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Under cover: detecting the existence of profit-shifting in China

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Abstract
This paper investigates profit-shifting behaviour among a large sample of multinational corporations (MNCs) in China. While profit-shifting behaviour is difficult to observe directly, it can be inferred from the behaviour of firms. That is the approach taken by Egger, Merlo, and Wamser (2014, henceforth EM&W) in their seminal analysis of tax elasticity of German MNCs. They developed a two-component mixture model that categorized MNCs into tax "avoiders" and "non-avoiders" based upon the estimated elasticities of investment to taxes. The authors of this paper apply their approach to their sample of MNCs in China. Like EM&W they find evidence of two distinct groups of MNCs. One group is responsive to changes in taxes, reducing investment when taxes increase. The other group is unresponsive to taxes, so that investment is not significantly associated with changes in tax rates. The authors show that the characteristics of these groups closely match the "avoiders" and "non-avoiders" of EM&W's sample. Even so, their estimated tax elasticities are much smaller than EM&W. This suggests that the extent of profit-shifting was relatively small during China's period of preferential tax treatment for foreign investors.

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Keywords MNCs; profit shifting; tax elasticity of investment; finite mixture model; China

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I. INTRODUCTION

This study investigates profit-shifting by multinational corporations (MNCs) in China. A large literature has established that MNCs arrange their financial affairs across multiple jurisdictions to lessen their tax liability. Almost all of this literature has concentrated on the U.S. and Europe. A recent report by the OECD highlighted the problem of "base erosion and profit shifting" (BEPS) for developing countries.[1] While a major concern is loss in tax revenues, there are others. As noted by the OECD report, "BEPS undermines the credibility of the tax system in the eyes of all taxpayers. If the largest and most high-profile taxpayers are seen to be avoiding their tax liabilities, confidence and effectiveness of the tax system is undermined" (OECD, 2014). Even so, relatively little is known about the existence and extent of profit shifting in developing countries.

As a developing country and one of the world's leading destinations for foreign investment, one would expect that China is also impacted by the phenomenon of profit shifting. It has relatively high taxes compared to Hong Kong, Macao, and Singapore; all of which have been identified as "tax havens" (Gravelle, 2015) and which are major trading partners with China.[2] Data on industry profitability from the Chinese National Bureau of Statistics (CNBS) suggests the existence of a problem. Over the period 2003-2011, approximately 23 per cent of MNCs in manufacturing industries reported negative profits. These firms comprised almost a third of all companies that earned negative profits in China during this period. Yet, paradoxically, the rate of FDI in

[1] OECD, 2014, *Part 1 of A Report to G20 Development Working Group on the Impact of BEPS in Low Income Countries*. See: http://www.oecd.org/tax/tax-global/part-1-of-report-to-g20-dwg-on-the-impact-of-beps-in-low-income-countries.pdf

[2] For a definition of tax haven, see Gravelle (2015).

Chinese manufacturing industries has continued unabated. This suggests that these MNCs have produced paper losses in China and shifted profits overseas.

To date there has been only one study of profit-shifting in China. An & Tan (2014, henceforth A&T) exploit a natural experiment that took place in China in 2008. For many years prior to that, foreign investment enterprises (FIEs) enjoyed preferential tax treatment vis-a-vis domestic enterprises (DEs). On January 1, 2008, the new Corporate Income Tax Law introduced changes with the intent of equalizing the tax rates of FIEs and DEs. A&T used data from 2002-2008 and a difference-in-differences approach to identify the effect of the law change on firms' profits. They found that FIEs' profits relative to DEs' profits were lower in 2008. Their explanation is that FIEs shifted profits overseas in response to the tax increase.

However, there are contextual issues with the new Corporate Income Tax Law that diminish its usefulness as a natural experiment. The new Corporate Income Tax Law did not immediately equalize tax rates for all FIEs. FIEs located in economic development zones were allowed to gradually transition to the new higher rates. From 2008 to 2012, the income tax rate was gradually raised from 18 to 25 per cent. Further, 2008 was also the first year that the global financial crisis (GFC) greatly impacted world economies. As A&T note, this would be expected to negatively impact FIEs more than DEs. As a result, it is possible that their results reflect the impact of the GFC rather than the law change.[3] For these reasons, further analysis of profit-shifting in China is warranted.

[3] An & Tan (2014, page 595): "The 2008 global financial crisis might have an impact on our estimates. Although the crisis originated in western economies, it also had a serious impact on the Chinese economy and on Chinese domestic enterprises. However, FIEs might be likely to be more exposed to the crisis, which implies that our results might overestimate the magnitude of the response of FIEs to the law."

To address the above issues, particularly the latter identification problem, our study employs an alternative approach developed by Egger, Merlo, and Wamser (2014, henceforth EM&W). EM&W use a two-component, finite mixture model (FMM) to estimate the tax elasticity of FDI by overseas affiliates of German multinational corporations (MNCs). Two things are needed for EM&W's approach to successfully uncover profit-shifting. First, the FMM needs to identify two distinct types of MNCs, with one being less tax-elastic than the other. Second, the less tax-elastic type should display characteristics associated with profit-shifting firms.

While the categorization of MNCs into two (and only two) groups might seem artificial, it is consistent with what is known about the profit-shifting capabilities of MNCs. Dharmapala (2014) notes, "…a surprisingly large fraction of MNCs do not have tax haven affiliates and thus lack what might be seen as a fairly reliable indicium of tax-planning activity." We apply EM&W's approach using a large dataset of MNCs in China in the period preceding the tax law change in 2008. We find evidence of profit-shifting, providing complementary support to the findings of EM&W and A&T.

The remainder of this paper is organized as follows. Section II provides a review of the literature that sets the context for our study. Section III discusses the empirical procedures and data used in our analysis. Section IV presents estimates of tax elasticity, categorized by whether an MNC is estimated to be a shifter or non-shifter. It also includes a comparison of the characteristics of shifter and non-shifter MNCs. Section V summarizes our findings and discusses the implications of our research.

II. LITERATURE REVIEW

Profit-shifting is an accounting strategy used by firms located in multiple tax jurisdictions. Costs and revenues are allocated across business operations so that profits are disproportionately located in low tax jurisdictions. It is usually distinguished from

the allocation of real resources. However, the line separating decisions made for real versus accounting reasons is not always clear. For example, the location of MNC headquarters in so-called "tax havens" is often given as evidence of profit-shifting even though it involves the allocation of real resources. In contrast, the location of manufacturing plants in low tax jurisdictions is generally not considered profit-shifting. While profit-shifting may affect the allocation of resources, the main concern is erosion of tax bases and subsequent loss of public revenues.

There is little doubt that profit-shifting by MNC's occurs, though its extent is debated. An indication that profit-shifting can be economically significant is given by the ratio of profits to GDP in G7 countries versus tax havens. In 2010, profits of foreign subsidiaries of U.S. MNCs located in G7 countries were approximately 0.7% of foreign countries' GDP. In the same year, profits of foreign subsidiaries of U.S. MNCs as a share of the host country's GDP were 41.9% for Ireland, 127% for Luxembourg, 1,614% for Bermuda, 1,803% for the British Virgin Islands, and 2,065.6% for the Cayman Islands, to give just a few examples. There is some indication that profit-shifting has increased over time (Gravelle, 2016). As a result, this subject has received increased interest from policy makers in recent years.

In June 2012, the G20 summit identified tax "base erosion and profit shifting" (BEPS) by MNCs as a major concern for the world's economies. Later that year, the G20 finance ministers called on the OECD to study international experiences with BEPS. This culminated in a major report by the OECD outlining the scope of the problem.[4] This increased attention is mirrored by the number of journal articles published on the subject. FIGURE 1 reports the number of articles having the topic

[4] OECD, 2013, *Addressing Base Erosion and Profit Shifting*, OECD Publishing. http://dx.doi.org/10.1787/9789264192744-en

"profit-shifting" or "income-shifting" that were published in Social Science Citation Index journals over the last 30 years. It shows a sharp increase in recent years.

A straightforward way to measure profit-shifting is to study the relationship between profit rates and tax rates across jurisdictions. All things constant, one would expect the marginal return on capital to be lower in low tax jurisdictions. Under the right conditions, this would cause average profits to be lower. Many studies have looked at profit rates, or the ratio of income to sales, for MNCs in high and low tax jurisdictions and found the opposite to be true: Profits/income rates are higher in low tax jurisdictions (Grubert and Mutti, 1991; Hines and Rice, 1994; Huizinga and Laeven, 2008; Clausing, 2009; Weichenrieder, 2009; Dharmapala and Riedel, 2013). This is taken as evidence that MNCs shift profits from high to low tax jurisdictions.

It is generally agreed that there are two main avenues by which MNCs shift profits. The first involves borrowing and debt shifting. Given a decision to borrow money, a firm can minimize its tax liability by borrowing funds in a high tax jurisdiction, since the associated interest rate payments are tax deductible. For the same reason, there is an incentive for firms to engage in internal borrowing, where the affiliate in the low tax jurisdiction lends funds to the affiliate in the high tax jurisdiction. As a result, MNCs with affiliates in low tax countries will carry more debt and engage in more borrowing than MNCs who do not have affiliates in low tax countries. Evidence that this occurs is given by Desai et al. (2004), Huizinga et al. (2008) and Buettner et al. (2012).

A second way firms can shift profits is through transfer pricing. Transfer pricing affects sales between affiliates of an MNC. MNCs can avoid taxes by having the low tax affiliate sell goods and services at high prices to the high tax affiliate. Alternatively, MNCs can produce expensive goods and services in the high tax jurisdiction and sell

them at low prices to their low-tax jurisdiction affiliates. While there are regulations that regulate the prices that firms can charge affiliates ("arm's length pricing"), there is scope for firms to game the tax differential when it is difficult to identify matching products outside the firm. Evidence of profit shifting through transfer pricing is provided by Clausing (2003) and Bartelsman and Beetsma (2003).

Using transfer prices to shift profits is more likely to occur when goods and services are difficult to price, such as is the case with intangibles and highly specialized products. Grubert (2003) concludes that R&D-related intangibles are responsible for half of the income shifted from high- to low-tax countries. Relatedly, Gravelle (2015) reports that overseas income from U.S. MNCs are disproportionately concentrated in the pharmaceutical, medical, computer, and electronic equipment industries. This is consistent with intellectual property/R&D/specialized products being produced in the U.S. and then sold to affiliates in low tax rate countries at below "cost" prices.

II. EMPIRICAL PROCEDURES AND DATA

IIA. Empirical Procedure

As noted in Dharmapala's (2014) review of the literature, the primary approach for identifying the existence and extent of profit-shifting consists of estimating how profits of an MNC affiliate *i* are affected by the difference in the tax rates between the MNC parent and its affiliate. A standard specification is given by the following:

$$\log(Profits)_i = \beta_0 + \beta_1(\tau_{pi} - \tau_i) + \beta_2 \log(K_i) + \beta_3 \log(L_i) + \boldsymbol{X}_i\boldsymbol{\gamma} + \varepsilon_i \quad (1)$$

where K_i and L_i are the affiliate's capital and labor inputs, and $\boldsymbol{X}_i$ is a vector of control variables that affect the affiliate's profits. The key variable is $(\tau_{pi} - \tau_i)$, which measures the difference in tax rates faced by the parent and its affiliate. Evidence of profit-shifting is given by the sign and significance of β_1. In particular, $\beta_1 > 0$ suggests

that MNCs shift profits out of high-tax, parent jurisdictions to low-tax, affiliate jurisdictions.

Unfortunately, as discussed below, our data do not allow us to estimate (1) because we only have data on MNC profits and taxes in China. Further, statutory rates for most of the firms in our study do not vary, as a common tax schedule applies across China. An additional complication is that China has a complex system of preferential tax treatments that cause actual rates to deviate from their statutory values. It is common to see tax exemptions such as "exemption for two years, halved corporate income tax rate for the ensuing three years" or "exemption for three years, halved corporate income tax rate for the ensuing two years" (Fan, 2002; Li & Lu, 2004). Thus tax payments can differ across MNCs dramatically, even if enterprises have exactly the same profits. Accordingly, our analysis relies on effective average tax rates (*EATR*), defined as the ratio of tax payments to profits ($EATR = \frac{Taxes}{Profits}$).[5]

Substitution into equation (1) highlights the problem:

(1') $$\log(Profits)_i = \beta_0 + \beta_1 \left(\frac{Taxes}{Profits}\right) + \beta_2 \log(K_i) + \beta_3 \log(L_i) + \boldsymbol{X}_i\boldsymbol{\gamma} + \varepsilon_i.$$

As *Profits* appear on both the left-hand and right-hand side of the equation, this will induce correlation between the profit variable and the tax rate variable that is unrelated to profit-shifting.

For this reason, we adopt an innovative approach developed by Egger, Merlo and Wamser (2014, henceforth EM&W). Their analysis focuses on FDI by affiliates of German MNCs, where FDI is measured by a firm's total fixed assets. They expect that FDI will be adversely affected by higher tax rates. However, not all firms will respond the same to higher tax rates. Some firms will be able to shield themselves from higher

[5] EM&W also include *EATRs* in their analysis of profit-shifting.

taxes by shifting profits to overseas affiliates. These profit-shifting firms will be less responsive to changes to tax rates than MNCs which lack low-tax, overseas options.

Accordingly, EM&W develop a model of MNC investment in which the population of MNCs is composed of two underlying classes or population components. MNCs belong to one or the other class, though their identity is unobserved. Instead, it is inferred by how they respond to changes in tax rates. Profit-shifters are expected to display a lower FDI tax elasticity than non-profit-shifters. To estimate this model, EM&W employ a finite mixture model in which the investment behaviour of firms is represented by a count model based on the negative binomial distribution.

The attraction of EM&W's approach is that the identification strategy relies on the different tax elasticities of the two groups. The existence of two groups can be tested against the alternative of one group to confirm whether this modelling approach is appropriate. Of course, establishing that there are two groups of MNCs with different tax elasticities is not sufficient by itself to allow one to conclude that the different tax elasticities are due to profit-shifting.

To investigate this further, we borrow another test from EM&W. Based on previous literature, they hypothesize that profit shifters are more likely to have higher levels of debt. As discussed above, a firm can minimize its tax liability by borrowing funds in a high tax jurisdiction, since the associated interest rate payments are tax deductible. For the same reason, there is an incentive for firms to engage in internal borrowing, where the affiliate in the low tax jurisdiction lends funds to the affiliate in the high tax jurisdiction. With respect to Chinese MNCs, presuming that profits are being shifted to low-tax jurisdictions such as Hong Kong, Macao, and Singapore, we should expect profit shifters to carry larger levels of debt.

EM&W also hypothesize that a larger share of foreign ownership in the affiliate is associated with a greater probability that the MNC is a profit shifter. Their argument is that the larger the share of foreign (in their case, German) ownership, the lower the coordination costs of arranging cross-country profit-shifting. A straightforward transfer of their argument to the Chinese setting implies that profit-shifters will be characterized by greater foreign ownership.

We now describe the empirical procedure employed in our analysis. Let y_i denote total fixed assets observed for MNC i. Let $\boldsymbol{x}_i$ be a vector of explanatory variables including a measure of taxes; and $\boldsymbol{\theta}^l$, $l = \{1,2\}$, a vector of parameters that are assumed to be the same for all firms within a given group of MNCs, but different across the two groups ($\boldsymbol{\theta}^1 \neq \boldsymbol{\theta}^2$). The distribution of y_i is assumed to be governed by one of two density functions, $f^l(y_i|\boldsymbol{x}_i, \boldsymbol{\theta}^l)$, $l = \{1,2\}$, depending to which group the MNC belongs.

Given that there is uncertainty regarding the group identity of a given firm, the density function for y_i adopts the following probabilistic, two-component finite mixture:

$$(2) \qquad f(y_i|\boldsymbol{x}_i, \boldsymbol{\theta}^1, \boldsymbol{\theta}^2, \pi^1) = \pi^1 f^1(y_i|\boldsymbol{x}_i, \boldsymbol{\theta}^1) + (1 - \pi^1) f^2(y_i|\boldsymbol{x}_i, \boldsymbol{\theta}^2)$$

where π^1 is the probability that the firm belongs to Group 1. π^1 is systematically related to MNC-specific characteristics, $\boldsymbol{z}_i$, through the following logistic specification,

$$(3) \qquad \pi^1 = \frac{exp(\boldsymbol{z}_i'\boldsymbol{\delta})}{[1+exp(\boldsymbol{z}_i'\boldsymbol{\delta})]} .$$

The density function, $f^l(y_i|\boldsymbol{x}_i, \boldsymbol{\theta}^l)$, is modelled by the negative binomial distribution. The associated likelihood function is then used to estimate the parameters $\boldsymbol{\theta}^l$ via maximum likelihood. Note that estimation of f^1 and f^2 allows one to identify separate tax elasticities for each of the two groups. Estimation of π^1 allows one to identify the factors that determine group classification.

The posterior probability that an observation y_i belongs to Group 1 is given by

(4) $$\Pr(y_i \in 1) = \frac{\pi^1 f^1(y_i|\boldsymbol{x}_i,\boldsymbol{\theta}^1)}{\pi^1 f^1(y_i|\boldsymbol{x}_i,\boldsymbol{\theta}^1)+(1-\pi^1) f^2(y_i|\boldsymbol{x}_i,\boldsymbol{\theta}^2)} \ .$$

It is easily confirmed that $0 \leq \Pr(y_i \in 1) \leq 1$, and $\Pr(y_i \in 2) = 1 - \Pr(y_i \in 1)$. MNCs for which $\Pr(y_i \in 1) \geq 0.5$ are characterized as belonging to Group 1. Equation (4) allows post-estimation categorization of observations into Groups 1 and 2 by replacing π^1, f^1, and f^2 with their respective estimates. Once individual firms are classified into one or the other group, they can be further studied to gain insight into the extent of profit-shifting across firms.

Before proceeding to a discussion of the data, we should comment on the appropriateness of using a count model – the negative binomial regression model – to model a continuous variable such as FDI. A common alternative is to take the natural log of the dependent variable and estimate the following linear specification:

(5) $$\log(y_i) = \boldsymbol{x}_i'\boldsymbol{\beta} + error_i.$$

However, it has been recently noted that count models possess a number of attractive features that make them preferable to log-linear models such as Equation (5) (cf., Silva and Tenreyro, 2006; Wooldridge, 2010, chapter 18; and Cameron and Trivedi, 2010, chapter 17.3.2).[6] To facilitate comparison with EM&W, we follow their approach of modelling FDI with the negative binomial distribution.

IIB. Data

Data overview. The major data source for this study is the Annual Industrial Survey Database from the China National Bureau of Statistics (CNBS). This database contains the most comprehensive information about domestic and foreign corporations in China (Chang & Xu, 2008; Tian, 2007). By law, all corporations in China are required to provide information to the CNBS (Chang & Xu, 2008). Coverage includes all state-

[6] See also the Stata blog by William Gould, "Use poisson rather than regress; tell a friend". http://blog.stata.com/2011/08/22/use-poisson-rather-than-regress-tell-a-friend/

owned corporations, and all non-state-owned corporations (including foreign ones) with annual sales of at least RMB 5 million (about USD $725,000 at the prevailing exchange rate at the time of this writing). The database includes key firm-level financial information such as sales, capital, and employment; as well as other firm-related data such as founding year and ownership details. Our data covers the years 2003-2007. While the dataset extends beyond 2007, there are difficulties with obtaining more recent data, as well as questions about their reliability.[7] We also found it advantageous to restrict coverage to the pre-2008 period in order to avoid confounding effects associated with the GFC. We supplemented the CNBS data with data from the *China Urban Statistical Yearbook*. The latter provided information about the business environments in which the MNCs were located.

For the purposes of this study, an "MNC" is defined as any firm whose capital from foreign investors exceeds the capital from other sources, as indicated by the database variable "paid-in capital." We deleted observations for which there were missing or negative values for key variables (such as total fixed assets, sales, employees, etc.). Our final sample consists of 20,985 MNC observations. While the data in principle allow for multiple observations per firm, in fact, there are less than 2 observations per firm on average in our sample.

Variables. As noted above, we follow EM&W in specifying the dependent variable as total fixed assets, which serves to measure MNC investment. The key explanatory variable in our analysis is the effective average tax rate, *EATR*, defined as the ratio of an MNC's total corporate income tax payments over its after-tax profits. It is widely used in studies of corporate tax effects (e.g., Devereux and Griffith, 2003). MNCs that are

[7] Huang and Chen (2017) and Wang (2017) have noted that the data from these years have a large number of missing data that are difficult to explain, indicating that they are of suspect quality, and of lower quality than preceding years.

able to profit-shift have the capacity to avoid taxes when faced with higher rates. As a result, we expect to find that investment by profit-shifters will be less responsive to tax changes than that by non-profit-shifters.

The literature on multinational enterprises predicts that size of the firm, market size, skilled labor endowments, capital-labor ratios and other variables related to trade and investment are important determinants of MNC behavior (Carr, Markusen, and Maskus, 2001; Markusen and Maskus, 2002; Bloningen, Davies, and Head, 2003; and Bergstrand and Egger, 2007). Accordingly, our analysis includes the log of the value of MNC sales, *lnSALES;* the log of the number of MNC employees, *lnEMP;* and the log of the capital-labor ratio, *lnKLRAT*.

We also include a number of variables to control for the MNC's business environment. These include features of the city where the MNC is located, such as the log of real GDP (*lnGDP*)*;* the log of tertiary school enrolment (*lnSKILL*); the log of labor cost (*lnLABOR*)*;* the log of the ratio of total public sector expenditures over real GDP (*lnMARK*), intended to measure the degree of marketization; the log of population density (*lnPOPDEN*)*;* the log of the ratio of total number of employees in the transportation, warehousing, postal, and communications sectors over the population (*lnINFRAS*), which measures the quality of infrastructure; the log of the ratio of total number of employees in the finance and insurance sectors over the population (*lnFINANCE*); and the log of effective foreign investment (*lnINVFOR*).

Our analysis also includes two determinants of the probability that a firm belongs to Group 1. *DEBT* measures the firm's internal ratio of debt to capital. As noted above, profit-shifting (non-profit-shifting) firms should have higher (lower) *DEBT* values. *FOREIGN* measures the ratio of foreign investment over paid-in capital ownership.

Based on EM&W, we expect that greater foreign ownership will be associated with greater profit-shifting.

TABLE 1 reports descriptive statistics for all the variables used in the analysis. Assets measure the MNC's total fixed assets, measured in units of thousands of RMBs. The mean value of MNC assets is approximately 59 million RMBs. The difference in the minimum and maximum values of *ASSETS* indicates the wide dispersion of asset sizes in our sample, ranging from a minimum of 4 thousand RMBs to a maximum of 13.5 billion RMBs. *EATR* is the effective average corporate tax rate. The mean *EATR* across our sample of MNCs is 17.4%. *SALES* is measured in 1000s of RMBs. It has a mean value of approximately 283 million RMBs and, like *ASSETS*¸ takes on a wide range of values. *EMP* measures the number of MNC employees in our sample. It ranges from 10 to 188,151 persons, with a mean number of employees equal to 489.

GDP is measured in units of 10,000 RMB. Real *GDP* of the city hosting the MNCs in our sample has a mean value of approximately 230 billion RMBs. The capital-labor ratio variable, *KLRAT,* is measured in units of 10,000 RMB/employee. It has a mean value of 1.74 million RMBs per worker. *SKILL* measures the tertiary school enrolment of the city hosting the MNCs. It has a mean value of 236,000 persons and ranges from 1,000 to about 1 million students. Labor costs are measured in units of 10,000 RMB, and has a mean value of approximately 232 million RMBs. *MARK* is the ratio of total public sector expenditures over real GDP. It ranges from 0.04 to 0.25 with mean value of 0.08. *POPDEN* measures population density of the city hosting the MNC and has a mean value of 700 persons per square kilometer. *INFRAS*, the ratio of total number of employees in the transportation, warehousing, postal, and communications sectors over the host city population, has a mean value of 0.01. The ratio of total number of employees in the finance and insurance sectors over the population is

measured by *FINANCE* and also has a mean value of 0.01. *INVFOR* measures effective foreign investment and is measured in units of 10,000 U.S. dollars. It has a mean value of 2.03 billon USDs. In addition, *DEBT* measures the firm's internal ratio of debt to capital. It has the mean value of 0.44. Lastly, *FOREIGN* measures the ratio of foreign investment over paid-in capital ownership. It ranges from 0.35 to 1 with the mean of 0.92 in our sample.

IV. RESULTS AND DISCUSSION

Column (1) of TABLE 2 reports the results of estimating a simple negative binomial regression model (NB). A one-percentage-point increase in the effective tax rate is associated with a 0.22% reduction in an MNC's total fixed assets, and this is significant at the 1 per cent level. This is substantially smaller than the tax elasticity estimated by EM&W. They found that a one-percentage-point increase in *EATR* reduced total fixed assets by 1.1% (cf. EM&W, Table 7, Specification XII). While their estimate was specifically for "non-avoiders", as we shall see below, our analogous estimate is similarly small in comparison.

Continuing with the control variables in Column (1), we find that, ceteris paribus, MNCs with larger sales (*lnSALES)*, more employees (*lnEMP*), a greater capital-labor ratio (*lnKLRAT*), and located in areas with a more educated labor force (*lnSKILL*) are all likely to be engaged in greater investment. These results are all in accord with prior expectations. We also find that MNCs located in areas with greater infrastructure (*lnINFRAS*) and in areas relatively abundant in foreign investment (*lnINVFOR*) are, ceteris paribus, likely to have fewer assets than other firms. Both results are surprising and contrary to prior expectations. As EM&W did not include these latter variables, we have no basis for comparison with their results. We also note

that all specifications include year dummy variables, though these are not reported in the table.

Columns (2) and (3) report the results of estimating the two-component negative binomial FMM model (FMNB). Consequently, the bottom part of the table reports various model diagnostics associated with the NB and FMNB models. The two-component FMNB model has both lower AIC and lower BIC values compared to the single-component NB model. Thus, both information criteria find the FMNB model to be preferable. Further, since the single component NB model is nested within the FMNB model, we can test the restrictive NB model against its more general, two-component alternative. When we do that, we strongly reject the single-component, NB model with a p-value well below 1 per cent. These results strongly support the existence of two classes of MNCs, consistent with EM&W's "tax avoiders" and "non-tax avoiders". Accordingly, we focus our attention on the tax elasticity estimates reported in Columns (2) and (3).

According to Column (2), a one-percentage-point increase in *EATR* is associated with a 0.14% reduction in total fixed assets for Group 1. The estimate is significant at the 1% significance level. The comparable estimate for Group 2 is -0.29%. While the latter estimate is larger in absolute size, it is statistically insignificant. Thus, while we find strong evidence that increased taxes discourage investment for Group 1, we cannot reject the hypothesis that taxes have no effect for Group 2.

These findings are also consistent with EM&W's identification of the two groups as tax "avoiders" and "non-avoiders." "Non-avoiders" are unable to shield themselves from tax increases, so higher taxes discourage investment (Group 1). "Avoiders" have the ability to shift profits to overseas affiliates, so higher taxes have little effect, leaving investment generally unresponsive to changes in taxes (Group 2). We perform further

analyses to see if there are other differences between the two groups that are consistent with this categorization.

The second panel of TABLE 2 reports that MNCs with greater *DEBT* have a lower (higher) probability of belonging to Group 1 (Group 2). As *DEBT* is an indicator of profit-shifting, this is consistent with Group 2 being "tax avoiders." In contrast, the estimate for *FOREIGN* appears to be wrong-signed and significant. EM&W found this variable to be correctly signed, but insignificant. A possible explanation for our contrary finding is that having Chinese partners in ownership may have facilitated profit-shifting in our sample: Preferential tax treatments made corporate tax rates very low for MNCs in mainland China during this period (more on this below). Some of the best opportunities for profit-shifting would have existed in the "tax havens" of Hong Kong, Macau, and Singapore (Gravelle, 2015). Chinese ownership (indicated by a smaller *FOREIGN* value) may be associated with a greater likelihood of having an affiliate in these tax-desirable locations. This would explain the positive coefficient on *FOREIGN*. While this is a case of "hypothesizing after results are known", it seems like a reasonable explanation that accounts for differences between our dataset and EM&W's.

TABLE 3 extends the analysis by presenting a side-by-side comparison of the characteristics of the two groups. The results are strikingly similar to EM&W's. Whereas EM&W found that profit-shifters comprised 11.1% of their sample of German firms, we find that 10.4% of our MNCs fit this category (Group 2). EM&W find that profit-shifters accounted for 57.6% of total fixed assets. We find that the corresponding number is 61.6%. EM&W found that profit-shifters were characterized by lower average tax rates than non-profit-shifters (26.6% versus 27.1%). We likewise found lower *EATRs* for profit-shifters (14.5% versus 17.7%). Finally, like EM&W, we find that profit-shifters (Group 2) have more assets, greater sales, and more employees than

non-profit-shifters. As larger firms have both greater opportunity and greater incentive to engage in profit-shifting, this provides further evidence that our two classes of MNCs correspond to EM&W's "tax avoiders" and "non-tax avoiders."

V. CONCLUSION

This paper investigates profit-shifting and tax avoidance among a large sample of multinational corporations (MNCs) in China. Despite much attention to the topic of tax avoidance in developing countries, and despite the importance of China to the world's economy, relatively little is known about the existence of profit-shifting in China.

To address this issue, we follow the approach taken by EM&W (2014) in their seminal analysis of tax elasticity of German MNCs. They developed a two-component mixture model that allocated MNCs into tax "avoiders" and "non-avoiders" based upon the estimated elasticity of FDI to taxes. Our analysis finds evidence of two distinct groups of MNCs in China that appear to match EMW's characterizations of tax "avoiders" and "non-avoiders." As such, our results provide a complement to the findings of An & Tan (2014) who detected profit-shifting behaviour after corporate tax rates were raised for foreign MNCs in China in 2008. Together, our findings provide some of the first evidences of profit-shifting in developing countries.

Our conclusion comes with two caveats. First, our results hinge on the statistical insignificance of the tax elasticity for the second group of MNCs. The tax elasticity of the group we classify as "profit-shifters" is larger than that for "non-profit-shifters", but it is less precise and hence statistically indistinguishable from zero. Second, our estimated tax elasticities are relatively small, roughly 20% of what EM&W estimate for their sample of German MNCs. This is likely due to the fact that the opportunities to benefit from profit-shifting in China during our sample period were much lower than for

EM&W's sample. While EM&W report a mean effective average tax rate (*EATR*) of approximately 27% for their sample, the mean *EATR* in our sample is only 17%. This would have made it more difficult for MNCs in China to find tax-attractive locations to which to shift profits. As corporate tax rates for foreign-owned MNCs in China have risen as a result of the 2008 Corporate Income Tax Law, the incentive to profit-shift has correspondingly also increased. Thus, we would expect that the effects we find in our sample are likely to be even more pronounced today.

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TABLE 1
Descriptive statistics

VARIABLE	*MEAN*	*STD. DEV.*	*MIN*	*MAX*
		Dependent variable		
ASSETS	59,421	307,234	4	13,500,000
		Independent variables explaining Total Profits		
EATR	0.174	0.131	0.000	0.999
SALES	283,210	1,844,359	393	187,000,000
EMP	489	1,890	10	188,151
GDP	23,100,000	15,700,000	819,087	71,100,000
KLRAT	174	1,163	0	91,084
SKILL	236	206	1	1,102
LABOR	23,276	7,229	15	40,561
MARK	0.08	0.02	0.04	0.25
POPDEN	0.07	0.03	0.00	0.27
INFRAS	0.01	0.01	0.00	0.06
FINANCE	0.01	0.01	0.00	0.03
INVFOR	203,312	175,644	22	716,471
Year2003	0.13	0.34	0	1
Year2004	0.22	0.42	0	1
Year2005	0.26	0.44	0	1
Year2006	0	0	0	0
Year2007	0.39	0.49	0	1
		Independent variables explaining π^1		
DEBT	0.44	0.24	-0.52	3.59
FOREIGN	0.92	0.15	0.35	1.00

NOTE: Number of observations is 20,985.

TABLE 2
The Impact of Corporate Income Taxes on MNC Investment

VARIABLES	*NB Model (1)*	*FMNB Model*	
		Group 1 (2)	*Group 2 (3)*
Determinants of Total Fixed Assets			
EATR	-0.2199***	-0.1438***	-0.2858
	(-2.62)	(-2.79)	(-1.54)
lnSALES	0.2123***	0.2077***	0.1659***
	(14.40)	(20.49)	(6.04)
lnEMP	0.6194***	0.7358***	0.5508***
	(27.12)	(42.10)	(12.33)
lnGDP	0.0759	0.0313	0.1257
	(1.43)	(1.01)	(1.32)
lnKLRAT	0.4964***	0.6155***	0.4191***
	(20.96)	(38.44)	(8.98)
lnSKILL	0.0638**	0.0684***	0.0281
	(2.42)	(3.43)	(0.63)
lnLABOR	-0.0887	0.0027	-0.2189
	(-1.49)	(0.07)	(-0.94)
lnMARK	0.1133	0.2110***	-0.0194
	(1.30)	(5.02)	(-0.11)
lnPOPDEN	-0.0060	-0.0966***	0.0960*
	(-0.22)	(-3.57)	(1.66)
lnINFRAS	-0.1439***	-0.1180***	-0.1340**
	(-3.32)	(-4.17)	(-1.83)
lnFINANCE	-0.0211	-0.0204	-0.0172
	(-0.55)	(-0.69)	(-0.23)
lnINVFOR	-0.0534**	0.0180	-0.1086**
	(-2.34)	(1.01)	(2.55)
Determinants of the Probability of Belonging to Group 1			
Constant	----	1.5379***	----
		(6.50)	
DEBT	----	-1.0373***	----
		(-7.26)	
FOREIGN	----	0.6587***	----
		(2.89)	
Observations	20,985	20,985	
AIC	465163.8	448222.7	
BIC	465298.9	448516.9	
Hypothesis Test (NB vs. FMNB): $\chi^2(20) = 16981.1$ *(p-value = 0.000)*			

NOTES: "NB" and "FMNB" represent the negative binomical and (2-component) finite mixture negative binomial models. The dependent variable is total fixed assets. In addition to the variables listed, all regressions include time dummies. t-statistics based on clustered robust (by firm) standard errors are reported in parentheses. *, **, and *** indicate significance at 10%, 5%, and 1%, respectively.

TABLE 3
Comparison of Characteristics for Groups 1 and 2

	GROUP 1		***GROUP 2***	
Observations	18,803		2,182	
Pct of Sample	89.6		10.4	
Pct of Total Assets	38.4		61.6	
VARIABLES	***MEAN***	***STD. DEV.***	***MEAN***	***STD. DEV.***
ASSETS	25,450	54,049	352,166	887,302
lnSALES	10.84	1.32	12.89	1.47
lnEMP	5.18	1.14	6.39	1.30
EATR	0.177	0.132	0.145	0.117
lnKLRAT	4.01	1.37	4.99	1.53
lnGDP	16.70	0.75	16.75	0.85
lnSKILL	5.08	0.91	5.18	0.97
lnLABOR	10.00	0.34	10.05	0.33
lnMARK	-2.56	0.27	-2.49	0.26
lnPOPDEN	-2.78	0.43	-2.79	0.53
lnINFRAS	-5.23	0.86	-5.04	0.97
lnFINANCE	-5.39	0.61	-5.26	0.68
lnINVFOR	11.71	1.23	11.68	1.43

NOTES: The classification of MNCs into Group 1 and Group 2 uses the estimates from the FMNB model in TABLE 1. For details, see Equation (3) in the text and the associated discussion.

FIGURE 1
Articles Having Topic As "Profit-shifting" OR "Income-shifting": 1987-2016 (SOURCE: Web of Science)