# How do Reductions in Foreign Country Corporate Tax Rates Affect U.S. Domestic Manufacturing Firms?

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**March 2018**

## Abstract

We examine whether reductions in foreign country statutory corporate tax rates affect the competitive environment of U.S. domestic manufacturing firms and how U.S. firms respond. We develop a measure of U.S. domestic firms' exposure to changes in foreign country corporate tax rates and find U.S. domestic firms' profitability is adversely affected by decreases in foreign country corporate tax rates, consistent with intensified competition. We find U.S. domestic firms respond by increasing investment in research and development and capital expenditures and by improving total factor productivity. In cross-sectional analyses, we find the impact of foreign tax cuts is concentrated among U.S. domestic firms with low product differentiation. Taken together, these findings suggest that reductions in foreign country statutory corporate tax rates escalate competition faced by U.S. domestic firms, and in response U.S. domestic firms increase investment and become more productive.

We appreciate helpful discussions from Yongsung Chang, Paul Ellickson, and Jerry Zimmerman. We also appreciate helpful comments from Xi Ai, Elizabeth Chuk, James Chyz, Alex Edwards, Erik Lie, LeAnn Luna, Linda Myers, James Myers, Kathleen Powers, Terry Shevlin, Jake Thornock, Aruhn Venkat, Charlie Wasley, and workshop participants at the University of California – Irvine, University of Rochester, and University of Tennessee and brown bag participants at the Michigan State University.

## 1. Introduction

On December 20, 2017, the U.S. House of Representatives and U.S. Senate passed the Tax Cuts and Jobs Act (TCJA), which decreased the top U.S. statutory corporate tax rate by 14 percentage points. The TCJA represents the first change in the U.S. corporate tax rate since 1993. In reducing the corporate tax rate, the U.S. is following the trend in declining tax rates across the globe. A recent OECD study finds average statutory corporate tax rates around the world have declined from 32.2 percent in 2000 to 24.7 percent in 2016 (Hannon 2017). In arguing the need for tax reform, House Speaker Paul Ryan said the U.S. has a "terrible tax system," noting that "we tax our corporations at 35 percent … (while) the average tax rate in the industrialized world for businesses is 22.5 percent." (Lewis 2017).[1] Despite the role that declining worldwide tax rates played in motivating the recent U.S. tax reform, there is currently no direct empirical evidence about the extent to which these declining foreign tax rates affect the competitive position of U.S. firms. We seek to fill this void in the literature. Specifically, we address two research questions: (1) whether and to what extent foreign country corporate tax rates affect the competitive environment of U.S. domestic firms? and (2) how U.S. domestic firms respond to the change in the competitive environment following foreign tax rate cuts?[2]

Reductions in foreign tax rates can affect the competitive environment in the U.S. through several channels. First, foreign tax cuts can affect foreign firms' investments. Tax cuts in their home market will result in some previously negative net present value investments

[1] Speaker Ryan's view is not shared by all observers. A November 2017 *New York Times* Editorial Board article points to a 2016 joint White House and Treasury Department report indicating that U.S. firms have an average effective tax rate of 18.1 percent. Thus, U.S. firms may not have been as disadvantaged as the difference in statutory rates would suggest. (Editorial Board 2017)

[2] Throughout the paper, we frame our discussion in terms of "reductions" in foreign country corporate tax rates as most foreign countries lowered tax rates during our sample period.

becoming positive ones on an after-tax basis.[3] As a result, foreign firms can increase investments in new products, product improvements, and production processes (e.g., Djankov et al. 2010) and sell these new, improved, or more efficiently produced products both domestically and in the U.S., leading to increased competition in U.S. markets.[4]

A second potential channel is through cross-subsidization between divisions within the same firm. Foreign firms can use the proceeds of a tax cut to subsidize their U.S. activities in order to gain market share in a potentially large market (i.e., the U.S.). Basevi (1970) notes that price discrimination between domestic and foreign markets (i.e., cross-subsidization from domestic to foreign activities) can be beneficial to exporting firms because expanding foreign activities allows them to enjoy economies of scale, thus lowering production costs. An assumption underlying both of these channels is that the foreign firms sell enough products domestically (or source enough profits to their home country) to gain an economically significant benefit from the tax cut.

Prior work posits that competition can result from either actual actions or the threat of actions by competitors (e.g., Tirole 1988). Thus, in our setting the competitive environment in the U.S. could change as a result of actual actions or the threat of actions by foreign firms.[5] If foreign country tax cuts increase the threat of or actual competition faced by U.S. domestic

[3] While some firms could have effective (or average) tax rates below their home country statutory tax rate, the statutory tax rate is most closely linked to the marginal tax rate for firms that are consistently profitable and, therefore, is what should influence incremental investment decisions.
[4] Hassett and Hubbard (2002) and Hassett and Newmark (2008) provide reviews of the literature on tax policy and business investment.
[5] Our discussion focuses on competitive threats posed by foreign firms. We acknowledge it is possible activities of U.S. multinational companies operating in countries that cut tax rates could affect U.S. markets, although U.S. repatriation taxes potentially constrained the ability of U.S. multinationals to use any benefits of lower foreign tax rates to support their U.S. activities. Regardless, this possibility suggests foreign tax cuts have the potential to affect the competitive environment of and elicit responses from U.S. domestic firms.

firms, this increased competition should be reflected in lower price-cost margins of U.S. domestic firms (e.g., Aghion et al. 2005, Gaspar and Massa 2006, Peress 2010).

If reductions in foreign tax rates affect the competitive environment in the U.S., we expect U.S. domestic firms to respond. Previous research has documented various actions that incumbents take in response to intensified competition. A stream of the industrial organization literature dating back to Sutton (1991) suggests firms can incur endogenous fixed costs (e.g., research and development (R&D) and/or advertising) to differentiate their products in order to absorb and escape competition. Another line of studies has documented that incumbents can increase capital expenditures in response to increased competition (e.g., Dixit 1980, Khanna and Tice 2000). Other studies also indicate increased competition compels firms to use their capital and labor in their production process more efficiently, resulting in improved productivity (e.g., Schmitz 2005, Holmes and Schmitz 2010, Matsa 2011). Thus, we examine whether reductions in foreign country tax rates are associated with increased investment and productivity for U.S. domestic firms.

In order to examine our research questions, we develop a measure of U.S. domestic manufacturing firms' exposure to changes in foreign country statutory corporate tax rates. We compute the weighted average change in foreign countries' statutory corporate tax rates at the industry-year level. The measure reflects the fact that: (1) multiple foreign countries have activities in U.S. markets, (2) countries change their corporate tax rates in different years, and (3) individual U.S. domestic firms face different degrees of competition from firms in specific foreign countries. For example, if Canada lowers its statutory corporate tax rate, U.S. domestic firms operating in industries in which a large share of imports come from Canada will be most affected. Therefore, when constructing the measure, we weight foreign countries' statutory

corporate tax rate changes by the ratio of country-industry import penetration to total industry import penetration.[6] Thus, the measure varies cross-sectionally by industry and also varies over time.

This measure has several strengths from an identification standpoint. First, it varies over time because countries change their statutory tax rates in different years, which mitigates the potential confounding effect of macroeconomic conditions in the U.S. Second, the measure varies across industries because different industries have different exposure to competition from specific foreign countries, which alleviates concerns about potential industry-level confounding effects. Third, changes in foreign country corporate tax rates are plausibly exogenous to individual U.S. domestic firms.

We focus our analysis on U.S. domestic firms because we are specifically interested in how foreign tax cuts impact the competitive environment in the U.S. and how U.S. firms respond. While reductions in foreign country corporate tax rates also potentially affect U.S. multinationals, the effects on multinationals' U.S. and non-U.S. activities are difficult to separate using publicly-available data.[7] We focus on manufacturing firms because these are the industries for which the import data used to construct our measure of exposure to foreign countries' tax rate changes are available.

We begin by providing evidence that changes in foreign country statutory corporate tax rates affect the competitive environment in the U.S. Following prior research (e.g., Aghion et al. 2005, Gaspar and Massa 2006, Peress 2010), we use price-cost margins to capture competition. Lower price-cost margins indicate greater competition. We find that averages of one- and two-year ahead gross margin and profit margin are adversely affected by reductions in foreign

[6] Appendix C provides an example that illustrates how the measure is constructed.
[7] In Section 7, we discuss sensitivity tests including U.S. multinationals.

country tax rates. A one percentage point decrease in the weighted average foreign country tax rate is associated with a 1.084 (1.895) percentage point decrease in average gross (profit) margin. The declining gross and profit margins are consistent with an increased threat of competition in U.S. markets following foreign tax rate cuts.

Next, we consider how U.S. domestic firms respond to reductions in foreign country corporate tax rates. Specifically, we examine the effect of foreign tax cuts on U.S. domestic firms' R&D, advertising, capital expenditures, and total factor productivity. We find that U.S. domestic firms on average increase spending on R&D and capital expenditures when foreign country tax rates decline. A one percentage point decrease in foreign country corporate tax rates is associated with an increase in average R&D spending of 1.508 cents per dollar of sales, and an increase in capital expenditures of 0.457 cents per dollar of average total assets. We do not find a significant effect on advertising expenditures. Finally, we find U.S. domestic manufacturing firms' average one- and two-year ahead total factor productivity increases after reductions in foreign tax rates. These findings are consistent with U.S. domestic firms responding to foreign tax cuts by increasing investment and becoming more productive, possibly to protect themselves from the threat of intensified competition.

Next, we strengthen our main results by considering cross-sectional differences in the effects of reductions in foreign country tax rates on U.S. domestic firms. The industrial organization literature posits that product differentiation softens the effects of competition (Shaked and Sutton 1982, Tirole 1988, Sutton 1991). Consistent with this prediction, Hombert and Matray (2017) find that firms with high product differentiation are more resilient to Chinese import penetration. Similarly, we expect the impact of reductions in foreign country tax rates on U.S. domestic firms' gross and profit margins will be more pronounced among firms with low

product differentiation and that these firms will have the strongest incentives to respond to foreign tax cuts by increasing investment and improving productivity. Consistent with expectations, we find the effects of foreign tax cuts on U.S. domestic firms' margins, R&D and capital expenditures, and productivity are concentrated among U.S. domestic firms with low ex ante product differentiation.

We perform several sensitivity analyses. China cut its top statutory corporate tax rate in 2008 and is a major source of imports in many U.S. industries. To ensure our results are not driven by China, we repeat our analyses excluding China when computing the weighted average change in foreign country tax rates, and our inferences are unaffected. In addition, several countries that are significant sources of U.S. imports cut their top statutory corporate tax rates in 2008, which coincided with the financial crisis. To ensure our analyses are not driven by the year 2008, we remove all 2008 observations and repeat our tests. Inferences are unchanged.

As noted previously, because changes in foreign countries' tax rates are plausibly exogenous to U.S. domestic manufacturing firms, our findings are unlikely to be confounded by unobservable correlated omitted variables. However, unobserved time-varying industry shocks could threaten our identification. For example, changes in foreign country statutory corporate tax rates could be correlated with unobserved shocks to U.S. product demand. Foreign countries could cut tax rates in anticipation of growth opportunities in the U.S. product market. This explanation would be consistent with our findings of increases in U.S. domestic firms' R&D but inconsistent with the observed decline in U.S. domestic firms' gross and profit margins. Another possibility is that changes in foreign country statutory corporate tax rates and U.S. domestic firms' margins are simultaneously correlated with unobserved shocks to product demand around the world. In anticipation of declining demand in an industry, foreign countries could cut tax

rates and U.S. domestic firms that operate in that industry could experience decreases in margins. This explanation would be consistent with the observed declines in U.S. domestic firms' gross and profit margins but would not predict increases in U.S. domestic firms' R&D. Overall, we conclude that unobserved time-varying industry shocks are unlikely to be an alternative explanation for our findings.

Our study, to the best of our knowledge, is the first to provide direct evidence on the effect of changes in foreign country statutory corporate tax rates on U.S. domestic firms. Our findings provide a nuanced picture of the effect of foreign tax rate cuts. Consistent with popular claims, reductions in foreign country corporate tax rates affect the competitive environment of U.S. domestic manufacturing firms. However, the results also suggest that reductions in foreign country corporate tax rates push at least a subset of U.S. domestic manufacturing firms to spend more on R&D and capital expenditures and become more productive. These results should be of interest to policymakers in considering the potential implications of a reduction in the U.S. corporate tax rate in response to declining corporate tax rates worldwide.

Our study relates to several literatures. First, it contributes to research that examines the real effects of taxation. Prior research has examined the effects of the taxation of a firm's own income on its decisions (e.g., Doidge and Dyck 2015, Heider and Ljungqvist 2015, Lester and Langenmayr 2017, Ljungqvist et al. 2017, Chow et al. 2017, Gallemore et al. 2017).[8] We extend this research by examining the real effects of reductions in *foreign* country corporate tax rates on U.S. domestic firms. Second, our study relates to research that examines the effects of competitors' taxes on firms (e.g., Kubick et al. 2015, Donohoe et al. 2016, Bird et al. 2018).

[8] Another stream of research examines the real effects of the U.S. worldwide tax system on U.S. firms (e.g., Albring 2006, Foley et al. 2007, Graham et al. 2011, Hanlon et al. 2015, Edwards et al. 2016, Bird et al. 2017, Harris and O'Brien 2017, Nessa 2017).

While prior studies focus primarily on firms' tax avoidance and reporting behavior, we extend this literature by examining the effects of foreign tax rate cuts on U.S. domestic firms' investment and productivity. Finally, our study is related to the broader literature that examines the effect of foreign competition on U.S. firms (e.g., Fresard 2010, Autor et al. 2013, Autor et al. 2016, Fresard and Valta 2016, Huang et al. 2017) and also the literature on the relation between competition and productivity (see Holmes and Schmitz 2010 for a review).

Our study is organized as follows. The next section discusses our motivation and develops our predictions. Section 3 describes our empirical strategy. Section 4 describes the sample and descriptive statistics. Section 5 presents the main results. Sections 6 and 7 report the results of extensions to the main results and sensitivity analyses. Section 8 concludes.

## 2. Motivation and Testable Predictions

### *2.1 Motivation*

Prior to the TCJA, both lawmakers and firms claimed the U.S. corporate tax system harmed the competitiveness of U.S. firms (e.g., NAM 2015, White House 2017). One often criticized feature of the U.S. tax system was the relatively high corporate statutory tax rate. One concern with the high U.S. rate was that while foreign firms are taxed on their U.S. source income at the same rate as U.S. firms, income earned (or shifted) outside of the U.S. is taxed at the foreign country tax rate. A lower foreign country tax rate increases the after-tax cash flow from pre-tax income earned by foreign firms in their home country, which could potentially provide foreign firms with a competitive advantage in U.S. markets. However, there is little direct empirical evidence on the extent to which foreign country tax rates affect the competitive position of U.S. domestic firms, and how U.S. domestic firms respond.

*2.2 Testable Predictions*

Reductions in foreign country corporate tax rates could increase competition faced by U.S. domestic firms through several channels. First, investment projects that were previously deemed negative present value investments by foreign firms could become positive net present value projects after the tax cut because the tax cut in their home market makes investments in new products or improvements to existing products or production processes more profitable on an after-tax basis. For example, foreign firms could make new investments to lower production costs or hire more capable employees, which will improve productivity. Following these new investments, the foreign firms' new and/or more efficiently produced products could be sold both domestically and in the U.S., thus increasing competition to U.S. domestic firms. Further, Bellone et al. (2010) provides evidence that financial constraints hinder firms' exporting activities and that easy access to external capital is positively associated with the likelihood of starting to export. To the extent that reductions in tax rates ease foreign firms' financial constraints (Edwards et al. 2016), reductions in foreign tax rates could increase exports to the U.S., thus increasing the threat of or actual competition to U.S. domestic firms.

A second channel linking foreign tax rate cuts to competition in U.S. markets comes through cross-subsidization. Prior research provides evidence of cross-subsidization across divisions within firms (e.g., Lamont 1997, Shin and Stulz 1998). Thus, higher home country after-tax cash flows resulting from reductions in foreign country tax rates could be used to support foreign firms' U.S. activities. For example, foreign firms could lower prices on goods sold in the U.S. Such a response would be consistent with Basevi (1970), which explains that price discrimination between domestic and foreign markets (i.e., cross-subsidization from domestic to foreign activities) can be beneficial to exporting firms because expanding foreign

operations allows them to enjoy economies of scale, thus lowering production costs. This can be especially beneficial when domestic markets are relatively small, and thus achieving economies of scale is difficult (Balassa 1971). Because most foreign markets are small relative to the U.S. market, foreign firms may decide to cross-subsidize U.S. exports when home country income tax rates decline, thereby increasing the competitive pressure on U.S. domestic firms. Regardless of the channel, if reductions in foreign country tax rates affect the competitive environment in the U.S., we expect the intensified competition to be reflected in U.S. domestic firms' price-cost margins (e.g., Aghion et al. 2005, Gaspar and Massa 2006, Peress 2010).

Despite the potential channels linking foreign tax cuts to competition in U.S. markets, decreases in foreign country tax rates could have no or limited effect on U.S. domestic firms' competitive environment. In order for the above-mentioned increased investment or cross-subsidization to occur, certain conditions must hold. First, foreign firms must have economically significant operations in their home country in order to meaningfully benefit from a home country corporate tax rate cut. Second, the potential effects of foreign tax cuts are impacted by who bears the economic burden of the corporate tax. For example, Donohoe et al. (2015) conclude employees and owners, but not suppliers or customers, benefit from the tax advantages enjoyed by banks organized as S-corporations. Research finds owners and employees bear significant portions of the corporate tax burden (e.g., Suarez Serrato and Zidar 2016, Fuest et al. 2018). If the benefits of foreign tax cuts are not used by at least some firms to increase investment or support foreign firms' U.S. activities, reductions in foreign country tax rates may not affect the competitive environment in the U.S.

Finally, if reductions in foreign country tax rates are accompanied by a decrease in foreign firms' expected pretax return (i.e., an implicit tax) (e.g., Scholes et al. 2009), the foreign

tax cut may not affect the U.S. domestic firms' competitive environment. As the supply of capital moves toward the tax-favored jurisdiction, pretax returns could decrease as the result of decreases in sales prices due to increased production and/or increases in input prices due to increased demand for factors of production. Prior research finds evidence consistent with the existence of implicit taxes at the corporate level (e.g., Wilkie 1992, Berger 1993, Jennings et al. 2012, Markle et al. 2017). For example, Markle et al. (2017) find a positive (insignificant) association between pretax (after-tax) return on assets and statutory tax rates among European single country firms. If implicit taxes counteract the reduction in explicit taxes such that reductions in foreign tax rates do not significantly affect foreign firms' U.S. activities, reductions in foreign country tax rates will not affect the competitive environment of U.S. domestic firms. Thus, whether and to what extent reductions in foreign country statutory tax rates increase competition is an empirical question. Our first prediction is:[9]

> ***P1****: Reductions in foreign country corporate tax rates increase competition for U.S. domestic firms.*

If reductions in foreign tax rates affect the competitive environment of U.S. domestic firms, we expect U.S. domestic firms to respond. Specifically, we draw on previous research (discussed below) and consider the potential effects of reductions in foreign country tax rates on U.S. domestic firms' investments in R&D, advertising, and capital expenditures.

One stream of research predicts that U.S. domestic firms will increase investments in response to foreign tax cuts. Beginning with Sutton (1991), the industrial organization literature suggests that firms incur endogenous fixed costs (e.g., R&D and/or advertising) to differentiate their products in order to absorb and escape competition. Several studies provide evidence

[9] All predictions are stated in the alternative.

consistent with competition increasing investments in innovation. For example, Peterson and Tran (2018) find firms with higher perceived competition invest more in R&D. Bloom et al. (2016) find a positive association between Chinese import penetration and patent activity and R&D expenditures among European firms. Similarly, Lie and Yang (2017) observe an increase in innovation among U.S. manufacturers in response to greater Chinese import penetration.

Foreign country tax rate cuts can also increase firms' spending on capital expenditures. R&D spending can be accompanied by concurrent spending on capital expenditures. For example, firms may update or expand existing facilities in order to produce newly developed products or implement improved production processes. Previous studies also support the prediction that U.S. domestic firms will increase capital expenditures in response to increased competition stemming from foreign tax cuts (e.g., Spence 1977, Dixit 1980, Khanna and Tice 2000). For example, Khanna and Tice (2000) find that in response to Wal-Mart's entry, larger and more profitable incumbents increase their investments (i.e., expand). Thus, U.S. domestic firms could increase investments in R&D, advertising, and/or capital expenditures in order to protect themselves from the competitive threats posed by reductions in foreign country tax rates.

However, if U.S. domestic firms do not believe they can absorb or escape the competitive threat posed by foreign tax cuts, they may instead decide to accommodate competitors (e.g., Tirole 1988, Fresard and Valta 2016), and as a result, reduce spending on R&D, advertising, and capital expenditures. Further, if reductions in foreign country tax rates reduce U.S. domestic firms' current or expected profitability, they may be less able or have less incentive to invest in R&D, advertising, or capital expenditures. Dasgupta and Stiglitz (1980) develop an analytical model in which more competitive product markets lead to lower investments in R&D. Brown et al. (2009) find that internal cash flow is an important source of financing for R&D. Autor et al.

(2016) examine the impact of Chinese import competition on U.S. manufacturers' patent activity and conclude increased import competition from China reduced U.S. manufacturers' profitability, which led to reductions in their innovation activity. Together, the findings in Dasgupta and Stigliz (1980), Brown et al. (2009), and Autor et al. (2016) suggest reductions in foreign country tax rates could decrease U.S. domestic firms' R&D expenditures. Further, Fresard and Valta (2016) find that on average U.S. firms decrease investment in response to tariff cuts. Thus, it is unclear ex ante whether and to what extent reductions in foreign country statutory tax rates alter U.S. domestic firms' investment decisions. This leads to the following predictions:

> ***P2a****: Reductions in foreign country corporate tax rates lead to increases in U.S. domestic firms' R&D expenditures.*
> ***P2b****: Reductions in foreign country corporate tax rates lead to increases in U.S. domestic firms' advertising expenditures.*
> ***P2c****: Reductions in foreign country corporate tax rates lead to increases in U.S. domestic firms' capital expenditures.*

Reductions in foreign tax rates could also affect U.S. domestic firms' overall productivity. Spending on R&D and capital expenditures can improve firms' productivity. For example, Doraszelski and Jaumandreu (2013) find that R&D investments increase both levels and variability of productivity growth. Capital expenditures can also lead to improved productivity in the form of the scale effect (Arrow 1962). Prior research also indicates increased competition compels firms to use their capital and labor in their production process more efficiently, resulting in improved productivity (e.g., Nickell 1996, Schmitz 2005, Holmes and Schmitz 2010; Matsa 2011). For example, Nickell (1996) finds competition is positively associated with productivity growth, consistent with competition creating incentives to innovate and increase production efficiency. Similarly, Schmitz (2005) finds that when Brazilian iron-ore producers entered iron-ore markets in the 1980s, the productivity of U.S iron-ore producers

dramatically increased, consistent with U.S. firms investing in new management practices in response to intensified competition. Matsa (2011) examines the supermarket industry and finds that more intense competition leads to fewer inventory shortfalls.[10] Therefore, the competitive threats prompted by foreign tax cuts could lead U.S. domestic firms to become more productive. This leads to our final prediction:

> ***P2d****: Reductions in foreign country corporate tax rates lead to increases in U.S. domestic firms' productivity.*

## 3. Variable Measurement and Empirical Strategy

### *3.1 Weighted Average Changes in Foreign Countries' Corporate Income Tax Rates*

To test our predictions, we develop a measure of U.S. domestic firms' exposure to foreign countries' changes in statutory corporate income tax rates. We use data on U.S. imports to capture the extent to which firms from specific foreign countries are active in U.S. markets.[11] Multiple countries export goods to U.S. markets, and those countries have changed their statutory corporate income tax rates by varying magnitudes at different points in time. U.S. domestic firms are not all equally affected by specific countries' corporate income tax changes. Rather, U.S. firms operating in industries to which specific countries export goods are most affected.

To illustrate, consider Mexico, India, and South Korea, which are among the top ten exporters to the U.S. and lowered their corporate income tax rates in 2005 (see Appendix A). As Appendix B shows, at least one of these three countries ranks among the top five sources of U.S. imports for 17 of the 21 three-digit NAICS manufacturing industries. In contrast, none of these three countries is among the top five sources of imports in the Wood Product, Paper, Petroleum

[10] See Holmes and Schmitz (2010) for a detailed review.
[11] Data on U.S. imports and exports are obtained from Peter Schott's website: http://faculty.som.yale.edu/peterschott/sub_international.htm (Schott 2008).

and Coal Products, or Chemical industries. Accordingly, the tax cuts of Mexico, India, and South Korea will impact U.S. firms in 17 industries to varying degrees but will have little impact in other industries. Because countries change tax rates in different years as shown in Appendix A, and the intensity of those countries' import penetration varies by industry as shown in Appendix B, U.S. domestic manufacturing firms face time-varying exposure to changes in foreign countries' tax rates.

Therefore, to test our predictions we compute the weighted average change in foreign countries' statutory corporate income tax rates by three-digit NAICS manufacturing industry and year. Changes in foreign country tax rates are weighted by the ratio of country-industry import penetration to total industry import penetration. The intuition underlying the weighting mechanism is that U.S. domestic firms will be affected to a greater extent by tax rate changes of countries that contribute more to industry import penetration.[12] Following prior work (e.g., Acemoglu et al. 2016), we calculate country-industry import penetration each year for each country-industry and total industry import penetration for each industry as follows:

$$Country - Industry\ Import\ Penetration_{c,j,t} = \frac{imports_{c,j,t}}{imports_{j,t} + domestic\ production_{j,t} - exports_{j,t}} \quad (1a)$$

$$Industry\ Import\ Penetration_{j,t} = \frac{imports_{j,t}}{imports_{j,t} + domestic\ production_{j,t} - exports_{j,t}} \quad (1b)$$

where c, j, and t index country, three-digit NAICS manufacturing industry, and year. The sum of country-industry import penetration across all countries in a given industry equals that industry's import penetration. We measure domestic production using GDP-by-industry data from the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce.

[12] Import penetration reflects the extent to which domestic (i.e., U.S.) demand is met by imports.

Appendix C illustrates how the measure is computed for a hypothetical industry-year. We use this methodology to compute the weighted average change in foreign countries' statutory corporate income tax rates for 3-digit NAICS manufacturing industries over an 18 year period (362 industry-years) and label it *FORTAXCH*. All observations in the same industry-year have the same value of *FORTAXCH*.

Figure 1 presents the weighted average change in foreign countries' corporate income tax rates (*FORTAXCH*) by industry over the sample period. Figure 1 illustrates that there is both inter-temporal and cross-sectional variation in *FORTAXCH*. Because foreign countries' tax rate changes are plausibly exogenous to individual U.S. domestic firms and *FORTAXCH* exhibits inter-temporal and cross-sectional variation, *FORTAXCH* offers a nice identification strategy.

*3.2 Empirical Strategy*

The objective of this study is to examine how foreign countries' corporate income tax rate changes affect U.S. domestic manufacturing firms. To address this question, we estimate the following basic regressions:

$$Y_{i,j,t+\tau} = \alpha + \beta_1 FORTAXCH_{j,t} + Controls_{i,j,t}^{firm} + Controls_{j,t}^{industry} + \varphi_j + \tau_t + \varepsilon_{i,j,t+\tau} \quad (2)$$

where $Y_{ijt+\tau}$ is an outcome variable for firm i operating in industry j in year t+τ. In all analyses, the dependent variable is the simple average of $Y_{ijt+1}$ and $Y_{ijt+2}$. Our variable of interest, $FORTAXCH_{jt}$, captures U.S. domestic manufacturing firms' exposure to foreign countries' corporate income tax rate changes as described in the preceding section. We focus on relatively short-term outcomes to decrease the possibility events other than the foreign tax shocks affect the outcome variables. $Controls_{i,j,t}^{firm}$ is a set of firm-level control variables that are specific to the respective outcome variables. We include lagged values of the outcome variable ($Y_{ijt}$) as a firm-level control variable. $Controls_{j,t}^{industry}$ is a set of industry-level control variables that are

included for all outcome variables. We describe firm-level control variables later when we discuss the estimation results of the respective outcome variables, whereas we describe industry-level control variables below because all regressions include them. The coefficient of interest is $\beta_1$, which captures the effect of foreign countries' changes in corporate income tax rates on the outcome variables of U.S. domestic manufacturing firms.

Although foreign countries' decisions to change corporate income tax rates are unlikely to be influenced by individual U.S. domestic firms, those decisions could potentially be correlated with other factors that affect foreign firms' U.S. activities, which in turn could affect U.S. domestic firms' competitive environment. For example, changes in real exchange rates between foreign currencies and the U.S. dollar, tariffs imposed by the U.S., and foreign countries' economic growth could be correlated with foreign countries' exports to U.S. markets, thus affecting U.S. firms' competitive environment. To mitigate concerns that such factors compromise our identification strategy, we include three additional industry-level control variables: *Changes in tariffs*, *Changes in foreign real FX*, and *Foreign GDP growth*. *Changes in tariffs* is the weighted average change in tariff rates from year t-1 to year t. *Changes in foreign real FX* is the weighted average change in foreign real exchange rates relative to the U.S. dollar from year t-1 to year t. *Foreign GDP growth* is the weighted average foreign country real GDP growth from year t-1 to year t. Similar to *FORTAXCH*, these variables are constructed for each U.S. industry-year, where the weighting is the ratio of country-industry import penetration to total industry import penetration. See Appendix D for detailed variable definitions.

We also include industry ($\varphi_j$) and year ($\tau_t$) fixed effects in all tests to ensure that neither time-invariant industry characteristics nor macroeconomic conditions confound the identification of $\beta_1$. Because *FORTAXCH* is measured at the industry-year level, we cluster standard errors by

three-digit NAICS industry and year. All continuous variables are winsorized at the 1st and 99th percentiles.

## 4. Sample and Descriptive Statistics

### *4.1 Sample*

Table 1 describes our sample construction. We begin with 158,700 (U.S.-incorporated) firm-years in Compustat over the period 1997 – 2014 based on the intersection of Compustat and CRSP. We remove firm-years with sales less than $5 million to mitigate outlier problems because sales is the deflator for several of our dependent variables. We also restrict all firm-years to have one-year lagged information to compute some variables used in our analyses. Next, we remove non-manufacturing firms because the import data used to construct *FORTAXCH* are only available for manufacturing industries.[13] We also delete firm-years with missing variables used in our analyses. For our main analyses, we restrict our sample to U.S. domestic firms by removing all firm-years with non-zero pre-tax foreign income (PIFO) and foreign income taxes (TXFO). This results in 7,746 firm-years (1,635 unique firms) for our main sample. Requiring firm-years to have non-missing values of total factor productivity (TFP) reduces our sample to 4,059 firm-years (899 unique firms).[14]

The sample begins in 1997 because the GDP-by-industry data used to construct the import penetration measures are available for 1997 and forward for all 21 manufacturing industries, and the sample ends in 2014 because our outcome variables are measured in years t+1 and t+2. As noted previously, we obtain U.S. import and export data from Peter Schott's website (http://faculty.som.yale.edu/peterschott/sub_international.htm) and GDP-by-industry data from the BEA. We obtain the data on top statutory corporate income tax rates from the EY

[13] See Appendix B for a list of the 21 industries.
[14] Estimating total factor productivity requires additional data items, including non-missing number of employees.

International Tax Online Reference Service, EY Worldwide Tax Guides, and University of Michigan World Tax Database. The statutory corporate income tax rates do not include subnational (e.g., state, province) taxes. We also obtain the data necessary to compute industry-level tariffs from Peter Schott's website. Foreign country GDP growth data are obtained from the World Bank (https://data.worldbank.org/). The exchange rate and Consumer Price Index data used to compute real foreign exchange rates are obtained from the Bank of International Settlements (http://www.bis.org/statistics/xrusd.htm?m=6%7C381%7C675) and World Bank (https://data.worldbank.org/indicator/FP.CPI.TOTL), respectively.

Figure 2 presents the number of observations by year and indicates that the number of domestic public firms in the U.S. has gradually declined over the past two decades. Figure 3 presents the distribution of observations by industry for our sample of 7,746 firm-years (the black bar) and for all domestic firms in Compustat (the gray bar). Chemical Manufacturing and Computer and Electronic Product Manufacturing are the two most dominant industries for both our sample and for Compustat.

*4.2 Descriptive Statistics*

Table 2 presents descriptive statistics for all variables used in our analyses and correlations of our variable interest (*FORTAXCH*) with all outcome variables. In Panel A, the mean and median of *FORTAXCH* are -0.6% and -0.4%. The third quartile of *FORTAXCH* is also negative (-0.2%). This indicates that during our sample period, foreign countries exporting to the U.S. on average cut corporate income tax rates. Panel B presents preliminary evidence supporting some of our predictions. Consistent with prediction 1, average gross margin is positively associated with *FORTAXCH*, suggesting that reductions in foreign countries' corporate tax rates adversely impact U.S. domestic manufacturing firms' gross margins.

Consistent with prediction 2a, R&D is negatively associated with *FORTAXCH*, suggesting U.S. domestic manufacturing firms increase R&D expenditures following reductions in foreign countries' corporate tax rates. Next, we formally test our predictions using multivariate analyses.

## 5. Research Design and Results

### *5.1 The Effect of Changes in Foreign Countries' Corporate Income Tax Rates on U.S. Domestic Firms' Competitive Environment*

To test prediction 1 regarding the effect of changes in foreign countries' corporate income tax rates on U.S. domestic manufacturing firms' competitive environment, we follow prior research (e.g., Aghion et al. 2005, Gasper and Massa 2006, Peress 2010) and examine price-cost margins. The price-cost margin captures firms' ability to price goods above marginal cost, with smaller price-cost margins indicating greater competition. Specifically, we estimate equation (2) using two outcome variables: (1) gross margin ([sales – cost of goods sold]/sales) and (2) adjusted profit margin ([pre-tax income + interest expense + depreciation/amortization + R&D + advertising]/sales). We add back R&D and advertising to remove the effects of possible changes in investments. For these tests, following previous research (e.g., Giroud and Mueller 2010, Xu 2012) we include the following firm-level control variables: sales growth (*Sales Growth*), firm size (*MVAL*), market-to-book ratio (*MB*), the ratio of capital to labor intensity (*Capital-labor intensity*), property, plant, and equipment (*PPE*), and intangible assets (*INTAN*). As noted previously, we also include the lagged value of the respective outcome variable as a control. We include a set of industry-level control variables and industry and year fixed effects as described previously.

We present the results of testing prediction 1 in Table 3. The dependent variables are simple averages of the two outcome variables in years t+1 and t+2. Columns (1) and (2) report the results of estimating equation (2) using average gross margin and average adjusted profit

margin as the dependent variable. Consistent with prediction 1, the coefficient on *FORTAXCH* is positive (1.084) and significant at the one percent level in column (1), suggesting that U.S. domestic manufacturing firms' gross margin is adversely affected by reductions in foreign countries' corporate tax rates, consistent with increased competition. The coefficient estimate implies that a one percentage point decrease in the weighted average foreign country tax rate is associated with a 1.084 percentage point decrease in U.S. domestic manufacturers' average gross margin in years t+1 and t+2. In column (2) where the dependent variable is average adjusted profit margin, we again find that the coefficient on *FORTAXCH* is positive (1.895) and significant at the one percent level. The coefficient estimate indicates that a one percentage point decrease in the weighted average foreign country tax rate is associated with a 1.895 percentage point decrease in average adjusted profit margin in years t+1 and t+2. Overall, our findings support prediction 1 that U.S. domestic manufacturing firms' face greater competition following declines in foreign countries' corporate income tax rates.

*5.2 U.S. Domestic Firms' Investment Decisions*

Given the above evidence that changes in foreign countries' corporate income tax rates affect U.S. domestic manufacturing firms' competitive environment, we investigate how U.S. firms respond. We predict that U.S. firms increase R&D, advertising, and/or capital expenditures in order to increase (perceived) product quality (i.e., differentiate their products from competitors), improve their production process, or reduce costs. We test this prediction by estimating equation (2) with averages of R&D, advertising, and capital expenditures in years t+1 and t+2 as the dependent variables.

We present the results in Table 4. Panel A reports the results for average R&D and advertising. These tests include the same set of firm-level and industry-level control variables as

in Table 3 and include the lagged value of the outcome variable to account for the potential confounding effect of its persistence. We find results consistent with prediction 2a using R&D. In column (1), the coefficient on *FORTAXCH* is negative (-1.508) and significant at the one percent level. The coefficient estimate indicates that U.S domestic firms increase R&D by 1.508 cents per dollar of sales in response to a one percentage point decline in foreign countries' tax rates, which represents 7.65 percent of the mean value of average R&D in years t+1 and t+2 (0.0765 = [-1.508*-0.01] / 0.197). Turing to advertising in column (2), we do not find evidence that U.S. firms' advertising expense is associated with changes in foreign countries' tax rates (prediction 2b). Thus, the results in Panel A support our prediction that U.S. domestic firms increase R&D spending in response to reductions in foreign country corporate tax rates, possibly to differentiate their products from competitors. In this regard, we extend the work of Sutton (1991) by providing evidence that firms increase R&D expenditures in response to a plausibly exogenous shock to competition.

Table 4, Panel B presents the results for average capital expenditures. The tests include the same set of industry-level control variables as previous tests and the following set of firm-level control variables (e.g., Biddle et al. 2009, Kim 2018): firm size (*MVAL*), market-to-book ratio (*MB*), cash flow from operations (*CFO*), sales growth (*Sales Growth*), stock return (*RET*), intangible assets (*INTAN*), property, plant, and equipment (*PPE*), and book leverage (*LEV*). As in previous tests, we include the lagged value of capital expenditures as a control variable. We find a negative and significant coefficient on *FORTAXCH* (-0.457), consistent with prediction 2c. The coefficient estimate indicates a one percentage point decrease in the weighted average foreign country tax rate leads U.S. domestic manufacturing firms to increase capital expenditures

by 0.457 cents per dollar of average total assets, which represents 10.63 percent of the mean value of average capital expenditures in years t+1 and t+2 (0.1063 = [-0.457*-0.01] / 0.043).

Overall, we find evidence U.S. domestic manufacturing firms increase investments in R&D and capital expenditures in response to reductions in foreign country tax rates. Taken together, the results are consistent with U.S. domestic manufacturing firms taking steps to create new products, improve product quality, or improve production processes in order to absorb and escape the competitive threats posed by foreign tax cuts.

*5.3 U.S. Domestic Firms' Productivity*

Next, we test our final prediction (2d) that reductions in foreign country statutory tax rates lead to increases in U.S. domestic manufacturing firms' productivity. To test this prediction, we follow Imrohoroglu and Tuzel (2014) and construct a firm-level measure of total factor productivity using Compustat data.[15] We estimate equation (2) with firm-level average total factor productivity for years t+1 and t+2 as the dependent variable and include the same set of control variables as in Table 3. The sample size is smaller relative to our main sample primarily because estimating TFP requires the availability of the number of employees.

We present the results in Table 5. Consistent with prediction 2d, the coefficient on *FORTAXCH* is negative (-3.320) and significant at the one percent level. The coefficient estimate indicates that a one percentage point reduction in foreign country tax rates is associated with a 7.22 percent in increase in U.S. domestic manufacturing firms' total factor productivity, relative to the absolute value of the sample mean (0.0722 = [-3.320*-0.01] / │-0.46│). This finding is consistent with the threat of intensified competition resulting from foreign tax cuts

[15] We thank Ayse Imrohoroglu and Selale Tuzel for sharing the estimation Stata code.

pushing U.S. domestic firms to use their capital and labor more efficiently in order to become more productive.

*5.4. Cross-Sectional Evidence: The Role of Product Differentiation*

Next, we reinforce our main results by exploring heterogeneity in the effects of reductions in foreign tax rates on U.S. domestic firms. Specifically, we consider cross-sectional differences based on product differentiation. Product differentiation could shield U.S. domestic firms from increased competition arising from reductions in foreign country tax rates. The industrial organization literature posits that product differentiation softens the effects of competition (Shaked and Sutton 1982, Tirole 1988, and Sutton 1991). Consistent with this idea, Hombert and Matray (2017) provide evidence that the sales growth and profitability of U.S. manufacturing firms with more differentiated products are less negatively affected by Chinese import competition. Thus, we expect the impact of reductions in foreign country tax rates on the competitive environment of U.S. domestic firms will be more pronounced among firms with low product differentiation. If this is the case, U.S. domestic firms with low product differentiation will have the strongest incentives to increase investment and become more productive in the face of foreign tax cuts.

To examine these cross-sectional predictions, we follow prior research (e.g., Dyreng et al. 2017, Hombert and Matray 2017) and use Hoberg and Phillips' (2016) text-based measure of product similarity as a proxy for product differentiation. Hoberg and Phillips (2016) use the product description in firms' Form 10-K to calculate pairwise word similarity scores for each pair of U.S. public firms in Compustat. They construct a firm-year measure of product similarity by taking the average of the pairwise similarity scores. Hoberg and Phillips (2016) validate the total product similarity measure by providing evidence R&D and advertising expenditures are

negatively associated with future total product similarity, consistent with the work of Sutton (1991) (i.e., firms can incur endogenous fixed costs to differentiate their products). Thus, the similarity measure is inversely associated with the level of product differentiation. We partition the sample based on above- and below-median total product similarity and designate them as low and high product differentiation subsamples. We separately estimate equation (2) for the two subsamples and compare the coefficients on *FORTAXCH* across the subsamples.

We present the results in Table 6. Panel A reports the results for gross margin and adjusted profit margin. In columns (1) and (3), the coefficient on *FORTAXCH* is positive and significant for the low product differentiation sample, but in columns (2) and (4) the coefficient on *FORTAXCH* is insignificant. The *FORTAXCH* coefficients are significantly different across the low and high product differentiation subsamples for both gross margin and profit margin. Thus, the results are consistent with the effects of reductions in foreign countries' corporate income rates on U.S. domestic manufacturing firms' competitive environment being concentrated among firms with low product differentiation, which consistent with our expectation that product differentiation mitigates the competitive threat posed by foreign tax cuts.

Panels B and C of Table 6 present the results for U.S. domestic firms' investment and productivity, respectively. In Panel B, we find the effects of reductions in foreign tax rates on U.S. domestic manufacturing firms' R&D and capital expenditures are concentrated among firms with low ex ante product differentiation. The *FORTAXCH* coefficient is negative and significant in Columns (1) and (5) for the low product differentiation subsample, insignificant in columns (2) and (6) for the high product differentiation subsample, and significantly different across the

subsamples.[16] Similarly, in Panel C, we find the effect of foreign tax cuts on total factor productivity is concentrated in the low product differentiation subsample. On balance, these results are consistent with the responses observed in our main tests being driven by U.S. domestic manufacturing firms whose competitive environment is most impacted by reductions in foreign country tax rates (i.e., low product differentiation firms).

## 6. Extensions of the Main Tests

### *6.1 The Effect of Changes in Foreign Countries' Corporate Income Tax Rates on Sales Growth*

In order to provide evidence regarding the effect of changes in foreign countries' corporate income tax rates on U.S. domestic manufacturing firms' competitive environment, we examine the effect of foreign tax cuts on firms' price-cost margins. Declines in price-cost margins can arise as U.S. firms take preemptive actions such as price cuts to combat the threat of increased competition from foreign firms. Unfortunately, we are not able to separately observe changes in prices and volumes. Instead, we extend these tests by examining U.S. domestic manufacturing firms' sales growth.

If lower prices increase consumers' demand for products, they will result in increased sales volume. This indicates that the threat of increased competition does not necessarily imply firms experience a decrease in sales. Either no change or an increase in sales growth would suggest the threat of increased competition leads to price cuts and simultaneously increases sales volume. This would be consistent with the findings of Goolsbee and Syverson (2008), who find airlines preemptively cut fares and experience increases in passenger traffic when threatened by Southwest's entry. To test this prediction, we estimate equation (2) with average sales growth in

[16] Interestingly, the coefficient on *FORTAXCH* is significantly positive in column (3), indicating that U.S. domestic firms with low product differentiation decrease advertising.

years t+1 and t+2 as the dependent variable and include the same set of control variables as in Table 3.[17]

We present the results in Table 7. The results support our expectation. The coefficient on *FORTAXCH* is not significantly different from zero. In concert with the price-cost margin results, these findings suggest that in response to the increased competitive threat arising from foreign countries' tax cuts, U.S. domestic manufacturing firms cut prices, which in turn appears to increase sales volume.

### *6.2 The Effect of Changes in Foreign Countries' Corporate Income Tax Rates on Industry-level Import Penetration*

In this section, we consider the effect of reductions in foreign countries' corporate income tax rates on industry-level import penetration. Throughout the paper, we maintain that foreign country tax cuts increase the competitive threat posed by foreign firms, and we provide evidence U.S. domestic manufacturing firms respond by increasing investment and becoming more productive. If on average U.S. domestic manufacturing firms are able to defend against the competitive threat arising from reductions in foreign tax rates, we may not observe an increase in industry-level import penetration. We examine this possibility by regressing average *industry* import penetration in years t+1 and year t+2 as measured in equation (1b) on *FORTAXCH* along with industry-level control variables and import penetration in year t.

The results presented in Table 8 confirm our expectation. The coefficient on *FORTAXCH* is insignificant, suggesting that changes in foreign county tax rates are unrelated to average industry import penetration in the two years subsequent to foreign tax cuts. This result is consistent with U.S. domestic manufacturing firms' responses to the competitive threat posed by foreign tax cuts allowing these U.S. firms to on average maintain their competitive position.

[17] Inferences are unchanged if we do not include a control for sales growth in year t.

## 7. Sensitivity Tests

We conduct a series of sensitivity analyses. First, we consider whether our results are sensitive to China's corporate income tax cut in 2008. As Appendix A and B show, China is a dominant exporting country in many industries and cut its corporate income tax rate by five percentage points in 2008. In addition, a growing literature documents the impact of China's import penetration on various aspects of the U.S. economy (see Autor et al. 2016 for a review). To assess the impact of China, we recalculate our variable of interest (*FORTAXCH*) excluding China and repeat our tests. Inferences are unchanged. We also repeat a similar exercise with respect to Mexico, and our inferences are unaffected.

Second, we repeat our tests excluding observations for the year 2008. Five countries that are among the top sources of U.S. imports (over the full sample period) cut their corporate income tax rates in 2008 (see Appendix A), and the U.S. economy experienced a recession around 2008. To address the concern that our results could be attributable to the 2008 recession that was concurrent with these tax rate cuts, we repeat our analyses excluding 2008 firm-year observations, and inferences are unchanged.

Third, we re-estimate our tests including U.S. multinationals, and our inferences are unaffected. This result implies that the effect of changes in foreign countries' corporate income tax rates affect domestic manufacturing firms as well as U.S. multinationals, at least in the short-run. Finally, our results are not sensitive to clustering the standard errors by firm.

## 8. Conclusion

Despite claims that the previously high U.S. statutory corporate tax rate relative to other countries harmed U.S. firms' competitiveness, there is limited empirical evidence regarding the effects of foreign country corporate tax rates on U.S. domestic firms. Our study fills this void in

the literature by addressing: (1) whether and to what extent reductions in foreign country corporate tax rates affect the competitive environment of U.S. domestic firms and (2) how U.S. domestic firms respond.

We find that averages of one- and two-year-ahead gross margin and profit margin are adversely affected by reductions in foreign country corporate tax rates, consistent with a change in the competitive environment faced by U.S. domestic manufacturing firms. Turning to U.S. domestic firms' responses, we provide evidence U.S. firms increase investments in R&D and capital expenditures. We also find that the U.S. domestic manufacturing firms experience an increase in total factor productivity following decreases in foreign country tax rates, consistent with these firms employing capital and labor more efficiently. Cross-sectional analyses reveal that these effects are concentrated among U.S. domestic firms with low product differentiation. Taken together, our study provides nuanced evidence regarding the effects of reductions in foreign country corporate tax rates on U.S. domestic manufacturing firms.

Our study is subject to several caveats. First, we are agnostic about the exact mechanism through which reductions in foreign country corporate tax rates increase competitive threats faced by U.S. domestic firms. While we believe the channels we articulate are plausible, we are unable to directly observe the threat of entry. Second, we do not directly test how foreign firms and U.S. domestic manufacturing firms interact following reductions in foreign country corporate tax rates. The outcomes for U.S. domestic manufacturing firms plausibly result from dynamic interactions amongst foreign firms that operate in countries that cut statutory tax rates, foreign firms that operate in countries that do not change statutory tax rates, and U.S. firms. In response to reductions in some countries' tax rates, all firms act to maximize their own profits given their expectation of how other firms will react. The direction and magnitude of the effects

on U.S. domestic firms that we observe are the outcomes of these interactions and also are affected by the price elasticity of demand and output of products in the U.S. Modeling such dynamic interactions is outside the scope of our study. Rather, in this paper we provide comparative static results using reductions in foreign country corporate tax rates as shocks to the threat of competition. This limits our ability to interpret the economic magnitude of our findings. Finally, in this paper we only observe the outcomes of U.S. public firms that have survived at least two years following foreign tax shocks. Thus, we are unable to draw inferences about the effects of foreign countries' tax cuts on aggregate outcomes at the industry-level or at the economy-level or relatively smaller private firms in the U.S. These caveats pose interesting avenues for future research.

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## Appendix A
## Corporate Tax Rate Changes among the Top Ten Sources of U.S. Imports

| Year | China | Canada | Mexico | India | Germany | Italy | S. Korea | Taiwan | U. K. | Vietnam |
|---|---|---|---|---|---|---|---|---|---|---|
| 1997 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **-0.02** | 0 |
| 1999 | 0 | 0 | **0.01** | **-0.05** | **0.05** | 0 | 0 | 0 | 0 | **0.07** |
| 2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **-0.01** | 0 |
| 2001 | 0 | **-0.01** | 0 | 0 | **-0.15** | **-0.01** | 0 | 0 | 0 | 0 |
| 2002 | 0 | **-0.02** | 0 | 0 | 0 | 0 | **-0.01** | 0 | 0 | 0 |
| 2003 | 0 | **-0.02** | **-0.01** | 0 | **0.015** | **-0.02** | 0 | 0 | 0 | 0 |
| 2004 | 0 | **-0.02** | **-0.01** | 0 | **-0.015** | **-0.01** | 0 | 0 | 0 | **-0.04** |
| 2005 | 0 | 0 | **-0.03** | **-0.05** | 0 | 0 | **-0.02** | 0 | 0 | 0 |
| 2006 | 0 | 0 | **-0.01** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 0 | 0 | **-0.01** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | **-0.05** | **-0.0262** | 0 | 0 | **-0.1** | **-0.055** | 0 | 0 | **-0.02** | 0 |
| 2009 | 0 | **-0.005** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **-0.03** |
| 2010 | 0 | **-0.01** | **0.02** | 0 | 0 | 0 | **-0.03** | **-0.05** | 0 | 0 |
| 2011 | 0 | **-0.015** | 0 | 0 | 0 | 0 | 0 | **-0.03** | **-0.02** | 0 |
| 2012 | 0 | **-0.015** | 0 | 0 | 0 | 0 | 0 | 0 | **-0.02** | 0 |
| 2013 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **-0.01** | 0 |
| 2014 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **-0.02** | **-0.03** |

Appendix A presents changes in corporate statutory tax rates for the top ten sources of U.S. imports based on averages of country-industry import penetration over the period 1997 – 2014.

## Appendix B
## Top Five Sources of U.S. Imports by Industry

| Industry | First | Second | Third | Fourth | Fifth |
|---|---|---|---|---|---|
| Food | Canada | Mexico | China | Australia | Italy |
| Beverage and Tobacco Product | France | Mexico | U.K. | Italy | Netherlands |
| Textile Mills | China | Canada | S. Korea | Mexico | Italy |
| Textile Product Mills | China | India | Pakistan | Mexico | Canada |
| Apparel | China | Mexico | Vietnam | Indonesia | India |
| Leather and Allied Product | China | Italy | Mexico | Vietnam | Brazil |
| Wood Product | Canada | China | Brazil | Chile | Indonesia |
| Paper | Canada | China | Finland | Brazil | Germany |
| Printing and Related Support Activities | China | Canada | U.K. | Mexico | Hong Kong |
| Petroleum and Coal Products | Canada | Russia | Venezuela | U.K. | Algeria |
| Chemical | Ireland | Canada | Germany | U.K. | Japan |
| Plastics and Rubber Products | China | Canada | Japan | Mexico | S. Korea |
| Nonmetallic Mineral Product | China | Mexico | Canada | Italy | Japan |
| Primary Metal | Canada | Mexico | Russia | China | Brazil |
| Fabricated Metal Product | China | Canada | Mexico | Japan | Taiwan |
| Machinery | Japan | Germany | China | Canada | Mexico |
| Computer and Electronic Product | China | Mexico | Japan | Malaysia | Taiwan |
| Electrical Equipment, Appliance, and Component | China | Mexico | Japan | Canada | Germany |
| Transportation Equipment | Canada | Japan | Mexico | Germany | S. Korea |
| Furniture and Related Product | China | Canada | Mexico | Vietnam | Italy |
| Miscellaneous | China | Israel | India | Mexico | Japan |

Appendix B presents the countries that are the top five sources of U.S. imports over the period 1997 – 2014 for the 21 three-digit NAICS manufacturing industries.

## Appendix C
## Illustration of the Calculation of the Weighted Average Change in Foreign Countries' Tax Rates (*FORTAXCH*)

Year 1
Industry A
Total industry import penetration = 0.20

| (1) Country | (2) Country-Industry Import Penetration | (3) Weight | (4) Change in Tax Rate | (5) Weighted Average Change in Tax Rate |
|---|---|---|---|---|
| Country 1 | 0.0030 | 0.015 | -1.0% | -0.015% |
| Country 2 | 0.0100 | 0.05 | 0.0% | 0.0% |
| Country 3 | 0.1000 | 0.5 | 0.0% | 0.0% |
| Country 4 | 0.0080 | 0.04 | -3.0% | -0.12% |
| Country 5 | 0.0006 | 0.003 | 0.0% | 0.0% |
| Country 6 | 0.0020 | 0.01 | 0.0% | 0.0% |
| Country 7 | 0.0784 | 0.392 | -2.0% | -0.784% |
| Sum: | 0.2000 | 1 | | **-0.919% (*FORTAXCH*)** |

Appendix C illustrates how the weighted average change in foreign country statutory corporate tax rate measure (*FORTAXCH*) is computed for a hypothetical industry-year. This industry imported goods from seven countries. Each country's import penetration is given in column (2), summing to this industry's total import penetration of 0.20. The countries' corporate income tax rate changes are weighted by dividing the country-industry import penetration in column (2) by the total industry import penetration, 0.20. The weights are shown in column (3). Column (4) presents the corporate statutory income tax rate changes for the countries. In column (5), we obtain the weighted average change in foreign countries' statutory corporate income tax rates for this industry-year by multiplying columns (3) and (4) and summing the products. The result is -0.919%.

## Appendix D: Variable Definitions

| Variables | Definition |
|---|---|
| *FORTAXCH* = | Weighted average changes in foreign countries' corporate income tax rates from years t-1 to year t at the three-digit NAICS level, where weight is the ratio of a country's industry import penetration to total industry import penetration |
| *Average GM* $_{(t+1,\ t+2)}$ = | Average gross margin in years t+1 and t+2 [Gross margin (GM) = (sales – cost of goods sold) / sales] |
| *Average PM_adj* $_{(t+1,\ t+2)}$ = | Average profit margin in years t+1 and t+2 [Profit margin (PM) = (Pre-tax income + Interest expense + depreciation/amortization + R&D + advertising) / sales] |
| *Average RD* $_{(t+1,t+2)}$ = | Average research and development in years t+1 and t+2 [RD = R&D / sales] (R&D = 0 if missing in Compustat) |
| *Average ADV* $_{(t+1,t+2)}$ = | Average advertising in years t+1 and t+2 [ADV = Advertising / sales] (Advertising = 0 if missing in Compustat) |
| *Average CAPEX* $_{(t+1,t+2)}$ = | Average capital expenditures in years t+1 and t+2 [CAPEX = capital expenditures / average total assets] |
| *Average TFP* $_{(t+1,t+2)}$ = | Average total factor productivity in years t+1 and t+2. See Imrohoroglu and Tuzel (2014) for a detailed description of the estimation method. |
| *Average Sales Growth* $_{(t+1,t+2)}$ = | Average sales growth in years t+1 and t+2 |
| *Sales Growth* = | Sales growth from year t-1 to t, calculated as (sales (t) – sales (t-1)) / sales (t). |
| *Import Penetration* $_{(t+1,\ t+2)}$ | Average industry-level import penetration in years t+1 and t+2 |
| *MVAL* = | Market capitalization ((PRCC*CSHO) / CEQ) |
| *MB* = | Market value of equity to the book value of equity |
| *Capital–labor intensity* = | The ratio of total invested capital to the number of employees |
| *PPE* = | Properties, plants, and equipment deflated by total assets |
| *INTAN* = | Intangible assets deflated by total assets |
| *Average CFO* $_{(t+1,t+2)}$ = | Cash flows from operation in year t+1 and year t+2, where CFO is calculated as cash flows from operation deflated by average total assets |
| *RET* = | Stock return over the fiscal year |
| *LEV* = | Long-term debt deflated by total assets. |
| *HHI* = | The Hirfindahl-Hirschman index at the three-digit NAICS level |
| *Change in tariffs* = | Changes in tariffs rates at the three-digit NAICS level |
| *Industry Sales Volatility* = | The volatility of median sales over years t-4 – t at the three-digit NAICS level |
| *Changes in foreign real FX* = | Weighted average changes in real exchange rates at the three-digit NAICS level, where weight is the ratio of a country's industry import penetration to total industry import penetration. |
| *Foreign GDP growth* = | Weighted average foreign countries' real GDP (percent) growth at the three-digit NAICS level, where weight is the ratio of a country's industry import penetration to total industry import penetration. |

Appendix D describes variable definitions.

**Figure 1**
**Variation in Weighted Average Changes in Foreign Country Corporate Statutory Tax Rates by Industry**

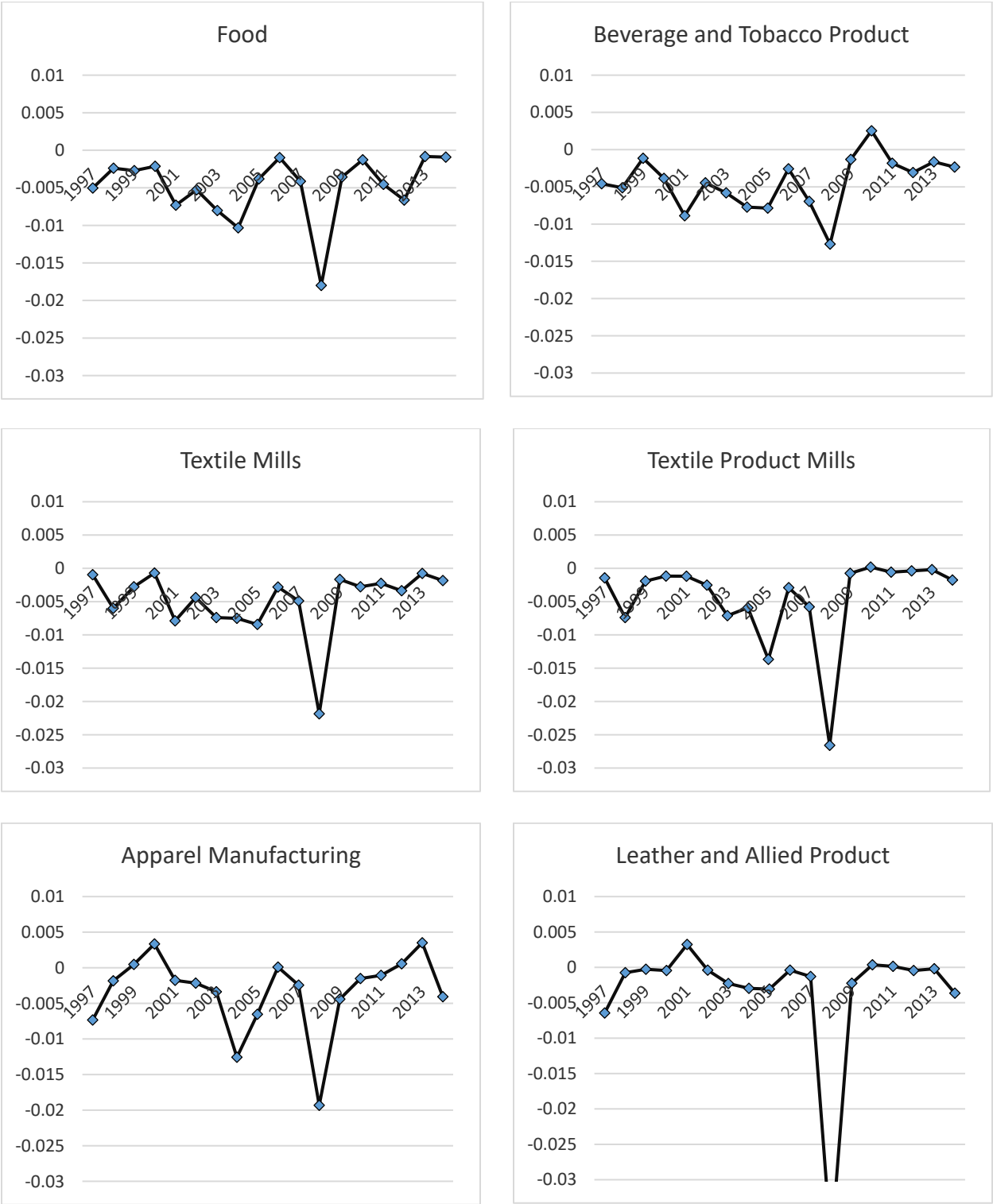
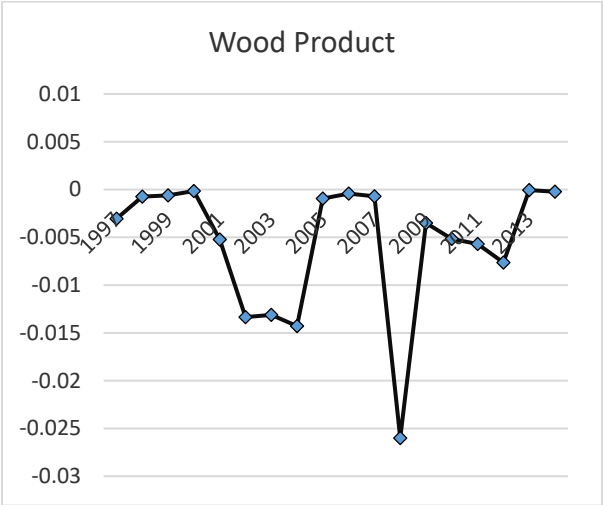
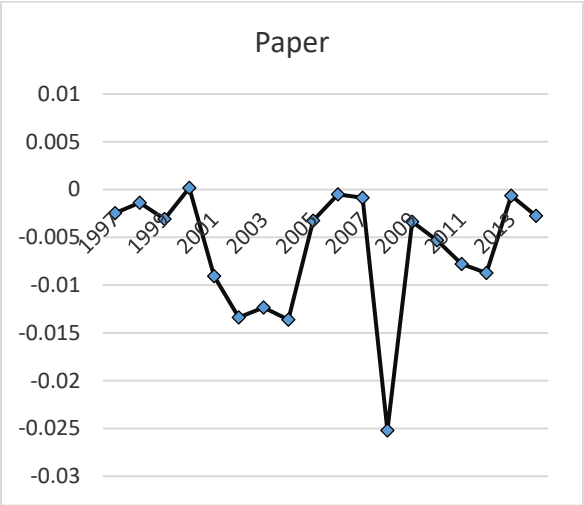
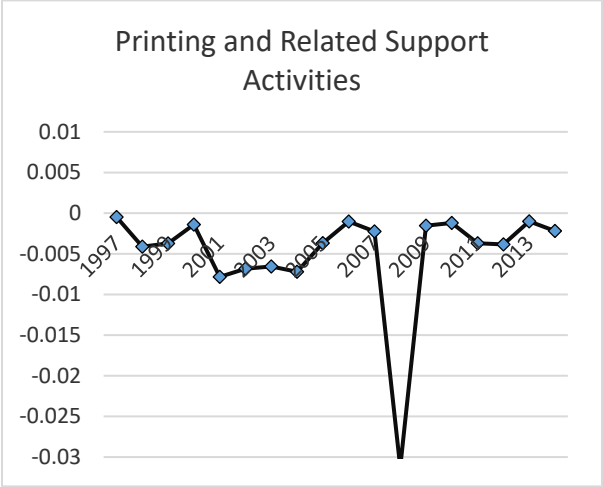
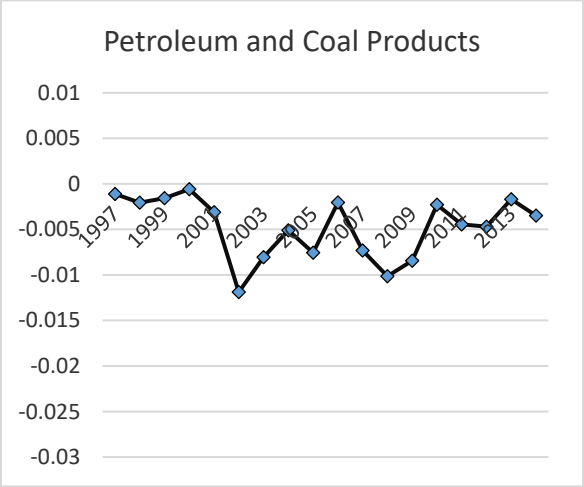


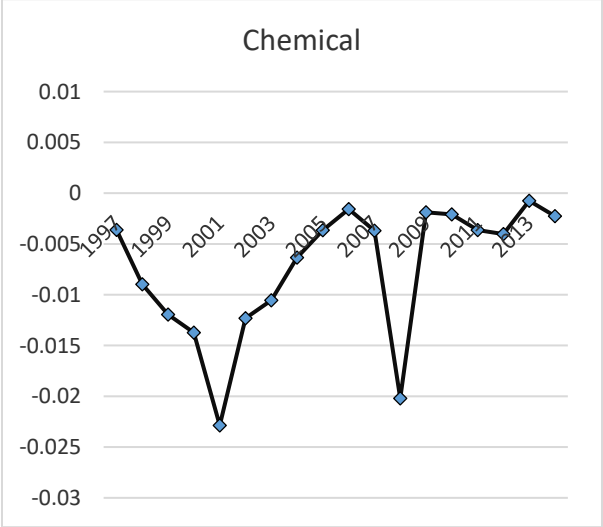
**Figure 1 (cont'd)**



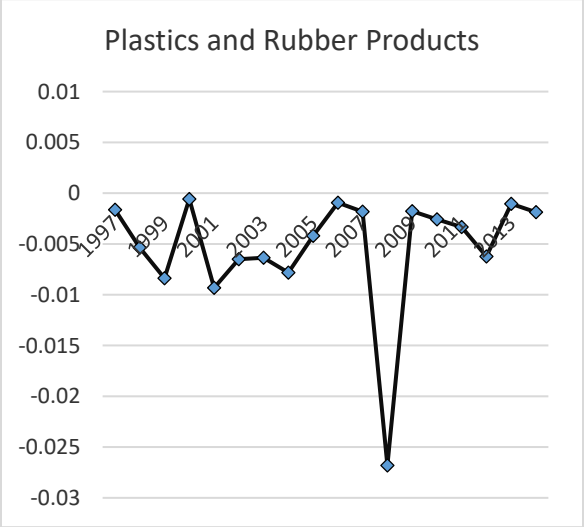
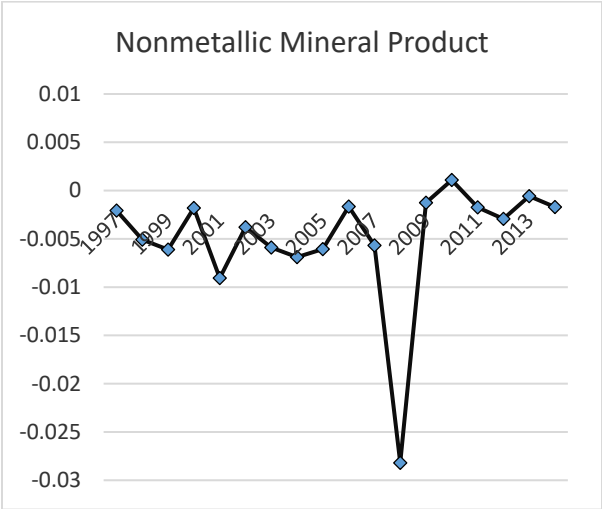
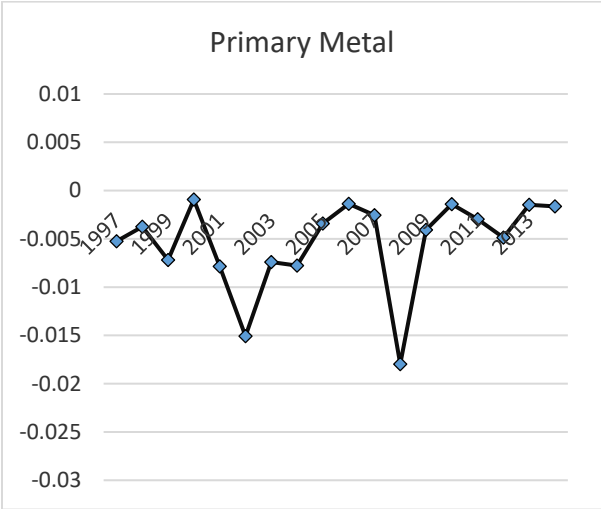
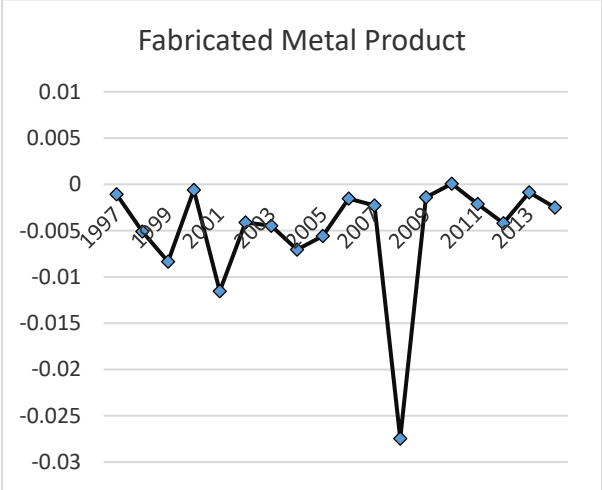
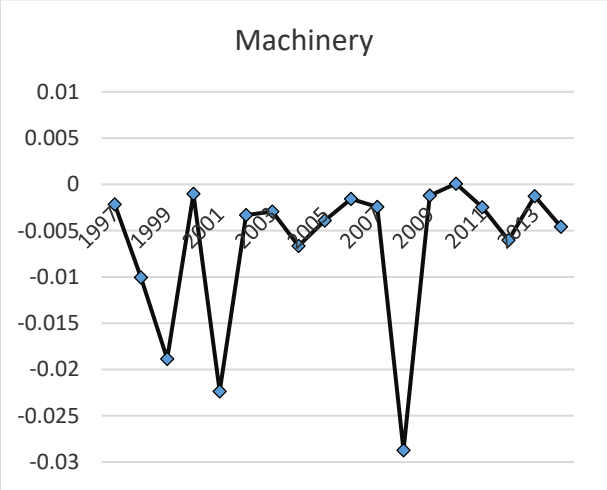



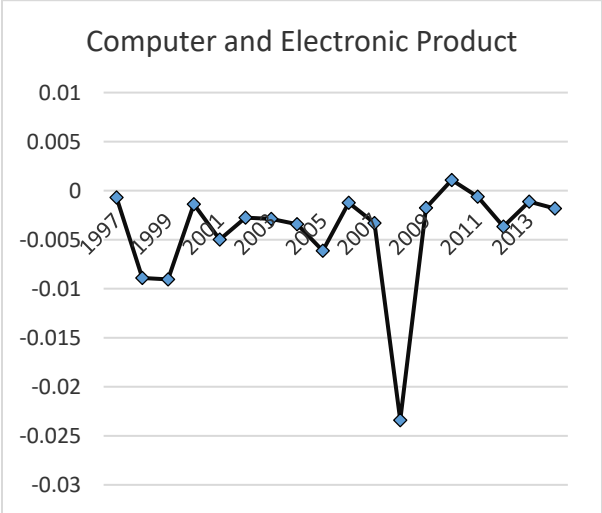
**Figure 1 (cont'd)**



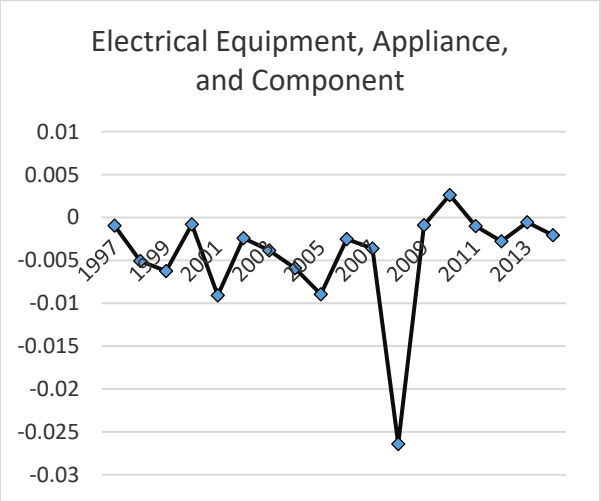
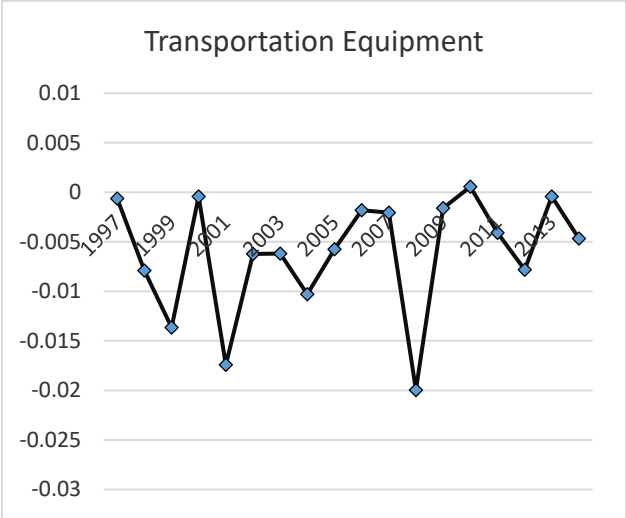
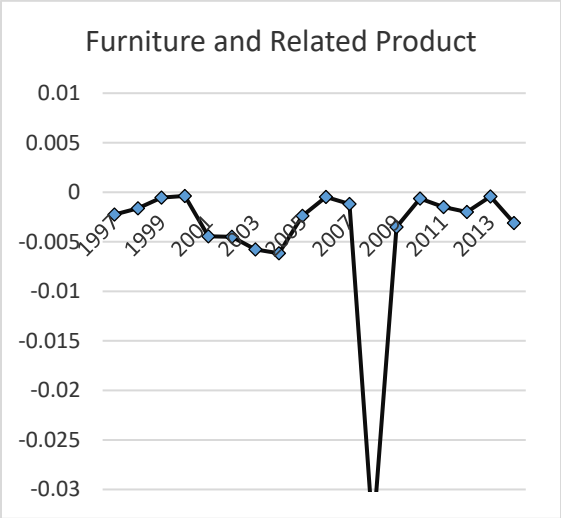



**Figure 1 (cont'd)**



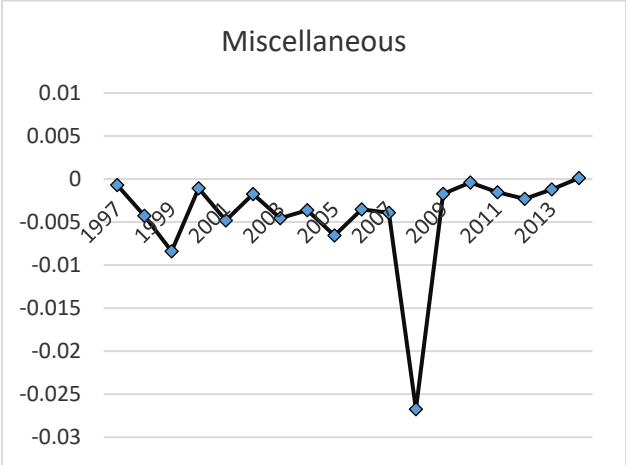
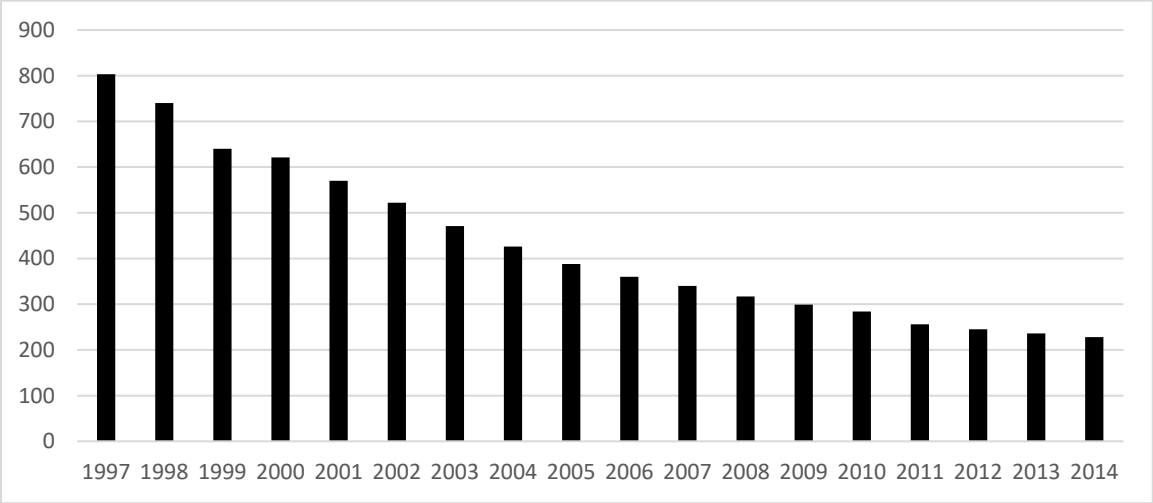
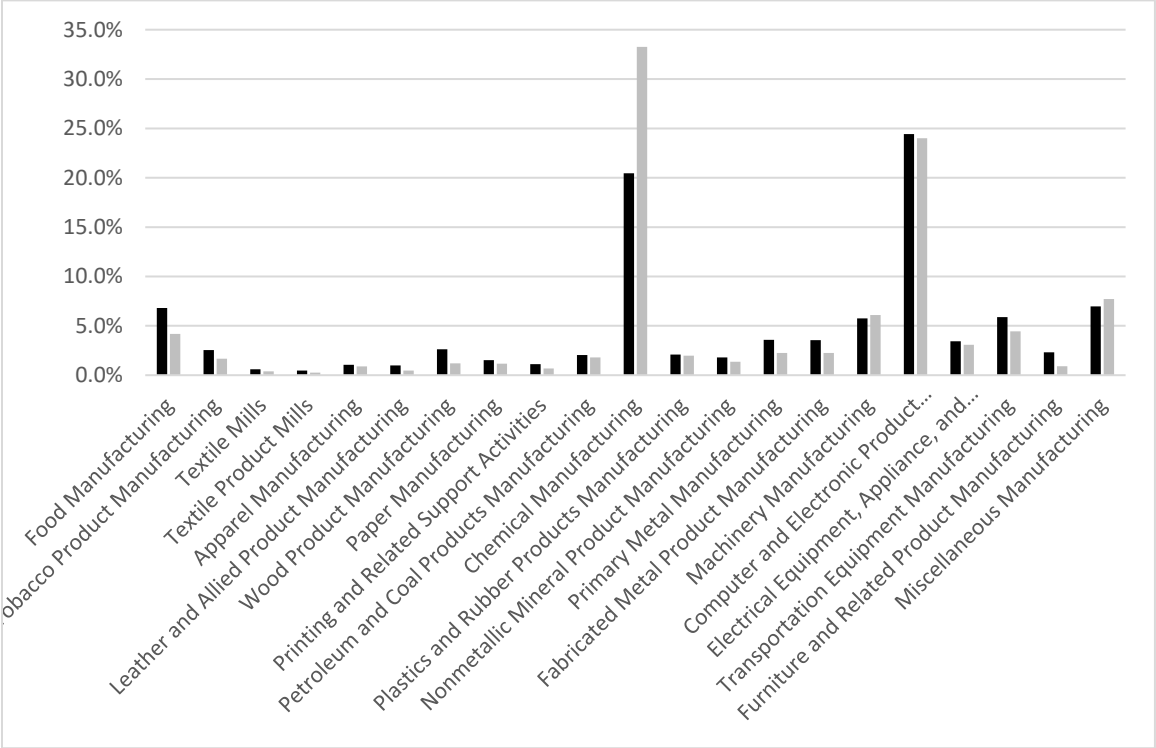



**Figure 2**
**Number of Observations by Year**




This figure shows the number of observations for our sample (N=7,746) by year

**Figure 3**
**Percentage of Observations by NAICS 3-digit Industries**




This figure shows the percentage of observations for our sample (black bar) and all domestic firms in COMPUSTAT (gray bar) by NAICS 3-digit industries.

**Table 1**
**Sample Selection**

| | Firm-years | Sample |
|---|---|---|
| COMPUSTAT (1997 - 2014) | 158,700 | |
| Delete observations with sales < $5 million | 110,595 | |
| Delete with observations with missing one-year lagged information | 95,710 | |
| Delete non-manufacturing firms | 33,574 | |
| Delete observations with missing variables used in regressions | 21,256 | |
| Delete multinationals | **7,746** | **Main Sample** |
| Delete observations with missing TFP | **4,059** | **Sample for TFP analysis** |

This table describes the sample selection procedure.

**Table 2**
**Descriptive Statistics and Correlations**

*Panel A: Descriptive Statistics*

| | N | Mean | STD | Q1 | Median | Q3 |
|---|---|---|---|---|---|---|
| *FORTAXCH* $_{(t)}$ | 7,746 | -0.006 | 0.006 | -0.008 | -0.004 | -0.002 |
| *Average GM* $_{(t+1,t+2)}$ | 7,746 | 0.266 | 0.444 | 0.189 | 0.314 | 0.469 |
| *GM* $_{(t)}$ | 7,746 | 0.267 | 0.428 | 0.188 | 0.314 | 0.467 |
| *Average PM_adj* $_{(t+1,t+2)}$ | 7,746 | 0.435 | 0.323 | 0.217 | 0.362 | 0.591 |
| *PM_adj* $_{(t)}$ | 7,746 | 0.442 | 0.331 | 0.222 | 0.364 | 0.595 |
| *Average RD* $_{(t+1,t+2)}$ | 7,746 | 0.197 | 0.492 | 0.000 | 0.017 | 0.120 |
| *RD* $_{(t)}$ | 7,746 | 0.200 | 0.491 | 0.000 | 0.016 | 0.117 |
| *Average ADV* $_{(t+1,t+2)}$ | 7,746 | 0.010 | 0.027 | 0.000 | 0.000 | 0.005 |
| *ADV* $_{(t)}$ | 7,746 | 0.010 | 0.027 | 0.000 | 0.000 | 0.004 |
| *Average CAPEX* $_{(t+1,t+2)}$ | 7,746 | 0.043 | 0.040 | 0.016 | 0.031 | 0.057 |
| *CAPEX* $_{(t)}$ | 7,746 | 0.049 | 0.050 | 0.016 | 0.033 | 0.064 |
| *Average TFP* $_{(t+1,t+2)}$ | 4,059 | -0.460 | 0.436 | -0.704 | -0.454 | -0.218 |
| *TFP* $_{(t)}$ | 4,059 | -0.433 | 0.452 | -0.667 | -0.426 | -0.194 |
| *Average Sales Growth* $_{(t+1,t+2)}$ | 7,746 | 0.125 | 0.279 | -0.035 | 0.074 | 0.224 |
| *Sales Growth* $_{(t)}$ | 7,746 | 0.170 | 0.412 | -0.045 | 0.085 | 0.272 |
| *MVAL* $_{(t)}$ | 7,746 | 4.627 | 1.697 | 3.371 | 4.571 | 5.803 |
| *MB* $_{(t)}$ | 7,746 | 2.898 | 4.360 | 1.030 | 1.836 | 3.402 |
| *Capital-labor intensity* $_{(t)}$ | 7,746 | 0.274 | 0.336 | 0.080 | 0.152 | 0.322 |
| *PPE* $_{(t)}$ | 7,746 | 0.248 | 0.188 | 0.094 | 0.209 | 0.363 |
| *INTAN* $_{(t)}$ | 7,746 | 0.096 | 0.153 | 0.000 | 0.020 | 0.128 |
| *Average CFO* $_{(t+1,t+2)}$ | 7,746 | 0.017 | 0.178 | -0.035 | 0.054 | 0.115 |
| *RET* $_{(t)}$ | 7,746 | 0.167 | 0.643 | -0.210 | 0.122 | 0.482 |
| *LEV* $_{(t)}$ | 7,746 | 0.154 | 0.194 | 0.000 | 0.075 | 0.246 |
| *HHI* $_{(t)}$ | 7,746 | 0.053 | 0.054 | 0.024 | 0.032 | 0.067 |
| *Changes in tariffs* $_{(t)}$ | 7,746 | 0.013 | 0.017 | 0.004 | 0.009 | 0.014 |
| *Industry Sales Volatility* $_{(t)}$ | 7,746 | 0.057 | 0.044 | 0.027 | 0.043 | 0.075 |
| *Changes in foreign real FX* $_{(t)}$ | 7,746 | 0.009 | 0.048 | -0.029 | 0.005 | 0.047 |
| *Foreign GDP growth* $_{(t)}$ | 7,746 | 3.768 | 1.791 | 2.709 | 3.818 | 4.769 |

**Table 2 (cont'd)**
**Descriptive Statistics and Correlations**

*Panel B: Correlations*

| | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| 1 | *FORTAXCH* $_{(t)}$ | | | | | | |
| 2 | *Average GM* $_{(t+1,t+2)}$ | **0.079** | | | | | |
| 3 | *Average PM_adj* $_{(t+1,t+2)}$ | **-0.032** | **0.340** | | | | |
| 4 | *Average RD* $_{(t+1,t+2)}$ | **-0.103** | **-0.706** | **0.321** | | | |
| 5 | *Average ADV* $_{(t+1,t+2)}$ | -0.019 | **0.154** | **0.144** | **-0.047** | | |
| 6 | *Average CAPEX* $_{(t+1,t+2)}$ | **0.038** | **0.066** | **-0.088** | **-0.141** | **-0.037** | |
| 7 | *Average TFP* $_{(t+1,t+2)}$ | -0.002 | **0.268** | **0.236** | **0.018** | **0.035** | **0.106** |

* Bold indicates significance at the five percent level.

Panel A presents descriptive statistics, and Panel B reports correlations for variables used in this paper. The sample comprises U.S. domestic manufacturing firm-years over the period 1997 – 2014. The sample used for correlations with *Average TFP* $_{(t+1,t+2)}$ includes 4,059 observations (1997 – 2014). Variable definitions are provided in Appendix D.

**Table 3**
**Changes in Foreign Countries' Corporate Tax Rates and**
**U.S. Domestic Manufacturing Firms' Competitive Environment**

| Dependent variable = | (1)<br>*Average GM* $_{(t+1,t+2)}$ | (2)<br>*Average PM_adj* $_{(t+1,t+2)}$ |
|---|---|---|
| ***FORTAXCH*** $_{(t)}$ | **1.084**** | **1.895***** |
| | **(2.37)** | **(2.62)** |
| *GP* $_{(t)}$ | 0.858*** | |
| | (40.91) | |
| *PM_adj* $_{(t)}$ | | 0.652*** |
| | | (26.01) |
| *Sales Growth (t)* | -0.029** | -0.020 |
| | (-2.18) | (-1.29) |
| *MVAL* $_{(t)}$ | 0.003 | 0.009* |
| | (1.05) | (1.70) |
| *MB* $_{(t)}$ | 0.000 | 0.002** |
| | (0.33) | (2.29) |
| *Capital–labor intensity* $_{(t)}$ | -0.058** | -0.012 |
| | (-2.49) | (-0.88) |
| *PPE* $_{(t)}$ | -0.007 | -0.128** |
| | (-0.48) | (-2.54) |
| *INTAN* $_{(t)}$ | 0.058 | -0.089*** |
| | (1.26) | (-4.80) |
| *HHI* $_{(t)}$ | -0.038 | -0.075* |
| | (-0.77) | (-1.86) |
| *Changes in tariffs* $_{(t)}$ | 2.518* | 2.375** |
| | (1.68) | (2.42) |
| *Industry Sales Volatility* $_{(t)}$ | 0.152* | 0.140* |
| | (1.90) | (1.71) |
| *Changes in foreign real FX* $_{(t)}$ | -0.096 | 0.217*** |
| | (-1.25) | (2.85) |
| *Foreign GDP growth* $_{(t)}$ | -0.001 | 0.007** |
| | (-0.41) | (2.34) |
| Observations | 7,746 | 7,746 |
| R-squared | 0.729 | 0.624 |

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on U.S. domestic manufacturing firms' average gross and profit margins in years t+1 and year t+2. The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix D. Industry and year fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by industry and year. t-statistics are reported in parentheses.

**Table 4**
**Changes in Foreign Countries' Corporate Tax Rates and U.S. Domestic Manufacturing Firms' Investments**

*Panel A: U.S. Domestic Firms' Decisions to Spend on R&D and Advertising*

| Dependent variable = | (1)<br>*Average RD* $_{(t+1,\ t+2)}$ | (2)<br>*Average ADV* $_{(t+1,\ t+2)}$ |
|---|---|---|
| ***FORTAXCH*** $_{(t)}$ | **-1.508**** | **0.026** |
| | **(-2.51)** | **(0.48)** |
| *RD* $_{(t)}$ | 0.841*** | |
| | (105.76) | |
| *ADV* $_{(t)}$ | | 0.856*** |
| | | (69.92) |
| *Sales Growth* $_{(t)}$ | 0.016*** | -0.001 |
| | (3.89) | (-0.75) |
| *MVAL* $_{(t)}$ | 0.004*** | 0.000 |
| | (3.24) | (0.69) |
| *MB* $_{(t)}$ | 0.001 | -0.000 |
| | (1.04) | (-0.02) |
| *Capital–labor intensity* $_{(t)}$ | 0.076*** | 0.000 |
| | (4.01) | (0.32) |
| *PPE* $_{(t)}$ | -0.064** | -0.002 |
| | (-2.19) | (-1.08) |
| *INTAN* $_{(t)}$ | -0.092 | 0.001 |
| | (-1.61) | (0.41) |
| *HHI* $_{(t)}$ | -0.002 | -0.004 |
| | (-0.05) | (-1.14) |
| *Changes in tariffs* $_{(t)}$ | -0.056 | 0.010 |
| | (-0.20) | (0.21) |
| *Industry Sales Volatility* $_{(t)}$ | -0.151** | 0.003 |
| | (-2.54) | (0.72) |
| *Changes in foreign real FX* $_{(t)}$ | 0.139 | -0.016*** |
| | (0.79) | (-3.21) |
| *Foreign GDP growth* $_{(t)}$ | 0.001 | 0.000 |
| | (0.40) | (0.83) |
| Observations | 7,746 | 7,746 |
| R-squared | 0.809 | 0.787 |

This table presents the results of examining the effect of changes in foreign country corporate statutory tax rates on U.S. domestic manufacturing firms' decisions to spend on R&D and advertising. The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix D. Industry and year fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by industry and year. t-statistics are reported in parentheses.

**Table 4 (cont'd)**
**Changes in Foreign Countries' Corporate Tax Rates and U.S. Domestic Manufacturing Firms' Investments**

*Panel B: U.S. Domestic Firms' Decisions to Spend on Capital Expenditures*

| Dependent variable = | *Average CAPEX* $_{(t+1,\ t+2)}$ |
|---|---|
| ***FORTAXCH*** $_{(t)}$ | **-0.457**** |
| | **(-2.32)** |
| *CAPEX* $_{(t)}$ | 0.364*** |
| | (27.87) |
| *MVAL* $_{(t)}$ | 0.001*** |
| | (4.12) |
| *MB* $_{(t)}$ | 0.000 |
| | (0.21) |
| *CFO* $_{(t+1,t+2)}$ | 0.012** |
| | (2.40) |
| *Sales Growth* $_{(t)}$ | 0.002** |
| | (2.53) |
| *RET* $_{(t)}$ | 0.007*** |
| | (8.94) |
| *INTAN* $_{(t)}$ | -0.011*** |
| | (-4.83) |
| *PPE* $_{(t)}$ | 0.040*** |
| | (6.72) |
| *LEV* $_{(t)}$ | -0.012*** |
| | (-5.16) |
| *HHI* $_{(t)}$ | -0.041** |
| | (-1.99) |
| *Changes in tariffs* $_{(t)}$ | 0.154 |
| | (0.69) |
| *Industry Sales Volatility* $_{(t)}$ | 0.033* |
| | (1.67) |
| *Changes in foreign real FX* $_{(t)}$ | 0.000 |
| | (0.01) |
| *Foreign GDP growth* $_{(t)}$ | -0.000 |
| | (-0.20) |
| Observations | 7,746 |
| R-squared | 0.422 |

This table presents the results of examining the effect of changes in foreign country corporate statutory tax rates on U.S. domestic manufacturing firms' decisions to spend on capital expenditures. The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix D. Industry and year fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by industry and year. t-statistics are reported in parentheses.

**Table 5**
**Changes in Foreign Countries' Corporate Tax Rates and U.S. Domestic Manufacturing Firms' Total Factor Productivity**

| Dependent variable = | *Average TFP* $_{(t+1,\ t+2)}$ |
|---|---|
| ***FORTAXCH*** $_{(t)}$ | **-3.320*** ** |
| | **(-2.67)** |
| *TFP* $_{(t)}$ | 0.547*** |
| | (24.17) |
| *Sales Growth* $_{(t)}$ | -0.009 |
| | (-0.32) |
| *MVAL* $_{(t)}$ | 0.031*** |
| | (5.35) |
| *MB* $_{(t)}$ | 0.012*** |
| | (4.02) |
| *Capital–labor intensity* $_{(t)}$ | 0.209*** |
| | (5.50) |
| *PPE* $_{(t)}$ | -0.093 |
| | (-1.47) |
| *INTAN* $_{(t)}$ | 0.045 |
| | (1.20) |
| *HHI* $_{(t)}$ | -0.229 |
| | (-0.60) |
| *Changes in tariffs* $_{(t)}$ | -0.463 |
| | (-0.14) |
| *Industry Sales Volatility* $_{(t)}$ | 0.380 |
| | (1.10) |
| *Changes in foreign real FX* $_{(t)}$ | 0.355* |
| | (1.79) |
| *Foreign GDP growth* $_{(t)}$ | -0.019* |
| | (-1.79) |
| Observations | 4,059 |
| R-squared | 0.528 |

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on U.S. domestic manufacturing firms' total factor productivity. The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix D. Industry and year fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by industry and year. t-statistics are reported in parentheses.

**Table 6**
**The Effects of Changes in Foreign Countries' Corporate Tax Rates:**
**The Role of Product Differentiation**

*Panel A: U.S. Domestic Manufacturing Firms' Competitive Environment*

| Dependent variable = | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | *Average GM* $_{(t+1,t+2)}$ | | *Average PM_adj* $_{(t+1,t+2)}$ | |
| Product Differentiation | Low | High | Low | High |
| ***FORTAXCH*** $_{(t)}$ | **2.003*** ** | **0.173** | **2.800** ** | **0.838** |
| | **(4.05)** | **(0.32)** | **(2.45)** | **(1.46)** |
| Test of High = Low p-value | 0.003 | | 0.040 | |
| Control Variables | Y | Y | Y | Y |
| Observations | 3,876 | 3,870 | 3,876 | 3,870 |
| R-squared | 0.726 | 0.752 | 0.597 | 0.614 |

*Panel B: U.S. Domestic Firms'Decisions to Spend on R&D, Advertising, and Capital Expenditures*

| Dependent variable = | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | *Average RD* $_{(t+1,\ t+2)}$ | | *Average ADV* $_{(t+1,\ t+2)}$ | | *Average CAPEX* $_{(t+1,\ t+2)}$ | |
| Product Differentiation | Low | High | Low | High | Low | High |
| ***FORTAXCH*** $_{(t)}$ | **-2.092*** ** | **-0.378** | **0.115** ** | **-0.067** | **-0.679*** ** | **-0.180** |
| | **(-3.60)** | **(-1.42)** | **(2.12)** | **(-0.83)** | **(-2.69)** | **(-1.17)** |
| Test of High = Low p-value | 0.008 | | 0.137 | | 0.060 | |
| Control Variables | Y | Y | Y | Y | Y | Y |
| Observations | 3,876 | 3,870 | 3,876 | 3,870 | 3,876 | 3,870 |
| R-squared | 0.789 | 0.814 | 0.708 | 0.857 | 0.448 | 0.411 |

**Table 6 (cont'd)**
**The Effects of Changes in Foreign Countries' Corporate Tax Rates:**
**The Role of Product Differentiation**

*Panel C: U.S. Domestic Manufacturing Firms' Total Factor Productivity*

| | (1) | | (2) |
|---|---|---|---|
| Dependent variable = | | *Average TFP* $_{(t+1,\ t+2)}$ | |
| Product Differentiation | Low | | High |
| ***FORTAXCH*** $_{(t)}$ | **-7.335*** ** | | **0.582** |
| | **(-4.42)** | | **(0.26)** |
| Test of High = Low | | | |
| p-value | | 0.427 | |
| Control Variables | Y | | Y |
| Observations | 1,803 | | 2,256 |
| R-squared | 0.512 | | 0.565 |

This table presents the results of examining whether the effects of changes in foreign country statutory corporate tax rates on U.S. domestic manufacturing firms vary with product differentiation: Gross and profit margins (Panel A), R&D, advertising, and capital expenditures (Panel B), and total factor productivity (Panel C). We partition the sample based on below and above median product differentiation (measured in year t). We use Hoberg and Phillips' (2016) total product similarity as the proxy for product differentiation. The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix D. Industry and year fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by industry and year. t-statistics are reported in parentheses.

**Table 7**
**Changes in Foreign Countries' Corporate Tax Rates and U.S. Domestic Manufacturing Firms' Sales Growth**

| Dependent variable = | *Average Sales Growth* $_{(t+1,\, t+2)}$ |
|---|---|
| ***FORTAXCH*** | **-1.315** |
| | **(-1.06)** |
| *Sales Growth (t)* | 0.071*** |
| | (3.58) |
| *MVAL* $_{(t)}$ | 0.018* |
| | (1.94) |
| *MB* $_{(t)}$ | 0.005*** |
| | (2.59) |
| *Capital–labor intensity* $_{(t)}$ | 0.058*** |
| | (5.32) |
| *PPE* $_{(t)}$ | -0.031 |
| | (-0.87) |
| *INTAN* $_{(t)}$ | -0.038 |
| | (-1.11) |
| *HHI* $_{(t)}$ | -0.135 |
| | (-0.89) |
| *Changes in tariffs* $_{(t)}$ | 2.647 |
| | (1.17) |
| *Industry Sales Volatility* $_{(t)}$ | 0.245 |
| | (1.46) |
| *Changes in foreign real FX* $_{(t)}$ | 0.566*** |
| | (2.99) |
| *Foreign GDP growth* $_{(t)}$ | -0.012*** |
| | (-3.12) |
| Observations | 7,746 |
| R-squared | 0.113 |

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on U.S. domestic manufacturing firms' sales growth. The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix D. Industry and year fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by industry and year. t-statistics are reported in parentheses.

**Table 8**
**Changes in Foreign Countries' Corporate Tax Rates and Industry-Level Import Penetration**

| Dependent variable = | *Average Import Penetration* $_{(t+1,\, t+2)}$ |
|---|---|
| ***FORTAXCH*** $_{(t)}$ | **0.050** |
| | **(0.19)** |
| *Import Penetration* $_{(t)}$ | 0.903*** |
| | (59.22) |
| *HHI* $_{(t)}$ | 0.039** |
| | (2.20) |
| *Tariffs* $_{(t)}$ | -0.050 |
| | (-1.55) |
| *Industry Sales Volatility* $_{(t)}$ | 0.039 |
| | (1.40) |
| *Changes in foreign real FX* $_{(t)}$ | -0.014 |
| | (-0.33) |
| *Foreign GDP growth* $_{(t)}$ | -0.002 |
| | (-0.56) |
| *Industry-median PM* $_{(t)}$ | -0.078** |
| | (-2.06) |
| *Industry-median MB* $_{(t)}$ | -0.001 |
| | (-0.63) |
| *Industry-median Sales Growth* $_{(t)}$ | -0.001 |
| | (-0.09) |
| Observations | 318 |
| R-squared | 0.997 |

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on industry-level import penetration. The sample includes industry-year observations over the 1997 – 2014 period. Variable definitions are provided in Appendix D. Industry and year fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by industry and year. t-statistics are reported in parentheses.