for the internal debt of affiliates of US multinationals (i.e. a 10 percentage point increase in the local statutory tax rate is associated with a 10% increase in internal debt).

While the underlying effect of taxes on internal debt is small, Buettner *et al*. (2012) find a relatively large impact of thin capitalization rules. These rules deny interest deductibility when the debt ratio (typically, the internal debt ratio) exceeds some specified threshold (for instance, the US threshold is a debt to equity ratio of 1.5 to 1). When thin capitalization rules are introduced or tightened, Buettner *et al*. (2012) find that the tax sensitivity of the internal debt ratio falls by about a half. Thus, thin capitalization rules seem to matter, but the background magnitude of inter-affiliate debt-shifting is quite small. Of course, it should be remembered that debt-shifting is only one potential channel through which BEPS may operate, and this analysis does not account for strategic transfer pricing or the location of intangible assets.

As explained in Section 3 above, the approach of Dharmapala and Riedel (2013), as represented by Equation (3), is quite different from the approaches discussed so far. The essential idea is to construct arguably exogenous income shocks to parent firms in a given year (using the income of other firms in the same country and industry in that year), and to analyze the extent to which this "unexpected" income of the parent is shifted to its low-tax affiliates abroad, relative to the extent to which this "unexpected" income is shifted to its high-tax affiliates abroad. Controlling for a variety of potential confounding factors (including unobserved affiliate and year effects, industry-year effects and country-pair-year effects), the baseline specification suggests that a 10% increase a parent's profits (before taxes and before shifting) is associated with an increase of 0.4% in the profits reported at that parent's low-tax affiliates (relative to the increase in the profits reported at that parent's high-tax affiliates).[12]

The average parent profit in the sample is $220 million, so a 10% increase at the sample mean represents an increase of $22 million (e.g. from $220 million to $242 million) as a result of the arguably exogenous shock. The average profits reported at low-tax affiliates is $7.7 million, so a 0.4% effect entails an increase of $30,000 in the profit reported by a given low-tax affiliate. On average, each parent has 14 low-tax affiliates in the Amadeus dataset. Thus, this estimate implies that of the original $22 million increase in the parent's income, a total of $420,000 is

[12] The focus of the analysis is on profit shifting from parents to low-tax affiliates. However, it is possible to use the same approach to analyze the impact of income shocks to all high-tax affiliates of a multinational group on the income reported by low-tax affiliates. This leads to fairly similar, albeit statistically weaker, results (Dharmapala and Riedel, 2013).

shifted to low-tax affiliates throughout Europe. This represents about 2% of the increase in the parent's income.[13]

The Hines-Rice approach to measuring BEPS (represented by studies implementing Equations (1) and (2)) is primarily designed to answer the question of how an affiliate's reported profits will change in response to a change in the tax rate that it faces. The approach in Dharmapala and Riedel (2013), on the other hand, yields a more direct answer to the question of what fraction of a parent's (or high-tax affiliate's) profit is shifted to low-tax affiliates, a question of great relevance to the current debate on BEPS. In terms of this debate, an estimate that only 2% of parents' income is shifted to low-tax affiliates may seem quite small, and raises the question of how it relates to the estimates derived from the Hines-Rice approach.

With some additional assumptions, it is possible to use the estimates from the Hines-Rice approach to also address the question of the fraction of income that is shifted. In the Amadeus data, the semi-elasticity of income-shifting from the parent to its low-tax affiliates is about 0.5 (see Dischinger, Knoll and Riedel (2013)) – i.e. a 10 percentage point increase in the tax incentive to shift income from the parent to affiliate *i* is associated with a 5% increase in the income reported by affiliate *i*. The average tax rate differential between parents and their low-tax affiliates in the Amadeus data used by Dharmapala and Riedel (2013) is 7.7 percentage points. Multiplying the semi-elasticity by this tax rate differential approximates the fraction of income that is shifted from the parent to its low-tax affiliates. For instance, imagine a simple world in which an MNC has two affiliates, one at home and one in a foreign country, and both affiliates face a 30% tax rate (so there is no tax-motivated profit shifting).Suppose initially that both affiliates report $100 of income. Now suppose that the foreign jurisdiction lowers its tax rate to 22.3%: the 0.5 semi-elasticity implies that income reported in the foreign jurisdiction will rise by a little under 4% (to about $104), and this will also represent the fraction of the parent's income that is shifted.

This example suggests that the Dharmapala and Riedel (2013) approach yields smaller quantitative estimates of BEPS than does the Hines-Rice approach. However, the difference (between 2% of parent profits and under 4% of parent profits being shifted) does not seem

[13] No financial data is available in Amadeus for non-European affiliates. However, assuming that the income-shifting behavior estimated among EU-25 affiliates can be straightforwardly extrapolated to subsidiaries outside Europe, a parent would on average shift profits of $564,000 to affiliates globally, representing 2.6% of the pre-shifting profit shock of $22 million (Dharmapala and Riedel, 2013).

dramatic. One reason for the lower estimates in Dharmapala and Riedel (2013) may be that their dataset is restricted to affiliates that operate in a different industry than the parents (so that the income shocks that affect the parent's industry do not directly affect affiliates). This potentially reduces the scope for the use of strategic transfer pricing between the parent and its affiliates. Indeed, supplemental analysis in Dharmapala and Riedel (2013) suggests that much of the profit-shifting captured by this approach is attributable to the use of debt across affiliates. This does not imply, however, that in reality transfer pricing is unimportant to BEPS; rather, it is more difficult to measure using this particular approach. We discuss further the question of how to interpret these magnitudes in Section 5 below.

Dyreng and Markle (2013), using the approach described in Section 4, provide an estimate of the fraction of US parents' income that is shifted to all foreign affiliates collectively. Their empirical approach involves comparing the foreign sales of US MNCs (assumed to be relatively nonmanipulable) with the income reported at home and abroad. The Compustat data that they use (a panel of US firms with significant foreign income over the period 1997-2011) does not permit affiliate–level analysis, but includes information on foreign and domestic sales, income and tax expense. The baseline estimate of outbound shifting entails that about 10% of US MNCs' domestic income (measured in pretax and pre-shifting terms) is shifted to foreign affiliates. As the authors concede, this may represent an overestimate because direct sales from foreign affiliates of US MNCs to US customers will be captured in the data as domestic sales (Dyreng and Markle, 2013, p. 25). However, these sales will at the same time give rise to foreign income, and thus this empirical method will attribute this pattern (i.e. the combination of domestic sales and foreign income) to income shifting out of the US. In fairness, however, it should be emphasized that the primary purpose of Dyreng and Markle (2013) is not to estimate the magnitude of BEPS *per se*, but to test whether income shifting differs across different subsets of US MNCs, for instance those that are financially constrained versus those that are not.

The empirical literature has also sought to identify the channels through with BEPS occurs. The primary channels are generally thought to be strategic transfer pricing (for instance, charging relatively low prices for goods and services transferred from high-tax to low-tax affiliates) and the strategic use of inter-affiliate debt (for instance, financing the activities of high-tax affiliates using debt issued by low-tax affiliates) – see Dharmapala (2008) for a simple discussion. One approach that has been adopted in the literature to distinguish between these

channels is to compare the effect of the tax variable on pretax profit (which includes financial income and payments) with the effect of the tax variable on earnings before interest and taxes (EBIT). The effect on pretax profit represents the combination of strategic transfer pricing and the strategic use of debt, whereas the effect on EBIT isolates the consequences of strategic transfer pricing.

The meta-regression study by Heckemeyer and Overesch (2013) seeks to calculate the fraction of BEPS that is attributable to strategic transfer pricing, using the results of studies that distinguish between pretax profit and EBIT. They argue that the consensus among these studies is that about 70% of the estimated magnitude of BEPS is due to strategic transfer pricing, with the remainder attributable to the strategic use of debt. However, it should be borne in mind that this is based on a smaller sample of studies than the calculation of the consensus magnitude. Many studies do not distinguish between pretax profit and EBIT, while others (by design or construction) only aim to estimate one or the other of these channels. For instance, Buettner *et al*. (2012) focus on debt ratios, while Bartelsmann and Beetsma (2003) and Clausing (2001; 2003) focus on the impact of tax differentials on transfer prices. As previously noted, the approach in Dharmapala and Riedel (2013) may be more suitable for capturing the effect of debt-shifting rather than strategic transfer pricing.

4.2) A Brief Review of Other Issues Related to BEPS

The previous discussion has presented an overview of a number of different approaches to estimating an overall magnitude of BEPS. The aim of Section 5 is to interpret the implications of these estimates and to place them in the context of current policy debates. Before proceeding to this task, however, it is helpful to briefly survey the existing evidence (or in some cases the lack thereof) with regard to five more specific issues relating to BEPS that have attracted considerable attention in recent policy debates and in academic discourse.

4.2.1) Parent-to-Foreign versus Foreign-to-Foreign Shifting

It has been established in the literature using Amadeus data on European firms that the magnitude of BEPS that involves shifting profits from parents is significantly lower than other types profit shifting. In particular, Dischinger, Knoll and Riedel (2013) run a regression similar to Equation (2) where the tax variable is the difference between the affiliate and its parent. To this, they add the variation of considering separately MNCs where the parent has a higher tax rate than the affiliate. They find that the semi-elasticity for income shifting from parents to low-

tax affiliates is 0.5 (i.e. a 10 percentage point increase in the tax incentive to shift income from the parent to affiliate *i* is associated with a 5% increase in the income reported by affiliate *i*), whereas the magnitude of shifting from high-tax affiliates to parents is substantially larger.

This asymmetry suggests the existence of disincentives to shift income away from parents. These may be attributable to tax or nontax reasons, or to some combination of the two. For instance, agency costs between the managers of the parent and managers of affiliates may make the former reluctant to shift income to the latter. Alternatively, repatriation taxes that make it costly to return funds to the parent, or CFC rules that render shifting out of the parent pointless, may account for this asymmetry.

In discussions of US MNCs, there generally seems to be a presumption that foreign-to-foreign shifting is more prevalent than shifting out of the US. For instance (although this issue is not the focus of their paper), Desai, Foley and Hines (2003) find a sensitivity among US MNCs to tax rate differences within Europe that is substantially greater than their sensitivity to tax rate differences elsewhere. The 1997 check-the–box regulations are generally thought to have facilitated foreign-to-foreign shifting.[14] However, there appear to be no explicit test with firm-level US data that mirrors the Dischinger, Knoll and Riedel (2013) findings. Indeed, some empirical approaches (e.g. Klassen and Laplante (2012), Dyreng and Markle (2013)) can by design only estimate US to foreign shifting, not foreign-to-foreign shifting.

This is an important issue, as the insight that foreign-to-foreign shifting benefits US national welfare has played a major role in discussions of international tax policy (e.g. Shaviro, 2011). The relative prevalence of foreign-to-foreign and US-to-foreign shifting is important in determining optimal CFC rules under either the current regime or a potential territorial regime. However, direct empirical evidence on this point is limited. Perhaps the most closely related evidence is in Markle (2012), which is discussed in more detail below. He finds that foreign-to-foreign shifting is very similar for MNCs based in territorial and worldwide regimes (including the US), while parent-to-foreign shifting is more prevalent among MNCs domiciled in territorial countries than those domiciled in worldwide countries (including the US).

4.2.2) Real Economic Activity, Intangible Assets, and BEPS

[14] Indeed, Desai and Dharmapala (2009) use the check-the-box regulations as an exogenous source of variation in US MNCs' tax avoidance activities.

As a general matter, the impact of taxes on the location of real economic activity and on income shifting are quite distinct phenomena. For instance, in an influential model of tax competition, Devereux, Lockwood and Redoano (2008) view countries as competing for real activity through their average effective tax rates, and competing for reported profits through their statutory tax rates. However, there may exist specific interactions between them – e.g. transferring intangible property to a foreign low-tax jurisdiction may be easier if some research facilities are also moved to that same jurisdiction. Considering these potential interactions also leads us to a branch of the literature that focuses on the role of intellectual property and intangible assets in income shifting.

The emphasis on intangible assets in this literature owes much to Grubert (2003), who uses a cross-section of corporate tax returns of US firms from 1996, including separate information on CFCs owned by these US firms. This data is linked to Compustat data on these parents to generate a dataset of 1751 CFCs owned by 389 parents. He regresses the ratio of a CFC's pretax earnings scaled by sales on a number of variables, including the local statutory corporate tax rate and measures of the parent's R&D intensity. The main finding relates to the interaction between parent's R&D intensity and the local tax rate, and suggests that the pretax earnings of CFCs with R&D-intensive parents are much more sensitive to local tax rates than are the pretax earnings of other CFCs.

Grubert (2003) conducts additional analysis on the location choices of 728 US MNCs engaged in manufacturing. A probit regression of whether a US MNC locates in each of 60 countries finds that R&D intensive firms are disproportionately attracted to both locations with very low tax rates and those with very high tax rates. The idea here is that opportunities for BEPS not only make low-tax locations attractive, but also reduce the disincentive to invest in high-tax locations (as income can be shifted out of those jurisdictions, at least by R&D intensive firms). Thus, BEPS opportunities shape location choices for real activity. This latter insight has been developed in a number of directions in the literature. One strand highlights the possibility that BEPS opportunities may reduce distortions to the location of real activity and thereby potentially enhance efficiency (see Hong and Smart (2010) for a formal theoretical model, and Dharmapala (2008) for an informal discussion).

More recent literature on the role of intangibles uses Amadeus data on European affiliates. Dischinger and Riedel (2011) use the balance sheet item "intangible fixed assets" from

Amadeus to test whether intangible asset holdings are disproportionately concentrated among affiliates in low-tax jurisdictions, controlling for unobserved affiliate effects that may influence the ownership of intangibles.[15] They find that a decrease in the average tax difference to all other affiliates by 1 percentage point raises the subsidiary's level of intangible assets by 2.2%. This gives some credence to the argument that intangibles tend to be located in low-tax jurisdictions.

Karkinsky and Riedel (2012) link Amadeus data on European affiliates with data on patent applications to the European Patent Office. Their analysis tests whether (within a MNC group) a patent application is more likely to be made by an affiliate facing a lower tax rate (both absolutely and in relation to other group affiliates). The results strongly confirm this hypothesis, and the estimated effect is quite large (especially in relation to the estimates of income-shifting using the same Amadeus dataset that were discussed above). The implied semi-elasticity is -3.5; i.e. evaluated at the sample mean, the baseline result suggests that an increase in the corporate tax rate by 1 percentage point reduces the number of patent applications by 3.5%. The mean number of patent applications is 0.9 per year, so this implies a reduction in the number of patent applications from 0.9 to 0.87 per year. These recent empirical contributions tend to reinforce the widespread idea that intellectual property constitutes a major channel of BEPS.

4.2.3) BEPS under Territorial versus Worldwide Tax Systems

A question of great relevance for current US policy discussions is whether the magnitude of income-shifting among multinational firms with parents based in countries with worldwide tax systems differs from that among multinational firms with parents based in countries with territorial (or participation exemption) tax systems. Markle (2012) uses the Hines-Rice empirical framework (Equation (2)) to address this very policy-relevant question. The analysis uses the commercial database Orbis, compiled by the Bureau van Dijk, which reports unconsolidated financial information and ownership data for a global sample of firms and affiliates. Markle (2012) also constructs bilateral tax measures (based on Huizinga and Laeven (2008)) that take account of both corporate and withholding taxes. The paper uses a panel dataset consisting of Orbis data for the years 2004-2008. The analysis finds that firms with worldwide parents tend to shift less income than firms with territorial parents. However, there are a number of important qualifications to this basic picture. First, there is no significant difference in shifting among firms

[15] Note that Grubert (2003) could not observe the R&D intensity or the ownership of intangibles by affiliates, and proxied for this by the R&D intensity of the (consolidated) MNC.

with similar foreign reinvestment opportunities. Second, there is no difference in foreign-to-foreign shifting, but MNCs based in worldwide countries (including the US) shift less from their parent. This is perhaps due to costs associated with future repatriation from abroad to the parent.

4.2.4) Has BEPS Grown Over Time?

Another important question is whether income shifting has grown over time. There is certainly a perception that the BEPS phenomenon has become more prominent in recent years. If this is true, that may help account for the growing political salience of the issue. On the other hand (though it is perhaps not directly relevant to this question), it is worth remembering that the estimates of the magnitude of BEPS have fallen over time to the current consensus estimate of 0.8 (and lower magnitudes under some approaches). This does not of course imply that the underlying phenomenon has changed in size, but rather that its measurement has possibly become more precise.

Grubert (2012) uses a panel of tax returns for 754 US MNCs over 1996-2004 to analyze changes over time in income shifting. His analysis suggests that the share of US MNCs' income that is reported abroad has grown over this period. In itself, this is not a surprise given growing global activity, but Grubert (2012) argues that foreign income has grown 12 percentage points more than has foreign sales. The analysis hints strongly that this discrepancy is due to income shifting. Klassen and Laplante (2012) also claim that income shifting has grown over time. Holding tax rate differences between U.S. and foreign jurisdictions constant, their empirical estimates imply that their sample of 380 corporations with low average foreign tax rates collectively shifted about $10 billion of additional income out of the United States annually during 2005–2009 relative to the 1998–2002 period. Clausing (2009) also finds that income shifting increased in the latter part of her sample period (1993-2004 relative to 1982-1993).

In contrast, estimates within the Hines-Rice approach have tended to be smaller in magnitude when using more recent time periods. For instance, Lohse and Riedel (2013) find a semi-elasticity of 0.4 (about half the consensus estimate from the literature reported by Heckemeyer and Overesch (2013)) using a panel of firms from Amadeus over 1999-2009. Lohse and Riedel (2013) also formally test whether the extent of BEPS has changed over time by including in their specification an interaction between the tax measure and a linear time trend. They find that the tax-sensitivity of reported income has fallen significantly in magnitude over time. In other words, BEPS has *declined* rather than grown over their 1999-2009 sample period.

While contrary to claims that are frequently made in policy discussions about the growth of BEPS, this finding is entirely consistent with what may be expected based on the spread of transfer pricing regulation and thin capitalization rules around the globe in recent years.

4.2.5) BEPS and Tax Revenue

Finally, the consequences of income shifting for tax revenue have greatly exercised governments around the world. Huizinga and Laeven (2008) use their results (from an Amadeus cross-section for 1999) to derive substantial revenue consequences. According to their calculations (see their Table 8), Germany (the highest-tax country in the sample) lost $1.26 billion in revenue in 1999, while most other sample countries gained revenue. However, as we have seen, the magnitude of estimated income shifting is smaller in subsequent studies, and the revenue consequences would be correspondingly smaller.

Clausing (2009) directly addresses the revenue issue, using a panel of aggregate BEA at the country-year level data over 1982-2004 (this is similar to that in Hines and Rice (1994), but with multiple observations on each country). She estimates that in the last year of the sample (2004), the revenue loss to the US Treasury from income shifting amounted to over one third of corporate tax revenue. This conclusion is based on an analysis of the effect on the profit rate (pretax income scaled by sales) for all US affiliates in a given country in a given year of the effective tax rate differential with the US. This analysis yields a coefficient of 0.5. The sample mean of the profit rate is 15%, so a 10 percentage point increase in the tax differential between a foreign country and the US is associated with an increase in the profit rate of US affiliates in that country from 15% to 20% - i.e. a 33% increase, evaluated at the mean. This implies a semi-elasticity of about 3.3. Thus, the implied revenue effects in Clausing (2009) rest on an estimated magnitude of BEPS that is very large relative to those derived from firm-level studies.

It is entirely understandable that governments would be concerned about the revenue implications of BEPS. However, a number of remarks are in order here that, while they do not fully address these concerns, nonetheless help to place them in context. First, if income shifting is indeed extremely sensitive to tax rates, this would not only imply that income shifting causes large revenue losses, but also that tax rate reductions would generate large amounts of inbound income shifting (and perhaps significant additional revenue). Second, corporate tax revenues are a relatively small component of revenues for the governments of most major economies, and there exist readily available (and surely less mobile) substitutes in the form of personal income

tax or VAT revenue. Of course, this does not address the distributional consequences of substituting across different sources of revenue, a question that depends in part on the empirically unresolved issue of corporate tax incidence.

Third, while tax revenue obviously matters to governments and (non-MNC) taxpayers, from a global welfare perspective, the primary concern is not with the distribution of revenue across governments but with the real resources expended in tax planning and compliance. These represent a source of deadweight costs that should be understood primarily as a misallocation of talent (where, for example, someone who could have been another Mozart or could have found a cure for cancer instead toils away producing transfer pricing documentation). Reducing these deadweight costs can generate gains for all countries, as discussed in Section 2. Of course, national governments generally do not have political incentives to care about global welfare. However, the BEPS initiative appears to represent an exercise in multilateral cooperation, and the gains from such cooperation are best analyzed with respect to global welfare.

Finally, notwithstanding BEPS activity, corporate tax revenue in large high-tax economies has generally been robust in recent times (see e.g. Hines, 2007; Dharmapala, 2008; OECD, 2013a, p. 16). Of course, corporate tax revenue fell significantly during the Great Recession, but this decline has obvious and well-attested causes that are unrelated to BEPS. The observation that corporate tax revenue has been relatively stable does not, of course, tell us about the counterfactual – the level of corporate tax revenue in the absence of BEPS activity. However, it is nonetheless difficult to reconcile the stability of revenues with very large revenue effects of income-shifting.

5) Interpreting the Magnitude of BEPS

5.1) Is the Estimated Magnitude of BEPS Large or Small?

We now turn to the interpretation of the magnitude of BEPS that emerges from the various studies discussed in Sections 3 and 4. For concreteness, we will focus on the consensus estimate that emerges from the Hines-Rice approach, with a semi-elasticity of 0.8 (although we will introduce other ways of conceptualizing the magnitude of BEPS where appropriate). Recall that a semi-elasticity of 0.8 implies that a 10 percentage point decrease in the tax rate faced by affiliate *i* (for instance, from 35% to 25%), or equivalently a 10 percentage point increase in the

tax differential between the affiliate and other group members, would increase the pretax income reported by affiliate *i* by 8% (for example, from $100,000 to $108,000).

An important question to address is whether this should be viewed as a large effect or a small one. It is certainly smaller than earlier estimates using country-level data, but for policy purposes a more absolute notion of the size and importance of this effect would be helpful. More concretely, imagine a simple world that consists of one high-tax country (with a tax rate of 25%) and a low-tax country (with a tax rate of 15%). If these countries are otherwise identical, and (subject to the caveats expressed earlier) we apply the estimated semi-elasticity to the relatively large (10 percentage point) difference in tax rates, then an affiliate in the low-tax country that would counterfactually have reported $100,000 of income would instead report $108,000. The high-tax country would lose $8000 of domestically reported income and $2000 of tax revenue. Is this effect of tax differences "large" or "small"?

In general public discourse and policy debates, it has become increasingly common to point to the fraction of the income of US (and other) MNCs that is reported in tax havens, to US affiliate profits as a fraction of GDP in tax haven jurisdictions, or to low effective foreign tax rates as in essence self-evidently demonstrating, *ipso facto*, the existence and large magnitude of BEPS. To illustrate descriptive statistics of this type, Table 2 reports the location of various measures associated with US MNCs' foreign direct investment *via* majority-owned foreign affiliates. This table uses aggregate country-level BEA data for 2011 (the most recent available year), as reported on the BEA website (www.bea.gov). Column 5 of Table 2 shows that 42.6% of the (foreign) net income of US MNCs is reported in tax haven jurisdictions. This calculation uses the classification of havens in Dharmapala and Hines (2009), with some minor modifications to reflect subsequent changes in the political status of some jurisdictions. This large fraction of net income in havens is often cited in support of the claim that BEPS is large in magnitude and that it is an important problem for governments to address.

While the simple descriptive statistics appear compelling to many, the conclusions that are generally drawn from them are in some respects at variance with the conclusions of the empirical literature. As described in Section 4, the general trend in the development of the empirical literature has been for researchers to obtain access over time to more detailed datasets that enable the use of more rigorous empirical techniques, thereby providing more credible

estimates of the magnitude of BEPS. Over the course of these developments, accepted estimates have become smaller in magnitude.

It should be noted that the policy discourse described above and the relatively small estimates of the magnitude of BEPS in the academic literature are not necessarily in direct contradiction. The latter relate to the consequences of *marginal* changes (for instance, in tax differentials) rather than to the levels of income reported in different jurisdictions. To illustrate this difference, consider another simple stylized world consisting only of a high-tax country H (with tax rate 25%) and a zero-tax country L. Suppose initially that an H-based MNC reports $90 of income in H and $10 of income in L, as shown in Scenario 1 in Table 3. Suppose that country H reduces its tax rate from 25% to 24% (the type of small "marginal" change that the estimates from the Hines-Rice approach are well-suited to analyze). Then, if we use the consensus estimate of a semi-elasticity of 0.8 from studies using the Hines-Rice approach, income reported in H will increase to $90.7 and income reported in L will fall to $9.3 (as shown in Table 3). Consider instead Scenario 2 (also in Table 3). Here, the initial allocation of income is $60 in H and $40 in L. If we again consider a fall in H's tax rate from 25% to 24%, the allocation of income changes to $60.5 in H and $39.5 in L. The marginal effect is identical across the two scenarios. However, it is clear that policymakers will be likely to be much more concerned about the BEPS phenomenon in Scenario 2 relative to Scenario 1. An analogous pair of scenarios can be constructed to illustrate the magnitude of BEPS that emerges from the alternative Dharmapala and Riedel (2013) approach (see Table 4).[16]

In the policy discourse described above, it would be common to point to the reporting of 40% of the MNC's income in L in Scenario 2 as *ipso facto* constituting BEPS activity. In the empirical literature, the aim is to identify the income shifting effect at the margin (i.e. for small changes in tax rates or in exogenous income), controlling for both observable and unobservable country-specific and affiliate-specific characteristics that may affect reported income, and using the standards for the credibility of evidence that are *de rigueur* in contemporary empirical economics. In contrast, the allocation of 40% of income to country L in Scenario 2 might be termed an "inframarginal" phenomenon. It is difficult to explain using the estimated elasticities –

[16] Suppose that $1 of income is exogenously added to the income of the affiliate based in H. Then, given the result in Dharmapala and Riedel (2013) that 2% of unexpected parent earnings are shifted, it follows in Scenario 1 that the income reported in H will increase to $90.98 while that in L will increase to $10.02. In Scenario 2, the income reported in H will increase to $60.98 while that in L will increase to $40.02.

for example, suppose that the average tax rate among nonhavens is 25% while that among havens is zero. Then, a semi-elasticity of 0.8 would (if it were possible to extrapolate from small changes in the tax rate) imply that 20% of income (rather than 40%) would be shifted to havens.

Does the large fraction of the net income of MNCs reported in havens reflect "inframarginal" income shifting that empirical analysis cannot detect, or does it have some other explanation? Hines (2010) attributes this pattern to the use by MNCs of holding companies located in havens. To illustrate this point, consider a US MNC that invests in France *via* a haven affiliate. It injects $1000 of equity into the latter, which lends the money to the French affiliate. The latter then uses the funds for active investment that generates a return of $100. If this $100 is paid as interest to the haven affiliate (and not subsequently repatriated to the US parent), then the haven affiliate will have $100 of net income (100% of the MNC's foreign income) while the French affiliate will have net income of zero (and 0% of the MNC's foreign income). Hines (2010) argues that value added (which equals sales minus the cost of inputs purchased, and excludes financial payments such as interest income or expense) is a more meaningful measure of the role of havens. Indeed, as shown in Column 6 of Table 2, the share of value added in havens is substantially smaller than the corresponding share of net income. Specifically, the share of value added in havens is 14.5% (this is somewhat larger but quite comparable to the figure reported by Hines (2010) for 2004).

Table 2 reports some evidence supportive of the Hines (2010) argument. The Netherlands does not appear on standard lists of tax havens and does not have a particularly low tax rate, but it is widely believed to be the location of a large number of holding companies owned by MNCs. The Netherlands shares with havens the same pattern of a much higher share of net income than of value added. This suggests that holding companies do indeed account for the large fraction of MNCs' net income reported in havens.

The question that follows from this is whether net (financial) income or value added is a better proxy for taxable income, bearing in mind that the BEPS phenomenon is fundamentally about the shifting of *taxable* income across borders. Even in the very simple example above of a US MNC investing in France *via* a haven affiliate, the answer will depend on a complex set of tax law provisions in France, the haven and the US. For example, ignoring residence country CFC rules, if the $100 interest payment from the French affiliate to the haven affiliate were fully deductible in France, then the haven affiliate's income would be $100 (of interest income) and

the French affiliate's income would be zero. This would mirror the distribution of net financial income across the affiliates. On the other hand, if the capital injection from the haven affiliate to the French affiliate were to be structured as equity, then the $100 dividend payment would typically be nondeductible in France, while it would typically be exempt under the haven's tax rules. Thus, taxable income would be zero in the haven and $100 in France, which mirrors the distribution of value added across affiliates. If the capital injection takes the form of debt, but the deductibility of the interest payment in France is limited by thin capitalization rules, earnings stripping rules or other provisions, then the pattern of taxable income would typically fall somewhere in between the distributions of net income and value added.

Thus, the question of whether net financial income or value added provides a better guide to taxable income is complex. Proponents of the *ipso facto* approach have not generally provided evidence that net financial income is a good proxy for taxable income. In principle, this question can be investigated empirically, but would require more information on taxable income and tax payments than is typically available in the datasets that are widely used in the literature. The question is important, however, because if taxable income is reasonably represented by value added, then the fraction reported in havens (about 14% for US MNCs) would be quite consistent with the relatively small estimated magnitude of BEPS.

Even if taxable income is thought to be closely approximated by net financial income, this would in part be a consequence of the use of interest deductions, as in the example introduced above. While the use of debt may be partly tax-motivated, it cannot entirely be viewed as part of the BEPS phenomenon, if BEPS is understood as consisting purely of *cross-border* tax planning. After all, even purely domestic firms in high-tax countries have a stronger tax incentive to use debt than do purely domestic firms in low-tax countries. While the cross-border setting creates new opportunities for the strategic use of debt, the component of interest deductions that is common to both domestic-only firms and MNC affiliates does not seem to fall within the scope of the BEPS phenomenon as it is generally understood (for a discussion of the treatment of MNCs' interest deductions, see Desai and Dharmapala (2013)).

5.2) Some Directions for Future Research

One of the major themes that emerges from this survey is that in the more recent empirical literature, which uses new and richer sources of data, the estimated magnitude of BEPS is typically much smaller than that found in earlier studies. Yet, the newspapers are full of

anecdotal evidence suggesting extensive income shifting among major MNCs. Consistent with a modest BEPS magnitude, but in tension with this anecdotal evidence, is the "stylized" fact noted earlier about the relative stability over time of corporate tax revenues in major economies (see e.g. Hines, 2007; Dharmapala, 2008; OECD, 2013a, p. 16).

How might we reconcile these apparently contradictory facts? Based on the relatively small marginal effects, we might posit that MNCs are rather less sensitive to taxes than was once believed. However, this would contradict the anecdotal evidence of extensive tax planning. In view of the latter, we might posit instead that MNCs have already shifted what income they can, and have reached the limits set by thin capitalization rules, transfer pricing regulations and other tax rules. Then, when tax rates change at the margin (or exogenous income is received) there would be limited scope for further shifting. However, this view is contradicted by the generally robust state of corporate tax revenues in high-tax jurisdictions such as the US and the EU.

So, the combination of observations described above is somewhat puzzling. However, one feature of MNCs' tax planning activities that has sometimes been remarked upon in the literature (but only rarely been the direct focus of study) is the considerable heterogeneity in the apparent tax sophistication of MNCs. For example, Desai, Foley and Hines (2006) report that in 1999, only 59% of U.S. firms with significant foreign operations had affiliates in tax haven countries. Dharmapala and Riedel (2013) report that only 58% of the affiliates in their Amadeus sample belong to multinational entities that include at least one affiliate in a non-European tax haven (such as those in the Caribbean). In other words, a surprisingly large fraction of MNCs do not have tax haven affiliates, a characteristic that might be seen as a fairly reliable indicium of tax planning activity.

The evidence on heterogeneity might perhaps be viewed as consistent with the existence of significant fixed costs of tax planning. If this is the case, then larger firms (or those expecting more benefits from planning) will incur the fixed cost. These firms will appear to be highly responsive to tax differentials, and will generate extensive anecdotal evidence of tax planning. Smaller firms will not incur the fixed cost and so will appear to be relatively unresponsive to taxes (and may forego even apparently obvious planning opportunities). There is some existing evidence that is consistent with this fixed costs view. For instance, Mills, Erickson and Maydew (1998) use data from a confidential survey about the tax planning practices of 365 large US firms. Consistent with the existence of fixed costs, tax planning expenditures are decreasing (as a

proportion) in firm size. In addition, MNCs tend to invest more than domestic firms. Tax planning expenditures are also found to generate an extremely high rate of return, raising the puzzle of why more is not invested in this activity.

There is an extensive and growing literature across a number of disciplines that analyzes corporate tax avoidance. For instance, Desai and Dharmapala (2006) analyze the impact of corporate governance and executive compensation on tax avoidance activity. However, there is very little literature apart from Mills, Erickson and Maydew (1998) that is directly on the process and structure of corporate tax planning. Future research in this area may shed light on the apparent puzzles highlighted above.

Also highly relevant to these issues of heterogeneity and the structure of tax planning is evidence on whether or not MNCs generally operate at or near the current legal limits on BEPS activities. For instance, an example is provided by the thin capitalization rules studied by Buettner *et al*. (2012). These rules are typically specified in terms of a maximum threshold of internal debt to total capital that an affiliate must remain below in order to be permitted to deduct interest payments. However, if the threshold is exceeded, it is typically only the incremental interest expense that is disallowed. It might thus seem that if a country imposes a 0.6 debt ratio, all multinational affiliates should aim to maintain a 0.6 debt ratio.[17] Evidence on the extent to which firms operate at limits of this type, and on the heterogeneity in their behavior, would also provide valuable insights into the apparent puzzles highlighted above.

The example of thin capitalization rules discussed above raises the more general question of the importance of existing legal and economic frictions as constraints on BEPS. Another fruitful area for future research would be to model these frictions more precisely, and to explore how we might assess their implications for the efficiency of the current international tax regime and for proposed reforms.

6) Conclusion

The unprecedented attention currently being paid to the issue of base erosion and profit shifting creates new opportunities for reform. At the same time, it has become even more

[17] The descriptive statistics in Buettner *et al*. (2012) suggest that for the US, the mean total debt ratio (of internal plus external debt) is about 0.6, which is the limit imposed by the US earnings stripping rule. However, it is not clear that this pattern holds for other countries. This may, at least in part, perhaps be due to German CFC rules that tax low-taxed foreign passive income (such as interest received in a tax haven) at 25% (see Ruf and Weichenrieder (2009)).

important to understand the findings of the empirical literature on BEPS. This paper provides a survey of the empirical literature on tax-motivated income-shifting within multinational firms. Its emphasis is on clarifying what is known about the magnitude of BEPS. It introduces a simple conceptual framework that helps to clarify aspects of governments' responses to the BEPS phenomenon and the potential role of the OECD initiative. The paper then discusses different empirical approaches to the measurement of BEPS. A major theme of this survey is that in the more recent empirical literature, which uses new and richer sources of data, the estimated magnitude of BEPS is typically much smaller than that found in earlier studies. The paper provides a framework within which to conceptualize this magnitude and its implications for policy. It concludes by highlighting the importance of existing legal and economic frictions as constraints on BEPS, and discussing possible ways in which future research might model these frictions more precisely.

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Table 1: Payoffs of Countries A and B

		Country B	
		CFC Rule	No CFC Rule
Country A	CFC Rule	100, 100	90, 106
	No CFC Rule	106, 90	96, 96

Table 2: Location of US MNCs' Direct Investment *via* Majority-Owned Affiliates in 2011

	Total Assets	Net PPE	Cap. Exp.	Sales	Net Income	Value Added	R&D	Empl. Comp.	No. of Empl.
All countries	20699	1202	190	5969	1115	1445	46	536	11,785
% in Havens	32.2	11.1	8.8	21.8	42.6	14.5	10.1	7.3	4.9
% in the Netherlands	8.6	1.6	2.1	3.8	13.4	2.4	3.1	3.2	1.9

Note: Based on author's calculations, using aggregate country-level data for 2011 from the Bureau of Economic Analysis (BEA) obtained from the BEA website at www.bea.gov. "PPE" is plant, property and equipment; "Cap. Exp." is capital expenditures; "R&D" is research and development; "Empl. Comp." is employee compensation; "No. of Empl." is the number of employees. All monetary variables are reported in billions of US dollars, and the number of employees is reported in thousands. Havens are defined using the classification in Dharmapala and Hines (2009). Subsequent to that classification, the Netherlands Antilles was dissolved. The jurisdictions that were formerly part of the erstwhile Netherlands Antilles (Curaçao, Sint Maarten, and what the BEA terms "Netherlands Islands, Caribbean") are classified here in the same way that the Netherlands Antilles was classified in Dharmapala and Hines (2009).

Table 3: The Response of Reported Income to Tax Rates

		Scenario 1		Scenario 2	
		Income reported in H	Income reported in L	Income reported in H	Income reported in L
H tax rate	25%	90	10	60	40
	24%	90.7	9.3	60.5	39.5

Table 4: The Response of Reported Income to Parent's Income Shocks

		Scenario 1		Scenario 2	
		Income reported in H	Income reported in L	Income reported in H	Income reported in L
H Income	100	90	10	60	40
	101	90.98	10.02	60.98	40.02