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

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Abstract

We examine how U.S. domestic manufacturing firms respond to increased competition stemming from corporate tax rate cuts in the home countries of their foreign competitors. We develop a measure of U.S. domestic firms' exposure to changes in foreign country corporate tax rates and validate that the measure captures increased competition in the U.S. We find evidence consistent with U.S. domestic firms lowering prices in response to declines in foreign country corporate tax rates. We also 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 the competitive threat faced by U.S. domestic firms, and in response U.S. domestic firms alter their pricing and investment strategies, and/or become more productive.

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I. 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 Organization for Economic Co-operation and Development (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 regarding the spillover effects of these declining foreign tax rates on U.S. firms. We seek to fill this void by examining how U.S. domestic firms respond to a change in their competitive environment following foreign tax rate cuts.[2]

Reductions in foreign tax rates have the potential to affect the competitive environment in the U.S. through several channels. First, foreign tax cuts can increase foreign firms' investments. Tax cuts in their home market can result in some previously negative net present value investments becoming positive ones on an after-tax basis.[3] As a result, some foreign firms may

[1] Speaker Ryan's view was not shared by all observers. A November 2017 *New York Times* Editorial Board article pointed 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. Empirically, we capture both increases and decreases in foreign tax rates, but decreases are more prevalent.

[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.

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]

Another potential channel is through cross-subsidization between divisions within the same firm. Some foreign firms may 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.[5]

Prior work posits that competition can result from actual actions or the threat of actions by competitors (e.g., Tirole 1988). Thus, in our setting we expect the competitive environment in the U.S. will change as a result of some combination of actual actions or the threat of actions by foreign firms.[6] Changes in the competitive environment can disrupt the equilibrium conditions under which firms were operating and alter the cost-benefit tradeoffs of business decisions. Previous research has documented various actions that incumbents take in response to intensified competition. One option is for U.S. firms to respond to the increase in competition by cutting prices, leading to lower price-cost margins (e.g., Aghion et al. 2005, Gaspar and Massa 2006,

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[4] Hanlon and Heitzman (2010) note that economists have struggled to document a link between corporate taxes and investment using *aggregate* data. As a result, the economics literature has turned to more powerful methods that exploit variation across firms, asset types, and locations. For example, Nallareddy, Rouen, and Suarez Serrato (2018) find decreases in state corporate tax rates lead to increases in industry-level investment. Based upon the reviews of the literature on taxes and investment provided by Hassett and Hubbard (2002) and Hassett and Newmark (2008), Hanlon and Heitzman (2010) conclude, "[R]ecent empirical studies appear to have reached a consensus that the elasticity of investment with respect to the tax-adjusted user cost of capital ranges between -0.25 and -1" (pg. 148).

[5] The discussion of these two channels is intended to illustrate possible reasons foreign tax cuts may affect the U.S. competitive environment. It is not necessary for all foreign firms to respond by increasing investment or subsidizing their U.S. activities. We explore this connection in detail in Appendix A.

[6] 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 during our sample period. Regardless, this possibility suggests foreign tax cuts have the potential to affect the competitive environment of and elicit responses from U.S. domestic firms.

Peress 2010). Another option is for U.S. domestic firms to increase research and development (R&D) and advertising spending. A stream of the industrial organization literature dating back to Sutton (1991) suggests firms can incur endogenous fixed costs (e.g., 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). Other research, however, indicates greater competition can lead firms to decrease innovation and investment (e.g., Autor et al. 2017, Fresard and Valta 2016). Consistent with the findings in prior research, we expect to observe some heterogeneity in the responses of U.S. domestic firms to the threat of increased competition stemming from reductions in foreign country tax rates.

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.[7] 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

[7] We begin our analysis by focusing 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, those effects may be somewhat mitigated if the U.S. multinationals are operating in the foreign countries that experience the tax rate cut, and thus also benefit directly from those tax cuts. However, we do not expect the competitive effects to be fully mitigated for U.S. multinationals, and in Section VII we present tests separately examining U.S. multinationals. 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.

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.[8] Thus, the measure varies cross-sectionally by industry and also varies over time.

We begin our analysis by first validating that our weighted measure of changes in foreign tax rates is reflective of an increase in competition for U.S. domestic firms. In Appendix A, we first provide evidence that reductions in foreign country tax rates translate into lower tax burdens for foreign firms. We then find that foreign firms adjust their investment decisions in response to changes in their home country tax rates. We also document an increase in the competition-related language used by managers in U.S. firms' 10-K filings following the foreign tax rate cuts. In sum, the results point to foreign tax rate cuts engendering competition faced by U.S. domestic firms.

We begin to address our primary research question by first providing indirect evidence on the effect of increased foreign competition on the pricing strategies of U.S. domestic firms. Following prior research (e.g., Aghion et al. 2005, Gaspar and Massa 2006, Peress 2010), we examine changes in price-cost margins in response to shocks to the competitive environment. We find that averages of one- and two-year ahead gross margin and profit margin are adversely affected by reductions in foreign country tax rates. A one percentage point decrease in the weighted average foreign country tax rate is associated with a 1.403 (2.112) percentage point decrease in average gross (profit) margin. In additional analysis, we find no change in sales

[8] Appendix D provides an example that illustrates how the measure is constructed.

growth for U.S. domestic firms around the foreign tax cuts. Together, these results are consistent with U.S. domestic firms reducing prices in response to increased competition.

Our second set of tests examine changes in investment and productivity by U.S. domestic firms in response 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 R&D spending of 10.8 percent and an increase in capital expenditures of 8.2 percent. 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 cutting prices, increasing investment, and/or becoming more productive in an attempt to protect themselves from intensified competition.

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 (2018) 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' competitive environment will be more pronounced among firms with low product differentiation. 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.[9,10]

To the best of our knowledge, this is the first study to provide evidence on the spillover effects 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. We observe decreasing gross and profit margins around foreign tax rate cuts. These (albeit indirect) findings are consistent with U.S. domestic manufacturing firms responding to increased competition with price cuts. The results also suggest that reductions in foreign country corporate tax rates are associated with increases in R&D, capital expenditures, and/or productivity for at least a subset of U.S. publicly-traded domestic manufacturing firms. These findings indicate there may be relatively complex spillover effects from changes in foreign tax policies on U.S. firms and the U.S. economy. While we discuss possible channels through which foreign tax cuts could affect the U.S. competitive environment, we do not test the specific mechanisms through which this occurs. It is possible U.S. firms respond to the threat of increased competition even before foreign firms change their investments in response to the tax cut. Further, the nature of the competitive response may vary across countries or as a function of the size of the tax cuts.

Our study provides initial evidence on how tax regulatory actions by foreign governments impact the U.S. economy. In contrast, most prior research examines the effects of the taxation of

[9] The cross-sectional tests on product differentiation also help allay concerns that the observed increase in capital expenditures following foreign tax rate cuts is related to the Domestic Production Activities Deduction (DPAD) enacted as part of the American Jobs Creation Act of 2004. Lester (2016) documents a positive effect of the DPAD on domestic capital expenditures.

[10] In supplemental tests, we also consider additional heterogeneity in the effects of reductions in foreign country tax rates on U.S. domestic firms. We expect that some firms may adjust their pricing policies while others focus on improving productivity. For this analysis, we partition the productivity sample based on the average change in U.S. domestic firms' gross margin and profit margin in the two years following the foreign tax cut. We find some evidence suggesting increases in productivity following foreign tax rate cuts are strongest among firms that are least likely to cut prices.

a firm's own income on its decisions (e.g., Doidge and Dyck 2015, Heider and Ljungqvist 2015, Langenmayr and Lester 2018, Ljungqvist et al. 2017).[11] The implications of examining the domestic economic consequences of foreign tax policies are particularly important given the recent U.S. tax legislation and the proposed international responses to it. Our study also contributes to a new but growing field of research examining the effects of taxes on competition (e.g., Kubick et al. 2015, Donohoe et al. 2018, Bird et al. 2018). 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. 2017, 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 results should be of interest to policymakers in considering the potential implications of the recent significant reduction in the U.S. corporate tax rate in response to declining corporate tax rates worldwide. We look forward to future research that examines the consequences of the changes in U.S. tax policy enacted in the TCJA for both U.S. and non-U.S. firms.

II. MOTIVATION AND TESTABLE PREDICITONS

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

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

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 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.

Reductions in foreign country corporate tax rates could increase competition faced by U.S. domestic firms through several possible channels. First, investment projects that were previously deemed negative net 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.[12]

This expected effect of reductions in foreign country tax rates on foreign firms' investments is supported by research on tax policy and business investment. In their review of this literature, Hassett and Hubbard (2002) conclude, "Recent empirical studies appear to have reached a consensus that the elasticity of investment with respect to the tax-adjusted user cost of capital is between -0.5 and -0.1…. This range of estimated responses of investment to tax parameters … suggests that investment tax policy can have a significant impact on the path of aggregate capital formation" (pg. 1325). Djankov, Ganser, McLiesh, Ramalho, and Shleifer

[12] Note that foreign firms need not be financially constrained in order for foreign tax cuts to turn incremental projects into profitable investments.

(2010) use survey data from 85 countries to examine the relation between effective tax rates and investment and find higher effective tax rates have an adverse impact on investment and entrepreneurial activity. More recently, Mukherjee, Singh, and Zaldokas (2017) examine staggered changes in state-level corporate tax rates and find that an increase in tax rates leads to a reduction in future innovation. They conclude that taxes affect not only patenting and R&D investment, but also new product introductions.

A second related 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.

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. Regardless of the channel, if reductions in foreign country tax rates affect the competitive environment in the U.S., we expect U.S. domestic firms will respond by lowering prices leading to reduced margins (e.g., Aghion et al. 2005, Gaspar and Massa 2006, Peress 2010).[13] Our first prediction is:[14]

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

Changes in the competitive environment can disrupt the equilibrium conditions under which firms were operating, thereby altering the cost-benefit tradeoffs of various business decisions. Thus, 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 can 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 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

[13] If U.S. domestic firms' input prices decline as a result of a foreign tax cut, we expect U.S. domestic firms' price-cost margins to increase or stay the same. Thus, a change in input prices resulting from foreign tax cuts would bias against finding evidence consistent with our prediction of intensified competition reflected in price-cost margins.
[14] All predictions are stated in the alternative.

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 an attempt 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. (2017) 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.[15] Together, the findings in Dasgupta and Stigliz (1980), Brown et al. (2009), and Autor et al. (2017) suggest reductions in foreign country tax rates could decrease U.S. domestic firms' R&D expenditures. Further, Fresard and Valta (2016) and Hombert and Matray (2018) find that on average U.S. firms decrease capital expenditures in response to tariff cuts and Chinese import penetration, respectively. 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

[15] Similar to Autor et al. (2017), Hombert and Matray (2018) find Chinese import competition led to slower sales growth and lower profitability among U.S. manufacturing firms.

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.[16] 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.

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

[16] See Holmes and Schmitz (2010) for a detailed review.

tax cut may not affect 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., Berger 1993, Jennings et al. 2012, Markle et al. 2018). For example, Markle et al. (2018) 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 U.S. domestic firms respond to reductions in foreign country statutory tax rates as a change in their competitive environment is an empirical question.

III. VARIABLE MEASUREMENT AND VALIDATION TESTS

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.[17] 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.

[17] 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).

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 B). As Appendix C 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 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 B, and the intensity of those countries' import penetration varies by industry as shown in Appendix C, U.S. domestic manufacturing firms face time-varying exposure to changes in foreign countries' tax rates.[18]

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 (i.e., both increases and decreases) 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.[19] The weighting mechanism is similar to the "value share" approach used by Bloom et al. (2016) to examine the impact of Chinese imports on technological change in European countries.[20] Following prior work (e.g., Acemoglu et al. 2016), we calculate country-industry import

[18] We note some countries in Appendix B have foreign tax rate decreases in consecutive years. In Section VI, we discuss supplemental analyses in which we consider anticipatory effects of these consecutive rate changes.
[19] Import penetration reflects the extent to which domestic (i.e., U.S.) demand is met by imports.
[20] Weighting by unscaled country-industry import penetration does not affect our inferences, but the results in general become statistically weaker.

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.

Appendix D illustrates how the measure is computed for one industry-year in our sample. 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 (378 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.

Changes in Foreign Countries' Corporate Tax Rates and Competition in the U.S.

We begin our analysis by first examining the links that connect our *FORTAXCH* measure to changes in competition faced by U.S. domestic firms. Because testing these links is not our primary research question, and because many of these links have been explored in the existing literature, we present the research design and results of these tests in detail in Appendix A. Our

first test examines the association between foreign tax rate cuts and the tax burden of foreign firms. In order for reductions in foreign country tax rates to increase competition for U.S. firms, a key assumption is that the tax rate reductions will actually reduce the tax burden of foreign firms. Lee and Swenson (2016) examine firms from more than 200 countries and find a strong, positive association between firm-level ETRs and the home country statutory corporate tax rate. Markle and Shackelford (2012, 2014) examine the effective tax rates of multinational firms from more than 80 countries and find that, despite the ability to shift income to low tax countries, the country of domicile substantially effects the ETRs of multinational firms. We conduct our own test of this link by examining the effect of foreign country tax rate cuts on foreign firms' cash effective tax rates (Cash ETR). Using firm-level data from Compustat Global for the period from 1997 – 2014, we find a positive association between changes in foreign country statutory tax rates and firm-level Cash ETRs (see Table A1 of Appendix A for detailed results).

Next, we investigate the link between foreign tax rate cuts and pricing and investment decisions by foreign firms. As discussed in Section 2, there is a long literature discussing the sensitivity of investment to changes in corporate tax rates (e.g., Hassett and Hubbard 2002, Djankov et al. 2010, Mukherjee et al. 2017). Using firm-level data from Compustat Global, we find a significant negative association between changes in capital expenditures and changes in home country tax rates. We do not observe a significant change in R&D expenditures or gross margins following home country tax cuts in the full sample, but when we partition the sample based on financial constraints, we do find a significant negative association between changes in R&D expenditures and changes in home country tax rates for the more constrained firms (see Tables A2 through A4 of Appendix A for detailed results). We view these results as generally

supporting the assumption that at least some foreign firms will increase investment following tax cuts in their home country.

Regardless of the channel, if reductions in foreign country tax rates affect the competitive environment, we expect U.S. firms' managers to perceive competition as intensified. In our last test (Table A5), we examine the association between *FORTAXCH* and changes in the number of competition-related words in U.S. *domestic* firms' 10-K filings (Li et al. 2013). Consistent with our prediction, we observe a significant relation (albeit weak) between *FORTAXCH* and the use of competition-related words. Together, the results in Appendix A provide support for the link between our weighted measure of changes in foreign tax rates and the competitive environment for U.S. domestic firms.

IV. 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:

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

where $\Delta Y_{ijt+\tau}$ is the change in the outcome variable for firm i operating in industry j from year t to year t+τ. In all analyses, the dependent variable equals the simple average of Y_{ijt+1} and Y_{ijt+2} minus Y_{ijt}. 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 mitigate the possibility that events other than foreign tax shocks confound the outcome variables.[21] $Controls_{i,j,t}^{firm}$ is a set of firm-level

[21] In Section VII, we discuss supplemental analyses that examine year-by-year changes in the outcome variables for years t+1 through t+5.

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 to account for potential mean reversion in the dependent variables. $Controls_{j,t}^{industry}$ 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 β_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 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*, *Changes in foreign real FX* and *Foreign GDP growth* 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 E for detailed variable definitions.

We also include industry (φ_j) and year (τ_t) fixed effects in all tests to ensure that neither time-invariant industry characteristics nor macroeconomic conditions confound the identification of β_1.[22] 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.

V. SAMPLE AND DESCRIPTIVE STATISTICS

Sample

Table 1 describes our sample construction. We begin with 41,505 (U.S.-incorporated) firm-years with non-missing one-year lagged total assets in manufacturing industries available in Compustat over the period 1997 – 2014. We focus on manufacturing firms because the import data used to construct *FORTAXCH* are only available for manufacturing industries.[23] 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 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) or non-zero foreign income taxes (TXFO). This results in 7,730 firm-years (1,533 unique firms) for our main sample. The tests requiring firm-years to have non-missing values of total factor productivity (TFP) result in 4,032 firm-years (896 unique firms).

[22] When we include firm-fixed effects, our main inferences remain unaffected. However, the results become weaker both economically and statistically, indicating that our results are driven by both within-firm and across-firm variation.
[23] See Appendix C for a list of the 21 industries.

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 using data for 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 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 7,730 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.[24]

[24] Pharmaceutical firms are included in Chemical Manufacturing.

Descriptive Statistics

Table 2 presents descriptive statistics (Panel A) and correlations (Panel B) for all variables used in our analyses. 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%). These statistics indicate that during our sample period, foreign countries exporting to the U.S. on average cut corporate income tax rates. In Panel B, the change in adjusted profit margin (*ΔPM_adj*) is positively associated with *FORTAXCH*, suggesting that reductions in foreign countries' corporate tax rates adversely impact U.S. domestic manufacturing firms' profit margins. The correlations between *FORTAXCH* and the other outcome variables are insignificant with the exception of capital expenditures, which is significant in the direction opposite our prediction. Next, we formally test our predictions using multivariate analyses.

VI. RESEARCH DESIGN AND RESULTS

The Response of U.S. Domestic Firms to Intensified Competition

To test prediction 1 regarding the response of U.S. domestic firms to intensified competition, we follow prior research (e.g., Aghion et al. 2005, Gasper and Massa 2006, Peress 2010) and examine changes in price-cost margins. 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, which we also investigate as outcome variables. The changes in the outcome variables are calculated as the simple average of the year t+1 and t+2 values less the year t value.

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 level of the respective outcome variable in year t 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 (column (1) for the change in average gross margin [$\Delta GM_{(t+1,t+2)}$] and column (2) for change in average adjusted profit margin [$\Delta PM\_adj_{(t+1,t+2)}$]) as the dependent variable. Consistent with prediction 1, the coefficient on *FORTAXCH* is positive (1.403) and significant 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 price cuts. The coefficient estimate implies that a one percentage point decrease in the weighted average foreign country tax rate is associated with a 1.403 percentage point decrease in U.S. domestic manufacturers' average gross margin in years t+1 and t+2 compared to gross margin in year t. In column (2) where the dependent variable is average adjusted profit margin, we again find that the coefficient on *FORTAXCH* is positive (2.112) and significant. The coefficient estimate indicates that a one percentage point decrease in the weighted average foreign country tax rate is associated with a 2.112 percentage point decrease in average adjusted profit margin in years t+1 and t+2 compared to year t. Overall, our findings are consistent with prediction 1 that U.S. domestic manufacturing firms cut prices following declines in foreign countries' corporate income tax rates.

U.S. Domestic Firms' Investment Decisions

Because changes in the competitive environment can disrupt the equilibrium conditions under which firms were operating, they have the potential to change the costs and/or benefits

associated with various business decisions. 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 processes, or reduce costs. We test this prediction by estimating equation (2) with changes in R&D, advertising, and capital expenditures as the dependent variables. The changes in the investment variables are calculated as the simple average of the year t+1 and t+2 values less the year t value.

We present the results in Table 4. Panel A reports the results for 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 level of the outcome variable in year t. We find results consistent with prediction 2a using R&D. In column (1), the coefficient on *FORTAXCH* is negative (-2.188) and significant. The coefficient estimate indicates that U.S domestic firms increase R&D by 2.188 cents per dollar of sales in response to a one percentage point decline in foreign countries' tax rates, which represents 10.8 percent of the mean value of R&D in year t (0.108 = [-2.188*-0.01] / 0.203). Turning 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).[25] 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.

Table 4, Panel B presents the results for 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 (*Average CFO*), sales growth (*Sales Growth*), stock return (*RET*),

[25] The insignificant results could be due to the fact that the advertising variable in Compustat is noisy because firms only disclose advertising expenditures when it is material (Heitzman et al. 2010).

intangible assets (*INTAN*), property, plant, and equipment (*PPE*), and book leverage (*LEV*). As in previous tests, we include the level of capital expenditures in year t as a control variable. We find a negative and significant coefficient on *FORTAXCH* (-0.403), 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 0.403 cents per dollar of average total assets, which represents 8.2 percent of the mean value of capital expenditures in year t (0.082 = [-0.403*-0.01] / 0.049).

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 enhance production processes in an attempt to absorb and escape the competitive threats posed by foreign tax cuts.

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.[26] We estimate equation (2) with the change in firm-level average total factor productivity as the dependent variable and include the same set of control variables as in Table 3. The change in productivity equals the simple average of the year t+1 and t+2 values less the year t value.

We present the results in Table 5. Consistent with prediction 2d, the coefficient on *FORTAXCH* is negative (-3.507) and significant. The coefficient estimate indicates that a one

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

percentage point reduction in foreign country tax rates is associated with a 7.6 percent increase in U.S. domestic manufacturing firms' total factor productivity, relative to the absolute value of the sample mean productivity in year t (0.076 = [-3.507*-0.01] / │-0.460│). This finding is consistent with the threat of intensified competition resulting from foreign tax cuts pushing U.S. domestic firms to use their capital and labor more efficiently in order to become more productive.

Cross-Sectional Evidence: The Role of Product Differentiation

In this section, 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 (2018) 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 cut prices, 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 2018) 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 changes in profitability. In columns (1) and (3), the coefficient on *FORTAXCH* is positive and significant for the low product differentiation subsample, 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. Overall, the results provide some evidence the effects of reductions in foreign countries' corporate income tax rates on U.S. domestic manufacturing firms' price cuts are concentrated among firms with low product differentiation, which is consistent with our expectation that product differentiation can mitigate 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. 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 likely to be impacted by reductions in foreign country tax rates (i.e., low product differentiation firms).

VII. SUPPLEMENTAL ANALYSES

Additional Heterogeneity in U.S. Domestic Manufacturing Firms' Responses

In this section, we provide further evidence on U.S. domestic firms' responses by exploring additional heterogeneity in the effects of reductions in foreign country tax rates. Specifically, we expect that some firms may work to improve productivity, whereas others change their pricing policies. To test this prediction, we partition the productivity sample based on the average change in U.S. domestic firms' gross margin and adjusted profit margin in the two years following the foreign tax cut.

We present the results in Panel A of Table 7. First, columns (3) and (4) show the results for the profit-margin subsamples. The means of the average change in adjusted profit margin are -0.063 for the low profit-margin subsample and 0.054 for the high profit-margin subsample. Thus, the low (high) profit-margin subsample firms on average experience decreases (increases) in profit margin. In column (4) the coefficient on *FORTAXCH* is significantly negative (-4.937) only for the high profit-margin subsample, whereas the corresponding coefficient for the low profit-margin subsample is insignificant. The difference between the two coefficients is significant at one-tailed p-value<0.10. The results suggest that some firms respond to foreign

country tax rate cuts by lowering prices and others by improving productivity, but not doing both. However, we find little difference between the high and low gross-margin subsamples in columns (1) and (2).

To shed further light on heterogeneity of the effects of reductions in foreign country tax rates, we study whether firms' ex ante productivity is associated with the probability of being delisted following tax cuts. For this test, we do not need to require an observation to have future productivity measures so the sample is larger (N=5,202) relative to the TFP sample in Table 5 (N=4,032). We partition this sample based on the average total factor productivity in years t-1 and t (*Average* $TFP_{(t-1,t)}$), and estimate logistic regressions of an indicator variable that equals one if a firm in year t is delisted due to poor performance within five years following the tax cuts.[27]

We show the results in Panel B of Table 7. The coefficients on *FORTAXCH* are significantly negative for the low productivity subsample in column (2) but insignificant for the high productivity subsample in column (3). We, however, cannot reject the null hypothesis that the two coefficients are different from each other. Together, the results in Table 7 provide some evidence on heterogeneous responses and consequences among U.S. domestic firms to increased competition stemming from foreign tax rate cuts.

U.S. Multinationals

Our main tests focus on U.S. domestic firms because we are interested in the effects of changes in foreign country corporate tax rates specifically on firms' U.S. activities. In supplemental analysis, we examine the effects of foreign tax cuts on U.S. multinationals. There are a number of reasons to expect that U.S. multinationals will be affected to a lesser extent than

[27] The CRSP delisting codes are 400 or 5000-599.

U.S. domestic firms by corporate tax cuts in countries that export goods to the U.S. First, if multinational firms have a significant presence in the country of the tax cut, they may also benefit from the reduced tax rate. Second, U.S. multinationals operate in multiple markets, and unless their operations map closely with those of foreign competitors who experience a home country tax cut, the effects of increased competition will be somewhat mitigated. Finally, we expect U.S. multinationals may be more insulated from shocks to their competitive environment because they invest more in product innovation. We find some evidence in support of this argument. Compared with U.S. domestic firms, we find that U.S. multinationals exhibit higher product differentiation and productivity, and are also more innovative (based on the scaled patent citations and the market value of patents).

Table 8 presents the results of repeating our analyses for U.S. multinationals.[28] Consistent with our expectations, the effects for U.S. multinationals are generally weaker than the effects for U.S. domestic firms observed in our main tests, providing additional support for the conclusion that the observed effects on domestic firms are due to increased competition in the U.S. stemming from foreign country tax cuts. Panel A presents the results for U.S. multinationals' profitability. The coefficients on *FORTAXCH* are insignificant across both measures. These results suggest the effect of declines in foreign countries' corporate income tax rates on U.S. multinational companies' pricing decisions is not as strong as the effect on U.S. domestic companies. Turning to U.S. multinationals' investment and productivity responses (Panels B and C), unlike U.S. domestic firms, we do not observe a significant effect of foreign

[28] These tests examine the effects of changes in corporate income tax rates in countries that import goods into the U.S. (i.e., *FORTAXCH*). They do not examine the effects of changes in corporate income tax rates in countries in which U.S. multinationals operate.

tax shocks on U.S. multinationals' worldwide R&D (Panel B), capital expenditures (Panel B), or productivity (Panel C).

When we study heterogeneity in the effects of foreign country tax cuts by product differentiation, we find some evidence that U.S. multinationals with low product differentiation respond to foreign country tax cuts. The results are presented in Table 9. For example, we observe that U.S. multinationals with low product differentiation respond by increasing R&D (column (1) of Panel B, Table 9) and advertising spending (column (3) of Panel B, Table 9). Taken together, these results indicate that changes in foreign country tax rates have less pronounced effects on U.S. multinationals, consistent with pricing, investment, and productivity of U.S. multinationals being less sensitive to changes in the U.S. competitive environment.

The Effects of Changes in Foreign Countries' Corporate Income Tax Rates in Years t+1 through t+5

In our main tests, we examine the effects of changes in foreign countries' corporate income tax rates on changes in the outcome variables from year t to the average value over years t+1 and t+2 in order to capture effects of the threat of competition and alleviate the possibility that events other than foreign tax shocks confound our identification. In untabulated analyses, we examine the effects of changes in foreign countries' corporate income tax rates on year-by-year changes in U.S. domestic firms' pricing, investment, and productivity separately for years t+1 through t+5. As explained below, overall the results suggest that the effects of foreign tax shocks are more pronounced in the several years immediately subsequent to the tax rate change.

When we examine changes in U.S. domestic manufacturing firms' pricing decisions, we observe positive and significant associations between foreign tax changes in year t and changes in gross margin from year t+1 to t+2. We also observe positive and significant associations with changes in adjusted profit margin from year t+1 to t+2. Turning to U.S. domestic firms'

investment decisions, we observe negative and significant effects of foreign tax changes in year t on changes in R&D spending from year t+1 to t+2 and t+2 to t+3 and capital expenditures from year t to t+1 following the tax rate change. We observe an insignificant association between changes in foreign corporate income tax rates and changes in advertising expenditures for all years except from year t+2 to t+3, when we find a negative and significant association. Thus, we do find evidence of an effect of foreign tax cuts on advertising expenditures when we consider a longer time horizon, but we acknowledge the possibility other intervening events could affect these results. For changes in U.S. domestic firms' productivity, we find significant effects of the tax rate change in the first year (i.e., from year t to t+1). Overall, these results are consistent with the strongest effects of foreign tax shocks manifesting in the several years immediately following the tax rate change.

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' pricing decisions, 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 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 for years t+1 and t+2 as the dependent variable and include the same set of control variables as in Table 3.

We present the results in Table 10. The results are consistent with our expectation. The coefficient on *FORTAXCH* is not significantly different from zero. In concert with the profitability results in Table 3, these findings suggest that in response to the increased competitive threat arising from foreign countries' tax cuts, U.S. domestic manufacturing firms likely cut prices, which in turn appears to increase sales volume, thereby allowing firms to maintain sales levels.

Endogeneity of Changes in Foreign Countries' Corporate Income Tax Rates

Because changes in foreign countries' tax rates are plausibly exogenous to individual 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 spending 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 and capital expenditures. Rather, the classic investment theory postulates that in response to declining growth opportunities, U.S. firms are likely to reduce investments (e.g., Abel 1983).

In addition, we empirically mitigate the endogeneity concerns by repeating our tests using world-wide industry-adjusted outcome variables. For example, we subtract world-wide industry gross margin from U.S. domestic firms' gross margin. The intuition is to remove time-varying world-wide industry shocks that affect both U.S. domestic and foreign firms. In untabulated results, we find that our inferences are unaffected. Specifically, *FORTAXCH* is significantly, negatively associated with changes in industry-adjusted values of changes in gross margin, profit margin, and R&D, with an exception of industry-adjusted capital expenditures that is insignificant (t-statistics=1.63). Overall, we believe that unobserved time-varying industry shocks are unlikely to be an alternative explanation for our findings.

Other Supplemental Analyses

We conduct several untabulated additional analyses. First, in Appendix B we observe that Canada, Mexico, and the U.K. experienced a series of tax rate decreases in consecutive years during our sample period. To address concerns regarding the anticipation of such tax rate changes, we re-estimate our tests including the full impact of the series of tax cuts in the year they began.[29] Our inferences are similar.

Second, we consider whether our results are sensitive to China's corporate income tax cut in 2008. As Appendix B and C show, China is a dominant exporting country in many industries

[29] Specifically, we treat Canada as experiencing a tax rate change of -0.07 in 2001 and -0.0712 in 2008, Mexico as experiencing a tax rate change of -0.07 in 2003, and the U.K. as experiencing a tax rate change of -0.07 in 2011.

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. 2017 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.

Next, 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 B), 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. We also find our results robust to the exclusion of 2002 firm-year observations.

Finally, Figure 3 shows that the chemical industry including pharmaceutical firms comprises the largest portion of manufacturing firms in the U.S. To see how the chemical industry contributes to our findings, we repeat our analysis by excluding firms in the industry. In untabulated results, we find that the relations of foreign country tax cuts with gross margin and R&D spending become insignificant, whereas the relations of foreign country tax cuts with profit margin, capital spending, and productivity remain significant. The results provide additional evidence on heterogeneity of U.S. domestic firms' responses, in that chemical firms respond to

foreign country tax cuts by cutting prices and increasing R&D, whereas firms in other industries lever other means. Finally, our results are not sensitive to clustering the standard errors by firm.[30]

VIII. 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 how U.S. domestic firms respond to reductions in the home country tax rates of their foreign competitors.

We find evidence consistent with U.S. domestic manufacturing firms adjusting pricing strategies following reductions in foreign country corporate tax rates. Specifically, we observe declines in U.S. domestic manufacturing firms' gross margins and profit margins. We also find evidence U.S. firms increase investments in R&D and capital expenditures. Further, we 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 interesting and important evidence regarding the effects of reductions in foreign country corporate tax rates on U.S. domestic manufacturing firms. This evidence should be of interest to academics, capital market participants, and regulators because it increases our understanding of the implications of tax policies in the global economy. We look forward to future research that

[30] We also examine whether foreign tax cuts affect the likelihood that U.S. public domestic manufacturing firms are delisted for performance-related reasons and whether the effect varies by firms' ex post decision to invest in R&D and/or capital expenditures. We do not find evidence of an association between foreign tax rate changes and performance-related delisting.

further advances our understanding of the spillover effects of foreign tax changes on U.S. firms and the U.S. economy.

Our study is subject to several caveats. First, although we provide some evidence on the mechanism(s) through which reductions in foreign tax rates affect the competitive environment in the U.S., in-depth analysis is beyond the scope of this study. Second, the outcomes for U.S. domestic manufacturing firms likely 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 also 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 on private firms in the U.S.

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APPENDIX A
The Links between Changes in Foreign Countries' Corporate Income Tax Rates and Competition Faced by U.S. Domestic Firms

In this Appendix, we explore the links that connect our *FORTAXCH* measure to changes in competition in the U.S. through several steps. We begin by examining the effect of foreign country tax rate cuts on the tax burden of foreign firms. We then investigate the association between foreign tax rate cuts and foreign firms' pricing and investment decisions. Finally, we test whether U.S. firms perceive competition as heightened as a result of foreign country tax rate cuts. We present the results in Tables A1 through A5.

Foreign Firms' Tax Burden

To test the effect of changes in foreign country tax rates on foreign firms' tax burden, we estimate the following regressions:

$$CETR_{i,j,c,t} = \alpha + \beta_1 \Delta TAXRATES_{c,t} + Controls_{i,j,c,t} + FE + \varepsilon_{i,j,c,t} \quad \text{(A1)}$$

where $CETR_{i,j,c,t}$ is cash effective tax rates (Cash ETR) for firm i in industry j in country c from year t. $\Delta TAXRATES_{c,t}$ is changes in statutory corporate income tax rates for country c from year t-1 to year t. $Control_{i,j,c,t}$ is a set of control variables. *FE* represents industry-year fixed effects and country fixed effects. We also cluster standard errors by year and industry.

We present the results in Table A1. We use firm-level data from Compustat Global and construct the sample over the period 1997-2014. We find a positive association between changes in foreign country statutory tax rates and firm-level Cash ETRs. The results support the notion that foreign country tax rate cuts indeed lower the tax burden of home country firms.

Foreign Firms' Pricing and Investment Decisions

Next, we study the association between foreign country tax rate cuts and foreign firms' pricing and investment decisions by estimating the following regressions:

$$\Delta Y_{i,j,c,t,t+1} = \alpha + \beta_1 \Delta TAXRATES_{c,t} + Controls_{i,j,c,t} + FE + \varepsilon_{i,j,c,t} \quad \text{(A2)}$$

where $\Delta Y_{i,j,c,t+1}$ is the change in gross margin (ΔGP), R&D spending (ΔRD), and capital expenditures ($\Delta CAPEX$) for firm i in industry j in country c from year t-1 to year t, t+1, measured as the simple average of $Y_{i,j,c,t}$ and $Y_{i,j,c,t+1}$ minus $Y_{i,j,c,t-1}$.[31] $\Delta TAXRATES_{c,t}$ is changes in statutory corporate income tax rates for country c from year t-1 to year t. $Control_{i,j,c,t}$ is a set of control variables regarding the respective outcome variable. *FE* represents industry-year and country fixed effects. We also cluster standard errors by year and industry.

[31] We do not examine profit margin because there can be heterogeneity in non-operating income such as fair value items across different countries.

We present the results in Tables A2 through A4. We use firm-level data from Compustat Global and construct the sample over the period 1997-2014. We show the results for the full sample and subsamples by financial constraints. Beginning with Table A2 (gross margin), we find little evidence that foreign firms engage in more aggressive pricing decisions in response to tax cuts in their home country. Turning to R&D spending (Table A3), we find that foreign firms increase R&D in response to tax cuts in their home country, when they are financially constrained (column (2)). The capital investment results (Table A4) are consistent with the R&D investment results. Foreign firms' capital investment is negatively associated with changes in foreign country tax rates, and the effect is more pronounced for financially constrained firms. Overall, our findings suggest that foreign country tax cuts affect some foreign firms' R&D and investment decisions.

U.S. Domestic Firms' Perception of Heightened Competition

Finally, we examine the association between reductions in foreign tax rates and the competitive environment perceived by U.S. firm managers by estimating the following regressions:

$$\Delta PCTCOMP_{i,j,t+1,t+2} = \alpha + \beta_1 FORTAXCH_{j,t} + Controls_{i,j,t}^{firm} + Controls_{j,t}^{industry} + \varphi_j + \tau_t + \varepsilon_{i,j,t+1,t+2} \quad \text{(A3)}$$

where $\Delta PCTCOMP_{i,j,c,t+1,t+2}$ is the change in the ratio of the number of competition-related words to total number of words in the 10-K filing (Li et al. 2013) for firm i operating industry j, measured as the simple average of $PCTCOMP_{i,j,c,t+1}$ and $PCTCOMP_{i,j,c,t+2}$ minus $PCTCOMP_{i,j,c,t}$. All other variables are defined as in equation (2) (also see Table 3).

We present the results in Table A5. The sample is a set of 2,580 U.S. domestic manufacturing firm-years (637 unique firms) with non-missing values of the 10-K text-based competition measure of Li et al. (2013).[32] An association between *FORTAXCH* and the change in the ratio of the number of competition-related words to total number of words in the 10-K filing is negative (-2.755) and significant (at the 10% level). We view these results as providing (albeit weak) evidence that managers of U.S. domestic manufacturing firms more frequently use competition-related words in 10-K filings after decreases in foreign country corporate tax rates. Overall, the results in Appendix A support the link between our weighted measure of foreign tax rate cuts (*FORTAXCH*) and the competitive environment for U.S. domestic firms.

[32] We use the text-based data provided by Li et al. (2013), which is available for the years 1995-2009. Because our dependent variable requires data for years t+1 and t+2, the analyses examining competition-related language are limited to the years 1997-2007. We thank the authors for making this data available.

APPENDIX A (continued)
The Links between Changes in Foreign Countries' Corporate Income Tax Rates and Competition Faced by U.S. Domestic Firms

Table A1: Foreign Firms' Cash Effective Tax Rates

Dependent variable =	(1) $CETR_{(t)}$	(2) $\Delta CETR_{(t)}$
$\Delta TAXRATES_{(t)}$	**0.456****	**0.399***
	(2.16)	**(1.66)**
$LNASSET_{(t)}$	0.000	-0.001
	(0.46)	(-0.70)
$RD_{(t)}$	0.318	0.454**
	(1.39)	(2.03)
$PPE_{(t)}$	-0.042***	0.003
	(-6.87)	(0.51)
$INTAN_{(t)}$	0.068***	0.022
	(3.96)	(1.23)
$LEV_{(t)}$	-0.064***	-0.019*
	(-4.40)	(-1.77)
$CAPEX_{(t)}$	-0.007	0.022***
	(-0.92)	(2.96)
$ROA_{(t)}$	-0.400***	-0.282***
	(-9.43)	(-6.95)
$SP_{(t)}$	-2.027***	-2.458***
	(-5.76)	(-6.21)
$LAG\_SP_{(t)}$	0.429***	3.440***
	(3.01)	(16.52)
$MNE_{(t)}$	-0.004	-0.003*
	(-1.48)	(-1.82)
Observations	99,079	99,079
R-squared	0.288	0.085

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on foreign firms' cash effective tax rates. The sample is constructed using Compustat Global over the years 1997 – 2014. Variable definitions are provided in Appendix E but *LNASSET* (log of total assets), *ROA* (pre-tax income scaled by average total assets), *SP* (special items scaled by average total assets), and *LAG_SP* (lagged *SP*). Industry-year fixed effects and country fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by country and year. t-statistics are reported in parentheses.

APPENDIX A (continued)
The Links between Changes in Foreign Countries' Corporate Income Tax Rates and Competition Faced by U.S. Domestic Firms

Table A2: Foreign Firms' Profitability

Dependent variable = Financial Constraint	(1) $\Delta GM_{(t,t+1)}$ ALL	(2) $\Delta GM_{(t,t+1)}$ High	(3) $\Delta GM_{(t,t+1)}$ Low
$\Delta TAXRATES_{(t)}$	**0.106**	**0.109**	**0.104**
	(1.50)	**(1.39)**	**(1.55)**
Sales Growth$_{(t)}$	0.013***	0.016***	0.007**
	(3.73)	(3.79)	(2.49)
$MVAL_{(t)}$	-0.000	-0.000	-0.001
	(-0.31)	(-0.36)	(-1.63)
$MB_{(t)}$	-0.000	-0.000	0.000
	(-1.52)	(-1.29)	(1.03)
$PPE_{(t)}$	-0.007*	-0.004	-0.004
	(-1.88)	(-0.90)	(-0.98)
$GM_{(t-1)}$	-0.002***	-0.001***	-0.002**
	(-3.66)	(-3.28)	(-2.54)
Test of High = Low p-value		0.892	
Observations	196,308	98,512	97,795
R-squared	0.054	0.062	0.070

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on foreign firms' gross margin. The sample is constructed using Compustat Global over the years 1997 – 2014. We partition the sample based on above and below median financial constraint, where financial constraint is measured by the Kaplan-Zingales index. Variable definitions are provided in Appendix E. Industry-year fixed effects and country fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by country and year. t-statistics are reported in parentheses.

APPENDIX A (continued)
The Links between Changes in Foreign Countries' Corporate Income Tax Rates and Competition Faced by U.S. Domestic Firms

Table A3: Foreign Firms' R&D Spending

Dependent variable = Financial Constraint	(1) $\Delta RD_{(t, t+1)}$ ALL	(2) $\Delta RD_{(t, t+1)}$ High	(3) $\Delta RD_{(t, t+1)}$ Low
$\Delta TAXRATES_{(t)}$	**-0.004**	**-0.007****	**-0.001**
	(-1.25)	**(-2.23)**	**(-0.24)**
Sales Growth$_{(t)}$	0.002***	0.002***	0.002***
	(12.57)	(11.24)	(9.88)
$MVAL_{(t)}$	0.000***	0.000***	0.000***
	(4.80)	(4.02)	(4.97)
$MB_{(t)}$	0.000***	0.000***	0.000***
	(3.83)	(3.89)	(3.59)
$LEV_{(t)}$	-0.001***	-0.001**	-0.003***
	(-5.26)	(-2.39)	(-3.81)
$RD_{(t-1)}$	0.020***	0.001	0.038***
	(3.72)	(0.08)	(6.20)
Test of High = Low p-value		0.644	
Observations	196,308	98,512	97,795
R-squared	0.068	0.066	0.085

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on foreign firms' R&D spending. The sample is constructed using Compustat Global over the years 1997 – 2014. We partition the sample based on above and below median financial constraint, where financial constraint is measured by the Kaplan-Zingales index. Variable definitions are provided in Appendix E. Industry-year fixed effects and country fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by country and year. t-statistics are reported in parentheses.

APPENDIX A (continued)
The Links between Changes in Foreign Countries' Corporate Income Tax Rates and Competition Faced by U.S. Domestic Firms

Table A4: Foreign Firms' Capital Investment

Dependent variable = Financial Constraint	(1) $\Delta CAPEX_{(t, t+1)}$ ALL	(2) $\Delta CAPEX_{(t, t+1)}$ High	(3) $\Delta CAPEX_{(t, t+1)}$ Low
$\Delta TAXRATES_{(t)}$	**-0.069****	**-0.098****	**-0.042**
	(-2.03)	**(-2.34)**	**(-1.52)**
Sales Growth$_{(t)}$	0.027***	0.023***	0.031***
	(27.50)	(22.01)	(22.00)
$MVAL_{(t)}$	0.001***	0.001***	-0.000
	(4.80)	(5.19)	(-0.95)
$MB_{(t)}$	-0.000**	0.000	0.000***
	(-2.47)	(0.52)	(3.02)
$LEV_{(t)}$	0.061***	0.087***	0.078***
	(16.33)	(19.56)	(9.96)
$CAPEX_{(t-1)}$	-0.338***	-0.360***	-0.302***
	(-23.67)	(-27.67)	(-14.44)
Test of High = Low p-value		0.047	
Observations	196,308	98,512	97,795
R-squared	0.168	0.187	0.181

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on foreign firms' capital investment. The sample is constructed using Compustat Global over the years 1997 – 2014. We partition the sample based on above and below median financial constraint, where financial constraint is measured by the Kaplan-Zingales index. Variable definitions are provided in Appendix E. Industry-year fixed effects and country fixed effects are included. *, **, and *** indicate significance (two-tailed) at the ten, five, and one percent levels, respectively, where standard errors are clustered by country and year. t-statistics are reported in parentheses.

APPENDIX A (continued)
The Links between Changes in Foreign Countries' Corporate Income Tax Rates and Competition Faced by U.S. Domestic Firms

Table A5: U.S. Domestic Firms' Perception of Heightened Competition

Dependent variable =	(1) $\Delta PCTCOMP_{(t+1,t+2)}$
FORTAXCH$_{(t)}$	**-2.755***
	(-1.75)
Sales Growth$_{(t)}$	0.004
	(0.12)
MVAL$_{(t)}$	-0.008*
	(-1.92)
MB$_{(t)}$	0.006**
	(2.49)
Capital–labor intensity$_{(t)}$	-0.019
	(-0.61)
PPE$_{(t)}$	-0.074***
	(-7.86)
INTAN$_{(t)}$	0.028
	(0.60)
HHI$_{(t)}$	0.588
	(1.22)
Industry Sales Volatility$_{(t)}$	-0.170
	(-0.55)
Import Penetration$_{(t)}$	-0.021
	(-0.07)
Changes in tariffs$_{(t)}$	3.439
	(0.54)
Changes in foreign real FX$_{(t)}$	0.100
	(0.31)
Foreign GDP growth$_{(t)}$	-0.010*
	(-1.85)
PCTCOMP$_{(t)}$	-0.504***
	(-11.94)
Observations	2,580
R-squared	0.422

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on changes in U.S. domestic manufacturing firms' percentage of competition-related words in 10-K filings in years t+1 and t+2 from year t. The sample includes the years 1997 – 2007. Variable definitions are provided in Appendix E. 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.

APPENDIX B
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 B 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 C
Top Five Sources of U.S. Imports by Industry

Industry	Average Total Industry Import Penetration	Source Countries				
		First	Second	Third	Fourth	Fifth
Food	0.0580	Canada 0.0161	Mexico 0.0051	China 0.0032	Australia 0.0027	Italy 0.0024
Beverage and Tobacco Product	0.0875	France 0.0160	Mexico 0.0135	U.K. 0.0083	Italy 0.0082	Netherlands 0.0071
Textile Mills	0.1951	China 0.0319	Canada 0.0240	S. Korea 0.0162	Mexico 0.0144	Italy 0.0135
Textile Product Mills	0.3322	China 0.1434	India 0.0440	Pakistan 0.0283	Mexico 0.0188	Canada 0.0120
Apparel	0.7227	China 0.2045	Mexico 0.0566	Vietnam 0.0373	Indonesia 0.0338	India 0.0276
Leather and Allied Product	0.8730	China 0.5451	Italy 0.0615	Mexico 0.0520	Vietnam 0.0363	Brazil 0.0300
Wood Product	0.1550	Canada 0.0897	China 0.0211	Brazil 0.0079	Chile 0.0070	Indonesia 0.0035
Paper	0.1206	Canada 0.0696	China 0.0107	Finland 0.0050	Brazil 0.0047	Germany 0.0046
Printing and Related Support Activities	0.0536	China 0.0171	Canada 0.0117	U.K. 0.0045	Mexico 0.0040	Hong Kong 0.0021
Petroleum and Coal Products	0.1081	Canada 0.0192	Russia 0.0111	U.K. 0.0061	Algeria 0.0051	Netherlands 0.0045
Chemical	0.2050	Ireland 0.0287	Canada 0.0286	Germany 0.0197	U.K. 0.0157	Japan 0.0152
Plastics and Rubber Products	0.1426	China 0.0360	Canada 0.0321	Japan 0.0125	Mexico 0.0109	S. Korea 0.0067
Nonmetallic Mineral Product	0.1481	China 0.0365	Mexico 0.0180	Canada 0.0170	Italy 0.0125	Japan 0.0079
Primary Metal	0.2796	Canada 0.0720	Mexico 0.0245	Russia 0.0176	China 0.0138	Brazil 0.0126
Fabricated Metal Product	0.1316	China 0.0307	Canada 0.0172	Mexico 0.0150	Japan 0.0113	Germany 0.0090
Machinery	0.3373	Japan 0.0680	Germany 0.0439	China 0.0411	Canada 0.0377	Mexico 0.0263
Computer and Electronic Product	0.5396	China 0.1622	Mexico 0.0763	Japan 0.0534	Malaysia 0.0385	S. Korea 0.0308
Electrical Equipment, Appliance, and Component	0.4142	China 0.1291	Mexico 0.1002	Japan 0.0318	Canada 0.0284	Germany 0.0216
Transportation Equipment	0.3073	Canada 0.0818	Japan 0.0637	Mexico 0.0565	Germany 0.0323	S. Korea 0.0126
Furniture and Related Product	0.2447	China 0.1172	Canada 0.0356	Mexico 0.0147	Vietnam 0.0109	Italy 0.0103
Miscellaneous	0.4570	China 0.1564	Israel 0.0424	India 0.0307	Mexico 0.0273	Japan 0.0214

Appendix C 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. It also presents the average total industry import penetration and average country-industry import penetration for the top five source countries over the sample period.

APPENDIX D
Illustration of the Calculation of the Weighted Average Change in Foreign Countries' Tax Rates (*FORTAXCH*)

Year: 2003
Industry: Chemical Manufacturing (NAICS3 = 325)

(1)	(2)	(3)	(4)	(5)
Country	Country-Industry Import Penetration	Weight	Change in Tax Rate	Weighted Average Change in Tax Rate
Ireland	0.0384	0.1950	-3.50%	-0.68%
Canada	0.0249	0.1263	-2.00%	-0.25%
United Kingdom	0.0179	0.0911	0.00%	0.00%
Germany	0.0177	0.0897	1.50%	0.13%
Japan	0.0158	0.0801	0.00%	0.00%
France	0.0132	0.0671	0.03%	0.00%
Switzerland	0.0056	0.0283	0.00%	0.00%
China	0.0054	0.0272	0.00%	0.00%
Singapore	0.0048	0.0245	-1.25%	-0.03%
Mexico	0.0048	0.0242	-1.00%	-0.02%
Italy	0.0046	0.0236	-2.00%	-0.05%
Netherlands	0.0041	0.0207	0.00%	0.00%
Belgium	0.0040	0.0204	-6.00%	-0.12%
Sweden	0.0038	0.0194	0.00%	0.00%
Russia	0.0029	0.0146	0.00%	0.00%
Israel	0.0025	0.0125	0.00%	0.00%
Spain	0.0023	0.0119	0.00%	0.00%
Trinidad and Tobago	0.0022	0.0112	-2.50%	-0.03%
India	0.0022	0.0112	0.00%	0.00%
Denmark	0.0019	0.0095	0.00%	0.00%
Other Countries	0.0180	0.0915	-0.04%	0.00%
Sum:	0.1970	1.0000		**-1.05%**

Appendix D illustrates how the weighted average change in foreign country statutory corporate tax rate measure (*FORTAXCH*) is computed for one industry-year in our sample. This industry imported goods from more than 100 countries. For purposes of this illustration, we present the top twenty sources of imports and aggregate the remaining countries in "Other Countries." Each country's import penetration is given in column (2), summing to this industry's total import penetration of 0.1970. 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, 0.1970. 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 -1.05%.

APPENDIX E
Variable Definitions

Variables	Definition
FORTAXCH =	Weighted average change 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.
$\Delta GM_{(t+1,\, t+2)}$ =	Average gross margin in years t+1 and t+2 minus gross margin in year t. Gross margin (GM) = (sales – cost of goods sold) / sales.
$\Delta PM\_adj_{(t+1,\, t+2)}$ =	Average profit margin in years t+1 and t+2 minus profit margin in year t. Profit margin (PM_adj) = (Pre-tax income + Interest expense + depreciation/amortization + R&D + advertising) / sales.
$\Delta PCTCOMP_{(t+1,\, t+2)}$ =	Average PCTCOMP in years t+1 and t+2 minus PCTCOMP in year t. PCTCOMP = the number of references to competition / the total number of words in the firm's 10-K filing as defined in Li, Lundholm, and Minnis (2013). See Li et al. (2013) for a detailed description of the PCTCOMP variable.
$\Delta RD_{(t+1,t+2)}$ =	Average research and development in years t+1 and t+2 minus research and development in year t. Research and development (RD) = R&D / sales. R&D = 0 if missing in Compustat.
$\Delta ADV_{(t+1,t+2)}$ =	Average advertising in years t+1 and t+2 minus advertising in year t. Advertising (ADV) = Advertising / sales. Advertising = 0 if missing in Compustat.
$\Delta CAPEX_{(t+1,t+2)}$ =	Average capital expenditures in years t+1 and t+2 minus capital expenditures in year t. Capital expenditures (CAPEX) = capital expenditures / average total assets.
$\Delta TFP_{(t+1,t+2)}$ =	Average total factor productivity in years t+1 and t+2 minus total factor productivity in year t. See Imrohoroglu and Tuzel (2014) for a detailed description of the estimation of total factor productivity (TFP).
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).
MVAL =	Market capitalization, computed as the natural logarithm of (PRCC_F*CSHO).
MB =	The ratio of market value of equity to the book value of equity.
Capital–labor intensity =	The ratio of total invested capital (ICAPT) to the number of employees (EMP*1000).
PPE =	Properties, plants, and equipment deflated by total assets.
INTAN =	Intangible assets deflated by total assets.
Average CFO $_{(t+1,t+2)}$ =	Average cash flows from operations (CF0) in year t+1 and year t+2, where CFO is calculated as cash flows from operations 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 calculated at the three-digit NAICS level.
Changes in tariffs =	Changes in tariff 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.
Import Penetration =	A ratio of import to [import + domestic production – export]
Changes in foreign real FX =	Weighted average change 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 E describes variable definitions.

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

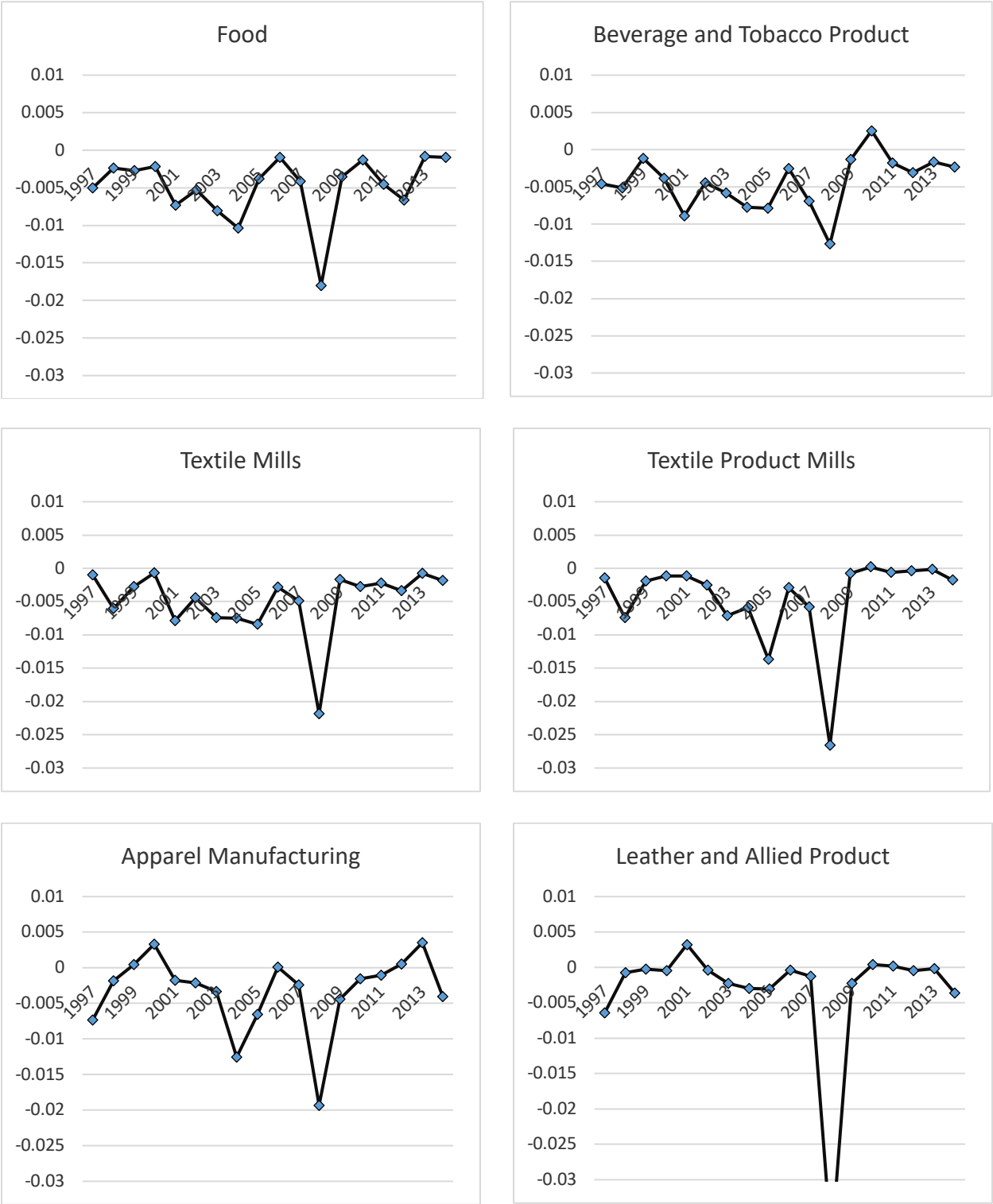
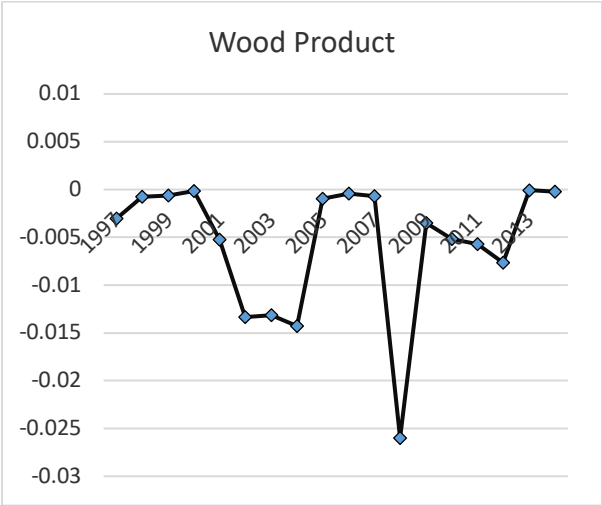
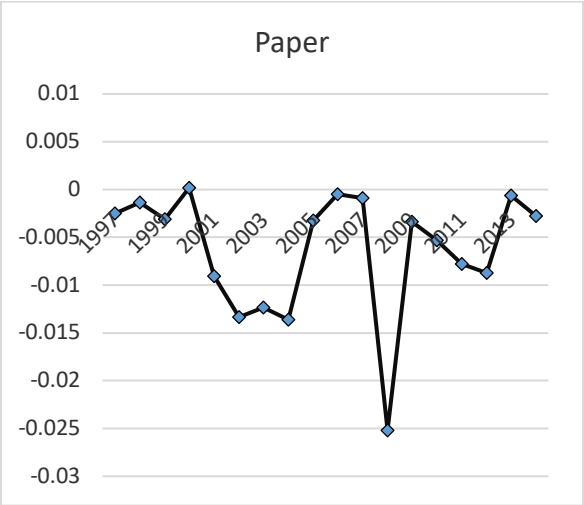
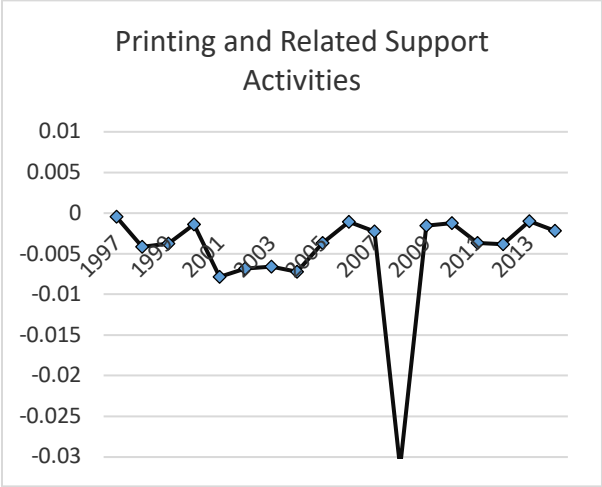
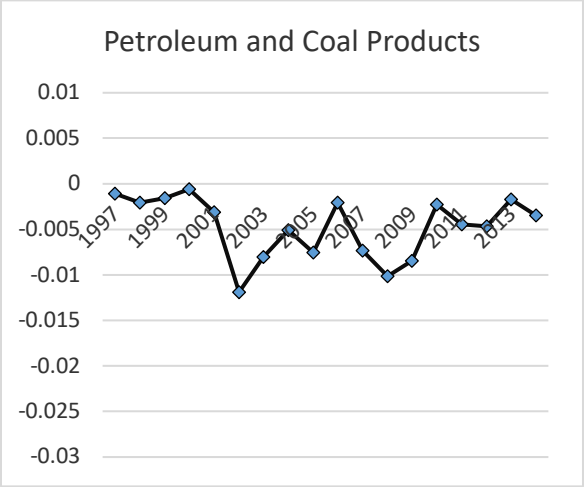


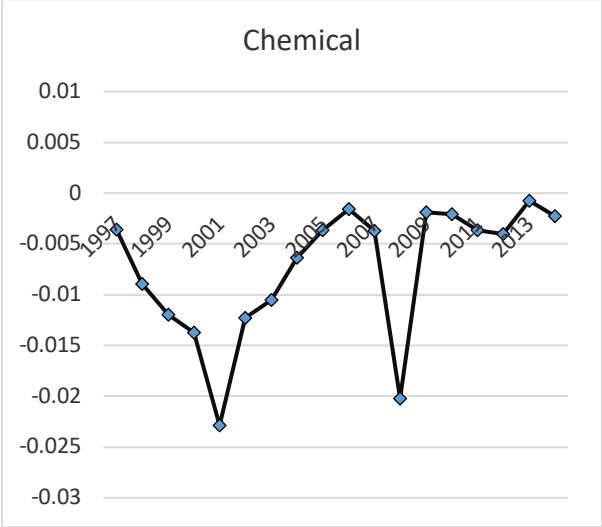
FIGURE 1 (continued)











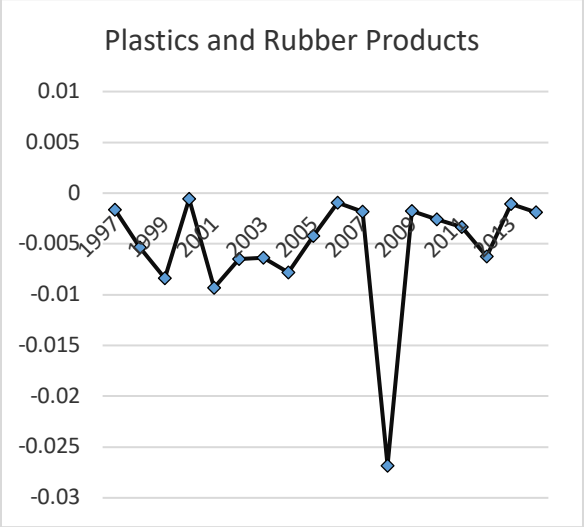
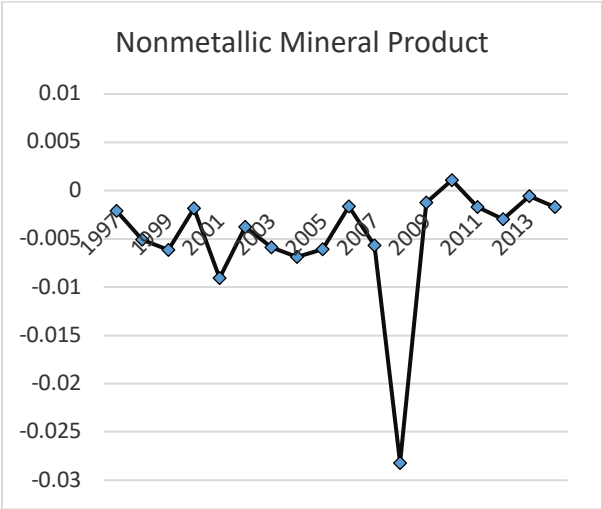
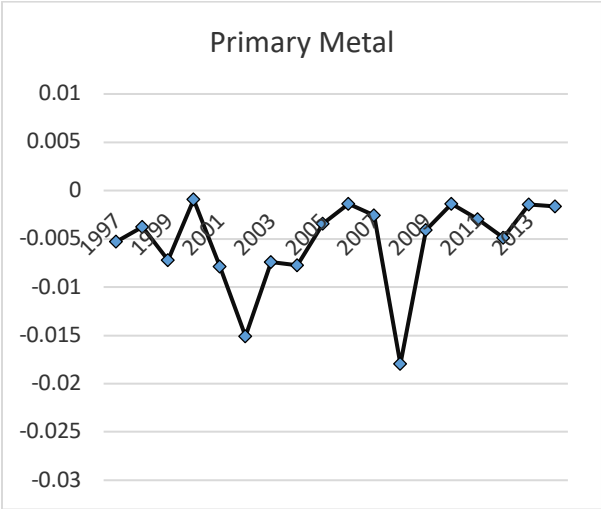
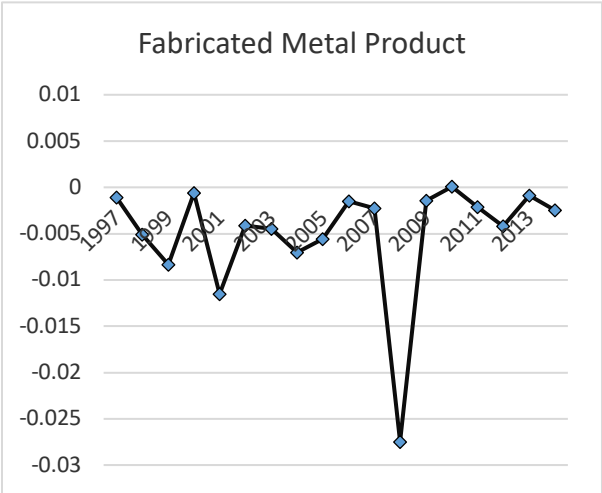
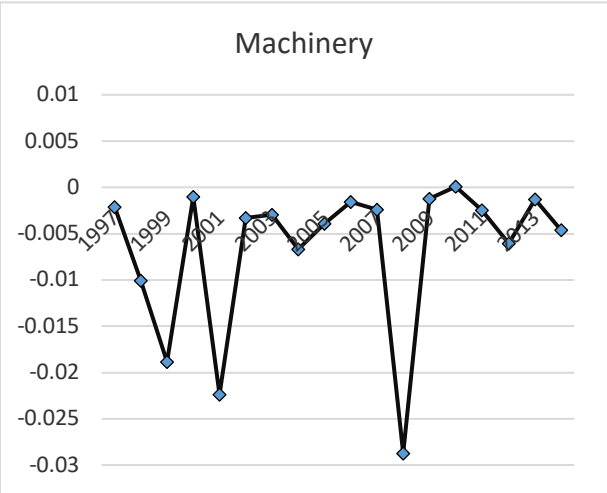


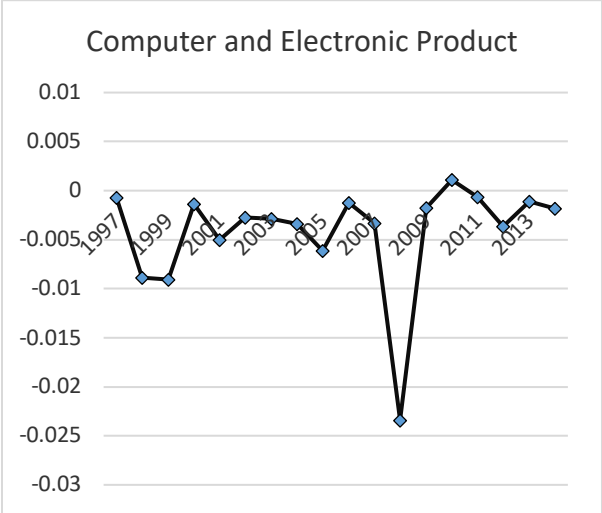
FIGURE 1 (continued)











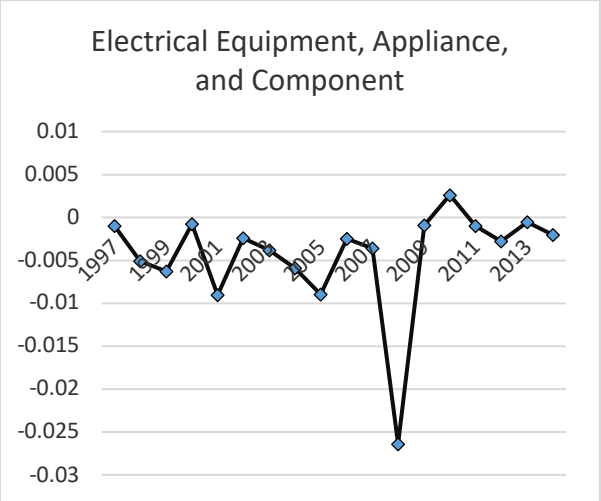
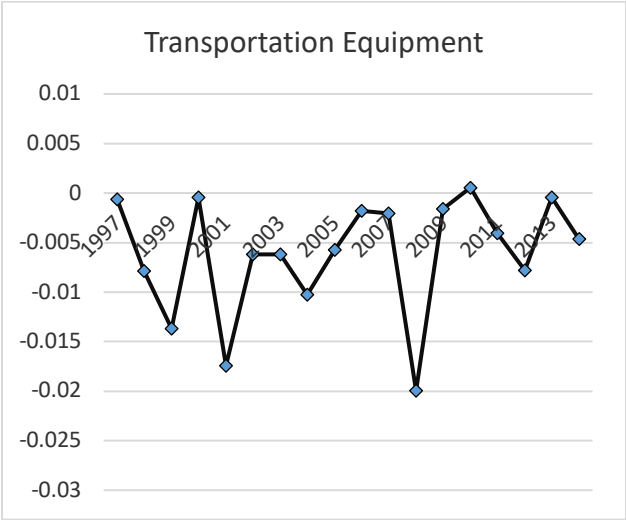
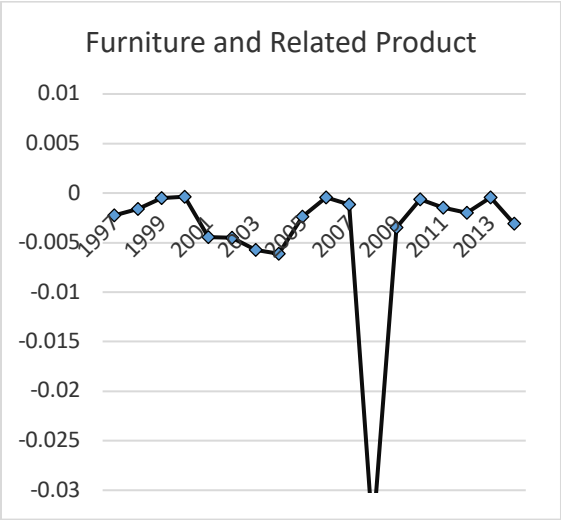


FIGURE 1 (continued)





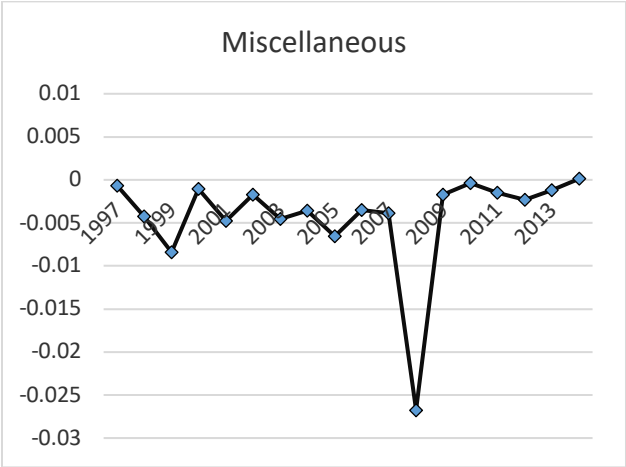
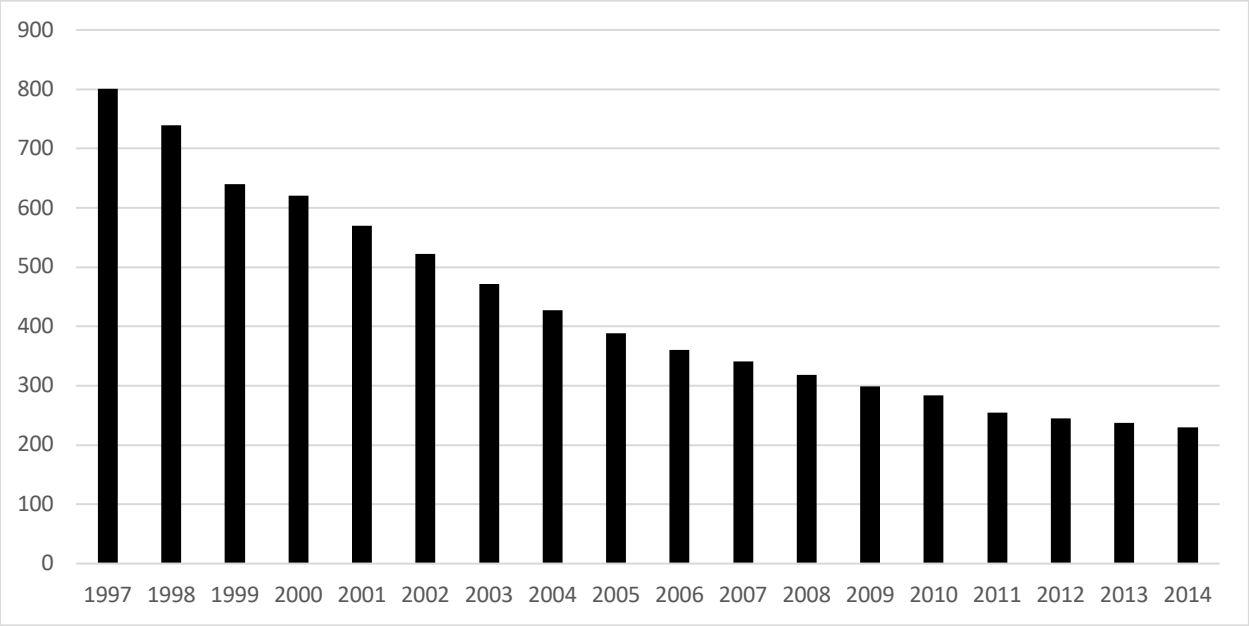
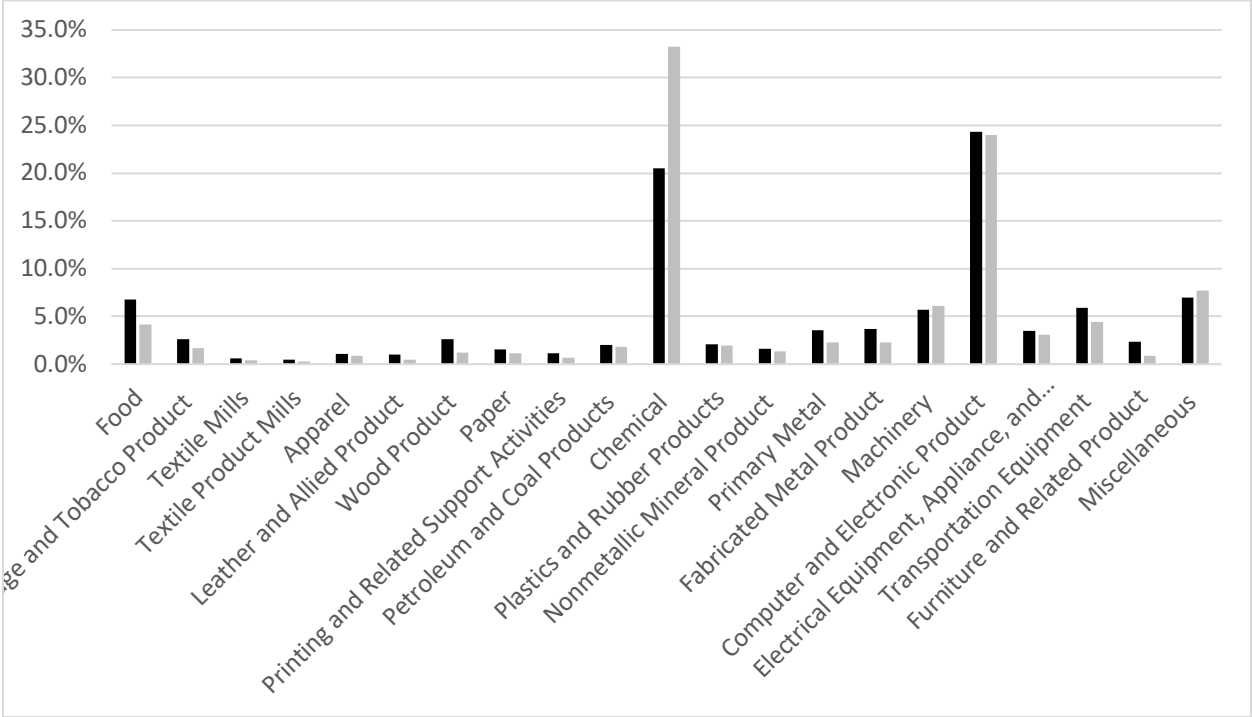


FIGURE 2
Number of Observations by Year



This figure shows the number of observations for our sample (N=7,730) 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
U.S.-incorporated manufacturing firm-years with non-missing one-year lagged total assets in COMPUSTAT (1997 - 2014)	41,505
Delete observations with sales less than $5 million	(10,606)
Delete observations with missing variables used in regressions	(9,756)
Delete multinationals	(13,413)
Main Sample (A)	**7,730**
Delete observations with missing Total Factor Productivity (TFP) **(B)**	(3,698)
Productivity Sample (A) – (B)	**4,032**

This table describes the sample selection procedure.

TABLE 2
Descriptive Statistics and Correlations

Panel A: Descriptive Statistics

	N	Mean	STD	Q1	Median	Q3
FORTAXCH $_{(t)}$	7,730	-0.006	0.006	-0.008	-0.004	-0.002
GM $_{(t)}$	7,730	0.264	0.439	0.188	0.315	0.467
ΔGM $_{(t+1,t+2)}$	7,730	0.007	0.167	-0.033	-0.002	0.030
PM_adj $_{(t)}$	7,730	0.442	0.332	0.223	0.367	0.597
ΔPM_adj $_{(t+1,t+2)}$	7,730	-0.006	0.229	-0.054	-0.006	0.038
RD $_{(t)}$	7,730	0.203	0.497	0.000	0.016	0.119
ΔRD $_{(t+1,t+2)}$	7,730	-0.005	0.176	-0.003	0.000	0.003
ADV $_{(t)}$	7,730	0.010	0.027	0.000	0.000	0.004
ΔADV $_{(t+1,t+2)}$	7,730	0.000	0.008	0.000	0.000	0.000
CAPEX $_{(t)}$	7,730	0.049	0.050	0.016	0.033	0.063
ΔCAPEX $_{(t+1,t+2)}$	7,730	-0.006	0.039	-0.017	-0.001	0.011
TFP $_{(t)}$	4,032	-0.460	0.437	-0.706	-0.457	-0.219
ΔTFP $_{(t+1,t+2)}$	4,032	-0.026	0.331	-0.169	-0.017	0.115
Sales Growth $_{(t)}$	7,730	0.170	0.412	-0.044	0.085	0.272
Average Sales Growth $_{(t+1,t+2)}$	7,730	0.125	0.278	-0.035	0.074	0.225
MVAL $_{(t)}$	7,730	4.629	1.693	3.374	4.573	5.805
MB $_{(t)}$	7,730	2.910	4.386	1.033	1.844	3.429
Capital-labor intensity $_{(t)}$	7,730	0.273	0.336	0.080	0.152	0.322
PPE $_{(t)}$	7,730	0.248	0.187	0.094	0.209	0.363
INTAN $_{(t)}$	7,730	0.096	0.154	0.000	0.020	0.131
Average CFO $_{(t+1,t+2)}$	7,730	0.016	0.178	-0.037	0.054	0.115
RET $_{(t)}$	7,730	0.169	0.651	-0.211	0.125	0.487
LEV $_{(t)}$	7,730	0.154	0.194	0.000	0.075	0.246
HHI $_{(t)}$	7,730	0.052	0.045	0.024	0.032	0.067
Industry Sales Volatility $_{(t)}$	7,730	0.057	0.042	0.027	0.043	0.073
Import Penetration $_{(t)}$	7,730	0.286	0.169	0.145	0.249	0.395
Changes in tariffs $_{(t)}$	7,730	-0.001	0.001	-0.001	0.000	0.000
Changes in foreign real FX $_{(t)}$	7,730	0.009	0.048	-0.029	0.005	0.047
Foreign GDP growth $_{(t)}$	7,730	3.757	1.753	2.709	3.818	4.769

TABLE 2 (continued)
Descriptive Statistics and Correlations

Panel B: Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	*FORTAXCH* $_{(t)}$	1.00	0.00	**0.02**	0.00	0.01	**0.04**	0.01	0.00	0.01	**0.01**	**-0.04**	0.01	**-0.01**	**0.07**	**0.18**	**0.14**	0.05	0.11	**-0.13**	**0.04**	0.10	**-0.02**	**0.07**
2	*ΔGM* $_{(t+1,t+2)}$		1.00	**0.45**	**-0.58**	-0.03	0.02	**0.53**	-0.06	**0.01**	**0.03**	-0.01	-0.05	-0.03	-0.03	-0.03	**0.00**	-0.01	-0.01	0.00	**0.00**	-0.03	0.03	-0.11
3	*ΔPM_adj* $_{(t+1,t+2)}$			1.00	**0.04**	**0.01**	0.03	**0.30**	**-0.09**	**-0.04**	0.01	**-0.08**	0.00	**-0.06**	0.00	**0.01**	0.00	-0.02	0.02	-0.01	**0.06**	0.00	0.00	0.01
4	*ΔRD* $_{(t+1,\ t+2)}$				1.00	**0.04**	-0.01	**-0.25**	0.03	0.00	0.01	**0.03**	0.02	**-0.01**	0.01	0.00	-0.01	-0.01	0.03	0.00	-0.01	**0.03**	-0.05	0.04
5	*ΔADV* $_{(t+1,\ t+2)}$					1.00	0.01	**-0.12**	0.00	0.02	0.01	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.02	0.05	-0.01	-0.01
6	*ΔCAPEX* $_{(t+1,\ t+2)}$						1.00	**0.09**	**-0.08**	-0.02	-0.01	0.00	**-0.20**	0.02	0.01	**0.06**	0.02	0.03	**-0.07**	-0.04	0.03	**0.14**	**-0.08**	0.00
7	*ΔTFP* $_{(t+1,\ t+2)}$							1.00	**-0.08**	**-0.04**	**0.05**	**-0.05**	0.01	-0.03	-0.01	0.03	0.00	-0.02	-0.01	**-0.06**	**0.19**	**0.03**	0.00	**0.00**
8	*Sales Growth (t)*								1.00	**0.23**	**0.21**	**0.16**	**-0.04**	**0.09**	**-0.08**	**-0.08**	-0.02	**-0.05**	-0.02	-0.03	-0.05	**0.16**	**0.08**	**-0.17**
9	*MVAL* $_{(t)}$									1.00	**0.29**	**0.37**	**0.11**	**0.08**	0.04	**0.06**	**-0.21**	0.07	**-0.11**	-0.12	**0.08**	**0.23**	**0.14**	**-0.31**
10	*MB* $_{(t)}$										1.00	**0.10**	**-0.10**	-0.01	**-0.10**	**-0.06**	0.00	-0.02	**-0.02**	-0.04	**-0.07**	**0.24**	**-0.02**	**-0.20**
11	*Capital–labor intensity* $_{(t)}$											1.00	**-0.14**	**0.05**	**-0.12**	0.04	-0.06	0.07	**-0.10**	**-0.11**	**-0.08**	0.05	**0.06**	**-0.45**
12	*PPE* $_{(t)}$												1.00	**-0.14**	**0.20**	0.06	**-0.38**	-0.04	0.06	**-0.10**	**0.28**	-0.01	**0.26**	**0.30**
13	*INTAN* $_{(t)}$													1.00	0.03	-0.02	-0.01	**0.05**	**-0.07**	0.02	0.05	-0.03	**0.21**	0.07
14	*HHI* $_{(t)}$														1.00	**0.10**	**-0.08**	**0.10**	**-0.09**	**0.14**	**0.18**	-0.01	**0.07**	**0.23**
15	*Industry Sales Volatility* $_{(t)}$															1.00	**0.28**	**0.27**	**-0.13**	-0.06	0.06	**0.07**	**-0.06**	**0.19**
16	*Import Penetration* $_{(t)}$																1.00	**0.16**	**-0.10**	**0.34**	**-0.11**	**0.01**	**-0.25**	**0.09**
17	*Changes in tariffs* $_{(t)}$																	1.00	**-0.30**	**0.02**	0.01	**0.03**	**-0.05**	**0.02**
18	*Changes in foreign real FX* $_{(t)}$																		1.00	**0.08**	0.02	**-0.03**	**0.05**	**0.04**
19	*Foreign GDP growth* $_{(t)}$																			1.00	0.01	**-0.12**	**-0.09**	0.13
20	*CFO* $_{(t+1,t+2)}$																				1.00	**0.07**	0.00	**0.37**
21	*RET* $_{(t)}$																					1.00	**-0.02**	**-0.05**
22	*LEV* $_{(t)}$																						1.00	-0.03
23	*Product Differentiation* $_{(t)}$																							1.00

* Bold indicates significance at the ten percent level.

Panel A presents descriptive statistics, and Panel B reports correlations for variables used in this paper. The sample comprises 7,730 U.S. domestic manufacturing firm-years over the period 1997 – 2014. The sample used for correlations with *ΔTFP* $_{(t+1,t+2)}$ includes 4,032 observations (1997 – 2014). Variable definitions are provided in Appendix E.

TABLE 3
Changes in Foreign Countries' Corporate Tax Rates and U.S. Domestic Manufacturing Firms' Pricing Decisions

Dependent variable =	(1) $\Delta GM_{(t+1,t+2)}$	(2) $\Delta PM\_adj_{(t+1,t+2)}$
FORTAXCH$_{(t)}$	**1.403****	**2.112****
	(2.45)	**(2.31)**
Sales Growth$_{(t)}$	-0.021***	-0.032***
	(-2.65)	(-2.61)
MVAL$_{(t)}$	0.002	0.008**
	(0.72)	(2.09)
MB$_{(t)}$	0.001**	0.003***
	(2.08)	(5.86)
Capital–labor intensity$_{(t)}$	-0.037**	-0.017
	(-2.03)	(-0.99)
PPE$_{(t)}$	-0.018	-0.117***
	(-1.58)	(-2.92)
INTAN$_{(t)}$	0.018	-0.089***
	(1.04)	(-3.44)
HHI$_{(t)}$	-0.113	-0.108
	(-1.45)	(-1.12)
Industry Sales Volatility$_{(t)}$	0.161***	0.176*
	(2.62)	(1.87)
Import Penetration$_{(t)}$	0.017	0.036
	(0.46)	(0.49)
Changes in tariffs$_{(t)}$	-2.131	-3.828*
	(-0.82)	(-1.70)
Changes in foreign real FX$_{(t)}$	-0.102	0.203
	(-1.15)	(1.59)
Foreign GDP growth$_{(t)}$	-0.003	0.006*
	(-1.25)	(1.90)
GP$_{(t)}$	-0.130***	
	(-9.81)	
PM_adj$_{(t)}$		-0.315***
		(-58.58)
Observations	7,730	7,730
R-squared	0.123	0.169

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on changes in U.S. domestic manufacturing firms' average gross margins and profit margins in years t+1 and t+2 from year t. The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix E. 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) $\Delta RD_{(t+1,\, t+2)}$	(2) $\Delta ADV_{(t+1,\, t+2)}$
FORTAXCH$_{(t)}$	**-2.188****	**0.000**
	(-2.35)	**(0.01)**
Sales Growth$_{(t)}$	0.004***	-0.000
	(5.76)	(-0.11)
MVAL$_{(t)}$	0.003***	0.000
	(3.11)	(0.67)
MB$_{(t)}$	0.001	-0.000
	(0.79)	(-0.17)
Capital–labor intensity$_{(t)}$	0.058***	-0.000
	(3.93)	(-0.14)
PPE$_{(t)}$	-0.045***	-0.001*
	(-2.97)	(-1.82)
INTAN$_{(t)}$	-0.062*	0.000
	(-1.90)	(0.03)
HHI$_{(t)}$	0.025	-0.001
	(0.44)	(-0.35)
Industry Sales Volatility$_{(t)}$	-0.165**	0.002
	(-2.43)	(0.53)
Import Penetration$_{(t)}$	-0.017	-0.002
	(-0.92)	(-0.85)
Changes in tariffs$_{(t)}$	0.694	0.099**
	(0.36)	(2.23)
Changes in foreign real FX$_{(t)}$	0.141	-0.008***
	(0.86)	(-2.79)
Foreign GDP growth$_{(t)}$	0.002	0.000
	(0.80)	(0.32)
RD$_{(t)}$	-0.121***	
	(-7.98)	
ADV$_{(t)}$		-0.068***
		(-5.75)
Observations	7,730	7,730
R-squared	0.090	0.063

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 E. 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 (continued)
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 =	$\Delta CAPEX_{(t+1,\ t+2)}$
***FORTAXCH*$_{(t)}$**	**-0.403*** **
	(-2.91)
$MVAL_{(t)}$	0.001***
	(4.66)
$MB_{(t)}$	0.000
	(0.05)
$CFO_{(t+1,t+2)}$	0.012**
	(2.44)
Sales Growth$_{(t)}$	0.002
	(1.47)
$RET_{(t)}$	0.006***
	(9.20)
$INTAN_{(t)}$	-0.010***
	(-5.41)
$PPE_{(t)}$	0.034***
	(5.96)
$LEV_{(t)}$	-0.011***
	(-4.62)
$HHI_{(t)}$	-0.077*
	(-1.81)
Industry Sales Volatility$_{(t)}$	0.042**
	(2.00)
Import Penetration$_{(t)}$	-0.015
	(-0.89)
Changes in tariffs$_{(t)}$	-0.615*
	(-1.74)
Changes in foreign real FX$_{(t)}$	-0.005
	(-0.26)
Foreign GDP growth$_{(t)}$	0.000
	(1.13)
$CAPEX_{(t)}$	-0.594***
	(-33.68)
Observations	7,730
R-squared	0.466

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 E. 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 =	$\Delta TFP_{(t+1,\ t+2)}$
FORTAXCH$_{(t)}$	**-3.507*** **
	(-3.81)
Sales Growth$_{(t)}$	-0.011
	(-0.38)
MVAL$_{(t)}$	0.028***
	(4.69)
MB$_{(t)}$	0.011***
	(4.01)
Capital–labor intensity$_{(t)}$	0.191***
	(5.37)
PP $_{(t)}$	-0.093
	(-1.57)
INTAN$_{(t)}$	0.033
	(0.76)
HHI$_{(t)}$	-0.522**
	(-2.04)
Industry Sales Volatility$_{(t)}$	0.495
	(1.31)
Import Penetration$_{(t)}$	-0.148
	(-0.90)
Changes in tariff $_{(t)}$	-7.189*
	(-1.75)
Changes in foreign real FX$_{(t)}$	0.283
	(1.58)
Foreign GDP growt $_{(t)}$	-0.011
	(-0.97)
TFP$_{(t)}$	-0.404***
	(-30.78)
Observations	4,032
R-squared	0.259

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 E. 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' Pricing Decisions

	(1)	(2)	(3)	(4)
Dependent variable =	$\Delta GM_{(t+1,t+2)}$		$\Delta PM\_adj_{(t+1,t+2)}$	
Product Differentiation	Low	High	Low	High
FORTAXCH $_{(t)}$	**2.844*** **	**-0.312**	**3.672** **	**0.511**
	(3.26)	**(-0.59)**	**(2.48)**	**(1.05)**
Test of High = Low p-value	0.011		0.083	
Control Variables	Y	Y	Y	Y
Observations	3,869	3,861	3,869	3,861
R-squared	0.131	0.131	0.185	0.169

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

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable =	$\Delta RD_{(t+1,\ t+2)}$		$\Delta ADV_{(t+1,\ t+2)}$		$\Delta CAPEX_{(t+1,\ t+2)}$	
Product Differentiation	Low	High	Low	High	Low	High
FORTAXCH $_{(t)}$	**-3.261*** **	**-0.408**	**0.023**	**-0.011**	**-0.609*** **	**-0.155**
	(-3.45)	**(-1.44)**	**(0.71)**	**(-0.18)**	**(-3.24)**	**(-1.37)**
Test of High = Low p-value	0.000		0.658		0.082	
Control Variables	Y	Y	Y	Y	Y	Y
Observations	3,869	3,861	3,869	3,861	3,869	3,861
R-squared	0.102	0.155	0.081	0.067	0.500	0.450

TABLE 6 (continued)
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 =		$\Delta TFP_{(t+1,\ t+2)}$	
Product Differentiation	Low		High
FORTAXCH $_{(t)}$	**-6.677*** **		**0.536**
	(-3.03)		**(0.23)**
Test of High = Low			
p-value	0.070		
Control Variables	Y		Y
Observations	2,020		2,012
R-squared	0.274		0.271

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: pricing (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 generally includes the years 1997 – 2014. Variable definitions are provided in Appendix E. 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
Heterogeneity in U.S. Domestic Manufacturing Firms' Total Factor Productivity

Panel A: Partitioning on Changes in Profitability

	(1)	(2)	(3)	(4)
Dependent variable =	$\Delta TFP_{(t+1,\ t+2)}$			
Partitioning variable =	$\Delta GM_{(t+1,t+2)}$		$\Delta PM\_adj_{(t+1,t+2)}$	
	Low	High	Low	High
***FORTAXCH*$_{(t)}$**	**-2.441***	**-3.051***	**-1.097**	**-4.937*****
	(-1.93)	**(-1.86)**	**(-0.66)**	**(-3.92)**
Sales Growth$_{(t)}$	-0.008	0.000	-0.015	-0.005
	(-0.19)	(0.01)	(-0.37)	(-0.23)
MVAL$_{(t)}$	0.019***	0.030***	0.027***	0.028***
	(2.83)	(5.89)	(5.34)	(4.61)
MB$_{(t)}$	0.010**	0.009***	0.013**	0.008***
	(2.17)	(5.32)	(2.41)	(3.61)
Capital–labor intensity$_{(t)}$	0.014	0.272***	0.156***	0.231***
	(0.25)	(7.28)	(7.32)	(4.53)
PPE$_{(t)}$	-0.038	-0.138***	-0.099	-0.066
	(-0.46)	(-3.00)	(-1.24)	(-1.01)
INTAN$_{(t)}$	0.140**	-0.036	0.087**	0.040
	(2.34)	(-0.87)	(2.00)	(0.79)
HHI$_{(t)}$	0.063	-0.736**	-0.183*	-0.325
	(0.33)	(-2.54)	(-1.83)	(-0.84)
Industry Sales Volatility$_{(t)}$	0.335	0.158	0.446	0.191
	(0.84)	(0.49)	(1.17)	(0.93)
Import Penetration$_{(t)}$	0.165	-0.160	-0.157	-0.027
	(1.05)	(-0.90)	(-1.09)	(-0.11)
Changes in tariffs$_{(t)}$	-3.761	-0.358	-8.676*	-0.952
	(-0.72)	(-0.06)	(-1.77)	(-0.24)
Changes in foreign real FX$_{(t)}$	0.648*	-0.189	0.140	0.362
	(1.86)	(-0.87)	(0.50)	(1.44)
Foreign GDP growth$_{(t)}$	-0.001	-0.012	0.001	-0.020*
	(-0.16)	(-1.24)	(0.12)	(-1.75)
TFP$_{(t)}$	-0.295***	-0.400***	-0.355***	-0.419***
	(-19.14)	(-17.82)	(-46.96)	(-17.99)
Test of High = Low				
p-value	0.823		0.124	
Observations	2,012	2,020	2,012	2,020
R-squared	0.189	0.377	0.227	0.321

TABLE 7 (continued)
Heterogeneity in U.S. Domestic Manufacturing Firms' Total Factor Productivity

Panel B: Probability of Performance-related Delisting

	(1)	(2)	(3)
Dependent variable =		*Delisted*$_{(t+1,\ t+5)}$ = 1	
Partitioning Variable =		*Average TFP*$_{(t-1,\ t)}$	
	All	Low	High
***FORTAXCH*$_{(t)}$**	**-11.756**	**-20.428****	**-12.746**
	(-1.41)	**(-2.35)**	**(-1.30)**
Sales Growth$_{(t)}$	0.057	-0.335***	0.231
	(0.54)	(-4.26)	(1.19)
MVAL$_{(t)}$	-0.782***	-0.780***	-0.725***
	(-10.15)	(-6.16)	(-3.78)
MB$_{(t)}$	-0.006	-0.002	-0.010
	(-0.68)	(-0.96)	(-1.26)
Capital–labor intensity$_{(t)}$	-0.214	-2.085	-0.833
	(-0.32)	(-1.12)	(-0.73)
PPE$_{(t)}$	0.996*	0.766	0.955
	(1.83)	(1.15)	(0.92)
INTAN$_{(t)}$	1.155**	1.918**	2.078**
	(2.05)	(2.08)	(2.26)
HHI$_{(t)}$	1.557	5.450	11.730
	(0.34)	(1.00)	(1.31)
Industry Sales Volatility$_{(t)}$	-1.329	-8.332*	-4.967
	(-0.43)	(-1.69)	(-1.45)
Import Penetration$_{(t)}$	-4.500	-4.875	-0.708
	(-1.39)	(-1.11)	(-0.20)
Changes in tariffs$_{(t)}$	52.156	86.917*	4.309
	(1.14)	(1.67)	(0.08)
Changes in foreign real FX$_{(t)}$	2.402	2.007	5.099**
	(1.05)	(0.56)	(2.14)
Foreign GDP growth$_{(t)}$	-0.117	-0.095	-0.287***
	(-1.16)	(-0.57)	(-2.66)
Test of High = Low			
p-value		0.327	
Observations	5,202	1,621	1,850
Pseudo R-squared	0.198	0.214	0.175

This table presents the results of examining heterogeneity in the effects of changes in foreign country statutory corporate tax rates on U.S. domestic manufacturing firms' productivity. Panel A shows the results of investigating the effect on productivity by changes in profitability and Panel B shows the results of estimating the probability of being delisted as a function of ex ante productivity. The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix E. 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
U.S. Multinational Manufacturing Firms

Panel A: U.S. Multinational Manufacturing Firms' Pricing Decisions

Dependent variable =	(1) $\Delta GM_{(t+1,t+2)}$	(2) $\Delta PM\_adj_{(t+1,t+2)}$
FORTAXCH $_{(t)}$	**-0.213**	**0.504**
	(-0.94)	**(1.24)**
Control Variables	Y	Y
Observations	13,413	13,413
R-squared	0.078	0.140

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

Dependent variable =	(1) $\Delta RD_{(t+1,\ t+2)}$	(2) $\Delta ADV_{(t+1,\ t+2)}$	(3) $\Delta CAPEX_{(t+1,\ t+2)}$
FORTAXCH $_{(t)}$	**-0.281**	**-0.036**	**-0.100**
	(-1.51)	**(-1.49)**	**(-1.26)**
Control Variables	Y	Y	Y
Observations	13,413	13,413	13,413
R-squared	0.078	0.044	0.435

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

Dependent variable =	(1) $\Delta TFP_{(t+1,\ t+2)}$
FORTAXCH $_{(t)}$	**-0.939**
	(-0.92)
Control Variables	Y
Observations	10,989
R-squared	0.236

This table presents the results of examining the effect of changes in foreign country statutory corporate tax rates on various outcomes for U.S. multinational manufacturing firms in years t+1 and year t+2: pricing (Panel A), R&D, advertising, and capital expenditures (Panel B), and total factor productivity (Panel C). The sample includes the years 1997 – 2014. Variable definitions are provided in Appendix E. 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 9
The Effects of Changes in Foreign Countries' Corporate Tax Rates in U.S. Multinational Manufacturing Firms: The Role of Product Differentiation

Panel A: U.S. Multinational Manufacturing Firms' Pricing Decisions

	(1)	(2)	(3)	(4)
Dependent variable =	$\Delta GM_{(t+1,t+2)}$		$\Delta PM\_adj_{(t+1,t+2)}$	
Product Differentiation	Low	High	Low	High
FORTAXCH $_{(t)}$	**-0.431**	**-0.013**	**0.605**	**0.298**
	(-0.78)	**(-0.06)**	**(0.97)**	**(1.08)**
Test of High = Low p-value	0.458		0.149	
Control Variables	Y	Y	Y	Y
Observations	6,710	6,703	6,710	6,703
R-squared	0.091	0.056	0.156	0.157

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

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable =	$\Delta RD_{(t+1,\ t+2)}$		$\Delta ADV_{(t+1,\ t+2)}$		$\Delta CAPEX_{(t+1,\ t+2)}$	
Product Differentiation	Low	High	Low	High	Low	High
FORTAXCH $_{(t)}$	**-0.519***	**0.016**	**-0.061****	**-0.027**	**-0.163**	**-0.027**
	(-1.65)	**(0.24)**	**(-2.07)**	**(-1.10)**	**(-1.64)**	**(-0.25)**
Test of High = Low p-value	0.129		0.423		0.247	
Control Variables	Y	Y	Y	Y	Y	Y
Observations	6,710	6,703	6,710	6,703	6,710	6,703
R-squared	0.087	0.139	0.074	0.041	0.430	0.453

TABLE 9 (continued)
The Effects of Changes in Foreign Countries' Corporate Tax Rates in U.S. Multinational Manufacturing Firms: The Role of Product Differentiation

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

	(1)		(2)
Dependent variable =		$\Delta TFP_{(t+1,\ t+2)}$	
Product Differentiation	Low		High
FORTAXCH $_{(t)}$	**-0.839**		**-0.869**
	(-0.43)		**(-1.13)**
Test of High = Low			
p-value	0.985		
Control Variables	Y		Y
Observations	5,499		5,490
R-squared	0.250		0.245

This table presents the results of examining whether the effects of changes in foreign country statutory corporate tax rates on U.S. multinational manufacturing firms vary with product differentiation: pricing (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 E. 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 10
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$_{(t)}$	**-1.133**
	(-1.10)
MVAL$_{(t)}$	0.018**
	(1.97)
MB$_{(t)}$	0.005**
	(2.37)
Capital–labor intensity$_{(t)}$	0.058***
	(5.00)
PPE$_{(t)}$	-0.037
	(-1.04)
INTAN$_{(t)}$	-0.037
	(-1.17)
HHI$_{(t)}$	-0.258
	(-0.82)
Industry Sales Volatility$_{(t)}$	0.445**
	(2.26)
Import Penetration$_{(t)}$	-0.006
	(-0.04)
Changes in tariffs$_{(t)}$	-10.984**
	(-2.16)
Changes in foreign real FX$_{(t)}$	0.566***
	(3.80)
Foreign GDP growth$_{(t)}$	-0.010*
	(-1.87)
Sales Growth$_{(t)}$	0.070***
	(3.36)
Observations	7,730
R-squared	0.114

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 E. 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.