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July 2017

WP 17/11

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Federal Reserve Board of Governors

Working paper series | 2017

SAID BUSINESS SCHOOL
UNIVERSITY OF OXFORD

The Role of Transfer Prices in Profit-Shifting by U.S. Multinational Firms: Evidence from the 2004 Homeland Investment Act*

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April 19, 2017

Abstract

Using unique transaction-level microdata, this paper documents profit-shifting behavior by U.S. multinational firms via the strategic transfer pricing of intra-firm trade. A simple model reveals how differences in tax rates, both the corporate tax rates across countries and the dividend repatriation tax rate over time, affect the worldwide profit-maximizing transfer-prices set by firms for intra-firm exports and imports. I test the predictions of the model in the context of the 2004 Homeland Investment Act (HIA), a one-time tax repatriation holiday which generated a discreet change in the incentives for U.S. firms to shift profits to low-tax jurisdictions. Matching individual trade transactions by firm, product, country, mode-of-transport, and month across arms-length and related-party transactions – following Bernard, Jensen, and Schott (2006) – yields a measure of the transfer-price wedge at a point in time. A difference-in-difference strategy reveals that this wedge responds as predicted by the model: In the period following passage of the HIA, the export transfer price wedge increased in low-tax relative to high-tax countries, while the *import* transfer price wedge exhibited the opposite behavior. Consistent with the form of tax avoidance known as "round-tripping", the results imply $6 billion USD of under-reported U.S. exports, nearly $7 billion USD of over-reported U.S. imports, and roughly $2 billion USD in foregone U.S. corporate tax receipts.

JEL Codes: F23, H26, F14, H25, H32

Keywords: Profit-Shifting, Transfer Prices, Intra-firm Trade, Corporate Taxes

*Arthi Rabbane and Emily Wisniewski provided excellent research assistance. Support for this research at the Michigan RDC from NSF (ITR-0427889) is gratefully acknowledged. Any opinions and conclusions expressed herein are those of the author and do not necessarily represent the views of the U.S. Census Bureau, the Board of Governors, or its research staff. All results have been reviewed to ensure no confidential information is disclosed. Federal Reserve Board of Governors, 20th and Constitution Ave, NW Washington D.C. 20036. aaron.b.flaaen@frb.gov.

1 Introduction

A large share of international trade takes place within the boundaries of the firm, and as a result the pricing of these transactions does not necessarily reflect market forces. Although trade regulations often require the price to be comparable to those undertaken at arms-length, the firm has many incentives to deviate from the arms-length principle. To take one well-known example, under-pricing the exports to and over-pricing the imports from a lower tax jurisdiction will lower the overall global tax burden faced by a multinational firm. Apart from the difficulties this presents to national tax authorities, for economists the result is a large fraction of international trade that may not behave as leading models would predict.

While a large literature looks at the many aspects of international transfer pricing – with profit-shifting motives being a prominent one – the challenge facing researchers is generally one of measurement. Obtaining the substantial amount of firm-level information required to assess whether intra-firm transaction prices mirror those at arms-length is typically only possible via costly audit proceedings. And even when rich data on transactions or balance sheet data at the firm level is available, most existing studies must assume that unobserved country-level heterogeneity that may affect intra-firm pricing decisions — potentially orthogonal to profit-shifting motives — is uncorrelated with country-level tax rates. After all, intra-firm prices could differ from those at arms length for many reasons that are unrelated to corporate tax rates.

This paper uses unique data to measure firm-level transfer-price differentials while leveraging a policy change which temporarily increased the incentives of profit-shifting. The Homeland Investment Act (HIA) – part of the 2004 American Jobs Creation Act (AJCA) – granted a one-time tax holiday for U.S. firms to repatriate foreign profits from their controlled foreign corporations. Although U.S. firms are taxed on their global income, they can defer their U.S. tax liability on foreign profits – after deducting foreign tax credits – until such funds are repatriated back to the United States. The tax rate for repatriated earnings is therefore intended to remove tax rate differentials from affecting cross-country investment behavior. By lowering the taxes faced by profits held abroad to enter the U.S., the HIA increased the value of such profits to U.S. firms. Indeed, several sources (i.e. Bradley (2016), Drucker (2011)) have highlighted the potential role of the HIA in the so-called "round-tripping" of domestic profits, in which a firm transfers profits out of the United States – typically to low-tax countries – and then moves them back under special tax pro-

visions (in this case, those granted under the HIA) for a lower overall net tax obligation. Strategic use of transfer prices is one such method of moving profits to low-tax jurisdictions.

To accurately measure the transfer-pricing behavior of firms during this policy change, I utilize the transaction-level transfer-price "wedge" first used in Bernard, Jensen, and Schott (2006). Using restricted access data from a partnership between the U.S. Census Bureau and U.S. Customs Bureau, Bernard, Jensen, and Schott (2006) matched individual arms-length (AL) and related-party (RP) transactions along a number of detailed dimensions available in the data, such as firm, country, detailed product, month, and method of transport. When used in the cross-section, the AL-RP wedge between the prices of these transactions amounts to an empirical analogue of the "comparable uncontrolled price" (CUP) method used by regulators to evaluate intra-firm prices against those at arms-length. This paper advances this measure by matching these wedges with new indicators of the nationality of the ultimate parent company, thereby identifying the U.S. multinational firms –rather than the U.S. affiliates of foreign multinationals – that would likely benefit from the HIA.

I first formalize the logic underlying the optimal profit-maximizing transfer pricing behavior following a change in the repatriation tax rate with a simple two-period model that allows for transfer-pricing on both export and import transactions. Following other models of transfer-pricing behavior (see Cristea and Nguyen (2016)) the firm is free to set any finite transfer-price, but with some nonzero probability is subject to an audit which assesses fines proportional to any deviations from a comparable arms-length transaction. The model demonstrates that the optimal export transfer price is increasing in the repatriation tax rate, whereas the import transfer price is decreasing in the repatriation tax rate.[1]

To test these predictions in the data I estimate the differential response of the AL-RP transfer price wedges in the post-HIA period in countries with low relative to high corporate tax rates. This difference-in-difference strategy has a number of attractive features. The variation in statutory tax rates determines which countries would be most profitable for changes to transfer pricing behavior following passage of the HIA. In addition to the appealing measurement of transfer-price wedges in the cross-section, the use of firm-by-product-by-country fixed effects in conjunction with examining changes in the time-series serves to mitigate any time-invariant measurement issues of

[1] Alternatively, the AL-RP export *wedge* is *decreasing* in the repatriation tax rate, and the AL-RP import wedge is increasing in the repatriation tax rate.

the transfer-price wedge that may compromise its use in a static setting to capture profit-shifting.[2] The correlation of the *change* in the transfer-price wedges with low vs high tax countries identifies whether profit-shifting motives are present.

I find that the export transfer-price wedges of U.S. multinationals increase in the post-HIA period in countries with relatively low tax rates, consistent with the model's predictions for optimal profit-shifting motives. Moreover, the import transfer-price wedges of these firms move in the opposite direction: decreasing in the post-HIA period in low-tax countries, once again consistent with theory. The classification of multinationals according to the country of tax is critical in these calculations; recalculating these effects for the U.S. affiliates of foreign multinationals yields no evidence of profit-shifting. Applying these coefficients to the magnitude of relevant intra-firm trade yields rough estimates of the impact on trade and corporate tax receipts. Under the preferred specifications, I estimate that the HIA resulted in 6 billion USD of under-reported U.S. exports, 6.8 billion of over-reported U.S. imports, and roughly 2 billions USD of foregone corporate tax receipts.

These results contribute to an expanding awareness of the differential behavior of intra-firm trade flows among international trade economists. A large fraction of this recent research has focused on the role of these trade flows in profit-shifting.[3] The current paper benefits heavily from the data construction methodology outlined in Bernard, Jensen, and Schott (2006). While the authors show that their export transfer-price wedge is correlated with country-level corporate tax rates in a manner consistent with profit-shifting towards low-tax jurisdictions, the measure is also correlated with several other firm and country characteristics, such as indicators of market power and exchange rate movements.

Corporate tax avoidance has received a large increase in attention by journalists, academics, and national/international institutions in recent years. Zucman (2014) documents that the share of corporate profits booked in tax havens has increased ten-fold since the 1980s to 20 percent of the total. Looking at the mechanisms for profit-shifting activities by firms, a meta-analysis of the literature by Heckemeyer and Overesch (2013) finds that the manipulation of transfer prices can account for over two-thirds of the measured total effect. Desai, Foley, and Hines (2006) demonstrate

[2] Chief among these measurement concerns are whether the arms-length and related-party transactions are truly comparable products, despite the narrow firm-HS10-country-month-method of transport match.

[3] For an example of this differential behavior apart from profit shifting, see Neiman (2010), which demonstrates the differences in the timing and duration of price spells between arms-length and related-party trade.

that firms with more extensive intra-firm trade are more likely to use tax haven operations. The OECD in particular has advanced an ambitious action plan on "base erosion and profit shifting" (see OECD (2013)) in response to the increased evidence on these topics.

Several recent papers on transfer-pricing also find evidence of profit-shifting behavior among multinational firms. Davies et al. (2017) demonstrate the granularity of transfer-pricing differentials in France, both across the set of firms and set of destination countries (specifically, those identified as potential tax havens). In their sample, about 25 firms account for 50 percent of the intra-firm trade with tax haven countries. Most recently, Cristea and Nguyen (2016) find evidence for profit-shifting by multinationals using detailed firm-transaction data from Denmark. The authors utilize a triple-difference estimation strategy that, uniquely, takes into account strategic manipulation of *arms-length* prices in order to more closely match the optimal intra-firm transfer prices. Cristea and Nguyen (2016) find that a 10 percentage point decrease in the tax rate of a low tax country leads to a 5.7 percent drop in the export unit values of multinationals.

One common challenge confronting these prior empirical studies is the difficulty of fully controlling for time-invariant, unobserved firm-specific determinants of pricing that may be unrelated to profit-shifting motives. A large literature has developed in recent years emphasizing quality differences, transport costs, and other factors influencing pricing-to-market practices by firms.[4] To the extent that these other motivations for a particular country are correlated with statutory tax rates, this behavior could be conflated with profit-shifting. By looking at the changes of a firm-specific price wedge over a narrow time window within firm-product-country categories and coincident with a U.S. policy change, the current methodology largely overcomes this concern.

Several existing strands of literature have used the AJCA/HIA to study firm behavior. One group of papers looks at the effectiveness of the HIA in achieving its stated aim of increasing U.S. investment or hiring. Using different data sources but a similar methodology, both Blouin and Krull (2009) and Dharmapala, Foley, and Forbes (2011) find no evidence that firms repatriating under the AJCA/HIA increased domestic investment or employment. Rather, these papers find that these firms were more likely to increase payouts to shareholders via share repurchases. Although this was not an approved use of the funds as specified under the law, both papers emphasize the fungible nature of cash once it was repatriated back to the United States. Survey evidence in

[4]See Manova and Zhang (2012) and Bastos and Silva (2010) for two examples.

Graham, Hanlon, and Shevlin (2010) confirms that share repurchases were a leading use of funds freed up by the repatriations under the AJCA/HIA. Contrary to these studies, however, Faulkender and Petersen (2012) finds a significant investment response, but only in those firms deemed to be financially constrained. The conflicting results are due to different control samples used for the difference-in-difference regressions.

Perhaps the paper most closely related to the present one is Bradley (2016), which evaluates profit-shifting activity among multinational firms in the years surrounding the HIA. Using the restricted-access microdata from the Bureau of Economic Analysis, Bradley (2016) finds that affiliate-reported earnings increase by an estimated $17 billion for the express purpose of exploiting the round-tripping benefits from the AJCA/HIA. The paper also looks for evidence of the role of transfer-pricing in particular, using a measure of the related-party trade balance of the multinational firm from the BEAs data on aggregated firm trade. The results support the explanation of transfer-pricing as a mechanism for profit-shifting during this period, but are only statistically significant when restricting the effect to firms with low levels of affiliate permanently reinvested earnings.

The next section provides a brief review of the current state of transfer-pricing regulations and the statutory environment for the international taxation of multinational firms. Section 3 sketches a simple two-period partial-equilibrium model of transfer-pricing to motivate the empirical exercises. Section 4 describes the relevant details of the Homeland Investment Act, and provides basic statistics of its effect in the aggregate. A description of the data and empirical results follows in section 5. The final section offers some related areas in need of further research.

2 Background on Transfer Pricing and U.S. International Taxation

2.1 Transfer-Pricing

Recognizing the role that the pricing of intra-firm goods can play in tax avoidance efforts, most national tax authorities have put into place transfer pricing regulations. The foundation for such regulations is typically the arms-length principle, which states that intra-firm transactions should be comparable to those conducted between unrelated parties at arms-length. The OECD has been

deeply involved in the coordination and harmonization of the various concepts and regulations in place; there are nevertheless substantial cross-country differences in the regulation of transfer pricing.

There are various official and unofficial methods of fulfilling the arms-length principles in pricing an intra-firm transaction, with the most common being the comparable uncontrolled price (CUP) method. A comparable uncontrolled transaction can be either an *internal comparable* if "it is between one party to the controlled transaction and an independent party" or an *external comparable* if it is "between two independent parties, neither of which is a party to the controlled transaction" (see OECD 2010). Fulfilling the *comparable* requirement is typically the most difficult to evaluate; as a result the OECD has identified a broad array factors to take into account, such as 1) characteristics (features, quality, etc) of the product, 2) functions performed (i.e. risks assumed), 3) the contractual terms, 4) the economic circumstances of the parties, and 5) the business strategies pursued by the parties. Because of this flexibility, any observed difference between arms-length and related-party prices of seemingly similar products may not necessarily indicate tax avoidance by the firm. On the other hand, it provides substantial leeway for firms in setting intra-firm prices.

If no comparable transaction can be identified, several other methods are approved for use by the United States and other countries. Some, such as the resale price and cost-plus methods are margins-based methods, while others are based on transactional profits, such as the profit-split and transactional net margin methods.[5] These other methods generally require a greater burden of documentation, and are consequently less popular.

2.2 A Brief Overview of U.S. International Taxation

The United States uses a residence basis for the taxation of multinational firms, taxing the foreign as well as domestic income of its residents. Although U.S. multinational firms incur U.S. tax liabilities on their income earned abroad, they receive credits for any taxes paid to foreign governments. Thus, in principle the U.S. tax liability from foreign earnings is limited to the difference between foreign taxes paid and the tax payments that would have been paid if earnings were taxed at the U.S. rate.

A number of details complicate this general setup. The first is the concept of deferral. U.S. taxation of foreign income occurs only upon repatriation, and so the income earned in a particular

[5]For more information on these and other regulations on transfer pricing, see Lohse, Riedel, and Spengel (2012)

period can be re-invested abroad and any U.S. tax liability is deferred until a later date. There are, however, some limitations to the benefits of deferral. Under sub part F provisions of U.S. tax law, certain types of foreign income – principally that from passive investments – is subject to immediate U.S. taxation, even if not repatriated as dividends to the U.S. parent firm.

A second complication comes from the way foreign tax credits are used to reduce the U.S. tax liability. Because the amount of foreign tax credits is limited to the tax obligation under the prevailing U.S. tax rate (such that a firm cannot receive a "refund" for foreign taxes paid above those that would have prevailed in the U.S.), any tax credits above this limit are referred to as "excess foreign tax credits". The current tax system allows a firm to use any excess foreign tax credits from a particular year to reduce their U.S. tax liability on foreign income in any of the two previous years or the subsequent five years. In addition, the foreign tax credit limit is not applied on a country-by-country basis, but rather by summing total worldwide foreign tax payments against total worldwide foreign income.

The combination of selective repatriation based on deferral, and the worldwide averaging of foreign tax credits give multinational firms some control over the U.S. taxes owed on their foreign earnings. Indeed, one would assume that the presence of a separate dividend repatriation tax would distort the behavior of repatriations back to the parent, as firms would find it optimal to keep income growing abroad (particularly in low-tax countries) and free of U.S. tax. However, Hartman (1985) showed that provided 1) the foreign affiliate is mature and financing investments out of retained earnings, and 2) that the dividend tax rate is constant over time, then the optimal repatriation decision is independent of the dividend tax rate. Of course, the HIA violates the second condition and therefore led to strategic repatriation decisions by firms based on the conditions and timing of the HIA. See section 3 below, as well as Clausing (2005), for further discussion of the Hartman (1985) result and the optimal repatriation decision.

3 A Simple Model of Transfer Pricing and Dividend Remittances

3.1 Static Model of Transfer-Pricing

Set-up

Consider a multinational firm with a parent incorporated in the home country (i.e. the United

States) and an affiliate incorporated in a foreign country. In order to separately consider the transfer-pricing implications of exported and imported goods, I will assume that both the parent and affiliate produce a good that is sold locally as well as exported abroad. Hence, the parent company exports a good from Home and also receives an import from its affiliate in Foreign. The goods are exchanged between parent and affiliate at transfer prices, and then, acting as the wholesale/distributor, the parent/affiliate sells the traded goods in the local market. For simplicity, I will assume that production $F(K)$ occurs using only capital, and that a fixed fraction (θ_h,θ_f) of the parent/affiliate output is exported abroad. I define the relevant prices below:

- p^{hh}: Arms-length price of parent product in Home
- p^{hfT}: Export transfer price
- p^{hfF}: Export price sold in Foreign
- p^{ff}: Arms-length price of Foreign affiliate product in Foreign
- p^{fhT}: Import transfer price
- p^{fhF}: Import price sold in Home
- r^h,r^f: Implied rental rate of capital in Home/Foreign

This setup implies that the parent and affiliate each engages in three activities: domestic production/sale, exports at transfer prices, and distributor/wholesaler for the imported product. Thus, assuming a tax rate of τ^h in the Home economy, the profits of the parent company in Home can be written as:

$$\Pi^H = \underbrace{(1-\theta^h)F(K^h)(p^{hh}-r^h)(1-\tau^h)}_{\substack{\pi^{hh}\text{: net profits on} \\ \text{Home domestic sales}}} + \underbrace{\theta^h F(K^h)(p^{hfT}-r^h)(1-\tau^h)}_{\substack{\pi^{hfT}\text{: Net Home transfer profits} \\ \text{on export sales}}} + \underbrace{\theta^f F(K^f)(p^{fhF}-p^{fhT})(1-\tau^h)}_{\substack{\pi^{fh}\text{: Net Home profits} \\ \text{on selling Foreign export good}}}.$$

Similarly, assuming a tax rate of τ^f, the profits of the affiliate in Foreign can be written identically:

$$\Pi^F = \underbrace{(1-\theta^f)F(K^f)(p^{ff}-r^f)(1-\tau^f)}_{\substack{\pi^{ff}\text{: net profits on} \\ \text{Foreign domestic sales}}} + \underbrace{\theta^f F(K^f)(p^{fhT}-r^f)(1-\tau^f)}_{\substack{\pi^{fhT}\text{: Net Foreign transfer profits} \\ \text{on export sales}}} + \underbrace{\theta^h F(K^h)(p^{hfF}-p^{hfT})(1-\tau^f)}_{\substack{\pi^{hf}\text{: Net Foreign profits} \\ \text{on selling Home export good}}}.$$

The tax authorities state that the intra-firm transaction must be set at arms-length, contingent to a comparable uncontrolled transaction (CUP); however, there is imperfect enforcement. With probability related to λ^i $i \in \{h, f\}$ the tax authorities audit the firm and, using the firms arms-length price (p^{hh} and p^{ff}) as the CUP, assess penalties based on the differences between the transfer price and the CUP. After incorporating this feature, the complete firm-level profits can be expressed as:

$$\Pi = \Pi^{US} + \Pi^{F} - \frac{\lambda^h}{2}\left[(p^{hh} - p^{hfT})\theta^h F(K^h)\right]^2 - \frac{\lambda^f}{2}\left[(p^{ff} - p^{fhT})\theta^f F(K^f)\right]^2. \tag{1}$$

In a static version of the model, it is sufficient to take first order conditions with respect to the two transfer price decisions:

$$\begin{aligned}\partial p^{hfT} : -\tau^h\theta^h F(K^h) + \tau^F\theta^h F(K^h) + \lambda^h(p^{hh} - p^{hfT})\theta^h F(K^h)\theta^h F(K^h) = 0 \\ (\tau^f - \tau^h) + \lambda(p^{hh} - p^{hfT})\theta^h F(K^h) = 0\end{aligned}$$

$$p^{hfT} = \underbrace{p^{hh} - \frac{(\tau^h - \tau^f)}{\lambda^h\theta^h F(K^h)}}_{\substack{\text{if } \tau^h > \tau^f \text{ then under-} \\ \text{price intra-firm exports}}} \tag{2}$$

$$\begin{aligned}\partial p^{fhT} : \tau^h\theta^f F(K^f) - \tau^F\theta^f F(K^f) + \lambda^f(p^{ff} - p^{fhT})\theta^f F(K^f)\theta^f F(K^f) = 0 \\ (\tau^h - \tau^f) + \lambda(p^{ff} - p^{fhT})\theta^f F(K^f) = 0\end{aligned}$$

$$p^{fhT} = \underbrace{p^{ff} + \frac{(\tau^h - \tau^f)}{\lambda^f\theta^f F(K^f)}}_{\substack{\text{if } \tau^h > \tau^f \text{ then over-} \\ \text{price intra-firm imports}}}. \tag{3}$$

We can see that in this static case, the firm finds it optimal to under-price intra-firm exports and over-price intra-firm imports whenever the tax rate of the home country exceeds that of the foreign country.

3.2 Adding in the Dynamics

Now I take the static structure of the transfer-pricing arrangement from below and build in dynamics in which the firm maximizes profits over multiple periods subject to deferral and dividend repatriation from Foreign to Home. Consider a firm that maximizes Home profits in a two-period version of the above framework, where the firm can repatriate foreign profits subject to a dividend tax rate of τ^d.[6]

In addition to its existing stock of capital, following Bradley (2016) I assume the foreign affiliate has a stock of cash holdings b^f invested in a passive asset earning a rate of return of ρ. I further assume that at the beginning of period 1, the firm is indifferent between moving funds between its stock of cash and its capital stock such that it has exhausted all profitable investments in its scale of production. I denote the dividends remitted to the parent as d_i. In the second period all foreign operations are liquidated and sent back to the parent firm. Assuming a discount factor of β, the multinational firm's optimization problem is now:

$$\max_{d_1, p_1^{hfT}, p_1^{fhT}} \left\{ \Pi_1^h + (1-\tau^d)d_1 + \beta\Pi_2^h + \beta(1-\tau^d)d_2 - \Lambda \right\}$$

$$\text{where} \qquad \Lambda = \frac{\lambda^h}{2}\left[(p_1^{hh} - p_1^{hfT})\theta^h F(K_1^h)\right]^2 + \beta\frac{\lambda^h}{2}\left[(p_2^{hh} - p_2^{hfT})\theta^h F(K_2^h)\right]^2$$

subject to the constraints:

$$d_1 \in [0, \Pi_1^f - \frac{\lambda^f}{2}\left[(p_1^{ff} - p_1^{fhT})\theta^f F(K_1^f)\right]^2 + (1-\tau^f)\rho b_1^f + b_1^f] \text{ [no borrowing to finance dividends]} \quad (4)$$

$$\left\{ p_1^{hfT},\ p_1^{fhT} \mid \Pi_1^h \geq 0 \right\} \qquad \text{[no negative domestic earnings]} \quad (5)$$

[6] Given the worldwide tax system used by the U.S., and ignoring cross-crediting and other considerations, the statutory dividend tax rate would be the U.S. tax liability net of any foreign tax credits. This amounts to a $\tau^d = \frac{\tau^h - \tau^f}{1-\tau^f}$.

There are also the following definitions:

$$d_2 = \Pi_2^f - \frac{\lambda^f}{2}\left[(p_2^{ff} - p_2^{fhT})\theta^f F(K_2^f)\right]^2 + \rho(1-\tau^f)b_2^f + b_2^f \quad \text{[liquidate foreign operations at t=2]} \quad (6)$$

$$b_2^f = \rho(1-\tau^f)b_1^f + \Pi_1^f - \frac{\lambda^f}{2}\left[(p_1^{ff} - p_1^{fhT})\theta^f F(K_1^f)\right]^2 - d_1 + b_1^f \quad \text{[LOM for foreign cash holdings]} \quad (7)$$

$$K_2^h = \Pi_1^h - \frac{\lambda^h}{2}\left[(p_1^{hh} - p_1^{hfT})\theta^h F(K_1^h)\right]^2 + (1-\tau_1^d)d_1 \quad \text{[LOM for home capital]} \quad (8)$$

$$K_1^f = K_2^f \quad \text{[due to constant returns on foreign cash holdings]} \quad (9)$$

Solving through the first order conditions for the transfer prices in this scenario, and assuming an interior solution where the shadow values pertaining to the constraints are zero, yields the following expressions:

$$p_1^{hfT} = p^{hh} - \frac{(1-\tau_1^d)(1-\tau^f) - (1-\tau^h)}{\lambda^h \theta^h F(K_1^h)} \quad (10)$$

and similarly

$$p_2^{hfT} = p^{hh} - \frac{(1-\tau_2^d)(1-\tau^f) - (1-\tau^h)}{\lambda^h \theta^h F(K_2^h)}. \quad (11)$$

Relative to equation (3), the dividend tax rate affects the optimal transfer price used by the multinational firm. Specifically, the optimal transfer-price on the export side is increasing in the dividend tax rate (the gap between the arms-length and transfer-price widens as the dividend tax rate falls). On the other hand, following the logic of equation (3), on the import side the optimal transfer-price is decreasing in the dividend tax rate.

What about the optimal dividend policy? The first order condition for the first period dividends yields the following intuitive expression:

$$1 + \beta\frac{\partial \widetilde{\Pi}_2^H}{\partial K_2^H} = \beta\frac{(1-\tau_2^d)}{(1-\tau_1^d)}[1 + \rho(1-\tau^f)] \quad (12)$$

where $\widetilde{\Pi}_2^H$ is defined as the second period after-tax profits from home production, net of any transfer price penalties. Equation (12) indicates that the optimal first-period dividend repatriation should balance the benefits from repatriation immediately (the left hand side) with the potential to reinvest earnings in the foreign passive asset and repatriate in the subsequent period subject

to (assuming $\tau_2^d < \tau_1^d$) a more favorable dividend tax rate (the right hand side). Going back to the discussion above, it is clear that if the dividend tax rate was constant, where $\tau_1^d = \tau_2^d$, then consistent with Hartman (1985) the repatriation decision would be independent of the dividend tax rate.

4 The Homeland Investment Act

This section provides the background and details pertaining to the Homeland Investment Act. An important component of the empirical strategy used in section 5 relates to the timing of this tax law change, and so I will devote particular attention to the specific dates and events that affected the resolution of uncertainty for this provision.

4.1 Background

The origins of the Homeland Investment Act date back to the early 1980s and the institution of foreign sales corporations (FSCs), a tax instrument intended to reduce the tax liability of U.S. corporations from profits derived from export activity. Following complaints from the European Community, the WTO ruled in March 2000 that the tax treatment of the FSCs were a form of export subsidy and therefore illegal according to current agreements. Later that year, the U.S. passed the *FSC Repeal and Extraterritorial Income Exclusion Act* which essentially extended the FSC tax break to all types of entities by excluding extraterritorial income from the calculation of gross income. (Foreign companies that are U.S. taxpayers could then also use the tax break.) In January of 2002, however, the WTO ruled that this modified tax treatment continued to constitute a prohibited export subsidy, and in May 2003, authorized the European Union to impose countervailing duties up to a level of $4.04 billion on certain products originating from the U.S.

With the beneficial treatment of the FSC tax measure for offshore sales likely to end, a number of U.S. based groups began lobbying for a potential replacement. Several dozen companies organized as the Homeland Investment Coalition pushed for a temporary cut in the tax rate on repatriated foreign profits. This effort received a substantial boost when a September 2003 study by JP Morgan estimated that such a measure would attract roughly $300 billion in capital inflows into the United States, and add a half-percentage point to economic growth over a two-year window (J.P Morgan Chase (2003)). The HIA was included as part of the larger American Jobs Creation Act (AJCA)

introduced in the House of Representatives in July of 2003, and was widely acknowledged to be in response to the WTO rulings.[7] Clausing (2005) contains a detailed summary of the features of the AJCA, but prominent among them were the repeal of the extraterritorial income (ETI) exclusion ruled illegal by the WTO, and an income tax deduction for domestic production activities.[8]

Debate on the AJCA was delayed until early 2004; meanwhile, in March 2004, the European Union began to impose the WTO-sanctioned countervailing duties. These tariffs were set at an initial rate of 5 percent and scheduled to increase by 1 percent per month while the ETI exclusion remained in place. Soon thereafter, the House of Representatives took up the AJCA and passed the bill on June 17, 2004 by a vote of 251-178. The House vote was mostly along party lines, with Republicans contributing 203 ayes, 23 noes, and 2 non-votes, and the Democrats consisted of 48 ayes, 154 noes, and 3 non-votes. Ignoring strategic interactions and conditional on Republican votes, a united block of Democrats against the bill would have effectively prevented passage. I interpret this fact to be evidence of unresolved uncertainty leading up to the passage of the AJCA by the House in June, 2004. The Senate approved the vote on July 15th, by a wider margin: 78-15. By the time President Bush signed the AJCA into law on October 22, 2004, the EU countervailing duties stood at 12 percent.

4.2 The HIA and the Dividends Received Deduction

The HIA allowed firms a one-time deduction of 85 percent of their extraordinary dividends received from additional taxes coming from controlled foreign corporations. Firms could elect to take this deduction beginning on or for one year after the AJCA was signed into law. This dividends received deduction (DRD) lowered the effective tax rate from the maximum statutory corporate rate of 35 percent to 5.25 percent (15% times 35%). There were a number of restrictions on the extraordinary dividends that would qualify for this deduction, and furthermore, on how the repatriated funds could be used by the parent firm.

Extraordinary dividends were defined as being the excess of repatriations during the selected year over the average amount of repatriations during the previous five years, excluding the high-

[7] An article in the San Francisco Chronicle with headline "Lawmakers push tax break for businesses; Passage seen as possible because of WTO ruling" appeared the day after the AJCA was introduced in the House. See Lochhead (2003).

[8] Because it would affect the arms-length and related-party transactions equally, the deduction for domestic production activities should not influence the empirical results presented in section 5.

est/lowest years. The qualifying dividends were further limited to be the greater amount of 1) $500 million, 2) earnings reported as permanently reinvested on the last audited financial statement on/before June 30, 2003, or 3) 35 percent of the tax liability of those permanently reinvested earnings. Finally, the qualifying amount was reduced by any increase in the amount of related-party debt incurred by foreign subsidiaries between October 3, 2004 and the close of the tax year for which the firm claimed the dividends received deduction. This final requirement was intended to prevent the practice of "intra-group lending" whereby a parent corporation loans funds to a foreign subsidiary, who in turn remits the cash back in the form of a cash dividend.[9]

There were also restrictions on the uses of the repatriated funds. After requests for clarification regarding these rules, in January 2005, the IRS released further guidance on the restrictions on the uses of the money received from the extraordinary dividend. The uses of these funds was generally limited to hiring or training of workers, infrastructure or capital investments, research and development, and certain administrative expenses and debt repayments. Expenditures that were explicitly prohibited were executive compensations, inter-company distributions, dividends and stock buybacks. The law required the CEO to submit a domestic reinvestment plan to accompany the firm's financial statements in the year of the repatriation.

For more details on the restrictions of the DRD, see Redmiles (2008).

4.3 The Effects of the HIA in the Aggregate

According to statistics compiled in Redmiles (2008), roughly 850 corporations repatriated $362 billion as part of the HIA in the years 2004-2006. Of this amount, $312 billion qualified for the deduction. As reported in Figure 1, this amounted to a quantity of net dividends that was roughly 10 times higher than the average in the years leading up to the DRD.

Table 1 documents the top 10 source countries of the funds repatriated as part of the HIA. Apart from the Netherlands, Canada, and the United Kingdom, the other top-10 countries had pre-2003 statutory tax rates that were significantly less than the U.S. tax rate – by 15 percentage points or more. The case of Netherlands is interesting: although the maximum statutory tax rate was 34.5 percent in 2004, the so-called participation exemption excludes capital gains, dividends from

[9]Such strategies were at the forefront of the minds of tax strategists as the debate on the HIA progressed. A 2003 article (see Pulizzi (2003)) referencing the HIA had as a headline: "Proposed US Tax Break Could Add Supply to Eurobond Mkt."

qualifying subsidiaries, and profit-participation loan interest from corporate tax. These exemptions, together with a large range of bilateral tax treaties, has given the Netherlands a reputation as an international tax haven despite its high statutory tax rate.[10]

For the purposes of this paper, the exemption of dividend taxation by countries such as the Netherlands makes infeasible a direct mapping between the countries involved with transfer pricing transactions and the dividend repatriations. Although the optimal countries to engage in trade transactions should exhibit a low tax environment, the affiliate profits could subsequently be transferred as tax-free dividends to countries, such as the Netherlands, provided the appropriate tax treaties are in place.

5 Empirical Results

5.1 Data Description

A principal contribution of this paper is the use of unique microdata that measures transfer-pricing differentials by matching arms-length and related-party transactions within narrow firm/country/product/month/transport-mode criteria. Thus, at the heart of the analysis is the Linked/Longitudinal Firm Trade Transaction Database (LFTTD), which is a joint collaboration between the U.S. Census Bureau and the U.S. Customs Bureau. This dataset links the universe of goods trade transactions to the Longitudinal Business Database, the Census Bureau's register of all establishments operating in the United States.[11] For each individual trade transaction, the LFTTD records, among other variables, the source (destination) country, product code, value, quantity, date, transport mode, and whether the transaction occurs at arms-length, or between related-parties. On the export side, a transaction between a U.S. producer and foreign consignee is defined to be between related-parties if "either party of the transaction owns directly or indirectly 10 percent or more of the other party."[12] On the import side, a transaction is defined as being between related parties "if any person directly or indirectly owns, controls, or holds power to vote 5 percent or more of the outstanding voting stock

[10] The famous "double Irish Dutch sandwich" tax strategy is a direct consequence of the exemptions allowed by the Netherlands for multinational firms. For an in-depth description of this particular tax strategy, see International Monetary Fund (2013).

[11] For more information on the LBD, see Jarmin and Miranda (2002).

[12] See section 30.7(v) of the Foreign Trade Statistics regulations (`https://www.census.gov/foreign-trade/regulations/regs062004.pdf`)

or shares" of the other party.[13]

A new addition to this dataset for purposes of transfer-pricing research are identifiers of the location of the ultimate parent company involved in the transaction. This information is crucial in the context of this research as it is the U.S.-incorporated firms that are relevant to receive the DRD, and the LFTTD transactions in general will contain many observations related to foreign multinationals with affiliates operating in the United States. These multinational identifiers come from a new link between two international corporate directories and the Business Register (BR) of the Census Bureau, and allows one to characterize each multinational firm as being part of either a U.S. (headquartered) or Foreign multinational. For information on these directories and the linking procedure, see Flaaen (2014) and Appendix A.1.

For the purposes of understanding how transfer prices may have interacted with country-level tax rates, I use estimates of statutory corporate tax rates from the now discontinued World Tax Database from the Office of Tax Policy at the University of Michigan. As this data only runs through year 2003, I extend it using a variety of sources, including Ernst & Young, KPMG, and estimates from Loretz (2013), taking care to ensure that definitional issues remained consistent across the datasets.

5.2 The AL-RP Transfer Price Wedge

From the raw LFTTD dataset, I first remove any transaction that has a missing, imputed, converted, or zero quantity. For the transactions that remain, I construct the unit value as the total value per unit of quantity, and define the AL-RP wedge as in Bernard, Jensen, and Schott (2006) where:

$$wedge_{ficmt} = \ln cup_{ficmt} - \ln rp_{ficmt}. \tag{13}$$

The cup_{ficmt} is defined as the average across all arms-length transactions for a firm f product i to/from country c in month t by transport mode m. The AL-RP wedge measures the difference between the actual related party unit value (price) and that implied by an empirically-constructed comparable uncontrolled price (specifically, using an internal comparable transaction).

New to this paper is calculating the identical transfer-price wedge using import transactions.

[13] This definition dates back to Section 402(e) of the Tariff Act of 1930; as amended currently it is found in 19 U.S.C. 1401a: (`https://www.law.cornell.edu/uscode/text/19/1401a`)

There is an important conceptual distinction between the AL-RP wedge calculated using export transactions data and that using the import transactions. On the export side, this strategy takes a product produced by a particular U.S. firm and then measures the differential observed selling price –in a given month, country, and mode of transport – to an intra-firm affiliate compared to an average across arms-length buyers. On the import side, this strategy is somewhat different. It takes a product imported by a particular U.S. firm, and then measures the differential observed price that product is purchased – in a given month, source country, and mode of transport – from an intra-firm affiliate compared to an average across arms-length sellers. The difference is subtle but important to keep in mind. Practically speaking, because the producing firm is the same, it is more likely that the export AL-RP wedge reflects identical products within the detailed HS-10 coding system. The import-based AL-RP wedge relies somewhat more heavily on the HS-code-based differentiation of product attributes.[14]

Bernard, Jensen, and Schott (2006) compute the average export AL-RP wedge for the years 1993-2000 (encompassing roughly 3.5 million observations) and find an average value of 0.43 log points (standard deviation of 1.77). For the same sample period, I find an average import AL-RP wedge of 0.18 log points (standard deviation of 1.39).[15]

Connecting these measures to country-level corporate tax rates is a first step in evaluating potential profit-shifting activity. The first two columns of Table 2 replicates results from Table 5 in Bernard, Jensen, and Schott (2006), showing that lower corporate tax rates are associated with larger export AL-RP wedges or lower intra-firm export prices. The columns (3) and (4) of Table 2 replicate this exercise for the import AL-RP wedges. Remarkably, after controlling for product-level fixed effects in column (4), the import AL-RP wedge has the opposite sign as the export AL-RP wedge specification, which is consistent with profit-shifting motives as specified in equation (3) above.

[14] One approach that could be used to narrow yet further the transaction-level match for the import transactions is to utilize the "manufacturer ID" variable on the LFTTD import database. This code, up to 15 characters in length, is meant to capture identifying information for the foreign manufacturer of a particular import transaction. For further details of this variable, see Monarch (2014) or Kamal, Krizan, and Monarch (2015). On the one hand, it is potentially plant-specific and therefore an improvement over the firm-based definition of production used on the export side. On the other hand, the limited firm and address information in the code itself may pose issues for differentiation, and the variable is less commonly used by researchers.

[15] Also similar to Bernard, Jensen, and Schott (2006), this import wedge is higher for differentiated products (as measured by Rauch (1999)) at an average of 0.28 log points, than commodities (0.08 log points).

5.3 Sample Construction

Not all firms were eligible for the DRD under the HIA, nor would many find it optimal to participate or find transfer-pricing strategies to be an effective method for minimizing their global tax burden. The ideal dataset would include only those parent corporations that took advantage of the deduction; unfortunately, the IRS does not disclose lists of firms underlying the repatriations. At present, I make no attempt to refine the sample of firms based on information on participation in the DRD, recognizing that the failure to do so may work against me in finding strategic transfer-pricing behavior in response to the DRD.[16]

After applying the cleaning procedures outlined above, I keep the six quarters before and after passage of the Homeland Investment Act, leaving a sample covering the years 2003Q1 to 2005Q4. In an attempt to limit one-off observations that will not provide useful information, I also limit the sample to only include those transactions for which the firm-product-country occurs more than four times during this two-year period.[17] Finally, the baseline results will use only those firms identified as U.S. (as opposed to Foreign) multinationals.

5.4 Results

The difference-in-difference specification described below exploits variation in the transfer-price wedges both across time (pre and post passage of the HIA) and across tax jurisdictions. I operationalize this specification as follows:

$$wedge_{ficmt} = \alpha_1 Post_t + \alpha_2 Post_t \times LowTax_c + \mu_{fic} + \varepsilon_{ficmt} \tag{14}$$

The $Post_t$ variable is an indicator variable equal to one for the six quarters following the passage of the American Jobs Creation Act (2004Q3 to 2005Q4).[18] The $LowTax_c$ variable is also an indicator, equal to one for those countries with a statutory corporate tax rate below 25 percent – 10 percentage points below that of the U.S. corporate rate.[19] The μ_{fic} fixed effects remove average

[16] A method used by Blouin and Krull (2009) and others to construct a DRD-relevant sample is to review Compustat firms for FSP 109-2 disclosures about the financial statement effects of the AJCA Act, as well as 10K forms. While promising, Census confidentiality and disclosure limitations may limit the feasibility of this approach for this study.

[17] Alternatively, I also try limiting the sample by removing large outliers based on swings in unit values – removing unit value changes greater than 200 percent. The results are qualitatively the same.

[18] According to Redmiles (2008), 86 percent of corporations reported the DRD for Tax Year 2005, while 7.7 percent reported it for Tax Year 2004. The remaining 6.8 percent reported it for Tax Year 2006.

[19] For a list of the potential trading partners that meet this threshold, see Appendix Table A1.

differentials that may or may not be affected by profit-shifting considerations in the steady state; thus, the α_2 coefficient provides the *additional* effect induced by the HIA in potential profit-shifting to low-tax countries.

Bertrand, Duflo, and Mullainathan (2004) argue that the failure to account for serially correlated outcomes in the computation of standard errors can potentially invalidate many difference-in-difference estimates. While the problem of serial correlation in this context is mitigated via the use of high-dimensional fixed effects and a relatively short time-series dimension (3 years), plausible scenarios exist that would require correction of standard errors. For the export wedge, the introduction of new products by a firm within a detailed HS-10 product category may lead to correlated values of the AL-RP wedge within a pre/post period. In addition, country-level pricing practices apart from tax policies may also introduce serially correlated errors. To account for these possibilities, I use two-dimensional clustering – by firm-product and country – utilizing the methodology described in Cameron, Gelbach, and Miller (2011), which also allows for high-dimensional fixed effects. On the import side one may additionally worry about the variation in firm-products in a country that compose the arms-length price matched to the intra-firm price; for this reason I cluster the errors by firm-product-country on the import side.

The results using the export AL-RP wedge are shown in Table 3, with unweighted regression results in column (1) and weighted (by arms-length values) in column (2). As predicted by theory, the export AL-RP wedge expands in low-tax countries during the period following passage of the HIA. Relative to the baseline effects, the wedge increases by somewhere on the order of 0.08 and 0.54 log points in low-tax countries in the period following the HIA. For further supportive evidence of firm response following the HIA, I look to the evidence provided by the import AL-RP wedges. Shown in Table 4, the import-based results show the opposite sign on the α_2 coefficient, consistent with the export-based results and theory outlined above. The import wedge decreases by 0.11 to 0.25 log points in low-tax countries on average in the six-quarters following the passage of the HIA, once again relative to baseline effects.

For a useful robustness test to check the validity of these findings, I turn to the sample of foreign multinationals. These firms are subject to a different system of taxation, and would likely not have found the DRD applicable. According to the survey evidence from Graham, Hanlon, and Shevlin (2010), for the DRD to be an attractive option a foreign parent would need to have a structure

such that non-U.S. subsidiaries were themselves organized as underneath a U.S. subsidiary. This structure is not common. however, due to the associated tax disadvantages. With this in mind I re-run the specification above for the sample of foreign multinationals. The results are shown in Table 5. Relative to the sample of U.S. multinationals, on the export side I find the opposite effect: the transfer-price wedges corresponding to low-tax countries in the post-period are relatively smaller.[20] The coefficient for the import AL-RP wedge is also negative, but insignificant. These additional results support the notion that it is the effects of the HIA, rather than something else, that are driving the results captured by the specification in equation (14).

I use the coefficients from Tables 3 and 4 to gain a sense of the aggregate effects of these results on trade flows and foregone tax revenue. To compute the effects on trade, I multiply the coefficients by the overall amount of related-party trade to/from low-tax countries of the firms included in the baseline samples from Tables 3 and 4. To then calculate the implied foregone tax revenue, I apply the country-specific statutory tax rate differential with respect to the United States. The precise calculation of implied foregone tax revenue is described below:

$$\text{Foregone Tax Revenue (Exports)} = \sum_{i \in C} \sum_{j \in J^E} exp_{ij}^{rp} \ \alpha_2^{EXP}(\tau^{US} - \tau_i) \tag{15}$$

$$\text{Foregone Tax Revenue (Imports)} = (-1) \sum_{i \in C} \sum_{j \in J^I} imp_{ij}^{rp} \ \alpha_2^{IMP}(\tau^{US} - \tau_i), \tag{16}$$

where C is the set of countries in Table A1 , and J^E and J^I are the set of firms in the samples underlying Tables 3 and 4 respectively.

Although the weighted coefficient estimates are the most appropriate for this aggregation exercise, Table 6 also displays the results using the unweighted coefficients. Panel A of Table 6 demonstrates that net exports during the 2003Q3-2005Q4 period were under-reported by roughly $12.7 billion dollars, or roughly $4 billion dollars using the unweighted coefficients. Panel B shows that the tax loss from the HIA due to round-tripping was approximately $2 billion dollars. Although this is a relatively small share of overall corporate tax revenues, it is roughly 50 percent

[20] It is difficult to account for this result for foreign multinationals following passage of the HIA, but one potential explanation could involve strategic responses to U.S. firm behavior. Recognizing the benefits to their competitors balance sheets following the round-tripping behavior documented in Tables 3 and 4, foreign multinationals may have felt compelled to transfer some resources to their U.S. affiliates. Because the typical foreign multinational parent is headquartered in a country whose statutory tax rate is not that dissimilar to that of the U.S., the global tax implications of this transfer would be small. A more formal test of this explanation would involve documenting the industry composition of the foreign vs U.S. multinational transfer-pricing behaviors.

of what Joint Committee on Taxation estimated as the cost of the bill (3.5-3.9 billion USD, see Joint Committee on Taxation (2004)). Nevertheless, the values in Table 6 should be understood as back-of-the-envelope estimates, as there are a number of factors that could lead to a bias in either direction. On the one hand, the estimates based on equations (15) and (16) are using the top statutory corporate tax rate in the U.S., whereas the likely marginal tax rate to additional U.S. earnings may indeed be lower. On the other hand, I am likely under-estimating the amount of related-party trade as a basis for the foregone tax revenue as I am only including the trade corresponding to the firms in my sample. Finally, it is important to emphasize that these estimates are the result of the *additional* increase in profit-shifting incentives due to the HIA, and not the effect of transfer-pricing related profit-shifting more generally.

5.5 Discussion

The estimates in this paper are consistent with a growing body of research that shows that profit-shifting generally – and transfer-pricing behavior in particular – is prevalent among multinational firms. The concern with prior empirical results is typically that the measurement of transfer prices is an imperfect analogue to the CUP methods used by both firms and tax authorities, or, that the regressions of such measures of transfer prices with country-level tax rates suffer from omitted variables that bias the conclusions. The approach of the current paper addresses both of these concerns. First, matching intra-firm trade prices at the firm-product-country-month level with arms-length trade prices creates a conceptually accurate measure of the object under study. Second, applying these measures to a pseudo natural experiment of a policy change removes many potentially conflating factors.

An illustration of the challenges confronting traditional measurement of profit-shifting via transfer price behavior comes from considering the difficulties in accounting for product heterogeneity. Even in the context of the AL-RP transfer price wedge calculated above, relying on a narrow matching strategy that includes firm, country, and HS-10 product categories, there is still scope for product-level differences – particularly in quality and other product attributes within an HS-10 code – to distort the interpretation of the AL-RP wedge as indicating strategic behavior. Product quality is notoriously hard to capture, and some disaggregated HS codes actually include a large variety of diverse products. Further, it is possible that such discrepancies of product attributes could

be correlated with country-level characteristics that align with corporate tax rates, etc. What one concludes from the results in Table 2, for example, could be subject to this concern. The benefits of the strategy used in this paper is that, to influence the results we obtain such discrepancies in the products within these narrow bins would need to also be changing systematically at a point in time that is also correlated with country-level tax rates. This additional layer of detail makes a spurious connection in these results unlikely.

One fair concern with the interpretation of the results from equation (14) is whether the periods used for the pre- and post-HIA environments accurately capture the timing of a firms' strategic response. If the HIA was anticipated by firms, it would have reduced the incentive to repatriate profits ahead of time for two reasons: 1) any current repatriation would be more costly than that under the holiday, and 2) because current dividends were used to calculate the firm-specific definition of "extraordinary" dividends that qualified for the deduction. The incentive to shift money abroad via transfer-pricing, however, would go in the opposite direction: firms would find it optimal to move money abroad to low-tax environments in anticipation of an impending, low-cost repatriation, making it more difficult to pick up the expected effect in the data. And, as indicated in section 4 the House vote in June 2004 implies that substantial uncertainty existed until at least June 2004, in line with the pre/post separation in equation (14).

Moreover, it should be noted that the data underlying these results do not contain the intangible transactions (i.e. intellectual property, patents, and the like) that are often the subject of scrutiny for tax authorities. Because these intangible goods are more difficult to price, they are often believed to be a major source of transfer pricing manipulation. As a result, by limiting the analysis to goods trade, the results may under-state the true extent of profit-shifting induced by the HIA. On the other hand, with a limited stock of such intangibles available to any given firm, prior motives for profit-shifting may have exhausted these one-off opportunities. Trade in goods may have been a convenient alternative.

6 Conclusion

Using a unique transaction-level dataset combined with a one-time policy change, this paper reveals the transfer-pricing mechanisms underlying cross-country profit-shifting activities of U.S. multinational firms. I find that the gap between arms-length and related-party export prices – within

narrowly-defined transaction pairs – increases for low-tax countries in the period following the passage of a one-time dividend repatriation tax holiday; the comparable gap between arms-length and related-party import prices decreases for low-tax countries during this same period. Both of these results point to strategic profit-shifting activity by U.S. multinationals. By moving income outside of the United States with transfer pricing, profits could be declared in low-tax environments and then brought back under the terms of the tax repatriation holiday – a strategy popularly known as "round-tripping". While such behavior is widely believed to exist, the unique microdata used in this paper allows for an empirical test that escapes the many pitfalls of prior efforts.

Apart from highlighting the importance of tax avoidance behavior by multinational firms, the results of this paper demonstrate that intra-firm trade prices do not always correspond to the allocative market values that international trade economists typically model. The implications of this can be far-reaching. To give one example, the scope for trade to adjust to external factors in an economy depends on whether the initial trade allocations were influenced by market conditions, rather than the accounting practices of multinational firms. The differential behavior of arms-length and related party trade flows is an area in need of further research.

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Table 1: Repatriated Dividends Under the Homeland Investment Act, Tax Year 2004-2006, Selected Countries of Incorporation

	Cash Dividends		Controlled Foreign Corporations	
Country of Incorporation	Amount (millions USD)	Percent of Total	Amount	Percent of Total
Netherlands	94,415	26.1	253	5.9
Switzerland	35,783	9.9	155	3.7
Bermuda	34,974	9.7	82	1.9
Ireland	27,588	7.6	112	2.6
Canada	25,541	7.1	426	10.0
Luxembourg	25,439	7.0	87	2.0
United Kingdom	22,264	6.2	330	7.8
Cayman Islands	19,894	5.5	101	2.4
Hong Kong	5,511	1.5	163	3.8
Singapore	5,518	1.5	89	2.1
All Other Countries	64,940	17.9	2,448	57.8
Total	361,866	100	4,246	100

Source: IRS Form 8895, and Redmiles (2008)

Table 2: Transfer Price Wedges and Tax Rates: 1993-2000

	Export AL-RP Wedge[1]		Import AL-RP Wedge[2]	
	(1)	(2)	(3)	(4)
Tax Rate (WTD)	-4.178^{***}	-1.638^{***}	-0.0923	0.600^{***}
	(0.665)	(0.447)	(0.278)	(0.226)
Fixed Effects	No	Product	No	Product
R-Squared	0.00	0.15	0.00	0.071
Observations	3,585,777	3,585,777	12,431,800	12,431,800

[1]Source: Bernard, Jensen, and Schott (2006)
[2]Source: This Paper

Table 3: Difference-in-Difference Analysis: Export Transfer-Price Wedges

	Export AL-RP Wedge	
VARIABLES	(1)	(2)
Post-Period X Low-Tax	0.080**	0.542***
	(0.040)	(0.099)
Post-Period	-0.028	-0.236*
	(0.026)	(0.142)
Constant	0.222***	0.723***
	(0.013)	(0.074)
Observations	149,100	149,100
R-squared	0.426	0.509
Fixed Effects	Firm-Country-Product	Firm-Country-Product
Weighted	No	Yes
Firms (Rounded)	1200	1200

The monthly sample period ranges from 2003Q1 to 2005Q4. The Post-Period is defined as the six quarters following the resolved uncertainty of the HIA, 2004Q3 to 2005Q4. The list of low-tax countries is given in Table A1. Standard errors clustered by firm-product and country following the methodology of Cameron, Gelbach, and Miller (2011). Column (2) weights the estimates using the arms-length export value.
*** p< 0.01, ** p< 0.05, * p< 0.1

Table 4: Difference-in-Difference Analysis: Import Transfer-Price Wedges

	Import AL-RP Wedge	
VARIABLES	(1)	(2)
Post-Period X Low-Tax	-0.110**	-0.235*
	(0.048)	(0.131)
Post-Period	0.0037	0.0462*
	(0.011)	(0.028)
Constant	0.106***	0.0327**
	(0.0059)	(0.016)
Observations	219,700	219,700
R-squared	0.300	0.415
Fixed Effects	Firm-Country-Product	Firm-Country-Product
Weighted	No	Yes
Firms (Rounded)	1000	1000

The monthly sample period ranges from 2003Q1 to 2005Q4. The Post-Period is defined as the six quarters following the resolved uncertainty of the HIA, 2004Q3 to 2005Q4. The list of low-tax countries is given in Table A1. Standard errors clustered by firm-product-country. Column (2) weights the estimates using the arms-length export value.
*** p< 0.01, ** p< 0.05, * p< 0.1

Table 5: Robustness: Difference-in-Difference Analysis for Foreign Multinationals

	Log Export AL-RP Wedge		Log Import AL-RP Wedge	
	(1)	(2)	(3)	(4)
Post-Period X Low-Tax	-0.262**	-1.234***	-0.0385	-0.118
	(0.122)	(0.406)	(0.045)	(0.146)
Post-Period	-0.0536	0.0749	-0.0204*	-0.0717*
	(0.062)	(0.084)	(0.012)	(0.038)
Constant	0.229***	0.341***	-0.114***	-0.0107
	(0.030)	(0.047)	(0.006)	(0.022)
Observations	49,900	49,900	120,200	120,200
R-squared	0.381	0.556	0.368	0.435
Fixed Effects	Firm-Country-Product	Firm-Country-Product	Firm-Country-Product	Firm-Country-Product
Weighted	No	Yes	No	Yes
Firms (Rounded)	800	800	1400	1400

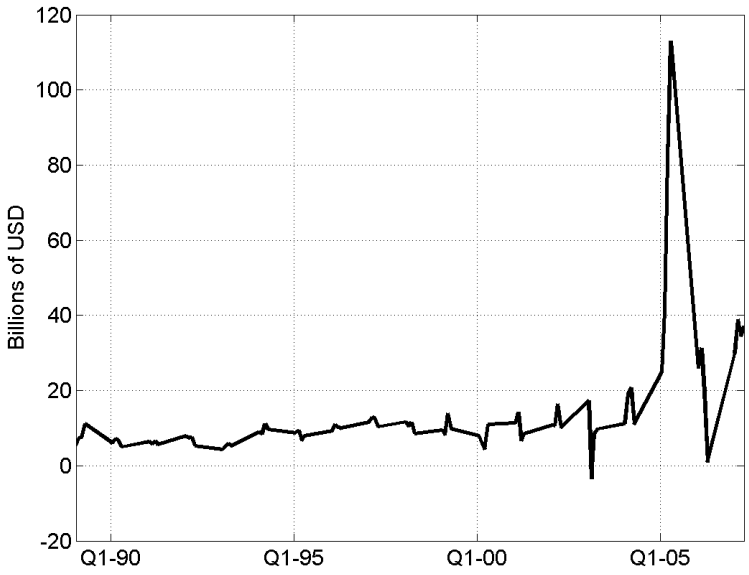
The monthly sample period ranges from 2003Q1 to 2005Q4. The Post-Period is defined as the six quarters following the resolved uncertainty of the HIA, 2004Q3 to 2005Q4. The list of low-tax countries is given in Table A1. In columns (1) and (2) standard errors are clustered by firm-product and country following the methodology of Cameron, Gelbach, and Miller (2011); in columns (3) and (4) they are clustered by firm-product-country. Columns (2) and (4) weight the estimates using the arms-length export value.
*** p< 0.01, ** p< 0.05, * p< 0.1

Table 6: Implied Effects on Trade and Taxes (millions USD)

	Weighted (1)	Unweighted (2)
Panel A: Trade Impacts		
Exports (Under-reported)	5,932.4	869.9
Imports (Over-reported)	6,777.6	3,716.1
Net Exports	12,710.0	4,046.0
Panel B: Implied Foregone Tax Revenue		
from Exports	951.1	139.5
from Imports	1,204.1	564.3
Total	2,155.1	703.7

Panel A applies the coefficients from tables 3 and 4 to adjust the related-party value of exports to and imports from low-tax countries during the post-period of 2003Q3 to 2005Q4. Panel B then multiplies the country-specific related-party trade by the difference in the statutory tax rate with respect to the U.S. rate. See equations (15) and (16) in the text.

Figure 1: Net Quarterly Dividends from Abroad: 1989Q1 - 2007Q4



Source: Board of Governors of the Federal Reserve, Financial Accounts of the United States (Z1).

A Data Appendix

A.1 Matching Corporate Directories to the Business Register

The discussion below is an abbreviated form of the full technical note (see Flaaen (2013)) documenting the bridge between the DCA and the Business Register.

A.1.1 Directories of International Corporate Structure

The LexisNexis Directory of Corporate Affiliations (DCA) is the primary source of information on the ownership and locations of U.S. and foreign affiliates. The DCA describes the organization and hierarchy of public and private firms, and consists of three separate databases: U.S. Public Companies, U.S. Private Companies, and International – those parent companies with headquarters located outside the United States. The U.S. Public database contains all firms traded on the major U.S. exchanges, as well as major firms traded on smaller U.S. exchanges. To be included in the U.S. Private database, a firm must demonstrate revenues in excess of $1 million, 300 or more employees, or substantial assets. Those firms included in the International database, which include both public and private companies, generally have revenues greater than $10 million. Each database contains information on all parent company subsidiaries, regardless of the location of the subsidiary in relation to the parent.

The second source used to identify multinational firms comes from Uniworld Business Publications (UBP). This company has produced periodic volumes documenting the locations and international scope of i) American firms operating in foreign countries; and ii) foreign firms with operations in the United States. Although only published biennially, these directories benefit from a focus on multinational firms, and from no sales threshold for inclusion.

Because there exist no common identifiers between these directories and Census Bureau data infrastructure, we rely on probabilistic name and address matching — so-called "fuzzy merging" — to link the directories to the Census data infrastructure.

A.1.2 Background on Name and Address Matching

Matching two data records based on name and address information is necessarily an imperfect exercise. Issues such as abbreviations, misspellings, alternate spellings, and alternate name conventions rule out an exact merging procedure, leaving the researcher with probabilistic string matching algorithms that evaluate the "closeness" of match — given by a score or rank — between the two character strings in question. Due to the large computing requirements of these algorithms, it is common to use so-called "blocker" variables to restrict the search samples within each dataset. A "blocker" variable must match exactly, and as a result this implies the need for a high degree of conformity between these variables in the two datasets. In the context of name and address matching, the most common "blocker" variables are the state and city of the establishment.

The matching procedure uses a set of record linking utilities described in Wasi and Flaaen (2014). This program uses a bigram string comparator algorithm on multiple variables with

differing user-specified weights.[21] This way the researcher can apply, for example, a larger weight on a near *name* match than on a perfect *zip code* match. Hence, the "match score" for this program can be interpreted as a weighted average of each variable's percentage of bigram character matches.

A.1.3 The Unit of Matching

The primary unit of observation in the DCA, UBP, and BR datasets is the business establishment. Hence, the primary unit of matching is the establishment, and not the firm. However, there are a number of important challenges with an establishment-to-establishment link. First, the DCA (UBP) and BR may occasionally have differing definitions of the establishment. One dataset may separate out several operating groups within the same firm address (i.e. JP Morgan – Derivatives, and JP Morgan - Emerging Markets), while another may group these activities together by their common address. Second, the name associated with a particular establishment can at times reflect the subsidiary name, location, or activity (i.e. Alabama plant, processing division, etc), and at times reflect the parent company name. Recognizing these challenges, the primary goal of the matching will be to assign each DCA (UBP) establishment to the most appropriate business location of the parent firm identified in the BR. As such, the primary matching variables will be the establishment name, along with geographic indicators of street, city, zip code, and state.

A.1.4 The Matching Process: An Overview

The danger associated with probabilistic name and address procedures is the potential for false-positive matches. Thus, there is an inherent tension for the researcher between a broad search criteria that seeks to maximize the number of true matches and a narrow and exacting criteria that eliminates false-positive matches. The matching approach used here is conservative in the sense that the methodology will favor criteria that limit the potential for false positives at the potential expense of slightly higher match rates. As such, the procedure generally requires a match score exceeding 95 percent, except in those cases where ancillary evidence provides increased confidence in the match.[22]

This matching proceeds in an iterative fashion, in which a series of matching procedures are applied with decreasingly restrictive sets of matching requirements. In other words, the initial matching attempt uses the most stringent standards possible, after which the non-matching records proceed to a further matching iteration, often with less stringent standards. In each iteration, the matching records are assigned a flag that indicates the standard associated with the match.

See Table A2 for a summary of the establishment-level match rate statistics by year and type of firm. Table A3 lists the corresponding information for the Uniworld data.

[21] The term bigram refers to two consecutive characters within a string (the word *bigram* contains 5 possible bigrams: "bi", "ig", "gr", "ra", and "am"). The program is a modified version of an existing string comparator algorithm by Michael Blasnik, and assigns a score for each variable between the two datasets based on the percentage of matching bigrams. See Flaaen (2013) or **?** for more information.

[22] The primary sources of such ancillary evidence are clerical review of the matches, and additional parent identifier matching evidence.

A.1.5 Construction of Multinational Indicators

The DCA data allows for the construction of variables indicating the multinational status of the U.S.-based establishment. If the parent firm contains addresses outside of the United States, but is headquartered within the U.S., we designate this establishment as part of a U.S. multinational firm. If the parent firm is headquartered outside of the United States, we designate this establishment as part of a Foreign multinational firm. We also retain the nationality of parent firm.[23]

There can be a number of issues when translating the DCA-based indicators through the DCA-BR bridge for use within the Census Bureau data architecture. First, there may be disagreements between the DCA and Census on what constitutes a firm, such that an establishment matches may report differing multinational indicators for the same Census-identified firm. Second, such an issue might also arise due to joint-ventures. Finally, incorrect matches may also affect the degree to which establishment matches agree when aggregated to a firm definition. To address these issues, we apply the following rules when using the DCA-based multinational indicators and aggregating to the (Census-based) firm level. There are three potential cases:[24]

Potential 1: A Census-identified firm in which two or more establishments match to different foreign-country parent firms

1. Collapse the Census-identified firm employment based on the establishment-parent firm link by country of foreign ownership
2. Calculate the firm employment share of each establishment match
3. If one particular link of country of foreign ownership yields an employment share above 0.75, apply that link to all establishments within the firm.
4. If one particular link of country of foreign ownership yields an employment share above 0.5 and total firm employment is below 10,000, then apply that link to all establishments within the firm.
5. All other cases require manual review.

Potential 2: A Census-identified firm in which one establishment is matched to a foreign-country parent firm, and another establishment is matched to a U.S. multinational firm.

1. Collapse the Census-identified firm employment based on the establishment-parent firm link by type of DCA link (Foreign vs U.S. Multinational)
2. Calculate the firm employment share of each establishment match
3. If one particular type of link yields an employment share above 0.75, apply that link to all establishments within the firm.

[23] The multinational status of firms from the UBP directories are more straightforward.

[24] Some of these cases also apply to the UBP-BR bridge.

4. If one particular type of link yields an employment share above 0.5 and total firm employment is below 10,000, then apply that link to all establishments within the firm.

5. All other cases require manual review.

Potential 3: A Census-identified firm in which one establishment is matched to a non-multinational firm, and another establishment is matched to a foreign-country parent firm (or U.S. multinational firm).

Apply same steps as in Potential 2.

Table A1: List of Countries with Average Statutory Corporate Tax Rates Below 25 Percent: 2004-2006

Country	Average Corporate Tax Rate	Country	Average Corporate Tax Rate
Albania	23.3	Isle of Man	6.6
Armenia	20	Latvia	15
Azerbaijan	24.5	Lebanon	15
Bahamas, The	0	Liechtenstein	15
Bahrain	0	Lithuania	15
Belarus	24	Macao, China	14
Bermuda	0	Macedonia, FYR	15
Bosnia and Herzegovina	10	Maldives	0
British Virgin Islands	15	Moldova	19
Bulgaria	16.5	Montenegro	9
Cambodia	20	Oman	24
Cayman Islands	0	Paraguay	20
Channel Islands	13.3	Poland	19
Chile	17	Romania	19
Croatia	20	Russian Federation	24
Cyprus	11.6	Saudi Arabia	23.3
Estonia	24.3	Serbia	10
Georgia	20	Singapore	20.6
Guernsey	0	Slovak Republic	19
Hong Kong, China	17.5	Switzerland	22.7
Hungary	16	Uzbekistan	19
Iceland	18	Vanuatu	0
Ireland	12.6	Yugoslavia	20

Source: Office of Tax Policy at the University of Michigan, Ernst & Young, KPMG, and Loretz (2013).
Note: Inclusion in this list does not signify that a matching AL-RP transaction pair exists in the baseline dataset used for analysis.

Table A2: DCA Match Statistics: 2003-2007

	# of DCA Establishments	Matched to B.R.	Percent Matched
Total			
2003	123,553	86,838	0.70
2004	117,639	84,450	0.72
2005	110,106	80,245	0.73
2006	110,826	79,275	0.72
2007	112,346	81,656	0.73
U.S. Multinationals			
2003	25,905	17,465	0.67
2004	24,028	16,923	0.70
2005	20,870	15,191	0.73
2006	21,335	15,539	0.73
2007	22,500	16,396	0.73
Foreign Multinationals			
2003	11,101	7,398	0.66
2004	10,152	7,156	0.70
2005	9,409	6,865	0.73
2006	9,981	7,243	0.73
2007	10,331	7,555	0.73

Table A3: Uniworld Match Statistics: 2003-2007

	# of Uniworld Establishments	Matched to B.R.	Percent Matched
Foreign Multinationals			
2004	3,220	2,347	0.73
2006	3,495	2,590	0.74
U.S. Multinationals[1]			
2003	3,001	2,403	0.80
2005	2,951	2,489	0.84
2007	4,043	3,236	0.80

[1]U.S. multinationals include only the establishment identified as the U.S. headquarters.

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