The Indirect Effect of Import Competition on Corporate Tax Avoidance

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Abstract: The role of competition in corporate tax avoidance is theoretically unclear in the existing literature. This paper empirically clarifies this role, with a focus on import competition. I exploit financial statements to measure tax avoidance of US-listed firms and the conferral of Permanent Normal Trade Relations status on China as a quasi-natural experiment to establish causality. The results reveal that import competition fosters corporate tax avoidance. The average effect is mainly driven by multinational enterprises implanted in tax havens. They invested in intangible assets to escape competition pressures, but these intangibles also allowed them to intensify their profit shifting activities. The findings shed light on the determinants of corporate tax avoidance. More generally, they help understand the decline in the average effective tax rate of US-listed firms, the current backlash against large corporations and globalization, and the calls for reform of the international tax system.

Keywords: Corporate tax avoidance, import competition, multinational firms, profit shifting, intangibles.

JEL codes: F14, F60, H25, H26, L60.

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1 Introduction

Aggressive tax planning has become a salient policy concern in a context marked by repeated tax scandals, persistent budget deficits, and rising income inequalities. A specific group of enterprises is often accused of large-scale tax avoidance: multinational enterprises (MNEs). A number of MNEs exploit legal technicalities to artificially shift profits to low- or no-tax jurisdictions and thereby reduce their effective tax rate (Dharmapala, 2014; Beer, de Mooij, and Liu, 2020). Given that MNEs are major actors in the global economy, losses in corporate income tax revenues due to profit shifting activities could be substantial. Recent estimations suggest that they reach 18 percent in the European Union and 14 percent in the US (Tørsløv, Wier, and Zucman, 2021). Therefore, identifying the factors influencing profit shifting and more broadly corporate tax avoidance is of foremost interest to both researchers and policy makers.

The present paper explores the determinants of corporate tax avoidance and more particularly studies the role played by competition, which remains an unresolved question in the literature. Existing theories posit that corporate tax avoidance could either increase or decrease as competition toughens (Marrelli and Martina, 1988; Goerke and Runkel, 2011). I clarify this through an empirical analysis. I show that, on average, import competition spurs corporate tax avoidance. Furthermore, the average effect is essentially driven by MNEs implanted in tax havens and passes through intangible assets. Competitive pressures prompt MNEs to invest in intangible assets to escape competition and limit revenue losses. However, these assets also fuel their income shifting activities.

To come to these conclusions, I exploit the rise of exports from China and financial statements of US-listed firms. In economics, a strand of research pioneered by Autor, Dorn, and Hanson (2013) documents the consequences of the surge in Chinese exports initiated in the 1990s, referred to as the China shock. The China shock was a sizable import competition shock. Within only 15 years, the penetration ratio of US imports from China in manufacturing increased sixfold, with notable disparities across sectors. An advantage of focusing on this episode lies in the possibility of using a quasi-natural experiment. The US granting Permanent Normal Trade Relations (PNTR) status to China in 2000 generates exogenous variations in Chinese import competition and allows a causal interpretation of the results. In parallel, a stream of research in accounting attempts to measure corporate tax avoidance. Quantifying corporate tax avoidance is a challenging task by nature because firms do not disclose to what extent they avoid taxes. Scholars usually gauge tax avoidance using balance sheets, income statements, and cash flows (Hanlon and Heitzman, 2010). [1] Building on this literature, I construct four indicators of tax aggressiveness for US-listed manufacturing firms between 1990 and 2005. I scrutinize the evolution of (i) the ratio of income taxes to pre-tax income (effective tax rate), (ii) the ratio of current

1. See also Frank, Lynch, and Rego (2009), Henry and Sansing (2018), Badertscher, Katz, Rego, and Wilson (2019), and De Simone, Nickerson, Seidman, and Stomberg (2019).

income taxes to pre-tax income, (iii) the ratio of cash income taxes paid to pre-tax income, and (iv) the ratio of cash income taxes paid to operating cash flows. These variables are standard in accounting, economics, and finance (e.g., Dyreng, Hanlon, Maydew, and Thornock, 2017; Suárez Serrato, 2019), and lower values are associated with higher tax avoidance. Moreover, when taken together, they encompass conforming, non-conforming, permanent, and temporary strategies. They thus reflect many tax avoidance techniques.

The analysis starts with three stylized facts. First, Chinese import competition and corporate tax avoidance exhibit a positive correlation. While the penetration ratio of US imports from China continuously increased between 1990 and 2005, the indicators of corporate tax avoidance fell throughout that period. Second, the China shock accentuated the sales slump of domestic firms and slowed the rise in sales of MNEs. Third, sales, pre-tax income, and effective tax rates are positively correlated. It implies that a positive correlation between changes in Chinese import competition and changes in corporate tax avoidance variables could in fact be spurious.

These observations naturally raise the following question: Did Chinese import competition really drive corporate tax avoidance upward ? I first regress each of the four tax avoidance variables on the penetration ratio of US imports from China in the output market. The regressions are run with ordinary least squares and control variables purge the effect of interest of numerous confounding factors. All other things being equal, a 1 percentage point increase in the penetration ratio of US imports from China is associated with a decrease of about 0.2 percentage point in each of the four tax avoidance variables. The baseline results are highly robust. They are corroborated by several econometric models and falsification tests. On the same note, leveraging imports from China of eight alternative high-income countries as an instrument to better capture the supply-driven changes in Chinese import competition and replicating the analysis with Mexican import competition yield comparable results. Importantly, integrating the US conferral of PNTR status on China in October 2000 in a difference-in-differences (DiD) exercise delivers the same conclusions. The motive for this approach is fivefold. (i) The granting was unanticipated (Pierce and Schott, 2016; Greenland, Ion, Lopresti, and Schott, 2020). (ii) This event alone is responsible for a third of the boom in China's exports to the US between 2000 and 2005 (Handley and Limão, 2017). (iii) The conferral exposed manufacturing sectors to Chinese import competition in a different way. (iv) This exposure mostly depended on non-normal trade relations tariff rates, set seventy years earlier in 1930, so the treatment is plausibly exogenous (Pierce and Schott, 2016). (v) There are no pre-existing trends. Prior to 2000, we observe no pattern between the evolution of the tax avoidance variables and the magnitude of the shock.

Next, I proceed in two steps to shed light on the benchmark results. In the first step, I separate MNEs and domestic firms and test for heterogeneous effects. We expect stronger effects for MNEs and especially for MNEs having subsidiaries in tax havens. Through various techniques, they can move profits from affiliates based in high-tax countries to

others located in tax-friendly jurisdictions. The results show no significant impact of import competition on tax avoidance among domestic firms. The fact that the effect is statistically significant solely for MNEs and more pronounced for those physically established in tax havens is reminiscent of profit shifting. In the second step, I investigate how MNEs intensified their tax avoidance practices in response to the China shock. A particular attention is paid on intangible assets. On the one hand, previous studies find that intra-firm royalty payments are considerably used for profit shifting purposes (Heckemeyer and Overesch, 2017; Beer et al., 2020). MNEs transfer intellectual property rights to no- or low-tax countries and deflate the profits registered in high-tax countries through royalties. On the other hand, Bloom, Draca, and Van Reenen (2016), Gutiérrez and Philippon (2017), and Hombert and Matray (2018) conclude that the China shock increased innovation, technical change, product differentiation, and investments in intangibles by industry leaders. Drawing on these papers, I examine whether import competition fosters tax aggressiveness indirectly through intangible assets, and I provide strong evidence to support this hypothesis. (i) The effect of Chinese import competition on tax avoidance becomes statistically insignificant when intangible assets are controlled for, suggesting that the China shock had no direct impact on tax avoidance conditional on intangibles. (ii) Intangible assets reduce MNEs' corporate income taxes but not those of domestic firms. Yet, domestic companies are also eligible for R&D tax deductions and similar tax relief proposed by public authorities. This confirms the use of intangibles as a tool to shift profits. (iii) I demonstrate that the China shock made MNEs invest in intangible assets, and these investments are more remarkable for MNEs involved in tax havens. This is in line with the aforementioned papers and with the common view that MNEs in tax havens are the most performing companies. (iv) Finally, sales of firms that were intensive in intangibles suffered from the China shock to a lesser extent; and MNEs operating in the most import-competitive sectors did not expand their network of subsidiaries in tax havens, despite a sharp increase in US-listed firms' operations in tax havens during the 2000s (Souillard, 2021). All in all, the results indicate that the China shock pushed MNEs to invest in intangible assets in order to escape competition, and these assets facilitated their income shifting activities. In a sense, the rise in tax avoidance is an indirect effect of import competition.

The findings have three policy implications. They provide insights into the decline in the average effective tax rate of US-listed firms (Dyreng et al., 2017). Back-of-the-envelope computations show that the tax avoidance effect caused by the China shock contributed 17 percent to the decline in the average effective tax rate observed between 1990 and 2005. More generally, this paper underscores a negative side of globalization. Globalization stimulates innovation of leading firms close to the technological frontier. The pro-competitive effect, by virtue of its effects on product prices and quality, is mostly perceived as one of the positive aspects of globalization. Nevertheless, the present paper argues that competitive pressures can indirectly accentuate the tax-dodging behavior of MNEs at the same time and unveils a new channel through which globalization eases tax avoidance. The findings could then partly explain the current backlash against globali-

zation and large corporations (Helpman, 2017; Ravallion, 2018; Rodrik, 2018; Walter, 2021). Lastly, they emphasize that import competition and corporate taxes are closely connected. The current international tax system was designed long before the recent globalization, when economic activities were carried out differently. This inadequacy creates loopholes, mismatches between tax systems, and other opportunities to aggressively save taxes. From this perspective, the paper calls for reform of the international tax system and reaffirms the need to better articulate fiscal and trade policies.

Related literature The paper lies at the intersection of two separate lines of research. A fast-growing literature studies the causes and methods of corporate tax avoidance. In particular, evidence shows that MNEs transfer part of their profits to low-tax countries by manipulating transfer prices (Swenson, 2001; Clausing, 2003; Cristea and Nguyen, 2016; Davies, Martin, Parenti, and Toubal, 2018), strategically locating intellectual property rights (Dischinger and Riedel, 2011; Karkinsky and Riedel, 2012; Griffith, Miller, and O'Connell, 2014; Alstadsæter, Barrios, Nicodème, Skonieczna, and Vezzani, 2018), recording sales in low-tax jurisdictions (Laffitte and Toubal, 2019), and by means of intra-firm loans (Egger, Eggert, Keuschnigg, and Winner, 2010; Buettner and Wamser, 2013), treaty shopping (Hong, 2018), and corporate inversions (Desai and Hines, 2002). I refer to Dharmapala (2014) and Beer et al. (2020) for surveys on profit shifting and to Alm (2019) and Wang, Xu, Sun, and Cullinan (2020) for reviews on the determinants of corporate tax avoidance. The present paper adds to this literature in two different ways. The impact of competition on corporate tax avoidance is theoretically unclear. Marrelli and Martina (1988) predict a negative effect, while Goerke and Runkel (2011) predict the opposite. Against this background, I provide empirical and systematic evidence that competition stimulates corporate tax avoidance. [2] Furthermore, the paper complements the findings of Martin, Parenti, and Toubal (2020). They find that tax avoidance gives large firms a competitive edge and amplifies industry concentration. Consequently, the relationship between competition and corporate tax avoidance is two-way.

Another range of papers investigate the consequences of the China shock. They document labor market effects (Autor et al., 2013; Mion and Zhu, 2013; Utar and Ruiz, 2013; Utar, 2014; Acemoglu, Autor, Dorn, Hanson, and Price, 2016; Pierce and Schott, 2016) and induced changes in firm product scope, factor reallocation (Iacovone, Rauch, and Winters, 2013; Chakraborty and Henry, 2019), innovation (Bloom et al., 2016; Hombert and Matray, 2018), productivity (Chen and Steinwender, 2019), and prices (Bai and Stump-

2. Note that tax evasion greatly differs from tax avoidance, the former being illegal. The strategies adopted and the companies involved are not the same in the case of tax evasion. Small and medium-sized enterprises are more prone to engage in tax evasion because they have limited knowledge of tax systems (Jones, Temouri, and Cobham, 2018), they have a lower probability of being audited (Hanlon, Hoopes, and Shroff, 2014), and they are more likely to turn to informality (Dabla-Norris, Gradstein, and Inchauste, 2008; De Paula and Scheinkman, 2011; Galiani and Weinschelbaum, 2012; Ulyssea, 2018). Cai and Liu (2009) and Gokalp, Lee, and Peng (2017) look at the effect of competition on tax evasion. Here, the focus is on tax avoidance and large corporations.

ner, 2019; Amiti, Dai, Feenstra, and Romalis, 2020). In this regard, my findings resonate with those of Bloom et al. (2016), Gutiérrez and Philippon (2017), and Hombert and Matray (2018), and highlight one of the downsides of the China shock and trade-induced competition. Although import competition encourages firms to innovate and move up the quality ladder, it also exacerbates MNEs' profit shifting practices.

The article is structured as follows. First, section 2 introduces the data and section 3 lays out three stylized facts on import competition and corporate tax avoidance. Section 4 then assesses the average effect of import competition on corporate tax avoidance, section 5 explains the mechanism, and section 6 concludes.

2 Data

To conduct the analysis, I assemble an unbalanced panel dataset of public manufacturing firms headquartered in the US operating between 1990 and 2005. This section describes the data sources, the main variables, and the final sample.

2.1 Data sources and main variables

The dataset comprises both firm- and industry-level data. The former are obtained from Compustat North America, and the latter originate from the NBER-CES Manufacturing Industry Database and Schott (2008).

Firm-level data Compustat North America gives rich information on consolidated balance sheets (assets, liabilities, and equity), income statements (revenues, costs, and expenses), and cash flows of publicly held companies in North America since 1950. Despite representing a small share of all firms, publicly listed firms account for 30 percent of employment, 40 percent of sales, and 50 percent of aggregate pre-tax profits (Asker, Farre-Mensa, and Ljungqvist, 2014). They are the largest and the most productive companies, and therefore the most likely to engage in multinational activities and aggressive tax planning (Helpman, Melitz, and Yeaple, 2004; Jones et al., 2018).

The information is used to construct four firm-year-specific indicators of corporate tax avoidance: (i) the ratio of income taxes to pre-tax income (effective tax rate, ETR), (ii) the ratio of current income taxes to pre-tax income ($ETR2$), (iii) the ratio of cash income taxes paid to pre-tax income ($CASHETR$), and (iv) the ratio of cash income taxes paid to operating cash flows (CFM). Lower ETR, $ETR2$, $CASHETR$, and CFM values are associated with higher tax avoidance. Exact formulas with Compustat codes are attached in Appendix A table AT1. The rationale for using cash income taxes in addition to tax expense is that accounting rules (e.g., Generally Accepted Accounting Principles and International Financial Reporting Standards) generally differ from tax rules. That is why cash income taxes do not always align with income tax expense. Note that infor-

TABLE 1 – Correlation between tax avoidance variables

	ETR	*ETR2*	*CASHETR*	*CFM*
ETR	1.00			
ETR2	0.53	1.00		
CASHETR	0.26	0.41	1.00	
CFM	0.20	0.27	0.64	1.00

Notes: This table reports the average within-firm correlation coefficients between the four tax avoidance variables. For a firm-year observation to be included in the computation of a correlation coefficient, the two tax avoidance variables must lie in the [0,1] interval. See section 2 for more details.

mation on taxes paid is a crucial advantage of Compustat over Orbis, another database widely used in the tax avoidance literature, where only accounting effective tax rates can be computed. Operating cash flows, for their part, depict firms' economic activities. They can be compared to accounting earnings to determine whether earnings are manipulated.

The four proxies have three key advantages. First, they have an intuitive interpretation. *ETR* is the simplest and will be the preferred variable in the rest of the paper. Second, they are the most popular in the accounting, economics, and financial literatures (e.g., Donohoe, 2015; Cen, Maydew, Zhang, and Zuo, 2017; Dyreng et al., 2017; Blaufus, Möhlmann, and Schwäbe, 2019; Suárez Serrato, 2019).[3] Lastly, they cover conforming, non-conforming, permanent, and temporary tax avoidance strategies,[4] thereby giving an overall snapshot of corporate tax avoidance. Table 1 confirms this complementarity and shows that the metrics simultaneously absorb a mix of common and uncommon features of corporate tax avoidance. One caveat is that the metrics can vary regardless of tax-dodging strategies. To mitigate this and precisely identify the effect of import competition on aggressive tax planning, factors determining tax liability like tax loss carry forward will be controlled for in the econometric exercise.

3. Book-tax differences, tax shelter scores, and unrecognized tax benefits are sometimes used as alternatives. Note that measures based on book-tax differences are by construction similar to those used in this article (De Simone et al., 2019) and that US firms are required to report unrecognized tax benefits as of 2006. In addition, although firms with negative profits are almost systematically excluded in the accounting literature, potentially biasing the results (Henry and Sansing, 2018), this is not the case here as long as the tax avoidance indicator lies between 0 and 1. Hence, 75 percent of loss-making firms remain in the sample. For more discussions on the measurement of corporate tax avoidance, see Hanlon (2003), Lev and Nissim (2004), Dyreng, Hanlon, and Maydew (2008), Dyreng, Hanlon, and Maydew (2010), Hanlon and Heitzman (2010), Guenther (2014), Henry and Sansing (2018), Badertscher et al. (2019), and De Simone et al. (2019).

4. Non-conforming tax avoidance refers to strategies affecting taxable income but not financial income. It can be seen as the deviation of tax position from what is expected based on book pre-tax income and the statutory tax rate. By contrast, conforming tax avoidance impacts taxable and financial income. *ETR*, for example, cannot capture the tax benefits of interest deductibility and more broadly conforming tax avoidance because it reduces taxable and financial income.

Industry-level data I supplement these data with industry data at the 4-digit 1987 SIC level from the NBER-CES Manufacturing Industry Database and Schott (2008). The NBER-CES Manufacturing Industry Database contains industry-level annual output, employment, payroll and other input costs, investment, capital stock, total factor productivity, and prices in the US from 1958 to 2011. The database built by Schott (2008) informs on annual US trade flows from 1972 to 2005. Combined, they allow for the calculation of the penetration ratio of US imports from China IMP, i.e., the ratio of US imports from China to US domestic demand, for each industry j and year t:

$$IMP_{jt} = \frac{Imports_{jt}^{\text{China,US}}}{Shipments_{jt}^{\text{US}} + Imports_{jt}^{\text{World,US}} - Exports_{jt}^{\text{US,World}}}$$

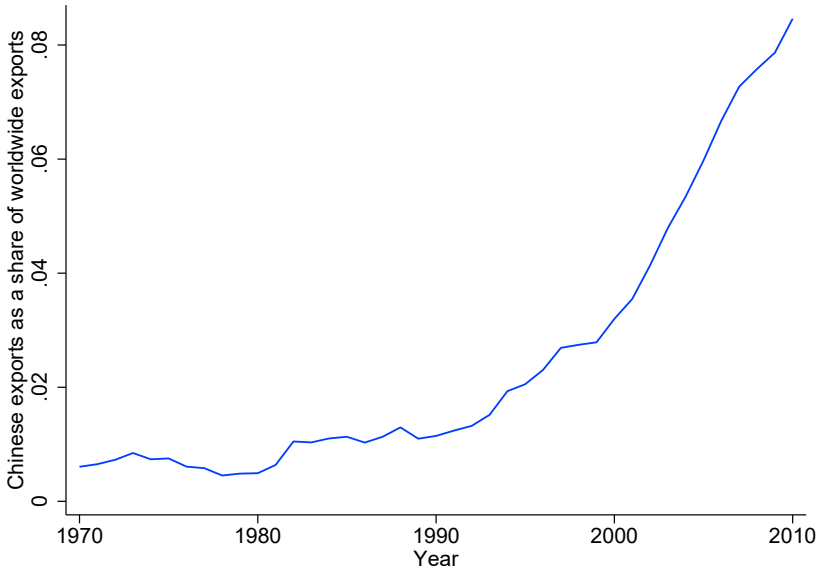
$Imports_{jt}^{\text{China,US}}$ symbolizes US imports from China in industry j and year t, $Imports_{jt}^{\text{World,US}}$ symbolizes total US imports in industry j and year t, $Exports_{jt}^{\text{US,World}}$ symbolizes total US exports in industry j and year t, and $Shipments_{jt}^{\text{US}}$ symbolizes US production in industry j and year t. The ratio varies over time (see next section) and across industries, even among similar products. In 2005, for instance, the penetration ratio of Chinese imports of hardwood veneer and plywood products (SIC 2435) was 12 percent, i.e., about twice the average, whereas the ratio for softwood veneer and plywood products (SIC 2436) was 40 times smaller. Owing to data limitations, multi-sector firms principally operating in the same industry j are considered to be equally exposed to Chinese import competition, i.e., $IMP_{ijt} = IMP_{jt}$ for all firm i and year t.

2.2 Sample

Only a subsample of the dataset described above is used for the study. I remove companies whose headquarters are not located in the US for comparability and exclude observations before 1990. As illustrated in figure 1, the 1990s mark the onset of the Chinese export boom. The share of Chinese exports in total world exports grew from 0.6 percent to 1.1 percent between 1970 and 1990 and then rose rapidly to 8 percent in 2010. In section 4, we will also see that the 1990-2005 period enables us to exploit the US granting PNTR status to China in 2000 as a quasi-natural experiment. Finally, I exclusively include manufacturing firms since manufacturing products represented the major portion of Chinese exports during that period and there is substantial variation in the import competition variable across manufacturing sectors.[5] In total, the subsample consists of an unbalanced panel of 51,791 firm-year observations, with 5,739 firms operating in 218 industries between 1990 and 2005, 1,087 of which operated over the entire time span. Summary statistics are provided in Appendix A table AT2.

5. The second argument justifies the non-use of services as a comparison group.

FIGURE 1 – Exports from China between 1970 and 2010



Notes: This figure plots the share of exports from China in worldwide exports between 1970 and 2010. The data originate from the World Bank.

3 First evidence on import competition and corporate tax avoidance

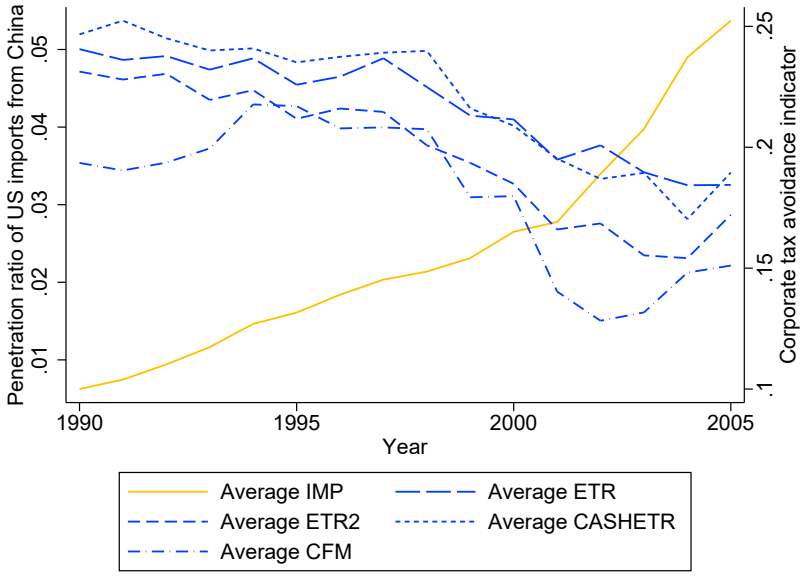
The dataset uncovers three facts: (i) Chinese import competition and corporate tax avoidance variables are positively correlated, (ii) the China shock reinforced the decline in sales of domestic firms and tempered the increase in sales of MNEs, and (iii) effective tax rates and sales/pre-tax income move in the same direction.

Stylized fact 1: The rise in Chinese import competition is associated with an increase in corporate tax avoidance.

Figure 2 plots the average penetration ratio of US imports from China and the mean value of the four corporate tax avoidance variables for each year between 1990 and 2005. For interpretability and as is common practice in the literature, firm-year observations are set as missing when the tax aggressiveness variable lies outside the $[0, 1]$ interval. The competition variable continuously increased throughout the period. [6] On the contrary, the indicators of corporate tax avoidance fell, in line with Dyreng et al. (2017). In Online Appendix table OAT1, the correlation is found to be statistically significant at the 1 percent

6. Online Appendix figure OAF1 reproduces figure 2 with the penetration ratio of US imports from all foreign countries.

FIGURE 2 – Import competition and corporate tax avoidance: macro-level evidence



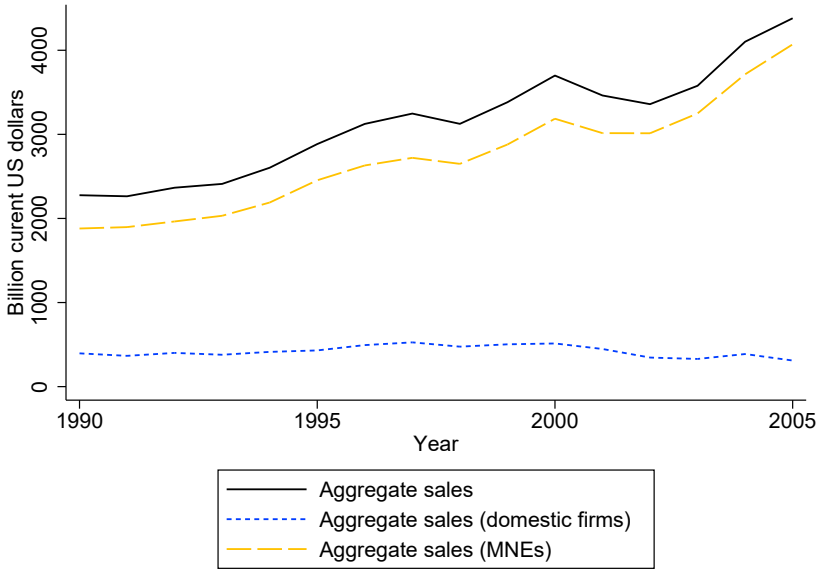
Notes: This figure plots the average penetration ratio of US imports from China (left y-axis) and the mean value of each of the four corporate tax avoidance variables (right y-axis) between 1990 and 2005. For the latter, firm-year observations are set as missing when the tax avoidance variable lies outside the [0,1] interval. See section 3 for more details.

level with just 16 data points. A 1 percentage point increase in the average import penetration ratio is associated with a 1.36 percentage point decrease in the average ETR, a 1.79 percentage point decrease in the average $ETR2$, a 1.47 percentage point decrease in the average $CASHETR$, and a 1.40 percentage point decrease in the average CFM. The correlation persists at the industry level, as outlined in Online Appendix table OAT2. It should be noted that the four metrics of tax avoidance appear relatively low (compared to US statutory tax rates) and somewhat volatile. This is because some firms have very low effective tax rates (see the distribution in Online Appendix figure OAF2[7]). I show in Online Appendix table OAT3 that the negative correlation still holds when this bias is corrected and revisit the volatility issue in the econometric analysis.

Stylized fact 2: Chinese import competition curtailed sales growth. In particular, it deepened the sales slump of domestic firms and dampened the sales increase of MNEs.

7. The left peak disappears when firm-year observations with a tax loss carry forward are dropped (see Online Appendix figure OAF3). Additionally, figures OAF4 and OAF5 suggest that tax loss carry forwards of domestic firms partly explain the discrepancy between the average effective tax rate of domestic firms and the average effective tax rate of MNEs displayed in Dyreng et al. (2017), the former being surprisingly lower on average. Eliminating firms with tax loss carry forwards substantially reduces not only the gap between ETR and statutory tax rates but also the gap between domestic firms' and MNEs' ETR.

FIGURE 3 – Aggregate sales



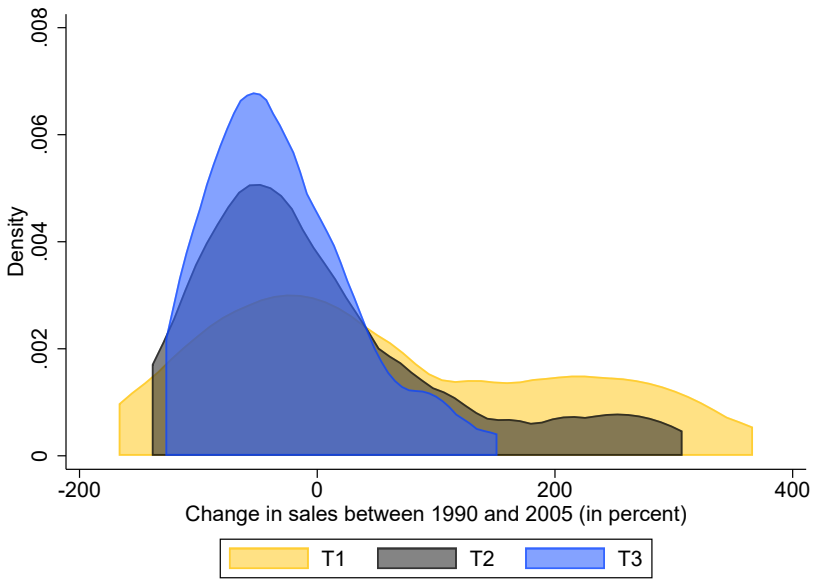
Notes: This figure plots sales of companies included in the sample between 1990 and 2005. See section 3 for more details.

TABLE 2 – Chinese import competition and firm sales

Dependent variable	$sales_{ijt}$
IMP_{jt}	-2,712.80
	(2,141.90)
Controls	Yes
Firm FEs	Yes
Year FEs	Yes
No. of obs.	33,297

Notes: This table reports regression results obtained with ordinary least squares. The standard error, in parentheses, is clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 3 for more details.

FIGURE 4 – Chinese import competition and sales of domestic enterprises



Notes: This figure plots sales growth distribution between 1990 and 2005 at the industry level, by tercile. Only domestic firms operating throughout the period are taken into account to calculate industry sales. Terciles are constructed based on the change in the penetration ratio of US imports from China between 1990 and 2005. T3 contains the sectors that were most affected by rising Chinese import competition. See section 3 for more details.

Figure 3 brings sales into the picture and reveals that they remarkably doubled during this time, notwithstanding growing Chinese import competition. Nonetheless, the increase in total sales was fueled primarily by the increase in MNEs' sales. Domestic firms' sales, by contrast, dwindled by 22 percent. In table 2 and figure 4, I prove that the China shock aggravated the contraction of domestic firms' sales and slowed the rise of MNEs' sales. Sales are regressed on IMP, an MNE dummy, and a set of firm and year fixed effects. The coefficient associated with IMP, negative, reflect the China shock's negative impact on sales. [8] The same applies to pre-tax income (see Online Appendix table OAT4) or if current US dollars are converted into 1987 US dollars with industry-level price indexes of shipments from the NBER-CES Manufacturing Industry Database. [9] The negative correlation is clear in figure 4. The graph exhibits the distribution of the growth rate of domestic firms' sales at the sector level. Sectors are divided into three groups of equivalent size based on exposure to the rising Chinese import competition. Growth rates are concentrated around -50 percent for the third tercile, composed of the sectors most exposed to rising Chinese import competition (transportation equipment, industrial machinery and

8. Note that the negative impact holds for both domestic and multinational enterprises. When allowing for heterogeneous effects, IMP becomes significant at the 10 percent level, and the interaction term $IMP \times MNE$ actually appears negative (although insignificant).

9. Figures 3 and 4 with pre-tax income and/or constant US dollars are available upon request.

equipment, electronic and other electric equipment). The distribution is flatter and shifts to the right for the second tercile and shifts even further for the first tercile.

Stylized fact 3: Effective tax rates and sales/pre-tax income are positively correlated.

Figure 5 examines the relationship between effective tax rates and sales/pre-tax income. The y-axis represents the effective tax rate and the x-axis represents either sales (left, in logarithm) or pre-tax income (right, in logarithm). The figure depicts a positive correlation in both cases and stays comparable if sales and pre-tax income are expressed in levels. The slope of the linear fit curve in the first graph indicates that a 10 percentage point increase in sales translates into a 0.37 percentage point increase in the effective tax rate, and the slope in the second graph indicates that a 10 percentage point increase in pre-tax income translates into a 0.10 percentage point increase in the effective tax rate. This pattern means that the negative correlation between effective tax rates and Chinese import competition is potentially attributable to the losses in sales induced by the China shock. In the ensuing sections, I will rule out the mechanical effect of import competition on tax avoidance variables passing through sales and pre-tax income by integrating these two variables into the vector of covariates. Interestingly, we will see that Chinese import competition only decreased the effective tax rate of MNEs, for which sales doubled.

4 Causal effect of import competition on corporate tax avoidance

This section goes beyond correlations and provides robust evidence of a positive and causal effect of import competition on corporate tax avoidance. I start with the baseline estimates and a simple counterfactual analysis. Next, I address endogeneity concerns.

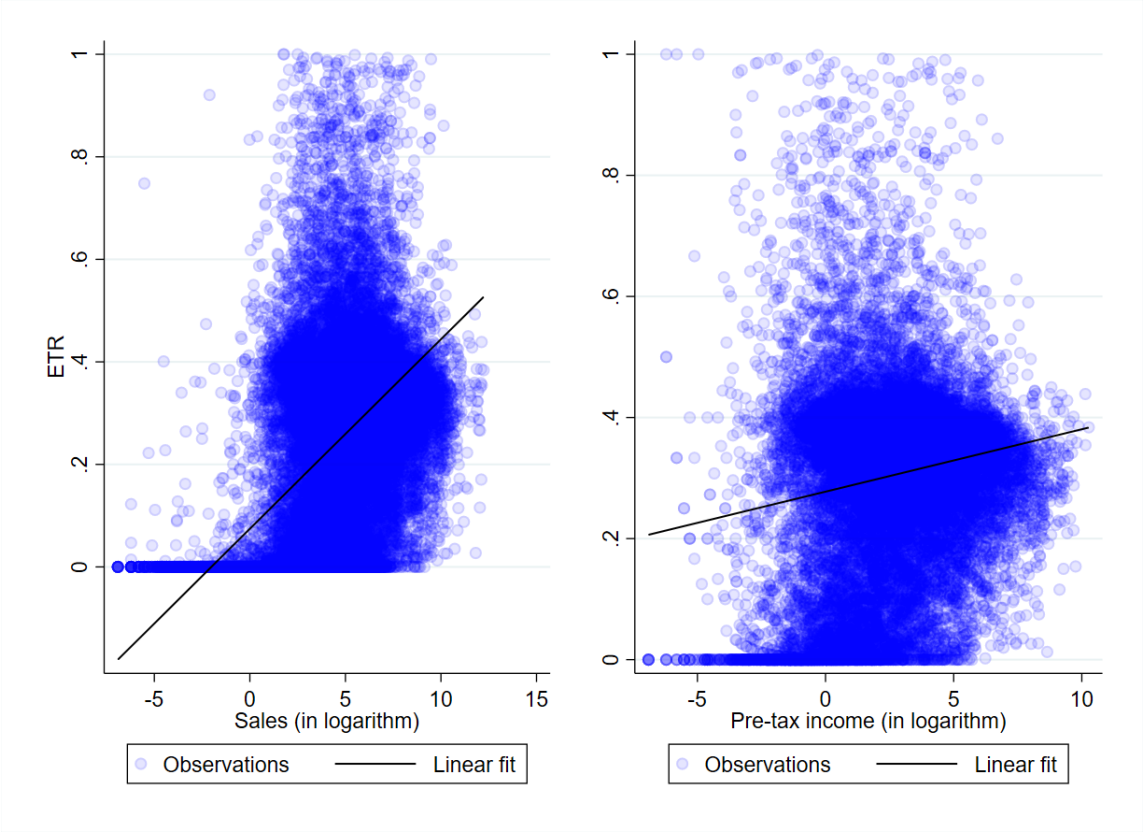
4.1 Baseline estimates and counterfactual analysis

I assess the effect of import competition on corporate tax avoidance with the following model:

$$CTA_{ijt} = \beta IMP_{jt} + \delta X_{ijt} + \mu_i + \nu_t + \epsilon_{ijt} \tag{1}$$

CTA_{ijt} is the corporate tax avoidance variable for firm i mainly operating in industry j in year t. Recall from section 2 that IMP_{jt} gauges the exposure to Chinese import competition. X_{ijt} is a vector of confounding factors. It includes firms' characteristics varying over time that determine tax liability and that are related to tax avoidance in the literature: sales, pre-tax income, tax loss carry forward, size, profitability, leverage, market power, inventories, market-to-book ratio, and multinational operations. More details on these variables can be found in Appendix A. Firm fixed effects μ_i are introduced to account for industry-specific strategies as well as persistent differences across firms (e.g.,

FIGURE 5 – Sales, pre-tax income, and effective tax rates



Notes: The subfigure on the left plots firm sales (in logarithm) on the x-axis and ETR on the y-axis, while the subfigure on the right plots firm pre-tax income (in logarithm) on the x-axis and ETR on the y-axis. Firm-year observations are set as missing when the effective tax rate lies outside the [0,1] interval. The slope of the linear fit in the first graph is equal to 3.7e-2, with a standard error equal to 3.1e-4. The slope of the linear fit in the second graph is equal to 1.0e-2, with a standard error equal to 4.0e-4. See section 3 for more details.

tax rulings).[10] Finally, year dummies ν_t neutralize global trends in tax avoidance and macroeconomic shocks. For the sake of clarity, I will focus on the coefficient of interest β and solely report $\hat{\beta}$ in the regression tables below.

Table 3 displays the estimation results of equation (1) for the four tax aggressiveness variables, with and without covariates. Consistently with the primary evidence presented in section 3, $\hat{\beta}$ is negative and statistically significant. The correlation remains economically and statistically significant when controls are introduced, so it is not spurious. In addi-

10. Egger, Strecker, and Zoller-Rydzek (2020) argue that MNEs, larger and more profitable, can threaten tax authorities to transfer their activities to other jurisdictions. Thus, MNEs have greater bargaining power and can obtain more tax deductions. The firm-level fixed effects and the multinational operation, sales, pre-tax income, and assets variables should capture this. They should also capture most of the changes in the tax avoidance variables ascribable to variations in the distribution of worldwide activity across countries.

tion, the coefficients have the same order of magnitude in all columns. With controls, they range from -0.18 to -0.26, implying that all types of strategies have expanded uniformly in response to the China shock. All other things being equal, a 1 percentage point hike in the penetration ratio of US imports from China is associated with a 0.20 percentage point reduction in ETR, a 0.18 percentage point reduction in $ETR2$, a 0.18 percentage point reduction in $CASHETR$, and a 0.26 percentage point reduction in CFM. In untabulated results, a composite index PCA_{ijt} is constructed by means of a principal component analysis. Three principal components are used and explain 85 percent of the point cloud inertia. Denote λ_l the eigenvalue associated to the l^{th} principal component and x_{ml} the coordinate of the variable m on the l^{th} principal component. Let A, B, C, and D be ETR, $ETR2$, $CASHETR$, and CFM after standardization. The composite indicator is defined as: $PCA_{ijt} = \sum_{l=1}^{3} \frac{\lambda_l}{\sum_{k=1}^{3} \lambda_k}(x_{Al} \times A + x_{Bl} \times B + x_{Cl} \times C + x_{Dl} \times D)$. The synthetic variable is then transformed as to lie between 0 and 1 by taking $PCA_{ijt} = \frac{PCA_{ijt} - min(PCA_{ijt})}{max(PCA_{ijt}) - min(PCA_{ijt})}$. Replacing CTA_{ijt} by PCA_{ijt} in equation (1) gives $\hat{\beta} = -0.25$, with a standard error equal to 0.04.

To better understand the amplitude of the effect, we can ask the following question: What would the average effective tax rate be in the absence of rising Chinese import competition? To respond to this question, I compute back-of-the-envelope counterfactual estimates. Armed with the estimation results of the preferred specification, i.e., table 3 column (2), I calculate a counterfactual average effective tax rate $\overline{ETR}_t^{counterfactual}$ for each year t:

$$\overline{ETR}_t^{counterfactual} = \overline{ETR}_t + 0.20 \times (\overline{IMP}_t - \overline{IMP}_{1990})$$

The evolution of $\overline{ETR}_t^{counterfactual}$ and $\overline{ETR}_t$ can be visualized in figure 6. The figure suggests that the average effective tax rate would have been 0.93 percentage point higher in 2005 had the penetration ratio of US imports from China stayed constant over the period. In other words, through tax avoidance, the China shock contributed 17 percent to the decline in the average effective tax rate observed between 1990 and 2005. Thus, the effect is far from negligible.

4.2 Robustness

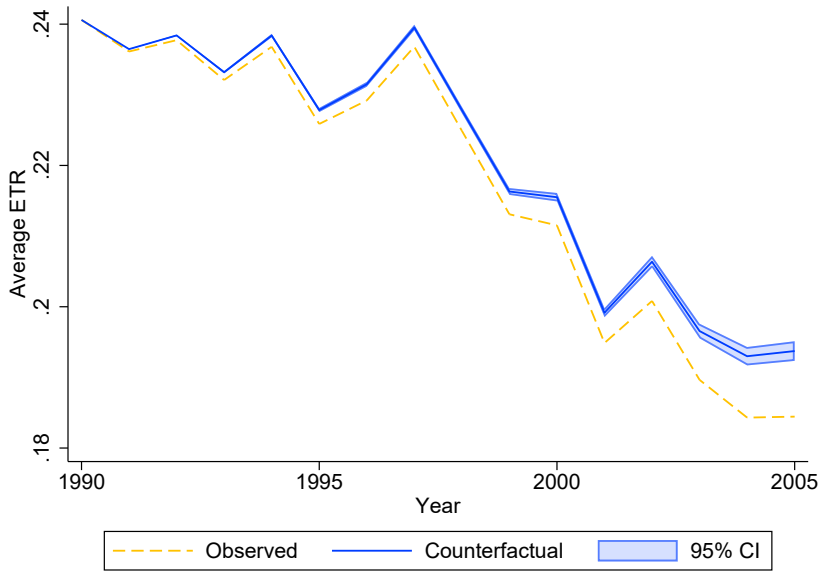
Table 4 evaluates the robustness of the results with four exercises. Panel A shows that deleting outliers does not affect the findings. I start by winsorizing the right-hand-side variables at the 2.5 and 97.5 percentiles to ensure that the estimates are not driven by extreme values of the independent variables (panel A1), and I eliminate firm-year data points with negative profits as is occasionally done in the accounting literature (panel A2). Next, firms not operating over the entire time span (panel A3) and firms involved in a merger and acquisition operation (panel A4) are excluded to rule out any compositional

TABLE 3 – Effect of import competition on corporate tax avoidance: baseline results

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	ETR_{ijt}		$ETR2_{ijt}$		$CASHETR_{ijt}$		CFM_{ijt}	
IMP_{jt}	-0.21[a]	-0.20[a]	-0.29[a]	-0.18[b]	-0.36[a]	-0.18[a]	-0.54[a]	-0.26[a]
	(0.03)	(0.03)	(0.08)	(0.07)	(0.07)	(0.04)	(0.09)	(0.06)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Firm FEs	No	Yes	No	Yes	No	Yes	No	Yes
Year FEs	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.00	0.20	0.00	0.21	0.00	0.13	0.00	0.12
No. of obs.	27,607	23,097	26,477	22,286	18,995	16,688	19,581	16,584

Notes: This table reports regression results of equation (1) obtained with ordinary least squares. In each regression, firm-year observations with a dependent variable outside the [0,1] interval are omitted. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. [d] $p < 0.15$, [c] $p < 0.10$, [b] $p < 0.05$, [a] $p < 0.01$. See section 4 for more details.

FIGURE 6 – Observed and counterfactual average effective tax rates



Notes: This figure plots the observed and counterfactual average effective tax rates for each year between 1990 and 2005. See section 4 for more details.

TABLE 4 – Effect of import competition on corporate tax avoidance: robustness checks

Column	(1)	(2)	(3)	(4)
Dependent variable	ETR	$ETR2$	$CASHETR$	CFM
Baseline estimates	-0.20^{a}	-0.18^{b}	-0.18^{a}	-0.26^{a}
Panel A: exclusion of outliers				
A1. Extreme values	-0.36^{a}	-0.30^{a}	-0.33^{a}	-0.43^{a}
A2. Negative profits	-0.15^{a}	-0.11^{c}	-0.17^{a}	-0.22^{a}
A3. Entries and exits	-0.22^{a}	-0.23^{a}	-0.17^{a}	-0.22^{a}
A4. Involved in M&A	-0.23^{a}	-0.19^{a}	-0.18^{a}	-0.27^{a}
Panel B: more controls				
B1. Trends in globalization	-0.17^{a}	-0.15^{b}	-0.19^{a}	-0.21^{a}
B2. Trends in globalization (USDIA included)	-0.20^{a}	-0.15^{c}	-0.18^{b}	-0.14^{b}
B3. State-year FEs	-0.20^{a}	-0.19^{a}	-0.16^{a}	-0.26^{a}
B4. State-year-MNE status FEs	-0.21^{a}	-0.18^{a}	-0.15^{a}	-0.27^{a}
Panel C: alternative specifications				
C1. SIC 3-digit industry	-0.15^{a}	-0.16^{a}	-0.10^{b}	-0.18^{a}
C2. 4-year periods	-0.30^{a}	-0.11	-0.17^{c}	-0.23^{a}
C3. 16-year differences	-0.18^{c}	-0.36^{a}	-0.16^{c}	-0.32^{b}
Panel D: falsification tests				
D1. Random industry	0.01	-0.02	-0.01	0.05
D2. Pre-period data	-0.11	-0.06	0.35	0.36

Notes: This table assesses the robustness of the regression results outlined in table 3. In each regression, firm-year observations with a dependent variable outside the [0,1] interval are omitted. Standard errors are clustered at the 4-digit 1987 SIC industry level and are not reported for space. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 4 for more details.

effect.[11] In all four cases, the results coincide with table 3, in terms of both magnitude and statistical significance. Notice that the coefficients double in panel A1, meaning that the estimates in table 3 could eventually downplay the role of import competition and be seen as lower-bound estimates.

Panel B verifies that the addition of covariates does not alter the results. One caveat is that IMP, as any other trade-induced variable, could pick up not only Chinese import competition but more broadly ongoing industry trends in globalization. To isolate the impact of import competition, equation (1) is augmented with five industry-year specific variables in panel B1: US exports to China, US total exports (from Schott, 2008), Chinese import tariffs (from Pierce and Schott, 2016), the penetration ratio of US imports from other

11. Firms first appear in Compustat two or three years before the initial public offering. Exits are of different types: merger and acquisition (M&A), bankruptcy, liquidation, reverse acquisition, leveraged buyout, etc. M&A transactions are the major cause of exits, and how Compustat treats the survivor depends on the method of acquisition.

foreign countries (from Schott, 2008), and the intensity of Chinese import competition in the input market. I proxy the intensity of Chinese import competition in the input market for (2-digit SIC) sector j and year t by $\sum_k \frac{\lambda_{kj}}{\sum_k \lambda_{kj}} IMP_{kt}^{2-digit}$, where $\frac{\lambda_{kj}}{\sum_k \lambda_{kj}}$ is the share of inputs from sector k used in the production of goods in sector j. The λ shares are calculated using input-output tables at the 1987 SIC 2-digit level for 1992 from the Bureau of Economic Analysis (BEA). In panel B2, I rerun this regression with one more independent variable measuring sales of US MNEs in China. The variable comes from the BEA's US Direct Investment Abroad (USDIA) database and deals with the widening of opportunities for American firms. The equation is estimated separately from panel B1 because the data are only available from 1999 onward. Similarly, I extend the set of dummies in panels B3 and B4. I replace year dummies with state-year and state-year-MNE status dummies. These regressions better take into account corporate income tax reforms implemented in the US state of incorporation over the study period. They should notably purge the effect of the check-the-box regulations enacted in 1997, accused by specialists of having facilitated MNEs' tax avoidance by giving them the opportunity to circumvent the subpart F income regulations. Again, the coefficients in panel B match those obtained in table 3.

In panel C, alternative specifications yield the same results. The exercise performed in panel C1 consists of replicating equation (1) at the SIC 3-digit level. As one may have noticed, the number of observations in table 3 is small compared to the total number of firm-year observations in the dataset (51,791). This loss stems from two sources. It is impossible to construct ETR and $ETR2$ for 10 percent of firm-year observations and $CASHETR$ and CFM for 20 percent of firm-year observations, and firm-year observations with a dependent variable lying outside the [0,1] interval are dropped for interpretability (around 15 percent of the restricted sample). Moreover, some firms report a SIC 3-digit code instead of a 4-digit code. Such firms do not appear in table 3 by construction. In panel C1, these missing values are imputed with the penetration ratio of US imports from China at the 3-digit level. The coefficients tend toward zero because the competition variable is less precise, but they remain statistically significant overall. In panel C2, I split the 1990-2005 period into four four-year subperiods and estimate equation (1) with long-run tax avoidance variables (sum of the numerator across years divided by the sum of the denominator across the same years) and four-year averages of the independent variables. The reason, as mentioned in section 3, is that tax avoidance variables are volatile. There is to date no consensus in the literature on the use of annual or multi-year tax avoidance variables. On the one hand, Dyreng et al. (2008) recommend computing long-run values to smooth transient shocks. On the other hand, these long-run values abstract from temporary strategies, and around 70 percent of managers surveyed by Hoopes, Mescall, and Pittman (2012) report being able to change tax positions within one year (see also De Simone et al., 2019). Nevertheless, I find evidence of a positive effect of import competition on corporate tax avoidance with either approach. In panel C3, the baseline results are also robust to the estimation of equation (1) with sixteen-year differences rather than levels.

Lastly, I carry out two falsification tests in panel D. In panel D1, I assign each firm to a random industry j' and substitute IMP_{ijt} with $IMP_{ij't}$ to give confidence that equation (1) truly estimates the effect of import competition in the industry in which the firm is mostly active. In panel D2, equation (1) is re-estimated using pre-sample data (1974-1989) for all variables except the penetration ratio to check that $\hat{\beta}$ is not capturing long-run trends in tax avoidance correlated with Chinese import competition.[12] The point estimates – statistically not different from zero, as expected – reinforce the results in table 3.

4.3 Endogeneity

Thus far, the right-hand-side variables have been treated as exogenous in equation (1). Yet, they may be endogenous.

Two concerns pertain to reverse causality and the "bad controls" problem discussed in Angrist and Pischke (2009). Firm-specific control variables X_{ijt} could be affected by tax aggressiveness, Chinese import competition, or both. In the two situations, the coefficient of interest would be biased. To alleviate this, table 5 panel A reproduces the results of table 3 when all variables in X have predetermined values. I employ one-year lags in panel A1 and two-year lags in panel A2, and the results are consistent.

Another reason why the results in table 3 could be biased is that changes in Chinese import competition, as measured by the penetration ratio of US imports from China, are ascribable to both supply- and demand-side shocks. To extract the supply-driven changes in Chinese import competition, I proceed with a two-stage least squares (2SLS) estimation. Building on Autor et al. (2013) and similarly to Iacovone et al. (2013) and Chakraborty and Henry (2019), I instrument the penetration ratio of US imports from China by the average share of Chinese imports in total imports among eight other high-income countries (Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland). Panel B1 shows that the instrument has power. The F-statistic in the first stage is always greater than 29, well above the range of Stock and Yogo (2005)'s critical values. Panel B2 reports the results obtained in the second stage and shows that, if anything, the baseline coefficients outlined in table 3 undershoot the effect of import competition on corporate tax avoidance. Following the same line of reasoning, I look at the effect of Mexican import competition and utilize the average share of imports from Mexico of the same set of high-income countries as an instrument. Besides China, Mexico is another suitable candidate insofar as the average penetration ratio of US imports from Mexico in manufacturing increased threefold between 1990 and 2005. The results are attached in Online Appendix table OAT6 and qualitatively unchanged. In panel B2, the identification relies on three assumptions: (i) High-income countries are exposed to the supply-driven

12. Another way to control for trends in tax dodging is to introduce a set of 2-digit SIC industry-year dummies. It is feasible because, as explained in section 2, Chinese import competition varies within 2-digit sectors. Doing so leads to consistent results (see Online Appendix table OAT5).

TABLE 5 – Effect of import competition on corporate tax avoidance: endogeneity

Column	(1)	(2)	(3)	(4)
Dependent variable	ETR	$ETR2$	$CASHETR$	CFM
Panel A: lagged controls				
A1. One-year lags	-0.21^{a}	-0.16^{b}	-0.19^{a}	-0.30^{a}
A2. Two-year lags	-0.21^{a}	-0.14^{d}	-0.19^{a}	-0.27^{a}
Panel B: 2SLS à la Autor et al. (2013)				
B1. First stage results: IMP_{jt} on instrument				
Point estimate	0.63^{a}	0.63^{a}	0.62^{a}	0.63^{a}
F-statistic	32.65	33.16	29.12	30.23
B2. Second stage results: CTA_{ijt} on $\widehat{IMP}_{jt}$				
Point estimate	-0.31^{a}	-0.28^{b}	-0.28^{a}	-0.37^{a}
Panel C: PNTR as a quasi-natural experiment	-0.06^{b}	-0.08^{c}	-0.01	-0.07^{d}
Controls	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes

Notes: This table tackles endogeneity concerns in equation (1) and table 3. In each regression, firm-year observations with a dependent variable outside the [0,1] interval are omitted. $\widehat{IMP}_{jt}$ is the prediction of IMP_{jt} after the first stage of the 2SLS procedure. Standard errors are clustered at the 4-digit 1987 SIC industry level and are not reported for space. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 4 for more details.

growth of exports from China in a comparable way, (ii) increasing returns to scale in Chinese manufacturing are moderate, and (iii) demand shocks are uncorrelated across the eight high-income economies. Although the literature suggests that a significant part of the rise of China's total exports during that period comes from the supply-side – due to the progressive dismantling of state-owned companies, the gradual removal of barriers to foreign investments, and, later, entry into the World Trade Organization (WTO) in 2001 (Brandt, Ma, and Rawski, 2014) –, we cannot categorically reject that demand shocks are correlated across countries. In the same vein, the exclusion restriction can be debated for MNEs, for which the median ratio of foreign profits to worldwide profits is 17 percent.

To overcome these limitations, an alternative strategy consists of exploiting a quasi-natural experiment: the US conferral of PNTR status on China in late 2000. US imports from non-market economies are normally subject to higher tariff rates, called non-normal trade relations (NNTR) tariff rates. However, the US Trade Act of 1974 allows US presidents to grant most favored nation (MFN) tariff rates to non-market economies on an annual basis and upon approval by the US Congress. That explains why China's exports to the US were subject to normal trade relations (NTR) tariffs (equivalently, MFN tariffs) between 1980 and 2000 despite China being a non-market economy. The annual renewal generated substantial uncertainty, especially after the Tiananmen Square protests in 1989.

While the renewal was nearly automatic in the 1980s, the House of Representatives tried to revoke this temporary status multiple times in the 1990s, and these threats were taken seriously (Pierce and Schott, 2016). In 1990, 1991, and 1992, for instance, more than 50 percent of votes in the House of Representatives were against the renewal. Public opinion seemed against it as well. Gallup polls found that 13 percent of Americans expressed a very or mostly unfavorable view of China months before the Tiananmen incidents, and this share suddenly increased and remained above 50 percent throughout the 1990s. [13] Other surveys showed that public opinion favored the US putting pressure on China and disapproved of Bush's handling of Sino-American relations (Skidmore and Gates, 1997). As a consequence, trade between the US and China was largely hampered, and the granting of PNTR status after an unanticipated and five-month process played a key role in the boom in China's exports to the US between 2000 and 2005. [14] According to Handley and Limão (2017), the induced reduction in trade policy uncertainty and expected import tariffs is responsible for a third of the growth of US expenditures on Chinese goods during that period. In the present paper, I adopt a DiD approach along the lines of Pierce and Schott (2016). I create a variable $PNTR_{jt}$ equal to 0 before 2001 for all industries j and equal from 2001 onward to the difference between the NNTR tariff rate and the NTR tariff rate in industry j in 1999, retrieved from Pierce and Schott (2016). Next, I estimate:

$$\begin{aligned} CTA_{ijt} &= \beta PNTR_{jt} + \delta X_{ijt} + \mu_i + \nu_t + \epsilon_{ijt} \\ \text{with } PNTR_{jt} &= \mathbb{1}_{t \geq 2001} \left(NNTR_{j1999} - NTR_{j1999} \right) \end{aligned} \tag{2}$$

The identifying assumption is that all other things being equal and absent the granting of PNTR status, tax avoidance variables would have evolved similarly in all firms, irrespective of their exposure to the shock ($PNTR$). The particularity of $PNTR$ resides in its exogeneity. Almost 90 percent of the variation in $PNTR$ comes from NNTR tariff rates, established under the Smoot-Hawley Tariff Act in 1930 (Pierce and Schott, 2016). The point estimates in table 5 panel C align with the previous results and remain globally negative and statistically significant. [15] They are significant at lower levels, however, and three reasons can be proposed: (i) The DiD approach automatically and drastically reduces variation in the treatment, (ii) the shock explains only a part of the boom in China's exports, and (iii) as we will see below, the effect is driven by a group of firms, namely MNEs.

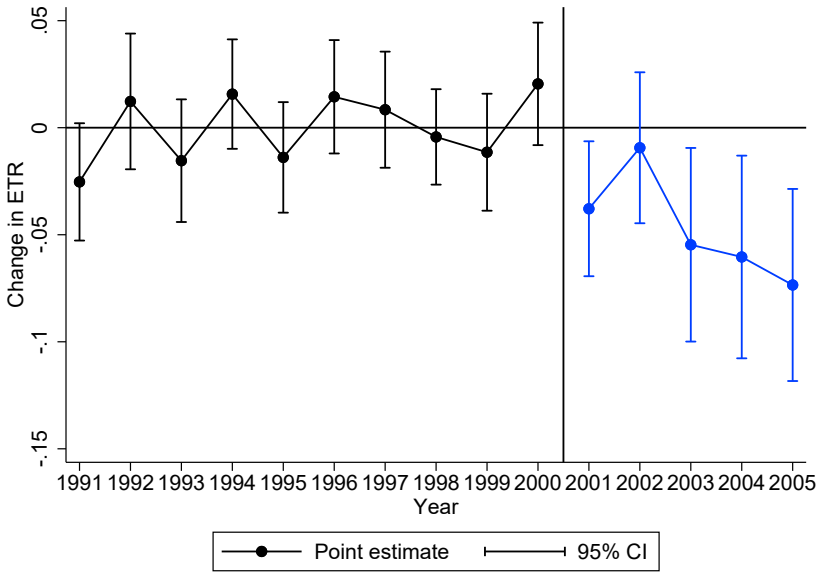
Figure 7 proves that the evolution of the effective tax rate prior to 2001 is unrelated to the tariff gap. It supports the common trend assumption and can be seen as a placebo test for panel C column (1). It also implies that the treatment is unlikely to be a proxy for unobserved industry-year shocks. Another important point recently raised in the econometrics literature is that linear regressions with high-dimensional fixed effects estimate weighted

13. See `https://news.gallup.com/poll/1627/china.aspx`.

14. Greenland et al. (2020) show that very few newspaper articles mentioned the PNTR status before the introduction of the bill in the House of Representatives in May 2000.

15. In the same spirit of table 5 panel B, using $PNTR$ as an instrument in 2SLS regressions delivers the same conclusions, qualitatively speaking (see Online Appendix table OAT7).

FIGURE 7 – Pre-trends in ETR and dynamics of the effect



Notes: This figure plots the coefficients when replacing in equation (2) $PNTR_{jt}$ with the following set of 15 variables: $\mathbb{1}_{t \geq x} \times \left(NNTR_{j1999} - NTR_{j1999}\right)$, $x \in \{1991, ..., 2005\}$. Standard errors are clustered at the 4-digit 1987 SIC industry level. See section 4 for more details.

sums of the average treatment effects (ATEs). Hence, the fact that some of these weights can be negative and that the ATEs could be heterogeneous across firms or periods is a source of concern. The coefficient of interest $\hat{\beta}$ could be negative even though all ATEs are positive. I follow the guidelines of de Chaisemartin and D'Haultfœuille (2020), who discuss this for models with two-way fixed effects akin to equation (2). I find a low share of negative weights in each regression, meaning that treatment effect heterogeneity should not constitute a major threat to the validity of the findings. On the whole, the sensitivity tests in tables 4 and 5 lend credence to a positive and causal effect of import competition on corporate tax avoidance.

5 Multinational firms and intangible assets

Section 5 delves into the channels through which import competition fosters corporate tax avoidance. I show that the positive effect highlighted in the previous section is specific to MNEs and most striking for those familiar with tax havens. Further, I show that the China shock prompted MNEs to invest in intangible assets and that these assets intensified their profit shifting activities. Before concluding, I demonstrate that intangibles tempered the negative impact of the shock on sales and that MNEs in import-competitive industries did not enlarge their network of subsidiaries in tax havens. Such observations suggest that MNEs' investments in intangibles were aimed at escaping competitive pressures rather

than avoiding taxes in the first place. The effect of import competition on profit shifting is thus indirect.

5.1 Domestic and multinational firms

To better understand what lies behind the average effect estimated in the previous section, I now investigate the existence of heterogeneous effects. More precisely, I differentiate between domestic firms and MNEs. The latter have more possibilities for avoiding taxes because they can shift profits toward their subsidiaries located in relatively low-tax jurisdictions. In addition, a helpful feature of the dataset is that financial statements are consolidated at the firm level, enabling profit shifting activities to be reflected in the effective tax rates. [16]

$$ETR_{ijt} = \beta_1 PNTR_{jt} + \beta_2 PNTR_{jt} \times MNE_{ijt} + \delta X_{ijt} + \mu_i + \nu_t + \epsilon_{ijt} \quad (3)$$

I use a triple difference estimator in equation (3). The new variable $PNTR \times MNE$ is the product of the treatment variable $PNTR$ and the multinational activity dichotomous variable MNE. The regression results are displayed in table 6 column (2) and Online Appendix figure OAF6 graphically reports the results for all four metrics of tax avoidance. The coefficient associated with $PNTR$ becomes insignificantly different from zero while the coefficient associated with the interaction term $PNTR \times MNE$ appears negative and statistically significant at the 1 percent level. The effect estimated in section 4 is therefore driven by MNEs.

Online Appendix figure OAF7 refines equation (3) and separates MNEs present in tax havens from the rest of MNEs. Each year, US-listed firms disclose a list of their "significant" subsidiaries in Exhibit 21 of Form 10-K in accordance with the rules of the Securities and Exchange Commission (SEC). A subsidiary is deemed "significant" if its assets (or income) represent at least 10 percent of consolidated assets (or income), or if by combining all undisclosed subsidiaries into one fictive subsidiary, the fictive subsidiary represents at least 10 percent of assets (or income). In other words, Exhibit 21 filings uncover subsidiaries where at least 90 percent of firms' consolidated assets and revenues are recorded and thus give a faithful picture of the worldwide network of US-listed firms' subsidiaries. Dyreng and Lindsey (2009)'s database summarizes this information starting from 1993. On this basis, I explore whether the most tax-aggressive MNEs, implanted in tax havens, are those for which the tax avoidance variables decreased the most. A country is classified as a tax haven if it appears on the lists elaborated by Hines and Rice (1994) and Dyreng and Lindsey (2009), typical in the tax avoidance literature (see the list in Online Appendix table OAT8). The results in Online Appendix figure OAF7 corroborate this conjecture. Together, table 6 column (2), Online Appendix figure OAF6, and Online Appendix figure OAF7 are fully reminiscent of profit shifting activities.

16. MNEs are not obliged to disclose in their financial statements the deferred US income tax expense related to their foreign earnings if they declare it as "permanently reinvested."

TABLE 6 – Effect of import competition on corporate tax avoidance: mechanism

Column	(1)	(2)	(3)	(4)	(5)
Dependent variable	ETR_{ijt}	ETR_{ijt}	ETR_{ijt}	ETR_{ijt}	$intangibles_{ijt}$
$PNTR_{jt}$	-0.06^{b}	-0.02	-0.03	-0.03	103.45
	(0.03)	(0.03)	(0.03)	.(0.03)	(270.53)
$PNTR_{jt} \times MNE_{ijt}$		-0.06^{a}			480.99^{b}
		(0.02)			(201.39)
$intangibles_{ijt}$			-2.54e-6^{c}	1.87e-5^{a}	
			(1.46e-6)	(6.79e-6)	
$intangibles_{ijt} \times MNE_{ijt}$				-2.14e-5^{a}	
				(6.91e-6)	
Controls	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
No. of obs.	24,162	24,162	20,758	20,758	24,481

Notes: This table reports regression results of equation (2) in column (1), equation (3) in column (2), equation (4) in column (3), equation (5) in column (4), and equation (6) in column (5). In all columns except column (5), firm-year observations with a dependent variable outside the [0,1] interval are omitted. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 5 for more details.

5.2 The role of intangible assets

The following question emerges: How did MNEs accentuate their profit shifting activities after the China shock? The literature emphasizes three major profit shifting methods. First, MNEs can manipulate transfer prices, i.e., distort the price of the transactions made between their affiliates. Second, they can take advantage of the tax deductibility of interest payments and adjust the capital structure of their affiliates by using intra-firm loans. Third, multinationals can locate intellectual property rights in tax-friendly jurisdictions and make affiliates in high-tax countries pay royalties for the use of intangible assets. Given that Compustat reports financial statements for each corporation on a consolidated basis, neither transfer prices nor intra-firm loans can be identified. I hereby focus on intangibles and intra-firm royalty payments, a well-known channel found by Heckemeyer and Overesch (2017) to be one of the most employed profit shifting techniques.

A possible answer is that Chinese import competition impacted tax avoidance through an increase in intangible assets. Should this be the case, we would expect the China shock to have no significant effect, or at least a smaller effect, on the effective tax rate conditional on the stock of intangible assets. I confront this hypothesis with data by adding intangible

assets into the right-hand-side variables and running:

$$ETR_{ijt} = \beta PNTR_{jt} + \gamma intangibles_{ijt} + \delta X_{ijt} + \mu_i + \nu_t + \epsilon_{ijt} \quad (4)$$

$$ETR_{ijt} = \beta PNTR_{jt} + \gamma_1 intangibles_{ijt} + \gamma_2 intangibles_{ijt} \times MNE_{ijt} + \delta X_{ijt} + \mu_i + \nu_t + \epsilon_{ijt} \quad (5)$$

As shown in table 6 columns (3) and (4), intangible assets diminish the effective tax rate of MNEs, thereby supporting the view that these firms strategically locate their intangibles to avoid taxes. [17] Importantly, the effect of the China shock dissipates. The coefficient is divided by two and becomes not statistically different from zero at standard levels. It suggests that import competition may indeed affect tax avoidance indirectly via intangibles. Equation (6) verifies this:

$$intangibles_{ijt} = \beta_1 PNTR_{jt} + \beta_2 PNTR_{jt} \times MNE_{ijt} + \delta X_{ijt} + \mu_i + \nu_t + \epsilon_{ijt} \quad (6)$$

Firms' intangibles are regressed on $PNTR$, accounting for the same confounding variables as in equation (2). In addition, and in light of what has been shown in the previous subsection, I allow for the possibility that rising import competition hits domestic firms and MNEs differently in equation (5). The point estimates in table 6 column (5) reveal that the competition shock had little incidence on domestic firms' intangible assets. By contrast, the China shock had a positive and significant impact on intangible assets of MNEs, and more notably on MNEs having ties with tax havens (see Online Appendix table OAT9).

The observations concur with preceding studies pointing out that the China shock led to more innovation and technical change (Bloom et al., 2016), investments in intangibles from industry leaders (Gutiérrez and Philippon, 2017), and product differentiation (Hombert and Matray, 2018). Perhaps a more challenging question is whether intangibles reduce income taxes paid by MNEs due to credits and deductions offered by governments or by facilitating profit shifting. The estimation results speak in favor of the second proposition. MNEs located in tax havens are the ones recording the largest variations in tax avoidance and intangibles at the same time. Moreover, the fact that intangible assets lower the effective tax rate of MNEs, and not that of domestic enterprises who are eligible for intangible-related tax breaks too, directly echoes the profit shifting literature.

5.3 Robustness

Online Appendix table OAT10 reviews an important threat to the validity of the results: the definition of intangible assets. There are two types of intangible assets: those acquired externally and those developed internally. US accounting rules are such that the former appear in balance sheets as part of the "intangible assets" category. This category is composed of goodwill, i.e., assets that are non-physical and difficult to precisely iden-

17. The p-value of the test whose null hypothesis is $\gamma_1 + \gamma_2 = 0$ is equal to 0.07.

tify (e.g., human capital, brand, reputation, and identity), and other intangible assets, i.e., assets that are non-physical but identifiable (e.g., copyright, patents, and software). Intangibles created within companies are generally not capitalized on balance sheets. Rather, they are mostly recorded as R&D expenditures or Selling, General, and Administrative (SGA) expenditures. [18] Table OAT10 replicates table 6 with a more comprehensive proxy of intangible assets, $intangibles2_{ijt}$, that includes both externally acquired and internally generated intangible assets. As in Eisfeldt and Papanikolaou (2014) and Peters and Taylor (2017), the stock of internally created intangibles is approximated by a fraction (30 percent) of all past and current R&D and SGA expenses. The results presented in table OAT10 align with previous results in all respects.

Symmetrically, Online Appendix table OAT11 narrows the definition of intangible assets and focuses on patents. I exploit the database of the NBER Patent Data Project to this end. The database covers the 1976-2006 period and reports numerous details on the patents registered at the US Patent and Trademark Office: assignee number, patent number, granting and application dates, etc. The information is used to replace the variable $intangibles_{ijt}$ with another one, $patents_{ijt}$, indicating the number of patents each firm was granted each year. Again, the results go in the same direction and thus further strengthen the findings.

Lastly, Online Appendix table OAT12 shows that the results presented in this section are consistent when $intangibles$ is expressed as a share of total assets or in logarithm, while Online Appendix table OAT13 shows that the findings are equivalent when the data sources are triangulated and the multinational activity variable is constructed using exclusively Exhibit 21 reports.

5.4 A side effect

MNEs' intangibles expenditures increased after the China shock, which resulted in more profit shifting. One question remains: Were these intangibles used purely for tax purposes? Table 7 provides some clues. Equations (7) and (8) examine whether firms in the most-exposed sectors expanded into tax havens:

$$TAXHAVEN_{ijt}^{ext} = \beta_0 + \beta_1 PNTR_{jt} + \beta_2 X_{ijt} + \mu_i + \nu_t + \epsilon_{ijt} \quad (7)$$

$$TAXHAVEN_{ijt}^{int} = \beta_0 + \beta_1 PNTR_{jt} + \beta_2 X_{ijt} + \mu_i + \nu_t + \epsilon_{ijt} \quad (8)$$

$TAXHAVEN_{ijt}^{ext}$ is a binary variable equal to 1 if firm i operating in sector j has at least one subsidiary located in a tax haven in year t. $TAXHAVEN_{ijt}^{int}$ counts the number of subsidiaries incorporated in tax havens. If MNEs invested in intangible assets mainly for tax purposes, we would expect MNEs to also broaden their activities in tax havens after

18. Note that in Compustat, R&D and SGA expenditures are combined and reported in a variable deceptively labeled "Selling, General, and Administrative Expense."

TABLE 7 – Effect of import competition on corporate tax avoidance: A side effect ?

Column	(1)	(2)	(3)
Dependent variable	$TAXHAVEN_{ijt}^{ext}$	$TAXHAVEN_{ijt}^{int}$	$sales_{ijt}$
$PNTR_{jt}$	0.04	3.15	-2,740.44^{b}
	(0.07)	(4.50)	(1,226.00)
$PNTR_{jt} \times intangibles_{ijt}$			1.44^{b}
			(0.70)
Controls	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
No. of obs.	28,443	4,651	30,141

Notes: This table reports regression results of equation (7) in column (1) and equation (8) in column (2). Equation (8) is regressed conditional on $TAXHAVEN_{ijt}^{int} > 0$ for the estimate not to capture a mix of extensive- and intensive-margin effects. The regression results in column (3) mirror those presented in table 2. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 5 for more details.

the China shock. Surprisingly in columns (1) and (2), Chinese import competition did not amplify the development of US-listed firms' foreign direct investments in tax havens over the period, neither at the extensive nor at the intensive margin. Moreover, column (3) refines table 2 and shows that the negative impact of the China shock on sales is mitigated by intangible assets. These findings are suggestive evidence that the positive effect of import competition on profit shifting is indirect. The primary objective of the investments in intangibles was not to save taxes but to escape import competition.

6 Conclusion

The role played by competition in corporate tax avoidance is theoretically ambiguous in the literature. I empirically explore this role in this paper, with a focus on the China shock and US-listed firms. The first part of the paper estimates an average effect. The results point to a positive and significant effect of import competition on corporate tax avoidance and are validated by a series of robustness tests. All other things held constant, they indicate that a 1 percentage point increase in the penetration ratio of US imports from China translates into a 0.20 percentage point decrease in the effective tax rate. The second part of the paper studies the underlying mechanism. I show that the effect of competition on tax avoidance is not homogeneous across firms. The effect does not hold for domestic firms and particularly kicks in for MNEs implanted in tax havens. Moreover, the rise in tax avoidance passes through intangible assets and can be seen as an indirect consequence of import competition. In response to the China shock, MNEs invested in intangible assets to alleviate revenue losses. However, these assets also magnified their profit shifting activities. The findings cast light on the evolution of effective tax rates, help

explain the current hostility to MNEs and globalization in public opinion, and emphasize the need to connect international trade and tax policies at the international level.

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Appendix

TABLE AT1 – Definition of the main variables

Variable	Definition
ETR_t	Income taxes over pre-tax income (excluding special items) $\frac{TXT_t}{PI_t - SPI_t}$
$ETR2_t$	Non-deferred income taxes over pre-tax income (excluding special items) $\frac{TXT_t - TXDI_t}{PI_t - SPI_t}$
$CASHETR_t$	Cash income taxes paid over pre-tax income (excluding special items) $\frac{TXPD_t}{PI_t - SPI_t}$
CFM_t	Cash income taxes paid over operating cash flows (excluding extraordinary items and discontinued operations) $\frac{TXPD_t}{OANCF_t + TXPD_t - XIDOC_t}$
$sales_t$	Sales $SALE_t$
$pre\text{-}tax\ income_t$	Pre-tax income (excluding special items) $PI_t - SPI_t$
$size_t$	Total assets AT_t
$profitability_t$	Pre-tax income (excluding extraordinary items) over total assets $\frac{PI_t - XI_t}{AT_t}$
$leverage_t$	Long-term debt over assets $\frac{DLTT_t}{AT_t}$
mtb_t	Market value of equity divided by book value of equity $\frac{CSHO_t \times PRCCF_t}{CEQ_t}$
$market\ power_t$	Sales over the cost of goods sold $\frac{SALE_t}{COGS_t}$
$inventory_t$	Inventories over total assets $\frac{INVT_t}{AT_t}$
$tlcf_t$	Dummy equal to 1 if there is a tax loss carry forward $\mathbb{1}_{TLCF_t > 0}$
MNE_t	Dummy equal to 1 if the firm is incorporated in a foreign country $FIC_t \neq USA$ or the pre-tax foreign income is different from zero $PIFO_t \neq 0$ or foreign income taxes are different from zero $TXFO_t \neq 0$ or deferred foreign income taxes are different from zero $TXDFO_t \neq 0$
$intangibles_t$	Intangible assets $INTAN_t$
$intangibles2_t$	Intangible assets + 30 percent of past and current selling, general and administrative expenses $INTAN_t + 0.3 \times \sum_{k=1990}^{t} XSGA_k$

Notes: This table lists the firm-specific variables from Compustat used in the paper. They all are constructed in accordance with the accounting literature (e.g., Armstrong, Blouin, and Larcker, 2012; Hoi, Wu, and Zhang, 2013; McGuire, Wang, and Wilson, 2014; Higgins, Omer, and Phillips, 2015; Khan, Srinivasan, and Tan, 2016).

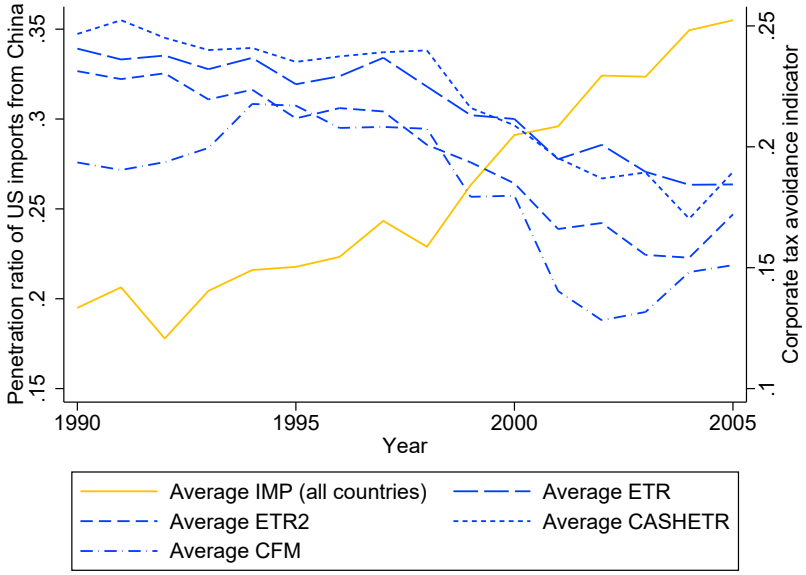
TABLE AT2 – Summary statistics

	P25	P50	Mean	P75	Std deviation	No. of obs.
ETR_t^*	0.00	0.26	0.22	0.37	0.19	40,101
$ETR2_t^*$	0.00	0.18	0.20	0.35	0.20	38,370
$CASHETR_t^*$	0.04	0.21	0.22	0.35	0.19	29,225
CFM_t^*	0.03	0.15	0.18	0.28	0.18	30,392
$sales_t$	10.23	67.55	1,037.09	374.48	6,245.36	48,467
pre-tax income$_t$	-2.61	1.209	79.74	19.60	576.18	47,214
$size_t$	14.01	65.35	1,107.81	343.12	8,435.78	48,596
$profitability_t$	-0.17	0.03	-0.72	0.10	25.67	48,349
$leverage_t$	0.00	0.09	0.31	0.27	7.93	48,341
mtb_t	0.99	1.92	3.14	3.62	169.82	42,060
market power$_t$	1.26	1.49	1.86	1.91	7.70	46,833
$inventory_t$	0.07	0.15	0.18	0.25	0.14	48,455
$tlcf_t$	0	1	0.71	1	0.45	51,791
MNE_t	0	0	0.37	1	0.48	51,791
$intangibles_t$	0	0.76	169.44	22.95	1,214.23	42,193
$intangibles2_t$	4.97	25.97	524.12	145.76	3,045.53	42,193

Notes: This table reports summary statistics for the Compustat firm-specific variables used in the paper. P25 refers to the first quartile, P50 refers to the median, and P75 refers to the third quartile. Monetary values are in current million US dollars. *Firm-year observations are set as missing when the tax avoidance variable lies outside the [0,1] interval.

Online Appendix (not for publication)

FIGURE OAF1 – Import competition and corporate tax avoidance: macro-level evidence (with all foreign countries)



Notes: This figure plots the average penetration ratio of US imports from all foreign countries (left y-axis) and the mean value of each of the four corporate tax avoidance variables (right y-axis) between 1990 and 2005. For the latter, firm-year observations are set as missing when the tax avoidance variable lies outside the [0,1] interval.

TABLE OAT1 – Import competition and corporate tax avoidance: macro-level regressions

Column	(1)	(2)	(3)	(4)
Dependent variable	$\overline{ETR}_t$	$\overline{ETR2}_t$	$\overline{CASHETR}_t$	$\overline{CFM}_t$
$\overline{IMP}_t$	-1.36^a	-1.79^a	-1.47^a	-1.40^a
	(0.09)	(0.31)	(0.21)	(0.27)
Controls	No	No	No	No
No. of obs.	16	16	16	16

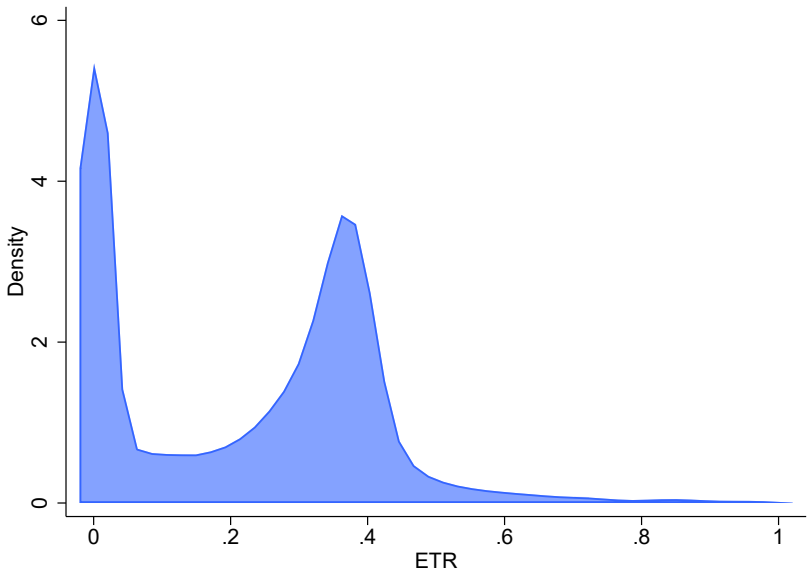
Notes: This table reports regression results obtained with ordinary least squares. The dependent variable is the year average of ETR in column (1), that of $ETR2$ in column (2), that of $CASHETR$ in column (3), and that of CFM in column (4). The independent variable $\overline{IMP}_t$ is the year average of the penetration ratio of US imports from China. Firm-year observations are set as missing when the tax avoidance variable lies outside the [0,1] interval. Standard errors, in parentheses, are heteroskedasticity-robust. $^d p < 0.15$, $^c p < 0.10$, $^b p < 0.05$, $^a p < 0.01$. See section 3 for more details.

TABLE OAT2 – Import competition and corporate tax avoidance: industry-level regressions

Column	(1)	(2)	(3)	(4)
Dependent variable	$\overline{ETR}_{jt}$	$\overline{ETR2}_{jt}$	$\overline{CASHETR}_{jt}$	$\overline{CFM}_{jt}$
IMP_{jt}	-0.11^{d}	-0.11^{c}	-0.06	-0.12^{d}
	(0.07)	(0.06)	(0.06)	(0.08)
Industry FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
No. of obs.	1,785	1,771	1,783	1,783

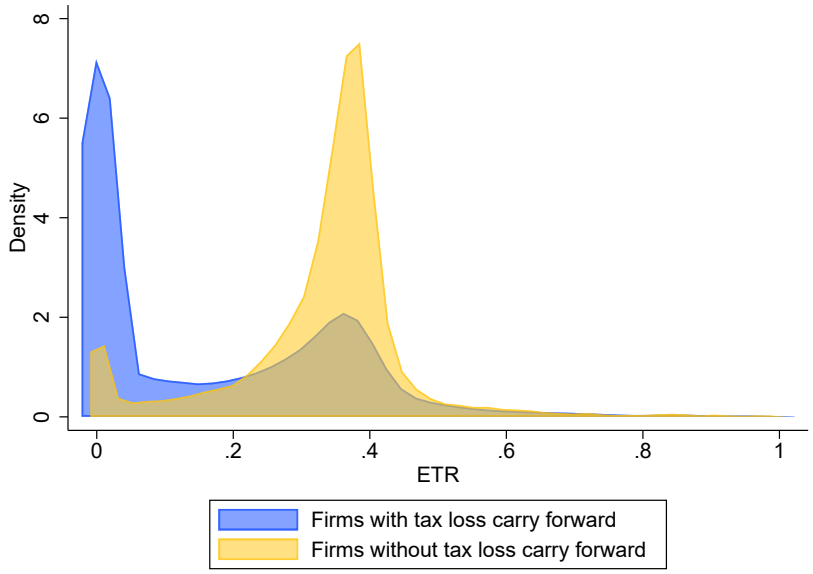
Notes: This table reports regression results obtained with ordinary least squares. The dependent variable is the industry-year average of ETR in column (1), that of $ETR2$ in column (2), that of $CASHETR$ in column (3), and that of CFM in column (4). The independent variable IMP_{jt} is the industry-year penetration ratio of US imports from China. Firm-year observations are set as missing when the tax avoidance variable lies outside the [0,1] interval. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 3 for more details.

FIGURE OAF2 – Distribution of effective tax rates



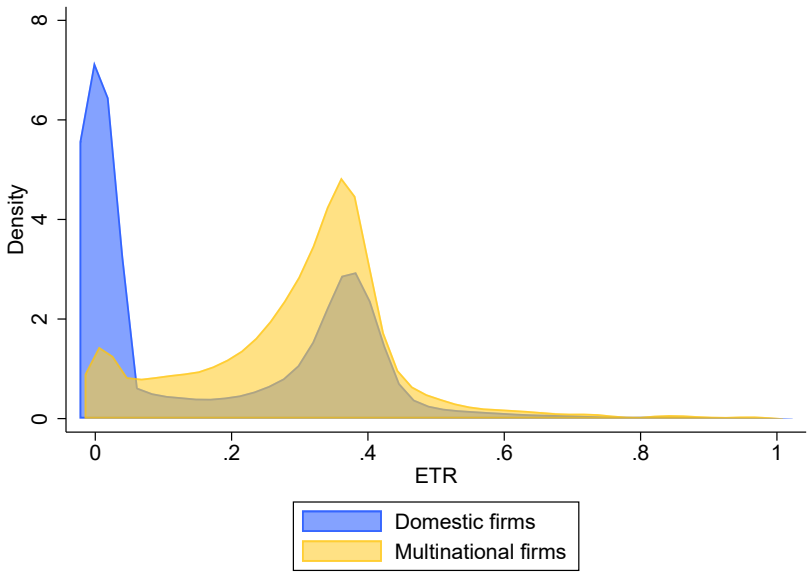
Notes: This graph plots the distribution of effective tax rates. Firm-year observations with an effective tax rate outside the [0,1] interval are omitted.

FIGURE OAF3 – Distribution of effective tax rates: firms with and without tax loss carry forward



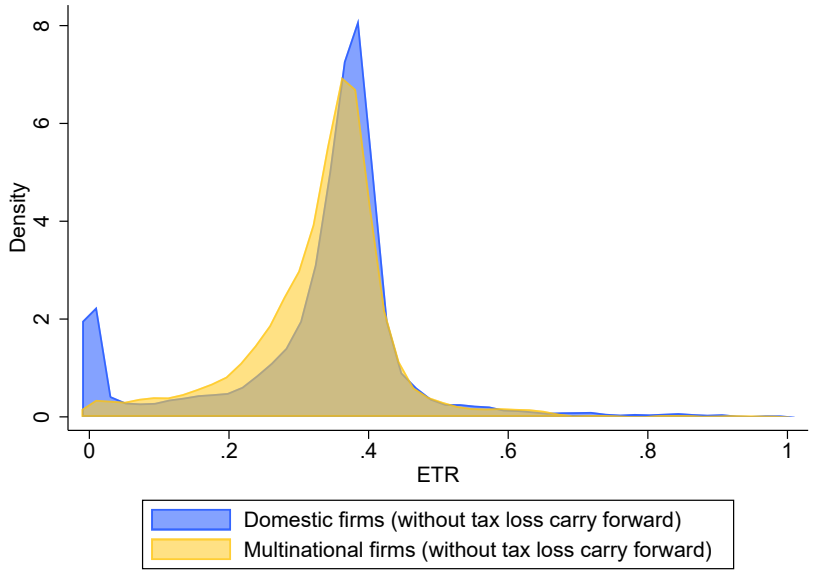
Notes: This graph plots the distribution of effective tax rates. Firm-year observations with an effective tax rate outside the [0,1] interval are omitted.

FIGURE OAF4 – Distribution of effective tax rates: domestic firms and MNEs



Notes: This plots depicts the distribution of effective tax rates. Firm-year observations with an effective tax rate outside the [0,1] interval are omitted.

FIGURE OAF5 – Distribution of effective tax rates: domestic firms and MNEs without tax loss carry forward



Notes: This graph plots the distribution of effective tax rates. Firm-year observations with an effective tax rate outside the [0,1] interval are omitted.

TABLE OAT3 – Import competition and corporate tax avoidance: macro-level regressions (bis)

Column	(1)	(2)	(3)	(4)
Dependent variable	$\widetilde{ETR}_t$	$\widetilde{ETR2}_t$	$\widetilde{CASHETR}_t$	$\widetilde{CFM}_t$
$\overline{IMP}_t$	-1.13^b	-0.58	-0.72^d	0.88
	(0.48)	(0.51)	(0.43)	(0.78)
Controls	No	No	No	No
No. of obs.	16	16	16	16

Notes: This table reports regression results obtained with ordinary least squares. In column (1), the dependent variable $\widetilde{ETR}_t$ is obtained by regressing, for each year, the numerator (income taxes) on the denominator (pre-tax income) with ordinary least squares. This way, the dependent variable minimizes the sum of quadratic errors for each year and gets closer to the statutory tax rate. The dependent variables in columns (2), columns (3), and columns (4) are obtained analogously. In each of the 64 ($= 4 \times 16$) regressions run to compute the dependent variables, firm-year observations are set as missing when the tax avoidance variable lies outside the [0,1] interval. Standard errors, in parentheses, are heteroskedasticity-robust. $^d p < 0.15$, $^c p < 0.10$, $^b p < 0.05$, $^a p < 0.01$. See section 3 for more details.

TABLE OAT4 – Chinese import competition and firm pre-tax income

Dependent variable	$pre\text{-}tax\ income_{ijt}$
IMP_{jt}	-341.52^{c}
	(174.67)
Controls	Yes
Firm FEs	Yes
Year FEs	Yes
No. of obs.	32,470

Notes: This table reports regression results obtained with ordinary least squares. The standard error, in parentheses, is clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 3 for more details.

TABLE OAT5 – Effect of import competition on corporate tax avoidance: inclusion of 2-digit SIC industry-year dummies

Column	(1)	(2)	(3)	(4)
Dependent variable	ETR_{ijt}	$ETR2_{ijt}$	$CASHETR_{ijt}$	CFM_{ijt}
IMP_{jt}	-0.13^{a}	-0.05	-0.13^{a}	-0.19^{a}
	(0.04)	(0.06)	(0.05)	(0.06)
Controls	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
No. of obs.	23,097	22,286	16,688	16,584

Notes: This table complements table 4 panel D since a set of 2-digit SIC industry-year dummies is now introduced. In each regression, firm-year observations with a dependent variable outside the [0,1] interval are omitted. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 4 for more details.

TABLE OAT6 – Effect of import competition on corporate tax avoidance: the Mexican case

Column	(1)	(2)	(3)	(4)
Dependent variable	ETR_{ijt}	$ETR2_{ijt}$	$CASHETR_{ijt}$	CFM_{ijt}
IMP_{jt}	-1.05^{c}	-0.55	-1.17^{d}	-1.50^{b}
	(0.58)	(0.52)	(0.72)	(0.75)
Controls	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
No. of obs.	20,728	20,728	15,329	15,187

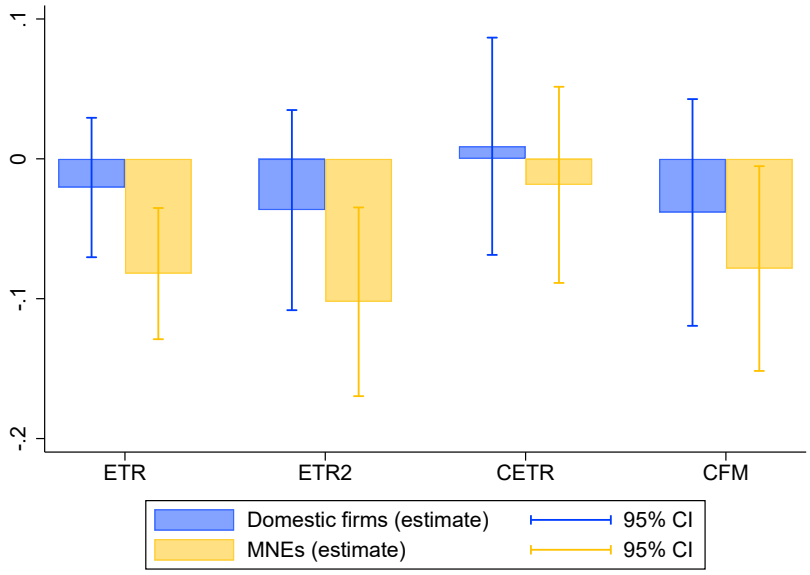
Notes: This table replicates Table 5 panel B using Mexican import competition instead of Chinese import competition. The results are obtained with 2SLS. The instrument is the average share of imports from Mexico in total imports among the eight other high-income countries mentioned in the paper. In each regression, firm-year observations with a dependent variable outside the [0,1] interval are omitted. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 4 for more details.

TABLE OAT7 – Effect of import competition on corporate tax avoidance: $PNTR$ as an instrument

Column	(1)	(2)	(3)	(4)
Dependent variable	ETR_{ijt}	$ETR2_{ijt}$	$CASHETR_{ijt}$	CFM_{ijt}
IMP_{jt}	-0.54^{a}	-0.79^{a}	-0.31	-0.74^{b}
	(0.21)	(0.29)	(0.29)	(0.37)
Controls	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
No. of obs.	22,715	22,286	16,286	16,157

Notes: This table supplements table 5 panel C by using $PNTR$ as an instrument. The results are obtained with 2SLS. In each regression, firm-year observations with a dependent variable outside the [0,1] interval are omitted. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 4 for more details.

FIGURE OAF6 – Effect of import competition on corporate tax avoidance: domestic firms and MNEs



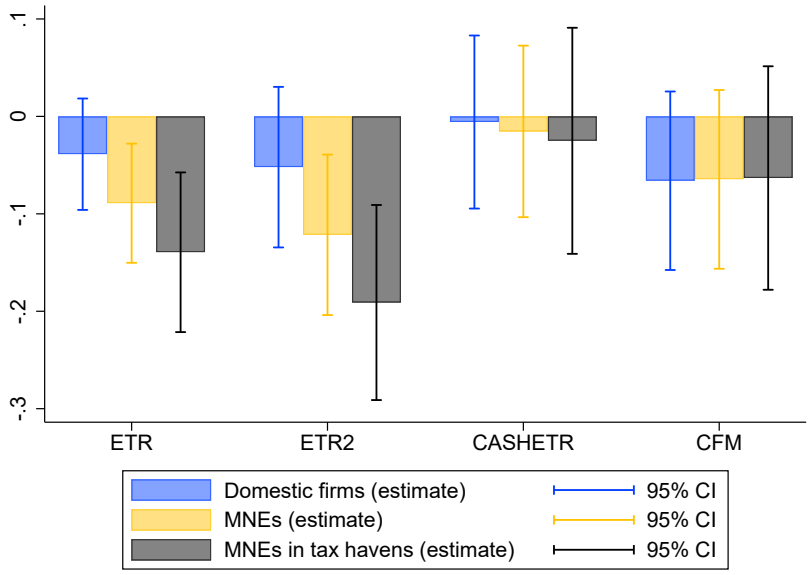
Notes: This graph plots the estimation results of equation (3) for the four tax avoidance variables. Standard errors are clustered at the 4-digit 1987 SIC industry level. See section 5 for more details.

TABLE OAT8 – List of tax havens

Andorra, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Bahrain, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cook Islands, Costa Rica, Cyprus, Dominica, Gibraltar, Grenada, Guernsey, Hong Kong, Ireland, Isle of Man, Jersey, Jordan, Lebanon, Liberia, Liechtenstein, Luxembourg, Macau, Malaysia, Maldives, Malta, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles, Niue, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Saint Martin, Samoa, San Marino, Seychelles, Singapore, Switzerland, Turks and Caicos Islands, Vanuatu

Notes: The list comprises 50 tax havens. The Channel Islands and UK Caribbean Islands, which both appear in Hines and Rice (1994), are omitted due to data limitations.

FIGURE OAF7 – Effect of import competition on corporate tax avoidance: domestic firms, MNEs, and tax havens



Notes: This graph plots the estimation results of an augmented version of equation (3) for the four tax avoidance variables. Standard errors are clustered at the 4-digit 1987 SIC industry level. See section 5 for more details.

TABLE OAT9 – Effect of import competition on corporate tax avoidance: mechanism (distinction between MNEs with or without subsidiaries in tax havens)

Column	(1)	(2)
Dependent variable	ETR_{ijt}	$intangibles_{ijt}$
$PNTR_{jt}$	-0.03	-131.14
	(0.03)	(280.63)
$PNTR_{jt} \times MNE_{ijt}$		228.10^{d}
		(138.39)
$PNTR_{jt} \times TAXHAVEN^{ext}_{ijt}$		534.21^{b}
		(264.30)
$intangibles_{ijt}$	2.21e-5^{a}	
	(7.49e-6)	
$intangibles_{ijt} \times MNE_{ijt}$	-2.52e-5^{a}	
	(7.98e-6)	
$intangibles_{ijt} \times TAXHAVEN^{ext}_{ijt}$	6.45e-07	
	(2.11e-06)	
Controls	Yes	Yes
Firm FEs	Yes	Yes
Year FEs	Yes	Yes
No. of obs.	20,758	24,481

Notes: This table reports regression results of an augmented version of equation (5) in column (1) and of an augmented version of equation (6) in column (2). In column (1), firm-year observations with a dependent variable outside the [0,1] interval are omitted. $TAXHAVEN^{ext}_{ijt}$ is a dummy equal to one if firm i discloses at least one subsidiary in a tax haven in year t. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 5 for more details.

TABLE OAT10 – Effect of import competition on corporate tax avoidance: mechanism (extended definition of intangibles)

Column	(1)	(2)	(3)	(4)	(5)
Dependent variable	ETR_{ijt}	ETR_{ijt}	ETR_{ijt}	ETR_{ijt}	$intangibles2_{ijt}$
$PNTR_{jt}$	-0.06^{b}	-0.02	-0.03	-0.03	1,279.28^{c}
	(0.03)	(0.03)	(0.03)	.(0.03)	(748.32)
$PNTR_{jt} \times MNE_{ijt}$		-0.06^{a}			2,352.42^{a}
		(0.02)			(422.26)
$intangibles2_{ijt}$			-1.81e-6^{b}	6.30e-6	
			(8.89e-7)	(4.76e-6)	
$intangibles2_{ijt} \times MNE_{ijt}$				-8.12e-6^{c}	
				(4.65e-6)	
Controls	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
No. of obs.	24,162	24,162	20,758	20,758	24,481

Notes: This table reports regression results of equation (2) in column (1), equation (3) in column (2), equation (4) in column (3), equation (5) in column (4), and equation (6) in column (5). In all columns but column (5), firm-year observations with a dependent variable outside the [0,1] interval are omitted. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 5 for more details.

TABLE OAT11 – Effect of import competition on corporate tax avoidance: mechanism (patents)

Column	(1)	(2)	(3)	(4)	(5)
Dependent variable	ETR_{ijt}	$patents_{ijt}$	$patents_{ijt}$	ETR_{ijt}	$log(1+patents_{ijt})$
$PNTR_{jt}$	-0.05^{c}	3.53	0.16	-0.05^{c}	-0.22
	(0.03)	(6.73)	(0.19)	(0.03)	(0.16)
$PNTR_{jt} \times MNE_{ijt}$		31.26^{c}	0.23^{c}		0.69^{a}
		(16.20)	(0.13)		(0.17)
$patents_{ijt}$	3.16e-4^{b}				
	(1.39e-4)				
$patents_{ijt} \times MNE_{ijt}$	-3.56e-4^{b}				
	(1.41e-4)				
$log(1+patents_{ijt})$				3.03e-3^{d}	
				(1.94e-3)	
$log(1+patents_{ijt}) \times MNE_{ijt}$				-5.40e-3^{b}	
				(2.40e-3)	
Controls	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
No. of obs.	24,162	28,443	18,917	24,162	28,443

Notes: This table replicates columns (4) and (5) in table 6. In columns (1), (2), and (3), *patents* is in absolute value. The equations are estimated with OLS in columns (1) and (2) and a negative binomial regression in column (3). In columns (4) and (5), *patents* is augmented by one unit and in logarithm and the equations are estimated with OLS. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 5 for more details.

TABLE OAT12 – Effect of import competition on corporate tax avoidance: mechanism (intangibles as a share of assets and in logarithm)

Column	(1)	(2)	(3)	(4)
Dependent variable	ETR_{ijt}	$intangibles_{ijt}$	ETR_{ijt}	$log(1+intangibles_{ijt})$
$PNTR_{jt}$	-0.03	0.02	-0.03	-1.02^{a}
	(0.03)	(0.03)	(0.03)	(0.33)
$PNTR_{jt} \times MNE_{ijt}$		0.04^{c}		1.92^{a}
		(0.02)		(0.32)
$intangibles_{ijt}$	0.04^{a}			
	(0.02)			
$intangibles_{ijt} \times MNE_{ijt}$	-0.06^{b}			
	(0.03)			
$log(1+intangibles_{ijt})$			0.01^{a}	
			(1.83e-3)	
$log(1+intangibles_{ijt}) \times MNE_{ijt}$			-0.01^{a}	
			(2.18e-3)	
Controls	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
No. of obs.	20,758	24,481	20,758	24,481

Notes: This table replicates columns (4) and (5) in table 6. In columns (1) and (2), $intangibles$ is expressed as a share of total assets. In columns (3) and (4), $intangibles$ is in current million dollars and logarithm. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 5 for more details.

TABLE OAT13 – Effect of import competition on corporate tax avoidance: mechanism (MNE activity measured with Exhibit 21 files)

Column	(1)	(2)	(3)
Dependent variable	ETR_{ijt}	ETR_{ijt}	$intangibles_{ijt}$
$PNTR_{jt}$	-0.04	-0.03	14.66
	(0.03)	(0.03)	(267.22)
$PNTR_{jt} \times MNE_{ijt}$	-0.05^{a}		412.28^{b}
	(0.02)		(200.47)
$intangibles_{ijt}$		-2.02e-6	
		(2.39e-6)	
$intangibles_{ijt} \times MNE_{ijt}$		-6.37e-7	
		(1.93e-6)	
Controls	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes
No. of obs.	24,162	20,758	24,481

Notes: This table replicates columns (2), (4), and (5) in table 6. This time, the multinational activity dummy is defined using Exhibit 21 filings. Standard errors, in parentheses, are clustered at the 4-digit 1987 SIC industry level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 5 for more details and Dyreng and Lindsey (2009) and Dyreng, Hoopes, Langetieg, and Wilde (2020) for more discussions on Exhibit 21 filings.