At A Cost: the Real Effect of Transfer Pricing Regulations on Multinational Investment

Ruud De Mooij   Li Liu*

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Abstract

Many countries are concerned that they lose tax revenue from profit shifting by multinational firms, and have implemented transfer pricing legislations or thin capitalization rules in response. However, unilateral implementation of anti-avoidance rules may have negative impact on real investment and revenue, when multinational firms respond by cutting their investment and reducing their presence in the local economy. This paper uses a panel data on more than 250,000 companies in 60 countries over the years 2006-2015 to empirically investigate whether these laws reduce investment by multinational firms. We find that multinational affiliates respond to host-country transfer-pricing regulations by reducing their investment, which is likely shifted to other low-tax countries as there is no significant reduction in investment at the multinational group level. The effect on affiliate investment is concentrated in large, complex group, decreasing with the share of intangible asset, and is economically relevant.

1   Introduction

The issue of tax-motivated income shifting within multinational firms – or "base erosion and profit shifting" (BEPS) – has been at the top of the international policy agenda since the global financial crisis. By exploiting differences between the tax system of two different jurisdictions, multinationals can often reduce their tax liabilities in either or both countries. There is solid empirical evidence demonstrating that profit shifting is indeed taking place. For example, recent empirical evidence suggests that German MNCs paid 27 percent less in taxes than a group of comparable domestic firms in 2007 (Finke, 2013). In the UK, taxable profits relative to total assets reported by foreign multinational subsidiaries are 12.8 percentage points lower than those of comparable domestic standalone companies, based on analysis using UK corporate tax return data (Habu, 2017).[1]

A common way to limit the extent of profit shifting by multinationals, as have adopted in many countries, is implementation of anti-avoidance policies — for example transfer pricing regulations or thin capitalization rules – in order to protect domestic revenue base and to curb potential unfair competition between domestic and multinational firms (OECD, n.d.; Fuest et al., 2013). However, given that multinationals are often more mobile than domestic firms, the potential benefits of anti-avoidance legislation could be undone if multinationals respond by cutting their investment and reducing their presence in the local economy. Multinationals are also often at the global productivity frontier, providing positive externalities for other firms in the local economy (Andrews and Gal, n.d.). Given these reasons, unilateral movement to restrict opportunities for tax planning may have adverse impact on multinationals investment and reinforce tax competition among countries Keen (2001); Janeba and Smart (2003); Bucovetsky and Haufler (2007). While there is limited empirical evidence on the effect of profit-shifting restrictions on investment, recent studies assessing their impact on reported profitability by multinational affiliates did find that profit-shifting restrictions may have positive or no impact on the reported operating profits of multinationals (Lohse and Riedel, 2013; Saunders-Scott, 2013).

To fill this gap in the literature, we consider in this paper the effects of anti-avoidance

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[1]On the other hand, little is known about the tax revenue consequences of profit shifting, as suggested in recent survey articles by Dharmapala (2014) and Hines (2014).

provisions on investment in fixed assets by multinationals in the host countries. Our analysis employs a micro-level database that provides rich information on multinational and domestic firms and corporate tax legislations in 27 countries, merged with detailed data on the introduction and enforcement of transfer pricing regulations and thin capitalization rules among these countries.

To motivate the empirical analysis, We illustrate the impact of anti-avoidance measure on the scale of multinational investment, distinguishing the differential impact of anti-avoidance measure on the scale of real investment by multinational affiliates in the host country, and on the scale of real investment worldwide by the multinational group. It does so by adding the possibility of profit shifting to the standard model for analyzing international tax effects of real investment (Zodrow and Mieszkowski, 1986; Wilson, 1986), allowing for anti-avoidance measures to increase the cost of profit shifting. Specifically, the model predicts that the scale of real investment by multinationals would decrease unambiguously in the strictness of the anti-avoidance rules. On the other hand, the impact of any change in the anti-avoidance measure in country i on the scale of total investment by the multinational group would depend on a number of additional factors , including how the introduction of the anti-avoidance measures affects the difference between the after-tax rate of return in the host country and the after-tax rate of return in the global capital market.

Summarize the main empirical findings.

Our paper contributes to a growing literature that exploits cross section variation to study the effectiveness of legislations which aim to limit international profit shifting on firm behavior including reported profits ((Bartelsman and Beetsma, 2003; Saunders-Scott, 2013; Beer and Loeprick, 2015; Saunders-Scott, 2015; Marques and Pinho, 2016; Katharina Nicolay and Pfeiffer, 2016), transfer prices (Clausing, 2003; Bernard et al., 2006; Davies et al., 2014; Vicard, 2015; Cristea and Nguyen, 2016; Flaaen, 2016; Liu et al., 2017), capital structure (Buettner et al., 2012; Buettner and Wamser, 2013; Blouin et al., 2014; Merlo and Wamser, 2015; DeMooij and Hebous, 2017), and foreign direct investment (Buettner et al., 2014). We depart by using detailed micro data and analyzing the causal effect of anti-avoidance legislations on real investment by multinational affiliates. Examining the investment responses also allows us to uncover the differential impact of transfer pricing regulation and thin capit-

alization rules on foreign direct investment. Our paper also directly relates to studies of the effect of taxes on business investment (Cummins et al., 1994; Caballero et al., 1995; House and Shapiro, 2008; Bond and Xing, 2015; Yagan, 2015; Zwick and Mahon, 2016), by offering a new perspective on the impact of anti-avoidance legislations on business investment.

The rest of the paper is structured as follows. Section 2 provides a detailed overview of the anti-avoidance regulations that target at transfer pricing manipulation and debt shifting. Section 3 sets up the conceptual framework for the mechanism through which anti-avoidance rules reduce real investment at the multinational affiliate level. Section 4 describes the data and sample selection. Section 5 explains the research design and Section 6 reports the main results. Section 8 concludes.

2   Institutional Background

Multinational corporations have a variety of profit-shifting methods available to reduce their tax liabilities, with ample evidence that they use these methods to arrange their affairs in a tax-sensitive matter.[2] Among a wide range of methods, transfer pricing manipulation and debt shifting have been identified as the most prominent methods for profit shifting and are the focus of our empirical analysis.[3]

2.1   Transfer Pricing Regulations

Transfer pricing refers to the pricing of goods and services sold between related parties. In principle, the setting of transfer prices should follow the arm's length price, such that prices of goods and services sold between related parties should be comparable to the prices that would be paid by unrelated parties.[4] However, given the nature of related-party transaction, there may exist a wide range of arm's length prices for the same transaction, particularly

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[2]Dharmapala (2014) and Hines (2014) provide comprehensive discussions on the extent of BEPS by multinationals. Heckemeyer and Overesch (2013) provides a quantitative review of 25 empirical studies on profit-shifting behavior of multinational firms and finds a substantial response of profit measures to international tax rate differentials.

[3]Cite studies on other profit-shifting method such as CFC rule and what else?

[4]The arm's length principle is established in Article 9 of the OECD and the UN Model Tax Conventions, and is the framework for the extensive network of bilateral income tax treaties between OECD countries, and many non-OECD governments, too.

so when a comparable transaction does not exist in the first place or is very costly for the tax authority to observe. As a consequence, by underpricing exports sold from a high tax country to a low tax country (or raising the price of imports), multinationals can shift their incomes across affiliates in different tax jurisdictions and reduce their global tax rate. Several empirical studies estimate the extent of the price wedge between arm's length and intra-firm trade with respect to the statutory corporate tax in the destination country relative to the home country, and all find significant responses of the price wedge to the tax rate differential as supportive evidence for tax motivated transfer pricing manipulation (Clausing, 2003; Bernard et al., 2006; Davies et al., 2014; Vicard, 2015; Cristea and Nguyen, 2016; Flaaen, 2016; Liu et al., 2017).

Many countries have implemented transfer-pricing regulations in recent years to mitigate the extent of base erosion from transfer pricing manipulation.[5] The scope and design of these regulations vary from application of the arm's length principle to requirement of detailed transfer pricing reports. Detected mispricing behavior and the failure to provide adequate documentation may also trigger non-negligible penalties in many countries. Rigid regulations increase the cost of transfer mispricing and are found to be effective in curbing the extent of profit shifting in developed countries.[6] Given that transfer-pricing regulations can vary in many dimensions, we use a measure of transfer-pricing risk, $tprisk$, developed in Mescall and Klassen (2014) to measure the overall strictness of the transfer pricing rule in a country.[7] Figure 2 provides an overview of the number of countries that introduced transfer pricing regulations in each year between 1983 and 2011, the last year covered in Mescall and Klassen (2014). In our dataset, ??? out of 27 countries have introduced some sort of transfer

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[5]In addition to requirement to use arm's length prices, transfer-pricing regulations often include specific requirements including (1) limitation on the methods that can be used for establishing an arm's length price, (2) specific requirements for the documentation needed to support the transfer prices used, (3) transfer-pricing specific penalties, for example.

[6]For example, Riedel et al. (2015) show that the introduction and tightening of transfer pricing rules raises (lowers) reported operating profits of high-tax (low-tax) affiliates and reduces the sensitivity of affiliates' pre-tax profits to corporate tax rate changes.

[7]The Mescall index takes values between ??? and ??? depending on the transfer-pricing regulation in a country. It aims to capture detailed features of the transfer-pricing regulation including: if disclosure of related party transactions is required on the tax return; the availability of information on comparable transactions; whether transfer-pricing penalties can be reduced by keeping sufficient documentation; the perceived likelihood of a transfer-pricing audit; and other, more technical, details of transfer-pricing regulation in a country (Saunders-Scott, 2013). Appendix A provides a detailed description of the transfer-pricing risk variable.

pricing regulation between 2006 and 2011. Figure 2 Panel B shows that there is considerable variation in *tprisk* both across countries and over time in our dataset.

2.2 Thin Capitalization Rules

Another common method used by multinationals to shift profits from a high-tax to a low-tax country is to borrow more in the high-tax jurisdiction, with loans extended from the parent company or affiliates in other countries.[8]. By strategically shifting debt in this way, multinationals can reduce their global tax liability without changing the overall debt exposure of the group. Empirical evidence has also confirmed that the debt ratio of multinationals affiliates is highly responsive to international tax rate differentials (Altshuler and Grubert (2003); Desai et al. (2004); Huizinga et al. (2008); Buettner et al. (2012), among others), and the effect of tax rate differential is larger in developing economies than in developed economies (Fuest et al., 2011).

To counteract the negative consequences of debt shifting on revenue collection, many countries have also instituted thin capitalization rules that restrict the deductibility of interest above a certain debt level (Figure 3). In practice, thin capitalization regimes differ widely across countries in several key dimensions (Blouin et al., 2014). First, they tend to target different types of debt ratio, which falls into two main categories: either they restrict total debt, or they limit debt from related parties. Second, they tend to vary in the maximum level of debt ratio, the so-called safe-harbor ratio, beyond which interest on debt is no longer deductible. Third, countries vary in how strictly their capitalization rules are enforced. In some countries, the rules trigger an automatic disallowance of interest deductions, while other countries allow for some discretion in the application of thin capitalization rules, and consider the corporate indebtedness at similar but unrelated firms to determine whether interest deductibility is limited. The impact of thin capitalization rules has been found to be important in constraining internal leverage of multinational affiliates (Blouin et al., 2014; Buslei and Simmler, 2012), and in constraining total leverage of the multinational group (IMF, 2016; DeMooij and Hebous, 2017), though their impact depends critically on

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[8]A more specific practice is referred to as earnings stripping, where the debt is not subject to tax by the recipient

how they are applied and how strictly they are enforced.

3 Theoretical Consideration

[**Ruud: To be expanded to incorporate profit shifting and tax competition**] To illustrate the effect of anti-avoidance measures on multinational investment, consider a very simple model of investment by a multinational company. Suppose the firm is a multinational affiliate and maximizes its profits Π in country k. Output is produced through the technology $F(.)$, by combining foreign direct investment K_i with domestic labor L_i. $F(.)$ has the standard properties that $F'(.) > 0$ and $F''(.) < 0$. Let τ_k denotes the statutory corporate tax rate that applies to pre-tax profits, and γ_k denotes the overall strength of the anti-avoidance rules. The after-tax profits of affiliate i is defined as:

$$\Pi_{ik} = (1 - \tau_k \gamma_k F(K_i, L_i) - w_k L_i - r_k K_i, \tag{1}$$

where w_k and r_k denote the wage rate and normal return to capital in country k. Specifically, γ_k is a reduced-form policy parameter in the range of $[0, 1]$ that captures the overall strength of anti-avoidance measures in country k.

The total tax payment by affiliate i equals to $\tau_k \gamma_k F(K_i, L_i)$. When there is perfect anti-avoidance measure, that is, when $\gamma_k = 1$, the tax payments are $\tau_k F(K_i, L_i)$. When there is no anti-avoidance rule ($\gamma_k = 0$) so that the firm is able to avoid tax completely through profit shifting, the tax payments are zero. The optimal level of capital is given by differentiating 1 with respect to K_i:

$$F'_k = \frac{r_k}{1 - \tau_k \gamma_k}. \tag{2}$$

It is easy to see that stronger anti-avoidance measures increases the cost of capital $\frac{r_k}{1 - \tau_k \gamma_k}$. Specifically,

$$\frac{dK}{d\gamma} = \frac{F'_k \tau}{F''_k (1 - \tau_k \gamma_k)} < 0. \tag{3}$$

Equation 3 implies that investment by multinational affiliate i decreases in the value of γ_k. For all positive values of γ_k, the level of K_i is lower compared with the case of no anti-

avoidance rules when $\gamma_k = 0$. This prediction guides our subsequent empirical analysis, that increases in the strictness of transfer pricing regulations (including its introduction), would lead to a reduction in multinational investment.

4 Data

The primary dataset for empirical analysis is an unbalanced panel of 130,062 companies in 29 countries for the years 2006 to 2014. It is constructed by using unconsolidated financial statements of affiliates of domestic and multinational company groups in the commercial ORBIS database provided by Bureau van Dijk. A company is defined as an multinational affiliate if it has an ultimate parent company owning at least 50% of its shares and locating in a foreign country. A company is defined as a domestic affiliate if it has an ultimate parent company (owning at least 50% of its shares) locating in the same country, and all the other affiliates of its parent company are located in the same country.[9] Figure B.1 shows the distribution of multinational and domestic affiliates across industry sectors in the dataset.

The main sample we use for regression analysis includes all non-financial multinational affiliates with non-missing (and non-zero) sales, total asset and fixed asset values. We discard any companies with missing industry information, with less than three consecutive observations, and countries with less than 1,000 observations. Table 1 shows the country distribution of affiliates by ownership type in the main estimation sample.

Firm-level Data The main accounting variables are investment in fixed capital assets, sales, cash flow, and earnings before interest and tax (EBIT). We compute investment spending (I_t) as changes in fixed capital assets (including the net book values of tangible and intangible fixed assets) plus depreciation, i.e. $K_{t+1} - K_t + depreciation$, where K_t denotes the book value of fixed asset in year t. Gross investment rate, $Investment_t$, is defined as the ratio between current-year gross investment spending and beginning-of-year net fixed capital asset.[10] Sales refers to operating revenue and profit margin is calculated as earnings

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[9]The comparison is thus between investment by multinationals and by domestic group, excluding all independent, stand-alone companies.

[10]Similarly, net investment per dollar of fixed asset, $Investment\_Net_t$, is defined as the ratio between current-year net investment spending and beginning-of-year net fixed capital asset.

before interest and tax (EBIT) divided by sales. All ratio variables are winsorized at top and bottom 0.01 percentile to minimize influence of outliers.

Transfer-pricing regulations Our key variables of interest on transfer pricing regulations, the dummy indicator on the existence of some transfer pricing regulation (TPR), and the measure of the overall transfer-pricing strictness (*tprisk*), are constructed using information provided in Mescall and Klassen (2014). The transfer-pricing risk index, discussed in detail in Appendix A, captures dimensions of transfer-pricing regulation enforcement including documentation requirement, applicability of penalty and interest, perceived likelihood of a transfer-pricing audit, and other, more technical aspects of transfer-pricing regulation in that country. Comparing to the discrete indicator of whether there is some transfer-pricing regulation in force, the *tprisk* measure has the advantage of capturing the variation in the strictness of efforts to prevent profit shifting across countries, which is worth exploiting to estimate the effect of increased enforcement on investment.

Thin-capitalization regulations . In our empirical analysis, we ask whether different anti-avoidance rules imply similar or different investment responses by comparing the effect of transfer-pricing regulation with that of thin-capitalization rule. Data on TCRs are from the IMF's Fiscal Affairs Department database, and contain information on three key aspects of the TCRs: (1) the introduction year of the TCR, (2) whether the TCR restrict interest deduction for only related-party debt or if the interest deduction applies to all debt, and (3) the key ratio that determines whether an interest deduction is denied[11], among other measures of their strictness.

Other Country-level Variables Data on country-level statutory corporate tax rate and macroeconomic characteristics, including GDP per capita, the growth rate of GDP per capita, population and unemployment rate, that capture the aggregate market size and demand characteristics in the host country are from the IMF's World Economic Outlook database.

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[11]Specifically, the safe-harbor ratio can be based on a fixed debt-equity ratio, a fixed interest earning ratio ("earning stripping rules"), or an arm's-length ratio. DeMooij and Hebous (2017) provides a detailed description of the TCR dataset.

Table 2 presents the summary statistics of the key variables that are used in the regression analysis.

5   Empirical Specification

This section describes the empirical strategy we use to identify the causal effect of TPR on multinational investment, by exploiting plausibly exogenous time-series variation in the effective cost of capital following the introduction of TPR in many countries. Intuitively, if adoption of a TPR raises the effective cost of capital for multinationals, we would expect a subsequent reduction in their investment relative to investment by domestic company groups. Formally, we test the investment response in the standard difference-in-difference (DD) specification:

$$Investment_{ikt} = a_i + d_t + \beta_{TPR}MNC_i \times TPR_{kt} + \beta_{\mathbf{x}}\mathbf{x}_{ikt} + \beta_{\mathbf{z}}\mathbf{z}_{kt} + \varepsilon_{ikt}, \qquad (4)$$

where i indexes firms, k indexes the host country, and t indexes time. We control explicitly in this specification changes in investment due to other non-tax factors, by using a control group of domestic company group in the same host country which are exposed to aggregate shocks similar to those experienced by the multinationals and controls for additional non-tax determinants of firm-level investment. The dependent variable $Investment_{ikt}$ denotes gross/net investment scaled by book value of fixed capital asset in (end of) year $t-1$. The key variable of interest is the interaction term between two indicators: an indicator equal to one if firm i is part of a multinational group and zero otherwise (MNC_i), and an indicator equal to one for all the years following the introduction of some transfer-pricing regulation in country k and zero otherwise (TPR_{kt}). The coefficient β_{TPR} represents the difference-in-different estimate of the effect of transfer-pricing regulation on investment by multinational affiliates, and is expected to be negative given the theoretical consideration.

Throughout the various specifications based on equation (4), a full set of firm fixed effects (a_i) is always included to control for unobserved heterogeneity in firm-level productivity and in their parent company characteristics. Firm fixed effects further subsume host-country

fixed effects (given that affiliates do not change their location), controlling for time-invariant differences across host countries that may affect the location choice of multinationals. These considerations could include, for example, perceived average quality of governance during the sample period, common language and/or former colonial ties with the home country, and geographical distance between the home and host country. We also include a full set of time dummies (d_t) to capture the effect of aggregate macroeconomic shocks, including the effect of the great recession, that are common to both multinational and domestic companies. X_{ikt} denotes a vector of firm-level non-tax determinants of investment including proxies for firm size, degree of financial constraints, and profitability, and ε_{ikt} is the error term.

Most specifications include the statutory corporate tax rate in the host country (or alternatively, a set of country-year fixed effects), to control for potential confounding effects of concurrent tax reforms on business investment. We also control for a set of time-varying country characteristics (Z_{kt}) for host countries, including GDP per capita, population size, and unemployment rate to capture the effect of time-varying local productivity, market size and demand characteristics on investment. More importantly, our most comprehensive specification includes a full set of industry-year fixed effects, country-year fixed effects and country-industry fixed effects that control for industry and country specific trends and macroeconomic factors that may differentially affect private investment by multinationals and would otherwise be captured by the DD estimates.

Our identification strategy rests critically on the assumption that prior to the introduction of transfer-pricing regulations, there is no differential changes in investment by multinationals relative to domestic companies, conditional on changes in non-TPR factors that are already controlled for empirically. We perform placebo tests to check the validity of the identification assumption by examining whether there was a differential change in multinational investment in any of the pre-TPR years. Figure 1 summarizes the DD estimates and their corresponding 95% confidence interval. The results suggest that on average, there were no significant differential changes in investment for the treated group in any period before the TPR reform.[**Li: need to come up with a better figure and description**]

6 Results

In this section we provide direct evidence on the extent of reduction in investment by multinationals in response to the adoption of transfer-pricing regulations in the introducing countries.

6.1 Baseline Results

Table 3 presents our main regression results based on equation (4). Column (1) reports results from the basic investment regression without the inclusion of any country-level control variables. The DD coefficient estimate is negative and significant at 1% level, indicating that the introduction of transfer-pricing regulation has a negative impact on multinational investment.[12] The coefficient estimates on the non-tax firm-level determinants of investment are also highly significant and consistent with previous findings in the literature. In particular, the results suggest that firms that less financially constrained (measured by the level of cash flow or profitability) on average invest more in fixed capital assets than their cash-poor or less profitable peers. The regression results also confirms the positive and significant relationship between firm-level investment and sales growth rate in the prior year.

Table 3 Column (2) checks the robustness of the baseline finding by including country-level statutory corporate tax rate, population, unemployment rate, exchange rate, real GDP per capita, and GDP growth rate. This is to ensure that the DD estimate is not confounded with any other contemporaneous changes in the host country that may also differentially affect foreign direct investment. While the result remains qualitatively similar, inclusion of country-level characteristics slightly reduces the magnitude of the DD estimate from -0.027 to -0.024.[13]

The next three columns further check the robustness of the baseline finding by subsequently adding two-way country-year fixed effects in Column (3), two-way industry-year fixed effects in Column (4), and two-way country-industry fixed effects in Column (5).[14] In the most comprehensive specification in Column (5), the DD estimate is around -0.01 and

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[12] A full set of firm fixed effects and year fixed effects are always included throughout varying specifications.

[13] However, the difference in the DD coefficient estimates are not statistically significant.

[14] Li to add one or two lines on the advantage of including each set of two-way fixed effects.

significant at 1 % level, suggesting that on average the adoption of the transfer-pricing reg-
ulation reduces investment by multinationals by around 1 percentage point. Given that the
average investment per dollar of fixed asset is around xxx for multinationals in the sample,
this translates to around 3 percent decrease in their investment.

Finally, column (6) includes a triple interaction term between $MNC_i \times TPR_{kt}$ and a
variable that measures the overall strictness of the transfer pricing regulation, $tprisk_{kt}$. In-
tuitively, more strict transfer-pricing regulation would have a larger impact on the effective
cost of capital faced by multinationals, therefore damping their investment by a larger ex-
tent. This is indeed the case as suggested by the negative coefficient estimate on the triple
interaction term, which is around -0.021 and significant at 1% level.

6.2 Evidence on Heterogeneous Investment Responses

We now explore whether investment responses differ with firm-specific and multinational
group characteristics that have been identified in the previous literature as key indicators of
extensive profit shifting. First, we analyze the extent of investment changes in relation to
the scale of international operation at the MNC group level. Second, we examine whether
investment responses vary with the intensity of intangible asset at the firm level. Third, we
check how quickly investment respond to the introduction of the transfer-pricing regulations.

The scale of MNC operation   We begin by asking whether firms that are part of large,
complex multinational group reduce more investment, as they are more likely to engage
in profit shifting and hence more adversely affected by the introduction of transfer-pricing
regulations. To test this hypothesis, we augment the baseline specification in (4) by adding
a three-way interaction term:

$$Investment_{ikt} = a_i + d_t + \beta_{TPR} MNC_i \times TPR_{kt} + \beta_{complex} MNC_i \times TPR_{kt} \times Complex_i + \beta_{\mathbf{x}} \mathbf{x}_{ikt} + \varepsilon_{ikt},$$
(5)

where $Complex_i$ aims to capture the size of the multinational group and its extent of organ-
izational complexity. Specifically, we use two alternative definition of $Complex_i$ to reflect
the complexity of the multinational group in different aspects. First, the dummy indicator

$Complex_i$ takes value of 1 if the total number of affiliates in firm i's MNC group exceeds the medium number of worldwide affiliates per MNC group in the sample. Thus the $Complex_i$ variable mainly reflect the size of the multinational group to which firm i belongs, in terms of the total number of affiliates in the group. In Table 4 Column (1), the coefficient estimate for the three-way interaction term is negative and significant at 10% level, suggesting that the observed reduction in investment is mostly concentrated in large MNC groups with many affiliates.

Alternatively, the dummy indicator $Complex_i$ in Table 4 Column (2) reflects the extent of cross-border linkage at the MNC group level, by taking value of 1 if the number of countries where firm i's peer affiliates locate exceeds the medium number of countries per MNC group operate in the sample. The coefficient estimate for this three-way interaction term is negative and significant at 5% level, indicating that the observed investment reduction is primarily driven by firms from MNC groups with extensive scale of cross-border linkages.[15] Our result is consistent if the extent of profit shifting increases with intangible asset endowment of subsidiaries and the supply-chain complexity of MNC groups, for which the empirical evidence is provided in Beer and Loeprick (2015).

The Intensity of intangible assets Firms with a higher share of intangible assets often produce more specialized products, making it more difficult to find a comparable price. This in turn makes it easier to shift profits through transfer pricing and implies that transfer pricing regulations are less effective for firms with intensive intangible assets. In addition, multinationals often use a variety of profit-shifting methods, while alternative methods of profit shifting through licensing and royalty payment are easily available for firms that are intangible capital intensive. If companies use different methods of profit shifting as substitutes (as suggested in Katharina Nicolay and Pfeiffer (2016)), firms with intensive intangible assets are less likely to rely on transfer pricing as their main channel of profit shifting, and hence are less likely to be affected by the transfer pricing regulations. We therefore test the effect of intangible asset intensity on the negative relationship between transfer pricing

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[15]Perhaps not surprisingly, these two measures of MNC group complexity are highly correlated, preventing us from running a horse-race test to see which dimension of complexity is more important in driving investment changes.

regulation and investment in the following specification:

$$Investment_{ikt} = a_i + d_t + \beta_{TPR} MNC_i \times TPR_{kt} + \beta_{Intang} MNC_i \times TPR_{kt} \times IntangShare_i + \beta_{\mathbf{x}} \mathbf{x}_{ikt} + \varepsilon_{ikt},$$

(6)

where $IntangShare_i$ is the average level of intangible fixed assets relative to total assets for firm i during the sample period. In this specification, β_{TPR} captures the impact of transfer-pricing regulation on investment for firms with no intangible assets, whereas $beta_{Intang}$ captures the changing impact of transfer-pricing regulation on investment across firms of different intangible asset intensity.

Table 5 Column (1) reports a small and positive coefficient on the three-way interaction term. Combining with a negative coefficient estimate on the main interaction term $\beta_{TPR} MNC_i \times TP_{kt}$, the result suggest that the negative effect of transfer-pricing regulation on multinational investment is decreasing in the firm's intensity of intangible assets. Column (2) allows for a non-linear impact of intangible asset intensity, which is estimated to be quite small but significant at 1% level.

The speed of adjustment   Another interesting question to ask is how quickly does multinational investment respond to the introduction of the transfer-pricing regulation, and how lasting is the impact of transfer-pricing regulation on damping multinational investment. Answers to this question would depend on a number of factors including the size of capital adjustment costs. We analyze the speed of adjustment in investment in the following specification, by replacing the dummy indicator TP_{kt} that takes value of 1 for all years post the TPR-introduction with four dummy indicators $TP_Yearj_{k,t}$, where $TP_Yearj_{k,t}$ is a dummy indicator that takes value of 1 for the $j-th$ year since the introduction of transfer pricing regulation in country k.

$$Investment_{ikt} = a_i + d_t + \sum_j \beta_{year_j} MNC_i \times TPR_{year_j,kt} + \beta_{\mathbf{x}} \mathbf{x}_{ikt} + \varepsilon_{ikt}.$$

(7)

Figure 1 summarizes the coefficient estimates β_{year_j} together with their 95% confidence interval. The results indicate that MNCs reacted quickly in the first year following the

introduction of the transfer-pricing regulations, which sees the largest reduction in their investment. This is consistent with that investment decision is forward-looking. The introduction of transfer-pricing regulations also has some lasting impact, given that multinational investment continues to exhibit a decreasing trend several years into the post transfer-pricing regulation regime.

6.3 The Investment Effect of Thin-Capitalization Rules

As discussed in Section 2, multinationals have a variety of methods such as intra-group interest and royalty payment in additional to transfer pricing to reallocate profits within the group to minimize their global tax liability. For example, faced with an increased ability of multinational corporations to use debt finance for profit shifting, many governments have adopted thin-capitalization rules to restrict the interest deductibility of debt. The increased popularity of thin-capitalization rule is also observed in our data, where more than half of countries in our dataset have introduced some sort of thin-capitalization rules during 2006-2015. Given that well-designed thin-capitalization rules have been found to be effective in reducing affiliate leverage (Buettner et al., 2012; Blouin et al., 2014; DeMooij and Hebous, 2017), it is natural for us to compare the effect of thin-capitalization rule on multinational investment, if any, with that of transfer-pricing regulations.

Specifically, we examine the impact of thin-capitalization rule on multinational investment in a similar setting to equation (4):

$$Investment_{ikt} = a_i + d_t + \beta_{TC}MNC_i \times TCR_{kt} + \beta_{\mathbf{x}}\mathbf{x}_{ikt} + \varepsilon_{ikt}, \tag{8}$$

where TC_{kt} is a dummy indicator that takes value of 1 for all years since the introduction of thin-capitalization rules in country k, and zero otherwise. The regression results are summarized in Table 7, which controlls for country-level characteristics and other time-varying and country-varying industry characteristics in Columns (2)-(5) (but not in Column (1)). The results suggest that the significance of the DD coefficient estimate depends critically on the inclusion of time-varying macroeconomic and industry characteristics. In particular, findings in Column (2) and (3) suggest that there is no significant impact of thin-capitalization rule

on multinational investment conditional on other relevant country-level and industry-level factors.

When applied to total debt at the group level, the thin-capitalization rule may also affect the capital structure of domestic affiliates and therefore invalidate the DD approach. To address this concern, we construct two dummy indicators to distinguish interest deductibility rules that apply to total debt ($TCR_{total,kt}$) from those that only apply to related-party debt ($TCR_{related,kt}$). Nevertheless, Column (4) shows that neither type of thin-capitalization rule has any significant effect on multinational investment. One possible explanation is that in each country where the thin-capitalization rule in place, only a small percentage of MNC affiliates have leverage ratio over the safe-harbor ratio, implying considerable amount of measurement errors in the definition of treatment group. Alternatively, previous literature has also found that there are other ways for multinationals to circumvent the thin-capitalization rule, for example, by adjusting their debt and asset simultaneously to maintain the same leverage ratio (Buslei and Simmler, 2012). This may explain the positive sign of the thin-capitalization rule, but nevertheless implies somewhat limited effect on the cost of capital and investment for multinational affiliates.

Finally, Table 7 Column (4) performs a joint test on the investment impact of transfer-pricing and thin-capitalization regulation. The results remain consistent with the previous findings. The DD coefficient estimate for transfer-pricing regulation remains to be negative and highly significant, in contrast to an insignificant impact of thin-capitalization rules on multinational investment.

7 The Effect of Transfer-Pricing Regulation on Total MNC Investment

The reduction in fixed capital investment by multinational affiliates identified in Section 6 may suggest a genuine reduction in the amount of total investment by the multinational company group due to increased cost of capital at the group level. Alternatively, it may represent a shift of investment to affiliates of the same group in other low-tax countries, while

the level of total investment remains unchanged. Both types of investment responses may reduce domestic welfare in the hos country that introduced the transfer pricing regulation, but they are also associated with different welfare outcomes for the rest of the world. Foregone investment by the multinational group may reduce global welfare, while reallocation of investments across countries to exploit differences in their transfer pricing policies can create cross-country spillovers and may intensify tax competition among national governments.

To examine the impact of domestic transfer-pricing regulation on total investment by the multinational group, we use consolidated accounts of parent companies in ORBIS to construct a measure of fixed capital investments at the company group level.[16] The sample for this analysis includes consolidated accounts for 17,638 observations corresponding to about 2,024 distinct non-financial, non-utility parent companies in more than 60 countries in the period from 2006 to 2015.

We follow a similar difference-in-difference empirical strategy based on equation 4 to identify the impact of transfer-pricing regulation on total investment group. All the key variables are as previously defined using consolidated accounts. In particular, $Investment_{ikt}$ now reflects the rate of investment at the multinational group level, with the parent company i in country k. TPR_{kt} is a discrete dummy variable that takes the value of one if there is some transfer pricing regulation in the parent country k. It is important to note that the TPR_{kt} variable defined this way only captures the effect of transfer-pricing regulation in the parent country on group-level investment, while ignoring the effect of transfer-pricing regulations in any other countries where affiliates are located.[17] In other words, the TPR_{kt} measures the total number of transfer-pricing regulations on the multinational group with some errors, which may prevent us from finding any effect of the regulations on total investment.

Table 8 report the regression results, where the DD coefficient captures the impact of parent-country transfer pricing regulation on total investment by the multinational group, relative to that by domestic group. Columns (1) reports results from the basic investment

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[16]Specifically, we restrict our sample to companies that are parent of multinational or domestic company group, among all companies with consolidated accounts in ORBIS. This is to eliminate double counting as regional headquarters are also required to file consolidated accounts.

[17]Alternatively, there is limited time variation in the TPR_{kt} variable that aims to capture the impact of transfer regulations both at the parent and affiliate countries, as its value depends on the first country that introduces the transfer-pricing regulation faced by any affiliate in the group within the sample period.

regression based on equation 4 with no country-level controls. Contrary to our expectation, the DD coefficient estimate is positive and significant at 1% level, and is robust to inclusion of country-level determinants of investment in Column (2). However, the DD coefficient is no longer significant with the inclusion of country-year fixed effects in Column (3), suggesting that the positive and significant effect of the transfer-pricing regulation as identified in the first two columns may reflect other unobserved common change in investment to all multinational investment that are unrelated to the anti-avoidance rules. The DD coefficient remains positive and insignificant when further including industry-year fixed effects and industry-country fixed effects in Column (4). Column (5) further interacts the discrete interaction term with the top statutory CIT rate in the parent country, and the basic finding remains unchanged. [18]

8 Conclusions

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[18]The basic finding also remains unchanged when interacting the discrete interaction term with the *tprisk* variable. **Data on CIT needs to be updated to include year 2015; but why 2015 rate was not missing in the affiliate level data???**

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9 Figures

Figure 1. Yearly DD Estimates
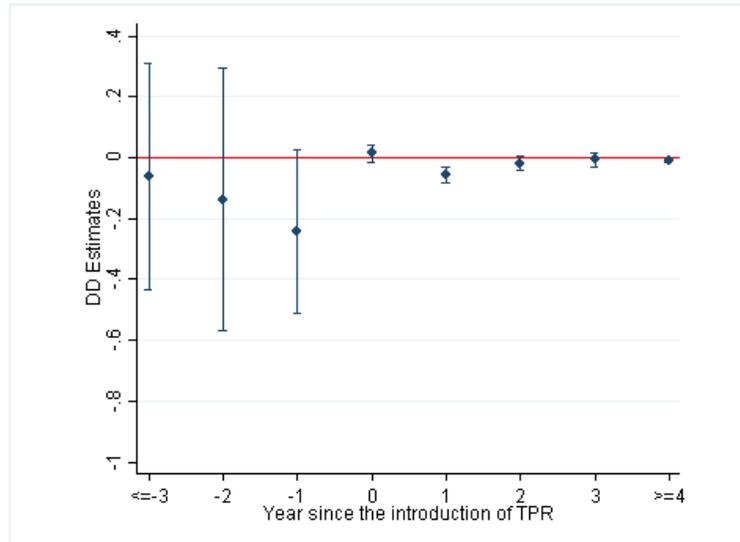
Figure 2. Introduction of Transfer Pricing Regulations
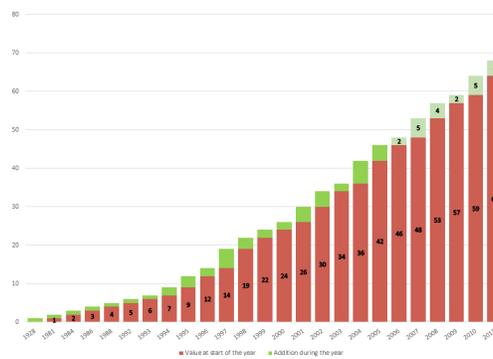
Figure 3. Introduction of Thin Capitalization Rules
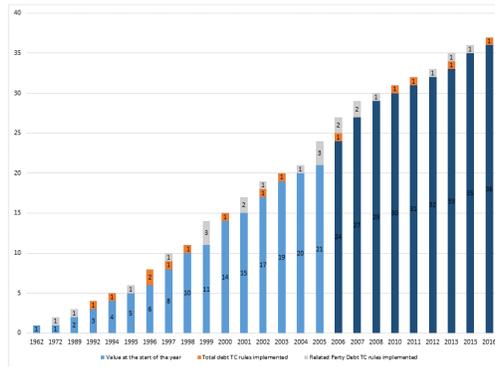
10 Tables

A   Details on Transfer-Pricing Risk Measure

The *tprisk* measure is created by regressing experts' perceptions of transfer pricing risk on 15 components of transfer-pricing regulation, by surveying 76 transfer pricing experts in 27 different countries in 2010. The regression results suggest nine factors are statistically significant in determining the level of transfer-pricing risk:

$$
\begin{aligned}
tprisk = 1.027 &+ (0.224)NoPriorityMethods + (0.251)RelatedParty + (0.387)SecretComp \\
&+ (0.227)NoPenaltyReduction + (0.178)TaxFirst + (0.229)NoSetoffs \\
&+ (0.175)NoCCAs + (0.326)NoBenchmark + (0.794)TPAudit
\end{aligned}
\tag{9}
$$

The coefficients obtained from the regression are then used to compute the transfer-pricing risk variable between 2006 and 2011, based on each country's observed transfer pricing regulation characteristics in these years. Depending on the year, the number of countries for which the necessary information is available varies, so the set of countries ranges from 37 countries in 2006 to 53 countries in 2011. Countries that are known to have no transfer-pricing regulations have a *tprisk* score of ???.

B   Appendix Figures

Figure B.1. Industry Distribution
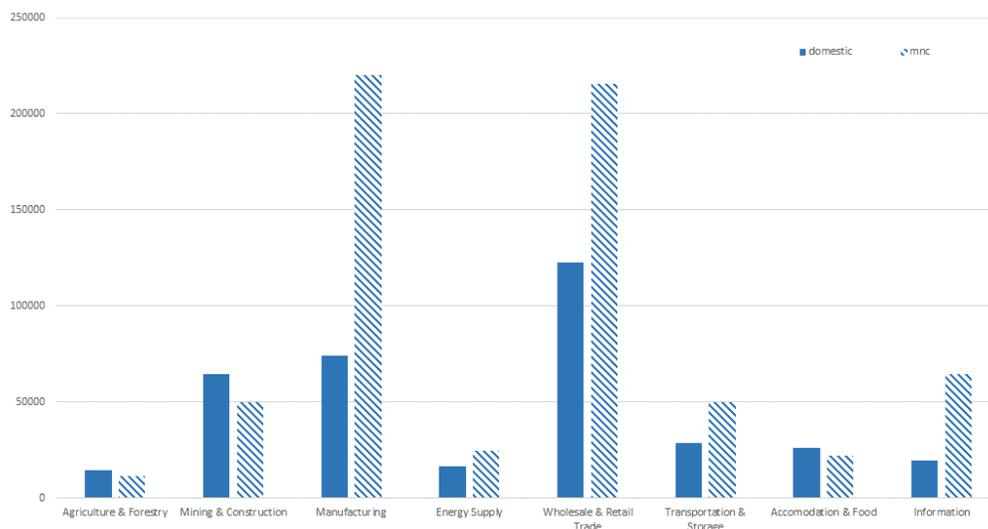
Notes: This figure shows the distribution of industries by ownership types for companies in the main estimation sample in the time period 2006 to 2014.

Table 1. Country Statistics

Number of Companies in:	Total	MNC	Domestic Company Group
Austria	9,591	8,442	1,149
Belgium	57,614	45,718	11,896
Bosnia & Herzegovina	3,362	2,865	497
Bulgaria	16,102	5,805	10,297
Czech Republic	36,882	25,074	11,808
Denmark	6,897	5,596	1,301
Estonia	7,502	5,240	2,262
Finland	30,152	18,342	11,810
France	196,373	120,910	75,463
Germany	48,616	38,620	9,996
Greece	12,169	8,797	3,372
Hungary	19,049	18,630	419
Japan	19,131	18,836	295
Korea, Republic of	18,804	14,714	4,090
Luxembourg	1,328	1,113	215
Netherlands	2,366	1,796	570
New Zealand	1,017	976	41
Norway	56,349	29,546	26,803
Poland	37,289	25,013	12,276
Portugal	44,653	28,338	16,315
Romania	21,123	16,181	4,942
Slovak Republic	13,585	10,914	2,671
Slovenia	8,015	6,910	1,105
Spain	153,129	89,895	63,234
Sweden	119,329	46,110	73,219
Ukraine	2,461	842	1,619
United Kingdom	81,571	63,028	18,543

Notes: This table lists the number of companies by ownership types in the main estimation sample in the time period 2006 to 2014.

Table 2. Summary Statistics

Variables:	Mean	Std Dev	Median	P10	P90
Firm-level variables:					
Investment spending ($1,000)	3,803	113,500	95.49	-59.59	3,398.20
Fixed Asset ($1,000)	29,941	557,200	959.15	33.31	22,601.34
Investment rate (I_t/K_{t-1})	0.34	0.54	0.15	-0.06	1.02
Operating Revenue ($1,000)	101,900	101,900	8,607	824	114,100
Cash flow rate	0.10	19.11	0.00	0.00	0.05
Profitability	0.09	0.17	0.06	-0.03	0.25
Sales Growth Rate (%)	6.34	30.06	2.66	-25.23	40.21
Country-level variables:					
CIT rate	0.28	0.06	0.28	0.19	0.33
Population (million)	36.64	28.38	44.36	5.40	63.70
Unemployment Rate (%)	9.36	5.06	8.10	4.87	17.88
Exchange rate (rel to USD)	28.24	149.31	0.75	0.68	7.65
GDP per capita	703,205	3,463,469	32,270	21,991	597,175
GDP Growth Rate (%)	0.97	2.89	1.24	-2.94	4.05

Notes: this table provides the summary statistics of the key variables in the main estimation sample for regression analysis.

Table 3. Baseline Results

Dependent variable: Investment per $ fixed asset	(1)	(2)	(3)	(4)	(5)	(6)
$MNC_i \times TPR_{kt}$	-0.027***	-0.024***	-0.011***	-0.010***	-0.010***	
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	
$MNC_i \times TPR_{kt} \times tprisk_{kt}$						-0.021***
						(0.004)
$log(Sales_{t-1})$	-0.094***	-0.096***	-0.088***	-0.088***	-0.088***	
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	
Cash flow per $ fixed asset	0.018***	0.018***	0.018***	0.018***	0.018***	0.019***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Profitability_{t-1}$	0.076***	0.072***	0.065***	0.064***	0.064***	0.016**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
$Sales\ growth\ rate_{t-1}$	0.031***	0.029***	0.027***	0.027***	0.027***	-0.013***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Country-Year FE	N	N	Y	Y	Y	Y
Industry-Year FE	N	N	N	Y	Y	Y
Country-Industry FE	N	N	N	N	Y	Y
R^2	0.317	0.318	0.324	0.325	0.325	0.359
N	679,555	679,555	679,554	679,554	679,554	492,087

Notes:

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Table 4. Heterogeneous Investment Responses in Complex MNCs

Dependent variable: Investment per $ fixed asset	(1)	(2)
$MNC_i \times TPR_{kt}$	0.007	0.004
	(0.012)	(0.012)
$MNC_i \times TPR_{kt} \times Complex_i$	-0.009***	-0.010***
	(0.003)	(0.003)
$log(Sales_{t-1})$	-0.088***	-0.088***
	(0.003)	(0.003)
Cash flow per $ fixed asset	0.018***	0.018***
	(0.000)	(0.000)
$Profitability_{t-1}$	0.064***	0.064***
	(0.007)	(0.007)
$Sales\ growth\ rate_{t-1}$	0.027***	0.027***
	(0.003)	(0.003)
Firm FE	Y	Y
Year FE	Y	Y
Country-Year FE	Y	Y
Industry-Year FE	Y	Y
Country-Industry FE	Y	Y
R^2	0.325	0.325
N	679,554	679,554

Notes:

Table 5. Heterogeneous Investment Responses in Intangible Assets Intensity

Dependent variable: Investment per $ fixed asset	(1)	(2)
$MNC_i \times TPR_{kt}$	-0.014***	-0.016***
	(0.003)	(0.003)
$MNC_i \times TPR_{kt} \times IntangShare_i$	0.001***	0.004***
	(0.000)	(0.001)
$MNC_i \times TPR_{kt} \times IntangShare_i^2$		-0.0001***
		(0.00001)
$log(Sales_{t-1})$	-0.088***	-0.088***
	(0.003)	(0.003)
Cash flow per $ fixed asset	0.018***	0.018***
	(0.000)	(0.000)
$Profitability_{t-1}$	0.064***	0.064***
	(0.007)	(0.007)
$Sales\ growth\ rate_{t-1}$	0.027***	0.026***
	(0.003)	(0.003)
Firm FE	Y	Y
Year FE	Y	Y
Country-Year FE	Y	Y
Industry-Year FE	Y	Y
Country-Industry FE	Y	Y
R^2	0.325	0.325
N	679,554	679,554

Notes:

Table 6. Heterogeneous Results: Timing

Dependent variable: Investment per \$ fixed asset	winsorized at P95 (1)	winsorized at P99 (2)
$MNC_i \times Year_0$	0.015	0.008
	(0.015)	(0.029)
$MNC_i \times Year_1$	-0.057***	-0.086***
	(0.013)	(0.025)
$MNC_i \times Year_2$	-0.022*	-0.030
	(0.012)	(0.023)
$MNC_i \times Year_3$	-0.004	-0.002
	(0.012)	(0.022)
$MNC_i \times Year_{\geqslant 4}$	-0.008**	-0.015**
	(0.003)	(0.007)
Firm FE	Y	Y
Year FE	Y	Y
Country-Year FE	Y	Y
Industry-Year FE	Y	Y
Country-Industry FE	Y	Y
R-squared	0.316	0.273
N	605,908	605,908

Notes:

Table 7. Investment Responses to Thin-Capitalization Rules

Dependent variable: Investment per \$ fixed asset	(1)	(2)	(3)	(4)	(5)	(6)
$MNC_i \times TCR_{kt}$	-0.044***	-0.002	0.011			
	(0.008)	(0.008)	(0.012)			
$MNC_i \times TCR_{total,kt}$				0.015		
				(0.022)		
$MNC_i \times TCR_{related,kt}$				0.010	0.010	0.001
				(0.014)	(0.014)	(0.014)
$MNC_i \times TPR_{kt}$						-0.010***
						(0.003)
$log(Sales_{t-1})$	-0.094***	-0.096***	-0.088***	-0.088***	-0.088***	-0.088***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Cash flow per \$ fixed asset	0.018***	0.018***	0.018***	0.018***	0.018***	0.018***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Profitability_{t-1}$	0.076***	0.072***	0.064***	0.064***	0.064***	0.064***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$Sales\ growth\ rate_{t-1}$	0.030***	0.029***	0.027***	0.027***	0.027***	0.027***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Country-Level Controls	N	Y	N	N	N	N
Country-Year FE	N	N	Y	Y	Y	Y
Industry-Year FE	N	N	N	Y	Y	Y
Country-Industry FE	N	N	N	N	Y	Y
R^2	0.317	0.318	0.325	0.325	0.325	0.325
N	679,555	679,555	679,554	679,554	679,554	679,554

Notes:

Table 8. Total Investment Responses to Transfer-Pricing Regulations

Dependent variable: Investment per $ of fixed asset	(1)	(2)	(3)	(4)	(5)
$MNC_i \times TPR_{kt}$	0.034***	0.032**	0.007	0.007	
	(0.010)	(0.013)	(0.013)	(0.013)	
$MNC_i \times TPR_{kt} \times \tau_{kt}$					0.029
					(0.058)
$log(Sales_{t-1})$	-0.042***	-0.069***	-0.036***	-0.036***	-0.064***
	(0.010)	(0.012)	(0.010)	(0.010)	(0.013)
Cash flow per $ fixed asset	0.005	0.017**	0.004	0.004	0.016**
	(0.006)	(0.008)	(0.006)	(0.006)	(0.008)
$Profitability_{t-1}$	0.004	0.007**	0.003	0.003	0.006*
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)
Sales growth rate$_{t-1}$	-0.009	-0.029**	-0.006	-0.006	-0.021*
	(0.010)	(0.012)	(0.010)	(0.010)	(0.012)
τ_{kt}		-0.641***			
		(0.190)			
Unemployment rate (%)		0.001			
		(0.001)			
Exchange rate (rel. USD)		-0.004**			
		(0.002)			
Population (mil)		0.000**			
		(0.000)			
GDP per capita (2005 Constant USD)		-0.000***			
		(0.000)			
GDP growth rate (%)		0.007***			
		(0.002)			
Firm FE	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y
Country-Year FE	N	N	Y	Y	Y
Industry-Year FE	N	N	N	Y	Y
Country-Industry FE	N	N	N	Y	Y
R^2	0.265	0.310	0.312	0.316	0.356
N	12,899	8,879	12,748	12,748	8,842

Notes: