Foreign Competition and the Durability of US Firm Investments

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Abstract

How does the exposure to product market competition affect the investment horizon of firms? When tougher competition reduces future profitability, firms have an incentive to shift investments towards more short-term assets. To study this mechanism empirically, we formulate a stylized theoretical framework of firm investments and derive a within-firm estimator that uses variation across investments with different durabilities. We exploit the Chinese WTO accession as a competition shock for US firms to estimate the effects of product market competition on the composition of firm investments using expenditures across different assets within listed US manufacturing companies. We find that firms that experienced tougher competition shifted their expenditures towards investments with a shorter durability. We find this effect to be relatively larger for firms with lower total factor productivities.

Keywords: import competition, firm investment behavior, investment life-span, short-termism

JEL classification: F14, F36, F65, G32, L20, D22

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1 Introduction

Firms invest in expectation of some future benefits. A vigorous policy debate is in progress over the origins and consequences of short-term corporate behavior: when firms in the economy face short-term incentives and do not invest sufficiently long-term into assets that pay off in distant future, this can be impedimental for economic growth. Since short-term investments depreciate earlier, net investments tend to fall and firms need refinance more frequently.[1] The literature has identified that credit crunches, uncertainty, investor pressures or agency problems can be causal for short-term investment behavior (see Aghion et al. (2010), Garicano and Steinwender (2016), Terry (2015), Garicano and Rayo (2016) and Bénabou and Tirole (2016)). In this paper, we put forward another reason for corporate short-termism: we argue that foreign competition can induce firms to distort investments away from assets that pay off in distant future towards short-term assets.

Falling trade barriers leading to a dramatic rise in international trade flows are a defining feature of the past century. The associated increase in competitive pressure from abroad can threaten domestic firms and affect their investment behavior. When tougher competition reduces the expectations of future profitability, firms have an incentive to shift investments towards more short-term assets.

To guide our empirical analysis, we provide a simple model. We consider a firm in a two-period economy which engages in two types of investment: a short-term one and a long-term one. While short-term investments reduce production costs today and yield an immediate payoff, investments into more durable assets reduce future production costs and therefore pay off at a later point in time.[2] When tougher competition from abroad reduces the rents on long-term investments, firms are incentivized to shift their investment expenditures towards nondurable investments. To estimate the effect of foreign competition on the investment composition inside firms, we use our model to derive a within-firm difference-in-differences estimator. Our model predicts that within a firm in a given year, tougher foreign competition should lead to a *relatively* larger reduction in long-term investments vis-à-vis short-term investments. Consider for example a firm that chooses between investing into computer equipment or some new machinery where computers depreciate faster than machinery. In the optimum, the firm invests such that the return on the marginal investment are equal for both categories. If competition now reduces profits in the long-run, this diminishes returns on machinery and the firm tilts its investments towards computers.

We use data for the population of stock listed manufacturing firms in the US between 1995 and 2009 and exploit the Chinese WTO accession in 2001 as a natural experiment to study how a change in competition prospects shapes the investment composition inside firms. After China was granted WTO membership in 2001, the US Congress was not anymore in the position to annually ratify tariff rates on Chinese imports. We argue that this abolition of the opportunity to protect US industries led to an increase in the exposure to competition from China, particularly for firms in industries

[1] According to Bureau of Economic Analysis data, there has been a fall in the fraction of net investments in gross investments of US private businesses during the period between 1995 and 2009 suggesting that a larger proportion of gross investments was conducted to replace old capital stock.

[2] The same argument holds when investments increase the perceived-quality of goods instead of reducing production costs.

that historically have been protected by high tariffs. Furthermore, firms in US industries that are more low-skill-intensive in their production might also be affected more severely since these industries face comparative disadvantages vis-à-vis Chinese producers. Since listed firms disclose investment expenditures across different asset categories which differ in their durability, we can exploit variation in durability across asset groups to distinguish between short- and long-term investments similar to Garicano and Steinwender (2016).[3] With the data at hand, we estimate how changes in the sectoral degree of competition lead to a shift of investments within firms. Based on our sample of listed manufacturing firms, we find that increasing Chinese import competition reduced the most durable investments more than the least durable investments. The estimated economic significance of our estimates compares to the effect that Garicano and Steinwender (2016) estimate for the financial crisis on investment of Spanish firms.[4]

We find this result to be robust to controlling for several alternative channels that could counteract our results. First, the level of import competition could for instance be correlated with developments in the domestic industry. For example, if US industries become more productive over time, this might lead to relatively more long-term investments and a lower level of import competition. Therefore, we control for changes in total factor productivity, capital- and low-skill-intensity of the US manufacturing industries. Second, we find our results to be robust to controlling for foreign inputs, export opportunities or financial frictions and alternative measures of investment lifespans. Lastly, as our estimation is based on the within-firm responses across investment categories, we are able to take account for potential alternative firm-specific demand or technology shocks.

Since the residual demand is relatively more elastic for less profitable firms, we expect that we observe stronger adjustments of the investment composition to an increase in foreign competition within the less productive firms of each industry. Thus, we expect that firm heterogeneity matters for the relative size of this effect. Consider for example two different firms that choose to invest into computers or machinery, one firm with higher unit costs than the other. While tougher competition shifts up the residual demand price elasticities for both firms at any given demand level, the long-term profits for the firm with higher costs fall more compared to the profits of the firm with lower costs since the high-cost firm charges higher prices and a lower mark-up. Therefore, we expect a stronger shift away from long-term machinery investments inside firms with lower productivity. We investigate this role of firm heterogeneity on investment responses empirically and find support for that prediction. When comparing investment responses across the within-industry TFP distribution, we find that shifts in investments towards less durable assets as a response to foreign competition are more vigorous among low productivity firms.

Generally, our paper relates to the literature that analyzes within-firm adjustments to international competition. Bloom et al. (2016), Hashmi (2013) and Gorodnichenko et al. (2010) examine the impact of foreign competition on innovation activities inside firms. Bustos (2011) and Lileeva and Trefler

[3]Specifically, we consider seven investment categories which we group according to their durability by means of depreciation rates derived from accounting rules: Advertising expenditures, Computer expenditures, expenditures on R&D, expenditures on Transportation Equipment, expenditures on Machinery, expenditures on Buildings and expenditures on Land.

[4]See subsection 4.4 for a deeper discussion of the economic magnitudes.

(2010) study how access to foreign markets can induce investments in technology upgrading. While these studies analyze the *absolute* level of firm investments and innovation activities in response to trade liberalization, our focus is on changes in the *composition* of investments within firms with respect to more or less durable assets. Furthermore, the literature on multiproduct firms suggests that the exposure to tougher foreign competition incentivizes firms to shift their product portfolio towards their core products (see e.g. Eckel and Neary (2010), Bernard et al. (2010) or Mayer et al. (2014)). While these studies analyze within firm adjustments to competition with respect to the production side of firms, our study considers a within firm adjustment with respect to the capital side of firms.

Furthermore, since investments are inherently a forward-looking factor choice, we also contribute to a growing literature that analyzes how economic conditions affect the beliefs of economic agents and determine firm decisions (see Bachmann et al. (2017), Buchheim and Link (2017), Coibion et al. (2015), Chen et al. (2017) and Gennaioli et al. (2016)). We think that there are at least two channels how the increase in Chinese import competition can affect the durability of investments. First, when the *realization* of tougher competition lowers profits, firms could expect to become insolvent with a higher probability as suggested by the selection mechanism in models of firm heterogeneity à la Melitz (2003).[5] Second, the *expectation* of tougher competition in the future might let firms expect lower future price-cost margins and thus a lower return on long-term investments. Since both economic mechanisms reduce the expected quasi-rents from durable investments such that competition discourages investments into durable assets, we do not aim to distinguish between them and rather aim to estimate the joint effect of competition.

Our paper is also related to a nascent literature that studies the impact of international trade on corporate finance. Fresard (2010) finds that large corporate cash holdings lead to systematic future market share gains at the expense of industry rivals when an industry is hit by an import competition shock. Valta (2012) studies how the costs of bank credit respond to foreign competition and finds that firms face higher loan spreads when import competition toughens. Xu (2012) studies the financing response during periods of higher competition and finds that firms reduce their leverage by issuing equity and selling assets to repay debt when experiencing increases in import competition. While previous studies show that credit constraints determine firms' opportunities to participate in exporting (see e.g. Manova (2013), Foley and Manova (2015)), our paper studies the impact of foreign competition on the composition of firm investments which affects demand for credit itself.

The remainder of the paper is structured as follows. Section 2 presents the theoretical framework, section 3 discusses the competition shock to US producers arising from the Chinese WTO accession, section 4 describes the data, identification and empirical results. Finally, section 5 concludes.

2 Theoretical Framework

To understand the impact of competition on the investment behavior of a firm, we lay out a framework which incorporates the inter-temporal investment decision of a firm with respect to short- and long-

[5] Garicano and Steinwender (2016) study this channel empirically in light of a credit crunch.

term investments. The main goal of the section is to guide our empirical work.

Demand and Industry Structure

We consider an economy that exists for two time periods $t \in \{0, 1\}$. During each period t the economy is composed of L_t consumers and firms face linear demand since consumers derive their demand from a linear-quadratic utility function following Melitz and Ottaviano (2008):

$$q_{it} = A_t - \frac{L_t}{\gamma} p_{it}, \tag{1}$$

where the intercept is given by $A_t \equiv \frac{L_t}{N_t+\gamma} + \frac{N_t}{N_t+\gamma}\frac{L_t}{\gamma}\bar{p}_t$. The degree of product differentiation is described by γ, N_t reflects the number of consumed varieties and $\bar{p_{it}} = (1/N_t)\int_{i\in\Omega_t} p_{it}di$ characterizes the average price level in the economy. Tougher competition translates into a lower demand intercept A_t which implies that firms face a lower demand level q_{it} for any given price p_{it}. Linear demand implies an upper price bound $p_t^{max} = \frac{\gamma}{N_t+\gamma} + \frac{N_t}{N_t+\gamma}\bar{p}_t$ at which a firm's demand is driven to zero. This upper price bound p_t^{max} is an inverse measure of the toughness of competition. A larger degree of differentiation γ, a larger mass of competing varieties N_t or a lower average price level $\bar{p}_t$ all trigger a decline in the price bound p_t^{max} such that firms are forced to charge lower prices in order to generate positive demand for their product.[6] Most importantly, firms face a larger price elasticity of demand if they set higher prices or if the intensity of competition in the economy increases.[7]

Production and Investment Decision

Production occurs at constant returns to scale with marginal costs c^*. We assume that profit maximizing firms can opt for two types of investment in order to reduce their marginal costs of production c^*.[8] Short-term investments k reduce the unit costs of production instantaneously to $c_0 = c^* - (c^*)^\theta k^{0.5}$ in period 0. Long-term investments z yield larger productivity gains which however only materialize during the subsequent period 1 and reduce the firm's unit production costs to $c_1 = c^* - \varphi (c^*)^\theta z^{0.5}$ with $\varphi > 1$.[9] Higher levels of investment relate to lower unit costs with decreasing returns to scale.[10] The magnitude of cost reductions however depends on firm productivity c^* and the parameter θ. With $\theta > 0$ a unit of investment reduces marginal costs to a larger extent for less productive firms whereas $\theta < 0$ implies that low cost firms are more efficient in cutting costs. For the sake of simplicity, we assume a unit of short-term investment k and long-term investment z are both equally costly and require r units of labor to finance the investment.

[6] For $\gamma > 0$, consumers value product differentiation. If $\gamma = 0$, the firms produce perfect substitutes and consumers only focus on the total level of consumption. A rise in γ however implies that the degree of differentiation augments and consumers care more about the distribution of consumption levels across different firms. An alternative isomorph model leading to a similar linear demand curve is Salop (1979) which assumes that consumers have idiosyncratic preferences for an ideal product.

[7] The price elasticity of demand is given by $\varepsilon_{it} \equiv |(\partial q_{it}/\partial p_{it})(p_{it}/q_{it})| = [(p_t^{max}/p_{it}) - 1]^{-1}$. This stands in contrast to a CES demand where price elasticity is uniquely determined by the level of product differentiation γ.

[8] In the Appendix A.1, we assume that investments raise perceived-quality and outline an isomorph model approach that leads to the same estimator as derived here.

[9] The basic set-up of the investment function is akin to Dhingra (2013).

[10] In order for the effective marginal costs c not to become negative, investments k and z are restricted by firm productivity c^*. This however is no critical assumption since our primary interest is in the composition and not in the absolute level of short- and long-term investments.

In both periods firms compete on a monopolistically competitive market and take the average price level $\bar{p_t}$ as well as the number of varieties N_t as given. This yields profits given by

$$\pi\left(c_t\right) = \frac{L_t}{4\gamma}\left(c_t^D - c_t\right)^2. \tag{2}$$

If a firm's unit costs are just as high such that it earns zero profits, it is indifferent about remaining in the industry. This firm is characterized by marginal costs of production c_t^D such that $p\left(c_t^D\right) = c_t^D = p_t^{max}$. Thus, c_t^D reflects the intensity of competition in the economy as the threshold incorporates the impact of both, the average price level and the number of firms. A reduction in c_t^D implies a rise in the toughness of competition, as firms need to exhibit lower costs of production in order to produce profitably. Moreover, c_t^D integrates the impact of competition on firms' prices, demand and profits. Intuitively, more productive firms with lower c_t charge lower prices for which reason they generate larger demand and earn higher profits. Beyond that, they face a lower price elasticity of demand which allows them to set higher mark-ups of price over marginal costs. An increase in market size L_t raises profits whereas more intense competition, reflected by a reduction in c_t^D, decreases demand and squeezes mark-ups implying that firms loose earnings.

Having explained the basic organization of production, we now turn towards firm investments and the choice between short- and long-term investments. Taking the size of the market L_t and the level of competition c_t^D as given, the firm optimizes profits discounted with a factor $\delta \in (0,1)$ over time

$$\max_{k,z} \pi\left(c_0\right) + \left(1-\delta\right)\pi\left(c_1\right) - rk - rz. \tag{3}$$

Determining the first order conditions with respect to short- and long-term investments and solving for the optimal level of k and z yields

$$k^{0.5} = \left[\frac{4\gamma r}{L_0} - \left(c^*\right)^{2\theta}\right]^{-1}\left(c_0^D - c^*\right)\left(c^*\right)^{\theta} \tag{4}$$

$$z^{0.5} = \left[\frac{4\gamma r}{L_1\left(1-\delta\right)\varphi} - \varphi\left(c^*\right)^{2\theta}\right]^{-1}\left(c_1^D - c^*\right)\left(c^*\right)^{\theta}. \tag{5}$$

From equations (4) and (5) it becomes clear that stronger competition (smaller c^D) reduces the marginal return of investment and thus diminishes investment volumes. However, we are not interested in the effects on the investment *volume* of firms but want to study the *composition* of investments inside firms. Building ratios of equations (4) and (5) and taking logs finally leaves us with the following expression for the relative composition of short-term and long-term investments k and z:

$$\begin{aligned}&\ln\left(k\right) - \ln\left(z\right) = \\ &2\left\{\left[\ln\left(c_0^D - c^*\right) - \ln\left(c_1^D - c^*\right)\right] - \left[\ln\left(\tfrac{4\gamma r}{L_0} - \left(c^*\right)^{2\theta}\right) - \ln\left(\tfrac{4\gamma r}{L_1(1-\delta)\varphi} - \varphi\left(c^*\right)^{2\theta}\right)\right]\right\}.\end{aligned} \tag{6}$$

The Impact of Competition on Investment Composition

We now analyze the effect of competition on the relative composition of short-term and long-term investments. When competition rises ($c_1^D < c_0^D$) firms' profits in period 1 fall which in turn diminishes the value of long-term investments relative to short-term investments. As such, firms have an incentive to adjust their investment composition towards short-lived investments when they expect competition to become tougher in period 1. Figure 1 illustrates the effect. Firms choose the investment composition that equalizes the marginal return of short- and long-term investments.[11] The optimal composition of investments (k^*, z^*) is therefore given by the intersection of the marginal return of short- (MR_k) and long-term investments (MR_z). According to our model, an increase in the intensity of competition reduces the return of long-term investments for any level of z thereby shifting the MR_z-curve downwards (the red, dashed curve). A new intersection of both marginal return curves emerges giving rise to a larger fraction of short-term investments and a smaller fraction of long-term investments.

In order to empirically identify the investment distortion created by Chinese competition, we compare the investment composition of a firm expecting an increase in import competition $(\triangle comp > 0)$ with the investment composition of a firm expecting no increase in import competition $(\triangle comp = 0)$. If the firm expects import competition to increase between period 0 and period 1, relative investments $[\ln(k) - \ln(z)]^{\triangle comp>0}$ are given by equation (6). If the level of competition however remains unchanged and $c_1^D = c_0^D$ it follows that

$$[\ln(k) - \ln(z)]^{\triangle comp=0} = -2\left\{\ln\left(\frac{4\gamma r}{L_0} - (c^*)^{2\theta}\right) - \ln\left(\frac{4\gamma r}{L_1(1-\delta)\varphi} - \varphi(c^*)^{2\theta}\right)\right\}. \tag{7}$$

Hence, with a constant level of competition the relative investments are exclusively determined by market size in both time periods. Subtracting the investment composition in the case with constant competition (7) from the investment composition in the case with increasing competition (6) provides us with the following difference-in-differences equation identifying the shift in the relative composition of investments induced by tougher competition

$$[\ln(k) - \ln(z)]^{\triangle comp>0} - [\ln(k) - \ln(z)]^{\triangle comp=0} = \ln\left(c_0^D - c^*\right) - \ln\left(c_1^D - c^*\right). \tag{8}$$

Summing up, international competition from abroad entails tougher competition in period 1. This lowers firms' market power and profits such that the value of long-term investments relative to short-term investments is reduced. Thus, an increase in import competition incentivizes firms to shift their investment expenditure towards investments characterized by a shorter lifespan. Based on these theoretical considerations we derive the following testable prediction.

Prediction 1: *The prospect of tougher import competition increases the amount of short-term relative to long-term investments.*

From our difference-in-differences equation (8) it becomes obvious that the size of the investment shift depends on the parameter c^*. For less productive firms, the relative loss in profits in period 1 compared to period 0 is more pronounced than for more productive firms. While all firms lose profits and market power, the relative change in profits across time decreases with firm productivity.

[11] If a firm expected a larger return in one type of investment than in the other, the firm would invest more into that investment type. Since we assumed decreasing marginal returns, the firm would increase investments until marginal returns are equalized.

Accordingly, this leads to a smaller reduction in the marginal return of long-term investments MR_z relative to the marginal return of short-term investments MR_k for more productive firms. Thus, less productive firms with a more elastic residual demand curve shift their composition of investments to a larger extent towards more short-lived investments.

Prediction 2: *The prospect of tougher import competition increases the amount of short-term relative to long-term investments more for less productive firms.*

3 The Chinese WTO Accession and Product Market Competition in the United States

We exploit a quasi-natural experiment based on the competition effect caused by China's accession to the WTO. The admission of China to the WTO was preceded by a lengthy process of negotiations since China's application for WTO membership status in December 1995. From 1995 onwards, multilateral bargaining at WTO level as well as bilateral bargaining between China and individual WTO members paved the way for China's actual admission in 2001. In particular, the Clinton administration played a key role in China's path to WTO accession by negotiating a bilateral trade agreement with the Chinese administration in 1999. This US-China Bilateral WTO Agreement already covered trade liberalization for many industrial goods and eased China's entry to the WTO since China gained the crucial support of the United States in its effort to join the WTO. Figure 2 plots monthly competition from Chinese imports and US newspaper coverage on the Chinese WTO accession over the sample period 1995-2010.[12] Import competition from China has increased substantially over that period, especially since the period between the US-China Bilateral Agreement and the WTO accession. Furthermore, the newspaper index peaks around the period between the US-China Bilateral Agreement and the WTO accession.

We think that the Chinese WTO accession is a useful quasi-natural experiment experiment to test our theory for mainly three reasons. First, Autor et al. (2016) argue that China's comparative advantage in industrial goods implies that China's growth resulted primarily in a large supply shock for manufacturing goods and a large demand shock for raw materials. Given that US imports from China vastly exceeded US exports to China, this suggests that our identification strategy is likely going to capture manufacturing import competition rather than export potential.[13] Furthermore, there was cross-sectoral variation on the magnitude of competition changes due to Chinese entry threats since the level of pre-WTO tariffs on Chinese goods varied substantially.[14]

[12]The aggregate monthly import competition from China is obtained from the US Census. It is calculated as imports from China divided by manufacturing sales plus Chinese imports less Chinese exports (all not seasonally adjusted). The news index plots the fraction of articles published about China, the WTO or trade policy (searching for the terms `(`*`China`* `OR` *`Chinese`*`) AND (`*`import`* `OR` *`WTO`* `OR` *`trade policy`* `OR` *`World Trade Organization`*`)` in the Nexis newspaper database) published during 1995 - 2009 in the newspaper outlets New York Times, Washington Post, Wall Street Journal or USA Today.

[13]Bloom et al. (2016), Iacovone et al. (2013) and Utar (2014) also use the WTO accession of China as a natural experiment for an increase in import competition.

[14]See for example `https://clintonwhitehouse4.archives.gov/textonly/WH/New/WTO-Conf-1999/factsheets/fs-004.html` for an overview of negotiated tariff schedules from the Clinton administration.

Second, China's accession to the WTO, and the dramatic increase of exports to the world that followed thereafter, was driven mostly by the change in China's internal conditions and not by the rising import demand of receiving countries.[15] As Autor et al. (2013) point out, this interpretation is corroborated by the fact that China had an average annual TFP growth in manufacturing of 8% during that time, compared to only 3.9% for the US. Autor et al. (2016) cite several studies indicating that the prospect of formal WTO accession was a major force stimulating the underlying restructuring of the manufacturing industry. The increasing privatization of public enterprises, the extension of trading rights for private firms, greater access to imported intermediates and a solidification of the MFN status, providing security to Chinese exporters, all helped to foster a new level of productivity growth after 2001. Thus, although China had already been granted most-favored nation status (MFN) during the 80s, the surge in exports significantly accelerated after 2001. This surge can be treated as mostly exogenous to dynamics in the US market which is crucial for identification.[16]

Third, as noted by Pierce and Schott (2016), the change in China's WTO membership status in 2001 had an effect that, in line with our theoretical framework, allows us to effectively interpret China's WTO accession as fundamental competition shock. It ended the uncertainty associated with the requirement of annual extensions of China's MFN status. Even before China was granted permanent MFN status in 2001, it was subject to the same tariff rates that applied to other member countries. However, according to US law, these tariff rates required annual approval by the US Congress. Pierce and Schott (2016) document that between 1990 and 2001, the average vote in the Congress against renewal of China's MFN status was 38 percent. If China had lost its MFN status, tariff rates would have increased to a much higher non-MFN tariff schedule. After China was granted WTO membership in 2001, this probability of higher protectionism due to an abolishment of the MFN status was omitted and China was granted a permanent MFN status.[17] We argue that this policy change reduced the expected profitability of long-term investments for US firms due to tougher competition from China, as domestic industries effectively had lost the option to fight China's MFN status through Congress.[18]

4 Empirical Analysis

4.1 Identification

Equation (8) serves as theoretical guideline to set up our baseline econometric estimation strategy in order to identify the effect of import competition on the composition of firm investments. Based on equation (8) we derive the following difference-in-differences specification where I_{isct} denotes

[15] Between 2000 and 2007, the low-income country share of US imports almost doubled from 15 to 28%, with China accounting for 89% of this growth. Compare Autor et al. (2013).

[16] See Iacovone et al. (2013) for a similar argument.

[17] Pierce and Schott (2016) also point out that China's WTO membership still led to a substantial reduction in *expected* US imports tariffs on Chinese goods. Interestingly, *actual* tariffs remained relatively stable from the year 2000 onward.

[18] Besides the reduction on the expected return on long-term investments, the reduction in uncertainty related to the WTO accession should ceteris paribus increase investment horizons. Therefore, we think that this mechanism leans our estimates against finding an effect of competition on shorter investment horizons.

investments by firm i in investment category c at time t:

$$\ln(I_{isct}) = \beta_0 + \beta_1 \times Post2000_t \times Pre\text{-}WTO\text{-}Tariffs_s \times Depr_c + \mathbf{X'_{isct}}\zeta + \lambda_{c/t} + \lambda_{it} + \varepsilon_{isct}, \quad (9)$$

where $Depr_c$ reflects the depreciation of an investment category c. In order to distinguish between long- and short-term investments, we rank each firm's investments into different assets according to their time to payoff (inverse depreciation rate). We follow here the approach suggested by Garicano and Steinwender (2016) and exploit expenditures on Advertising, Computer Equipment, R&D, Transportation Equipment, Machinery Equipment as well as on Buildings and Land. In our specification, the rate of duration follows an ordering where a higher ranking implies a more short-lived investment category. Alternatively, we also use depreciation rates. By taking the natural logarithm of investment expenditures, we exclude zeros from our estimations. However, since we consider the universe of stock listed manufacturing firms, zero investments occur relatively rarely in our data.[19] $\mathbf{X'_{isct}}$ is a vector of control variables. $\lambda_{c/t}$ are fixed effects for different investment categories (or category-year fixed effects) and λ_{it} are fixed effects for firm-year combinations which sweep out unobserved firm-specific factors that vary across time and affect the investment decisions of firms. Notably, this includes demand shocks, credit shocks or technology shocks as long as they do not affect short- and long-term investments differently. Identification is therefore based on variation across investment categories *within* a firm for a given year.

Most importantly, in this specification β_1 identifies the distortion in the relative composition of firm investments created by tougher competition and reflected in our theoretical model in equation (8).[20] Following *Prediction 1*, if import competition leads firms to adjust their composition of investments towards short-term investment categories, the coefficient of interest is expected to be positive ($\beta_1 > 0$). We argue that the loss of an opportunity to seize protectionist actions was especially important for industries that were traditionally shielded from foreign competition. Therefore, we use the average US tariff level on Chinese imports by industry during the period *preceding* the WTO accession of China as our treatment variable for affected industries. Technically, this approach is related to Guadalupe and Wulf (2010). Specifically, we use the US effectively applied import tariff *vis-à-vis* China, averaged over the years 1995 to 1999 and specific to firms within US SIC 3 digit industries. $Post2000_t$ is a dummy variable equal to one for years within the panel which succeed China's WTO entry. $Pre\text{-}WTO\text{-}Tariffs_s$ represents the average US tariff level on Chinese imports by industry between 1995 and 1999. The coefficient of interest is the interaction of a post-2000 dummy with the pre-trade-agreement level of tariffs and our proxy for the depreciation of an investment category (β_1). In our baseline specifications, we restrict our sample period to the years around the WTO accession, either from 1999 to 2003 or from 2000 to 2002. By exploiting the competition effect triggered by China's WTO accession as a quasi-natural experiment, we aim to provide evidence of capturing a causal and economically significant effect.

[19] See Table 2 for the amount of zeros and missing observations in investment categories. Furthermore, we also estimate our empirical models where we use the inverse hyperbolic sine transformation instead of taking logarithms to keep the zeros in the estimation sample.

[20] $\beta_1 = [\ln(k) - \ln(z)]^{\triangle comp>0} - [\ln(k) - \ln(z)]^{\triangle comp=0}$

Alternatively, we estimate equation (8) using Chinese import competition directly as a regressor:

$$\ln\left(I_{isct}\right) = \beta_0 + \beta_2 \times \ln\left(ImpComp_{st}\right) \times Depr_c + \mathbf{X'_{isct}}\zeta + \lambda_{c/t} + \lambda_{it} + \varepsilon_{isct}, \tag{10}$$

where $ImpComp_{st}$ is our proxy for the exposure of Chinese import competition in year t which varies across US SIC three digit industries s and over time t.[21] Also here, we expect a positive coefficient of interest $\beta_2 > 0$. Since the coefficient estimate β_2 might suffer from endogeneity bias, for instance when lower long-term US investments attract more import competition from China, we also estimate (10) where we instrument $\ln\left(ImpComp_{st}\right)$ with the interaction between the post-2000 dummy with the pre-trade-agreement level of tariffs used in the empirical models (9).[22]

4.2 Data

We employ data on the population of listed manufacturing firms in the US for the years 1995 - 2009. The firms in our sample are obtained from the CRSP database. We match all CUSIP identifiers in the CRSP database for firms with a primary US SIC industry code between 2000 and 3999 with firm-level information from the Compustat and the Worldscope databases. Overall, we end up with 4,428 stock market listed manufacturing firms in our sample. Table 13 describes the variables and their data sources.

Measuring Firm Investments

We follow the approach suggested by Garicano and Steinwender (2016) and exploit expenditures on Advertising, Computer Equipment, R&D, Transportation Equipment, Machinery Equipment as well as on Buildings and Land. Garicano and Steinwender (2016) assign the following depreciation rates to these investments based on a survey of the accounting literature to proxy for $Depr_c$:[23] 60% for Advertising, 30% for Computer Equipment, 20% for R&D, 16% for Transportation Equipment, 12% for Machinery, 3% for Buildings and 0% for Land. Besides using these explicit depreciation rates, we also employ a simple ranking that orders the investments from the most long-term one (Land with a durability rank of 1) to the most short-term one (Advertising with a durability rank of 7). Table 2 and Figure 3 summarize information on the investment data.

Measuring Foreign Competition from China

We use the US effectively applied import tariff *vis-à-vis* China, averaged over the years 1995 to 1999 and specific to firms within US SIC three digit industries. The effectively applied tariff $\textit{Pre-WTO-Tariffs}_s$ is defined as the lowest available tariff, given by preferential tariffs if existent and MFN tariffs otherwise. Tariff data are measured in ad-valorem terms and obtained from the UN Trains database. We measure import competition at the sector level s for a given year t following Bernard et al. (2006) by

$$ImpComp_{st} = \frac{Imp_{st}\left(CHN\right)}{Prod_{st} + Imp_{st}\left(CHN\right) - Exp_{st}\left(CHN\right)}, \tag{11}$$

[21] We measure import competition from China following Bernard et al. (2006) by $ImpComp_{st} = \frac{Imp_{st}(CHN)}{Prod_{st}+Imp_{st}(CHN)-Exp_{st}(CHN)}$.

[22] The specification in (9) can thus be regarded as the reduced form of the IV regression.

[23] Note that an investment's depreciation rate is the inverse of its time to payoff in years.

where $Imp_{st}\,(CHN)$ and $Exp_{st}\,(CHN)$ represent the value of US imports from China and exports to China at the 3 digit US SIC level derived from UN Comtrade data. $Prod_{st}$ reflects the value of US domestic shipments at the 3 digit US SIC level taken from the NBER CES manufacturing database.

Sector Level Controls

The investment composition as well as the level of foreign competition might be affected by sector specific attributes. If import competition is primarily traced back to low-wage countries such as China, the factor proportions framework predicts firms in capital or skill intensive sectors to be relatively less affected than their counterparts in labor or low-skill intensive industries. Furthermore, trade exposure might be related to trends in technology adoption which alter the demand for skill and capital and determine sector specific productivity. We therefore use the capital stock per worker and the share of non-production worker wages in total compensation in order to control for capital and skill intensity at the sector level. We also control for sector specific productivity using a 5-factor total factor productivity index. The entire set of industry level controls is obtained from the NBER CES manufacturing database.

Insert Tables 1, 2 and Figure 3 about here

4.3 Baseline Results

Table 3 presents our main results from estimating equation (9). In panel A we use the simple ordering as our measure of duration. The ordering of categories follows the ordering of depreciation rates and ranges from 1 (Land) to 7 (Advertising). Panel B repeats all specifications using absolute depreciation rates from the literature as a measure of duration. By offering two distinct measures we aim to ensure that our results do not hinge on specific assumptions regarding the duration of investments, except for a broad ordering. We will show that our story goes through irrespective of the measure chosen.

When discussing our results, we will focus on the sign of the interaction between the $Post2000_t$, the $\textit{Pre-WTO-Tariff}_s$ and duration $Depr_c$, allowing us to compare how long-term investments react *relative* to short-term investments (both measured in percentage terms), when sector level import competition is increasing. According to *Prediction 1*, if competition induces firms to shift their investments towards less durable categories, we expect our coefficient of interest β_1 to be positive. This implies that competition is associated on average with a *relative* shift of investments towards more short-term categories, i.e. categories with a higher rate of depreciation.

All specifications include our measure of interest, firm-year fixed effects, and either category or category-year fixed effects. We correct for clustered standard errors throughout all specifications. We cluster at the 3 digit US SIC industry level, as the treatment in our experimental design is correlated across all firms within the same industry. Abadie et al. (2017) suggest to correct the standard errors by clustering at the treatment cluster level which is a 3 digit US SIC industry, here. Furthermore, this clustering choice corrects for autocorrelation of standard errors at the firm-/investment-/year level. The interaction of $Post2000_t$ and $\textit{Pre-WTO-Tariff}_s$ is sector-year specific and thus absorbed by firm-year fixed effects. Thus, we do not identify the average effect of import competition on investments when including firm-year fixed effects. Similarly, due to the inclusion of category fixed effects, we do not identify the between-category differences in average investments. We include these fixed effects because they allow us to effectively control for alternative channels that otherwise could potentially be confounding our results.[24] The inclusion of firm-year fixed effects will also account for confounding effects at the firm or industry level, as long as the change in investments is uniform across the different types of investment.

Insert Table 3 about here

Table 3 shows the results for the two measures of depreciation. Throughout specifications (1) to (3) we consider the more narrow sample window around China's WTO accession from 2000 to 2002. In specifications (4) to (6) we extend the sample period by two years from 1999 to 2003. In specifications (1) and (4) we include category fixed effects to control for time-invariant differences in investments across categories. The other specifications include category-year fix effects to swipe out confounding effects that might arise from economy-wide investment trends for any particular category (for instance, Figure 3 suggests that there might be an overall fall in advertising or machinery and an increase in R&D investments).

The degree of foreign competition could also be correlated with developments in the domestic industry. For example, if US industries become more productive over time, this might lead to relatively more long-term investments and a lower level of foreign competition. Therefore, we control for changes in total factor productivity, capital- and low-skill-intensity of the US manufacturing industries. Columns (3) and (6) are our preferred specifications. Here, we additionally include these industry control variables interacted with our measure of depreciation.

For all specifications, the coefficient of interest β_1 is positive and significantly different from zero at the 1% level when we focus on the more narrow sample window and it is positive and significantly different from zero at the 5% level when we consider a wider sample window. This is due to the effect that our coefficient estimates for β_1 are a bit larger in the smaller sample window. These estimates imply that the WTO accession of China led to a higher decrease (or lower increase) in long-term investments, compared to short-term investments, and that this effect was more pronounced in sectors that had higher average tariffs during the second half of the 1990s.

Insert Table 4 about here

In order to see whether our difference-in-differences estimations with differences in pre-WTO tariff rates capture the effects of actual competition changes, we present results from estimating equation

[24] For example, sectors and firms will be exposed to temporary shocks that, on average, will have an impact on investments. Think about a domestic demand shock that reduces the demand for durable consumer goods. Potentially, this demand shock will be correlated with sectoral import competition. In response to the shock, firms in the durable goods sector might reduce average investments. Because this decision is due to the demand shock and independent of investment durations, the relative composition of short and long-term investments *within* firms and industries would remain constant. Nevertheless, our coefficient of interest might falsely pick up the variation if the investment composition in the durable goods sector happens to be on average more long-term than in other sectors. The uniform investment reduction in the durable goods sector would then shift the *economy-wide* investment composition towards more short run investments. Consequently, we would find a positive coefficient on the durability interaction and wrongly conclude that import competition was causing firms to invest more short-term.

(10), where we use the actual import competition from China instead of the interaction of $Post2000_t$ and $Pre\text{-}WTO\text{-}Tariffs_s$. These estimates are reported in Table 4. While we use the full sample time between 1995 and 2009 in specifications (1) to (3), we restrict ourselves to the smaller sample window from 1999 to 2003 in specifications (4) to (6). Also here, we estimate a positive coefficient of interest β_2 and the coefficient estimates are again slightly larger when we focus on a smaller sample period.

In columns (3) and (6), we instrument $\ln(ImpComp_{st}) \times Depr_c$ with $Post2000_t \times Pre\text{-}WTO\text{-}Tariffs_s \times Depr_c$. This allows us to check if our difference-in-differences estimations with differences in pre-WTO tariff rates from Table 3 are indeed picking up a competition effect induced by the Chinese WTO accession. In the first stage, the coefficient of $Post2000_t \times Pre\text{-}WTO\text{-}Tariffs_s \times Depr_c$ is positive and significant at the 1% level. The F-statistics for Kleibergen-Paap rank tests are between 13.83 and 30.95 depending on the measure of depreciation and the sample window. The estimated coefficient of interest β_2 in the IV regressions is significant at the 1% level for the ordering measure of depreciation (Panel A) and it is significant at the 10% level for the depreciation rate (Panel B).

Insert Figure 4 and Table 5 about here

Lastly, we take a closer look at the timing when the adjustment of investments occurs. While we compared firm investment behavior before 2001 with that from 2001 onwards in the difference-in-differences estimations of equation (9) in Table 3, it is a priori not entirely obvious when we expect that firms adjust their investment behavior. On the one hand, firms might face adjustment costs such that the investment response is observed after an actual competition shock. On the other hand, since investments are a forward looking factor choice and since there already has been substantial newspaper coverage in the end of 1999 (see Figure 2), firms might have also been reacting shortly before the actual WTO accession. The exact timing of the adjustment might not be that crucial for the previously presented results since we compare pre- and post shock periods more broadly. However, it is still interesting to see when firms react to the competition shock.

To explore empirically when this investment adjustment takes place, we regress a set of year dummies, each one interacted with $Pre\text{-}WTO\text{-}Tariffs_s \times Depr_c$ on our dependent variable. The estimates are reported in Table 5 and we plot the estimated coefficients of interest for each year between 1997 and 2004 in Figure 4 (the dashed lines correspond to 95% confidence intervals). The estimates from this exercise also suggest that the adjustment takes place in the WTO accession year. Graphically, this is visible from the kink in the curve between the years 2000 and 2001 which is present for either measure of depreciation. Statistically, the null hypothesis that the coefficients for the year 2000 and 2001 are equal can be rejected at the 5% level for both measures of depreciation.

4.4 Economic Significance

In our sample of listed manufacturing firms, we observe a 57.4% increase in Chinese import competition in our firm sample between 1999 and 2003. Our coefficient estimate of 0.218 from Table 4, specification (4), Panel B, implies that the most durable investments were reduced 18% more than the least durable investments. The estimated economic significance of our estimates compares to the effect that Garicano and Steinwender (2016) estimate for the financial crisis on investment of Spanish firms: they estimate that the recession led to a 17% difference between the reduction of the most and the least durable investments, excluding land investments. Alternatively, when instrumenting the actual sectoral change in Chinese import competition with pre-WTO tariffs in specification (6), the economic significance would increase to 47%.

If we consider a counterfactual situation, where land investments are inelastic to competition changes and apply our coefficient estimates for the distortions across the other categories, we can calculate how much the average durability of investments decreases in response to a competition shock. Using our estimates from Table 4, we find that the average increase in Chinese competition decreases the investment durability by 64 days (147 days for the IV estimate). Presuming a refinancing interest rate of 3% per annum, this would impose an additional interest cost of \$ 5.26 for each \$ 1,000 invested (\$ 12.08 for the IV estimate).[25]

Another counterfactual exercise to assess the economic significance of our estimates can be to compare two hypothetical firms. One firm is in an industry with low pre-WTO tariffs at the 25th percentile of the tariff distribution with an ad valorem tariff rate of 1.914%; the other firm is in an industry with high pre-WTO tariffs at the 75th percentile of the tariff distribution with an ad valorem tariff rate of 3.786%. During 1999 and 2003, the difference-in-differences coefficient estimates in Table 3 specification (4), Panel B suggest that the high-tariff firm reduces the most durable investments by 73.20% more than its least durable investments. This distortion is larger compared to the low-tariff firm which reduces its most durable investments by 56.25% more than its least durable investments. This translates to a 195 days shorter investment life-span and would impose an additional interest cost of \$ 16.03 for each \$ 1,000 invested.[26]

4.5 Firm Heterogeneity

In our theoretical framework we show that the import competition effect on investment composition should be less pronounced for more productive firms. These firms can charge larger markups and face less elastic residual demand. In Table 6, we confront *Prediction 2* with the data. We estimate each firm's total factor productivity and rank the estimated productivities within each industry into five quintile bins. We re-estimate the empirical model (10) but additionally interact $\ln(ImpComp_{st}) \times Depr_c$ with a dummy indicator for each productivity bin (Q_i, $i = 1, ..., 5$). If the adjustment towards short-term investments is more pronounced in less productive firms as suggested by *Prediction 2*, we expect a larger coefficient of interest for lower productivity quintiles.

Insert Figure 5 and Table 6 about here

We report the coefficient estimates in Table 6. More illustratively, Figure 5 plots the estimated coefficient of interest by TFP quintile (again, the dashed lines correspond to 95% confidence intervals). Specification (1) and the two graphs on the left hand side of Figure 5 show the heterogeneous effects

[25] See the Appendix B.1 for details on the calculation of effects.
[26] Again, we refer to Appendix B.1 for details on the calculation of effects.

from OLS estimation. We focus on the sample period 1999 - 2003 and include category and firm-year fixed effects. We find a clean ordering of our coefficients of interest by TFP quintile, no matter which measure of depreciation we consider. For firms in the top TFP quintile of our sample our estimates are even insignificantly different from zero while for those firms in the bottom two quintiles they turn out positive and significant at the 1% level. The null hypothesis that the coefficients for the top and bottom quintiles are identical is rejected at the 5% level in both estimations (p-value 0.016 in Panel A and < 0.001 in Panel B). Furthermore, the null hypothesis that the coefficients are identical throughout all five quintiles is rejected at 1% level in Panel B (p-value 0.004) but cannot be credibly rejected in Panel A (p-value 0.137).

In order to further assess the robustness of the heterogeneous results, we estimate the same empirical model with the instrumental variable $Q_i \times Post2000_t \times Pre\text{-}WTO\text{-}Tariff_s \times Depr_c$ for $Q_i \times \ln(ImpComp_{st}) \times Depr_c$. Due to the five endogenous regressors and five first stage regressions, these estimates in specification (2) are likely to suffer from some bias due to the weak instrumentation problem. This is also suggested by the rather small overall first stage F-statistics for Kleibergen-Paap rank tests of 3.343 and 2.843. Nevertheless, we test the null hypothesis that the coefficients for the top and bottom quintiles are identical. Again, this null hypothesis can be rejected at the 5% level (p-value 0.004 in Panel A and 0.026 in Panel B). Futhermore, also the null hypothesis that the coefficients are identical throughout all five quintiles is rejected in Panel B (p-value 0.04) but not in Panel A (p-value 0.146).

Insert Figure 6 and Table 7 about here

We also estimate the difference-in-differences model (9) and additionally interact the coefficients for $Post2000_t \times Pre\text{-}WTO\text{-}Tariff_s \times Depr_c$ and its subinteractions with the dummies for each productivity quintile Q_i. The estimates are reported in Table 7. Figure 6 plots the coefficients of interest by TFP quintile. Also in the difference-in-differences we find support for heterogeneous results across the productivity distribution. Here, the coefficient of interest is only significant at the 1% level for firms in the lowest TFP quintile and even becomes negative for firms in the top TFP quintile. The null hypothesis that the coefficients for the top and bottom quintiles are identical is rejected at the 5% level for both measures of depreciation (p-value 0.012 for the ordering measure and 0.005 for the depreciation rate measure). The null hypothesis that the coefficients are identical throughout all five quintiles is again only rejected for the depreciation rate measure at the 5% level (p-value 0.049). Overall, we interpret these results as evidence for heterogeneous effects of competition on firm investments in line with *Prediction 2*.

4.6 Robustness and Alternative Channels

In this subsection, we assess the robustness of our estimates and study alternative channels that could affect our results. First, we present an alternative difference-in-differences estimation based on industry differences in comparative advantage where we use variation in industry-specific low-skill-intensity instead of tariff rates. Then we study if our results hinge on the specific ordering of investment categories. Next, we study how missing observations and the treatment of zero investments affect our results. Lastly, we also analyze the robustness of our estimates when we control for different channels of trade liberalization (such as market access or intermediate imports) or financial frictions.

Insert Figure 7 and Tables 8 - 12 about here

In Table 8 we reestimate our within-firm estimator and use differences in the average low-skill-intensity of US industries instead of differences in the $\textit{Pre-WTO-Tariff}_s$ across industries. We vary between sample windows (either 2000 - 2002 or 1999 - 2003), category or category-year fixed effects and including industry controls or excluding them throughout the specifications (1) to (4). The idea behind this exercise is that firms in industries that face a comparative disadvantage vis-à-vis Chinese producers experience a relatively stronger competition shock due to the Chinese WTO accession. Since China is a labor-abundant economy, we exploit the average low-skill-intensity during 1995 - 1999. Identical to the low-skill-intensity in the industry control variables, we define low-skill-intensity as the share of compensation for non-production workers in total compensation (from the NBER CES database). However, $Low - Skill - Intensity_s$ is time invariant here since it is computed as the simple industry average over the years 1995-1999, analogous to the pre-WTO tariff rates.[27] Also here, we estimate a positive coefficient of interest β_1 throughout all specifications in line with *Prediction 1*. While the coefficient estimates are significant at the 1% in Panel A, they are significant at either the 1% or 5% level in Panel B.

Next, we analyze how strong our results hinge on the assumed ordering of investment categories in terms of depreciation rates. First,we estimate the effects separately by investment category by interacting a dummy for each category with $\ln(ImpComp_{st})$. Table 9 shows the coefficient estimates from these estimates (specification (1) reports OLS estimates, specification (2) reports IV estimates) and Figure 7 plots them graphically. The omitted category is advertising, such that the estimates should be treated as relative to the most short-term investment category. Broadly, our assumed ordering of investment categories corresponds to the estimated magnitudes, here. Additionally, we omit and regroup various categories for the ordered measure of depreciation in Table 10. Specification (1) repeats specification (2) from Table 4 as a baseline regression for comparison. In specification (2) we omit R&D investments in order to see whether R&D expenses are driving our result. For example, a rise in import competition might lead firms to foster innovation by investing more heavily in research activities.[28] This decision is independent of the duration of R&D investments, but would still render our coefficient positive because R&D expenditures just happen to be classified as relatively short-term. Omitting R&D investments reduces the number of observations by more than a quarter but the size of our coefficient remains fairly constant (0.0213 instead of 0.0209) and significant at the 5% level indicating that R&D is not the (only) driver of our results. In specification (3) we further omit investments in Advertising. Because different from the other categories, both R&D and

[27]According to the WIOD socio-economic accounts, the average low-skill-intensity during 1995 - 1999 was 58.5% in China and 6.2% in the US, defined as the share of low-skilled labor in total labor compensation where low-skilled labor includes workers with primary or lower secondary education.

[28]Bloom et al. (2016) show that Chinese import competition increases technical change within firms, among other things, by increasing the amount of R&D.

Advertising expenses are taken from the income statements rather than being derived from asset data, one concern is that our results are due to these constructional differences. The results in specification (3) show that our results go through when restricting the sample to asset data. Specification (4) omits Transportation and Computer investments. Computer investments are reported only for the years 1999 and onwards and Transportation is reported very little over the full range of years. Accordingly, these two categories might not be very representative and specifically prone to be affected by outliers. But again, our results remain robust when estimating the equation for the remaining categories. Specification (5) omits Land and Building investments as these are investment categories for which prices are very sensitive to market shocks.[29] Therefore, it is not clear whether price changes or quantity changes trigger a change in that investment category and we exclude those categories. However, our coefficient remains significantly positive and increases in magnitude. Since estimates of depreciation rates vary in the literature, we regroup assets that are close to each other into single categories in specifications (6) to (9). In specification (6), we assign the same rank to Land, Buildings and Machinery. R&D and Computer investments are grouped into another category. The coefficient increases in size and remains significant at the 10% level. Adding Transportation to the group of long-term investments in specification (7) further increases the coefficient, confirming that switching from one rank to another now has a higher impact on investment durability. Because the depreciation rate of Transportation is relatively close also to R&D and Computer investments, specification (8) assigns it into one group with these categories. Our results are not significantly altered. Finally, it could be that firms increase research expenditures in order to remain competitive in the future, rendering R&D effectively a long-term investment. Then our ranking of investment categories would be flawed. Specification (9) therefore ranks R&D as the most long-term investment. Our coefficient estimate is smaller than in specification (1) but remains significant at the 10% level. We conclude that our original ordering is more coherent, given that R&D investments are not the sole driver of our results.

Next, we try to rule out some alternative stories in Table 11 that relate to other channels of trade liberalization or financial constraints that firms face and that might affect our results. In specifications (1) and (2), we additionally control for the effects arising from a larger supply of foreign inputs from China ($\ln(\mathit{Offshoring}_{st})$) and larger export markets ($\ln(\mathit{ExpMarket}_{st})$). We investigate the effect of offshoring by adapting the offshoring measure suggested by Feenstra and Hanson (1999), which uses the input-output tables to measure for each industry the share of input industries. Specifically, our proxy for offshoring from China is $\mathit{Offshoring}_{st} = \frac{ImpInputs_{st}(CHN)}{Prod_{st}+ImpInputs_{st}(CHN)-Exp_{st}(CHN)}$, where $ImpInputs_{st}$ are the imported Chinese inputs by industry s in year t and constructed as proposed by Feenstra and Hanson (1999) using input-output tables from the U.S. Bureau of Economic Analysis. Additionally, we include $\mathit{ExpMarket}_{st} = \frac{Exp_{st}(CHN)}{Prod_{st}+Imp_{st}(CHN)-Exp_{st}(CHN)}$ to control for increases in market size induced by the Chinese WTO accession.[30] As one would expect, we find that increases in market size and access to (cheaper) Chinese inputs render firm investments towards the more long-term categories as suggested by the negative coefficients in columns (1) and (2) (significant at the 1%-5% level). By including these trade controls, the magnitude of our coefficient of interest increases.

[29] Consider for example the subprime crisis as an extreme example for such a market shock.

[30] See subsection A.2 in the Appendix.

In specifications (3) and (4), we aim to control for financial constraints that firms face and that might affect our results. Shocks to credit supply or the cost of obtaining (long-term) credit could alter the relative return of long-term investments. Since we want to identify the effect of competition, we need to make sure that time varying financial characteristics are properly controlled for. We add interactions of the depreciation measure with *(i)* the firms' current ratio in order to control for differences in firm liquidity, *(ii)* the firms' external dependence, i.e. the fraction of capital expenditures that are not financed by internal capital flows to control for differences in credit demand and *(iii)* a proxy for the capital costs that the firm faces measured as interest expenditures over total liabilities. Including these financial controls leaves our coefficient of interest positive and significant at the 5% level (with the exception of specification (2), Panel B where it renders insignificant).

Lastly, we assess the robustness of our estimations with respect to the measurement of investments in Table 12. In the theory section, we derived a within-firm difference-in-differences estimator (see equations (7) and (8)) suggesting that the *elasticity* of investments within firms with respect to product market competition should depend on the depreciation of the investment category. This naturally translated to specifications using the logarithm of investments as the dependent variable. In order to illustrate that our results are not determined by a scale effect since some investments are much smaller in their magnitudes on average, we use the investment of each category normalized by the total investment expenditures across categories within a firm-year as the dependent variable. Specifications (1) to (3) estimate the tariff difference-in-differences, the import competition OLS and the IV for the period 1999-2003 including firm-year and category-year fixed effects as well ass industry controls. We still find empirical support for *Prediction 1*: we estimate positive β_1 and β_2. The coefficient β_2 for $\ln(ImpComp_{st}) \times Depr_c$ is significant at the 1% level. The significance for the coefficient β_1 is weaker: it turns out significant at the 10% level in Panel A and insignificant in Panel B.

Next, we deal with zero investments which are excluded when the dependent variable is the logarithm of investments. It should be noted that also in specifications (1) to (3), when we use the share of investments as dependent variable, zero investments are included (with the exception that those observations are excluded where all investments within a firm-year are zero). As an alternative method to handle zero investments, we use the inverse hyperbolic sine transformation of investments as the dependent variable in specifications (4) to (6). This transformation keeps zero investments but basically looks like the natural logarithm for values above about two. We still estimate a positive and significant coefficient β_2, however the positive estimates of β_1 turn out insignificant in both Panels.

Finally, we consider the of role missing investment observations. In Table 2 that summarizes our investment data it becomes apparent that there are many cases of missing investments. Apparently, we do not know the correct value of those observations. To assess the robustness of our estimations, we assume that these were zero investments and again apply the inverse hyperbolic sine transformation throughout specifications (7) to (9) in order to see if our results would go through if missings were in fact mostly non-investments. Here we estimate a positive and significant coefficient β_2 at the 1% level and again the positive estimates of β_1 turn out insignificant in Panel B and significant at the 5% level in Panel A.

5 Conclusion

This paper examines how the exposure to foreign competition affects the composition of short-term relative to long-term investments within firms. In order to guide our empirical strategy, we develop a stylized framework which illustrates the investment decision of a representative firm with respect to short- and long-term investments. An increase in the toughness of competition reduces the relative value of long-term investments and induces firms to shift their investment composition towards short-term investments. The magnitude of this effect varies with firm productivity. We test these predictions based on the population of listed US manufacturing firms by using data on seven asset classes which we order according to their depreciation rates. Based on our framework, the empirical strategy employs a difference-in-differences estimator where we exploit the rise in Chinese imports to the US due to China's accession to the WTO as quasi-natural experiment. This approach allows using firm-year fixed effects as well as investment category fixed effects in order to identify the effect of trade induced competition on the composition of investments within firms. The empirical results are in line with our predictions. Import competition shifts the composition of investments towards more short-lived categories and the effect depends on firm size. Our results are robust to the inclusion of controls that account for alternative channels at the firm and sector level such as various measures of financial constraints and factor intensities.

We believe that adjustments in the composition of investments can have important economic implications. If trade induced competition incentivizes firms to disregard the long-term perspective this implies a loss in sustainability, higher financing costs as well as changes in the firm size distribution. This suggests new research directions. Future research might for example study how changes in the composition of investment relate to the welfare effects of globalization.

References

Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey Wooldridge. When Should You Adjust Standard Errors for Clustering? NBER Working Papers 24003, National Bureau of Economic Research, Inc, 2017.

Aghion, Philippe, George-Marios Angeletos, Abhijit Banerjee, and Kalina Manova. Volatility and Growth: Credit Constraints and the Composition of Investment. *Journal of Monetary Economics*, 57(3):246–265, 2010.

Atkeson, Andrew G., Andrea L. Eisfeldt, and Pierre-Olivier Weill. Measuring the Financial Soundness of U.S. Firms, 1926-2012. Working Paper 19204, National Bureau of Economic Research, 2013.

Autor, David H., David Dorn, and Gordon H. Hanson. The China Syndrome: Local Labor Market Effects of Import Competition in the United States. *American Economic Review*, 103(6):2121–68, 2013.

Autor, David H., David Dorn, and Gordon H. Hanson. The China Shock: Learning from Labor Market Adjustment to Large Changes in Trade. Working Paper 21906, National Bureau of Economic Research, 2016.

Bachmann, Rüdiger, Steffen Elstner, and Atanas Hristov. Surprise, Surprise - Measuring Firm-Level Investment Innovations. *Journal of Economic Dynamics and Control*, 83(C):107–148, 2017.

Bénabou, Roland and Jean Tirole. Bonus Culture: Competitive Pay, Screening, and Multitasking. *Journal of Political Economy*, 124(2):305–370, 2016.

Bernard, Andrew B., J. Bradford Jensen, and Peter K. Schott. Survival of the Best Fit: Exposure to Low-Wage Countries and the (Uneven) Growth of U.S. Manufacturing Plants. *Journal of International Economics*, 68(1):219–237, 2006.

Bernard, Andrew B., Stephen J. Redding, and Peter K. Schott. Multiple-Product Firms and Product Switching. *American Economic Review*, 100(1):70–97, 2010.

Bloom, Nicholas, Mirko Draca, and John Van Reenen. Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity. *Review of Economic Studies*, 83(1):87–117, 2016.

Buchheim, Lukas and Sebastian Link. The Effect of Disaggregate Information on the Expectation Formation of Firms. Technical Report, LMU Munich, mimeo, 2017.

Bustos, Paula. Trade Liberalization, Exports, and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinian Firms. *American Economic Review*, 101(1):304–340, 2011.

Chen, Cheng, Tatsuro Senga, Chang Sun, and Hongyong Zhang. Firm Expectations and Investment: Evidence from the China-Japan Island Dispute. Technical Report, University of Hong Kong, mimeo, 2017.

Coibion, Olivier, Yuriy Gorodnichenko, and Saten Kumar. How Do Firms Form Their Expectations? New Survey Evidence. NBER Working Papers 21092, National Bureau of Economic Research, Inc, 2015.

Dhingra, Swati. Trading Away Wide Brands for Cheap Brands. *American Economic Review*, 103(6):2554–84, 2013.

Eckel, Carsten and J. Peter Neary. Multi-Product Firms and Flexible Manufacturing in the Global Economy. *Review of Economic Studies*, 77(1):188–217, 2010.

Feenstra, Robert C. and Gordon H. Hanson. The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the United States, 1979-1990. *Quarterly Journal of Economics*, 114(3):907–940, 1999.

Foley, Fritz and Kalina Manova. International Trade, Multinational Activity, and Corporate Finance. *Annual Review of Economics*, 7(1):119–146, 2015.

Fresard, Laurent. Financial Strength and Product Market Behavior: The Real Effects of Corporate Cash Holdings. *Journal of Finance*, 65(3):1097–1122, 2010.

Garicano, Luis and Luis Rayo. Why Organizations Fail: Models and Cases. *Journal of Economic Literature*, 54(1):137–92, 2016.

Garicano, Luis and Claudia Steinwender. Survive Another Day: Using Changes in the Composition of Investments to Measure the Cost of Credit Constraints. *Review of Economics and Statistics*, 98:913–924, 2016.

Gennaioli, Nicola, Yueran Ma, and Andrei Shleifer. Expectations and Investment. *NBER Macroeconomics Annual*, 30(1):379–431, 2016.

Gorodnichenko, Yuriy, Jan Svejnar, and Katherine Terrell. Globalization and Innovation in Emerging Markets. *American Economic Journal: Macroeconomics*, 2(2):194–226, 2010.

Guadalupe, Maria and Julie Wulf. The Flattening Firm and Product Market Competition: The Effect of Trade Liberalization on Corporate Hierarchies. *American Economic Journal: Applied Economics*, 2(4):105–27, 2010.

Hashmi, Aamir Rafique. Competition and Innovation: The Inverted-U Relationship Revisited. *Review of Economics and Statistics*, 95(5):1653–1668, 2013.

Iacovone, Leonardo, Ferdinand Rauch, and L. Alan Winters. Trade as an Engine of Creative Destruction: Mexican Experience With Chinese Competition. *Journal of International Economics*, 89(2):379 – 392, 2013.

Lileeva, Alla and Daniel Trefler. Improved Access to Foreign Markets Raises Plant-level Productivity ... For Some Plants. *Quarterly Journal of Economics*, 125(3):1051–1099, 2010.

Manova, Kalina. Credit Constraints, Heterogeneous Firms, and International Trade. *Review of Economic Studies*, 80(2):711–744, 2013.

Mayer, Thierry, Marc J. Melitz, and Gianmarco I. P. Ottaviano. Market Size, Competition, and the Product Mix of Exporters. *American Economic Review*, 104(2):495–536, 2014.

Melitz, Marc J. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica*, 71(6):1695–1725, 2003.

Melitz, Marc J. and Gianmarco I. P. Ottaviano. Market Size, Trade, and Productivity. *Review of Economic Studies*, 75(1):295–316, 2008.

Pierce, Justin R. and Peter K. Schott. The Surprisingly Swift Decline of US Manufacturing Employment. *American Economic Review*, forthcoming, 2016.

Salop, Steven C. Monopolistic Competition with Outside Goods. *Bell Journal of Economics*, 10(1):141–156, 1979.

Terry, Stephen J. The Macro Impact of Short-Termism. Discussion Papers 15-022, Stanford Institute for Economic Policy Research, 2015.

Utar, Hale. Workers Beneath the Floodgates: The Impact of Removing Trade Quotas for China on Danish Workers. Working Paper 12-2014, 2014.

Valta, Philip. Competition and the Cost of Debt. *Journal of Financial Economics*, 105(3):661–682, 2012.

Xu, Jin. Profitability and Capital Structure: Evidence from Import Penetration. *Journal of Financial Economics*, 106(2):427–446, 2012.

Table 1: Selected Summary Statistics on Firms and Industries

	Obs.	Mean	Std. Dev.	Min.	Max.
Industry Level					
Pre-WTO-Tariff	127	4.4	3.9	0.0	21.8
Low-Skill-Intensity (industry average)	133	0.6	0.1	0.1	0.8
Industry-Year Level					
Capital-Intensity	1,849	129.0	150.2	8.7	1,450.5
Low-Skill-Intensity	1,849	0.4	0.1	0.2	0.9
TFP Index	1,849	1.0	0.3	0.5	7.0
Import Competition	1,872	0.1	0.4	-4.6	7.1
Offshoring	1,854	0.1	0.1	0.0	0.9
Export Market Exposure	1,872	0.0	0.3	-5.6	6.1
Firm-Year Level					
Current Ratio	33,498	3.8	6.6	0.0	503.3
External Dependence	32,974	15.2	232.3	0.0	26,257.0
Capital Costs	33,392	0.2	0.3	-0.1	11.9

Table 2: Summary Statistics on the Investment Categories

Investment (in mio. USD)	Applied Depr. Rate	Obs.	Mean	Std. Dev.	Min.	25th pct.	75th pct.	Max.	Zeros	Missings
Advertising	60%	9,559	81.5	397.7	0	0.3	14.8	8,667.0	119	54,410
Computer	30%	2,702	6.1	26.9	0	0.1	3.3	776.8	8	61,267
R&D	20%	27,357	75.3	383.8	0	1.2	25.7	8,000.0	2,982	36,612
Transportation	16%	4,088	1.2	8.6	0	0.0	0.1	221.7	1,429	59,881
Machinery	12%	24,631	71.2	291.0	0	1.0	31.3	8,910.6	20	39,338
Buildings	3%	17,741	36.7	176.0	0	0.7	17.6	11,104.5	228	46,228
Land	0%	14,600	6.6	73.0	0	0.1	2.5	7,150.9	252	49,369

Figure 1: The Impact of Tougher Competition on the Composition of Investments

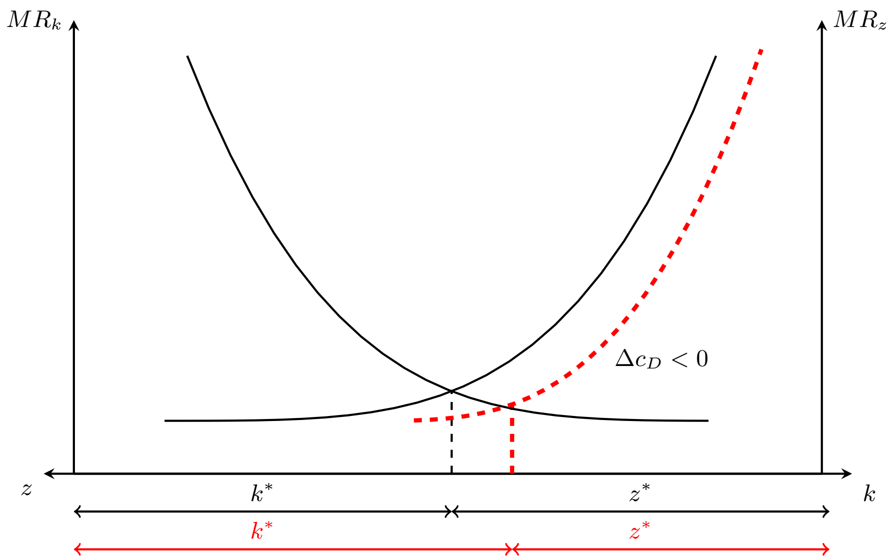


Figure 2: Monthly Import Competition from China and Newspaper Coverage on the Chinese WTO Accession

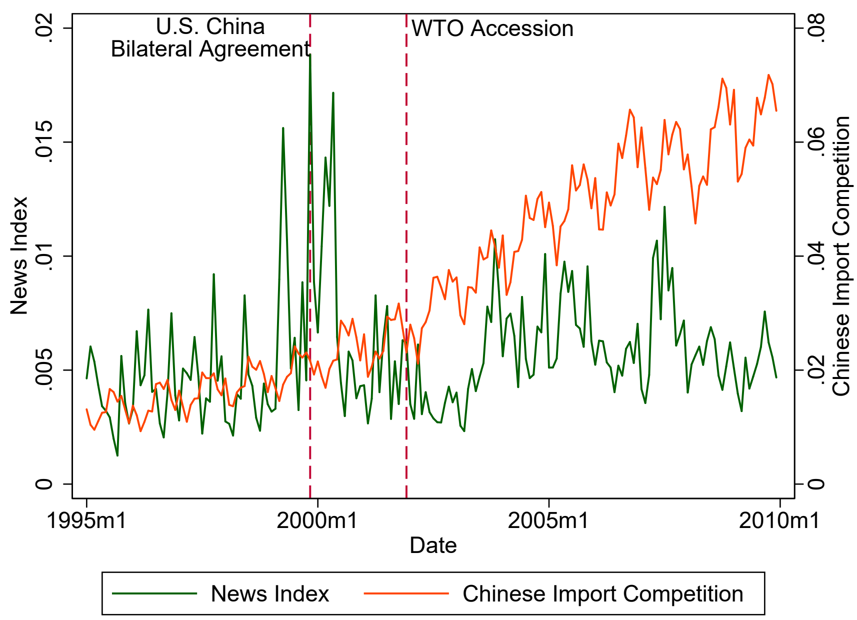
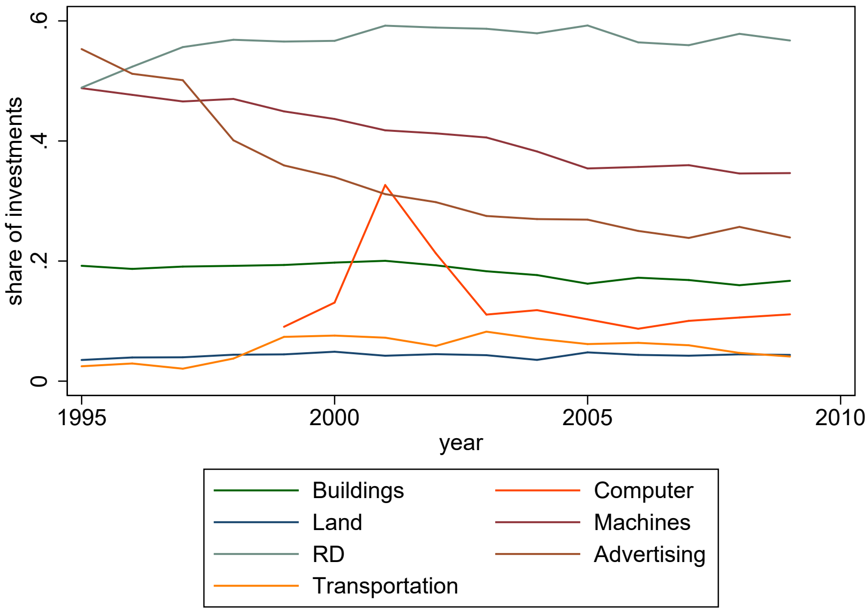
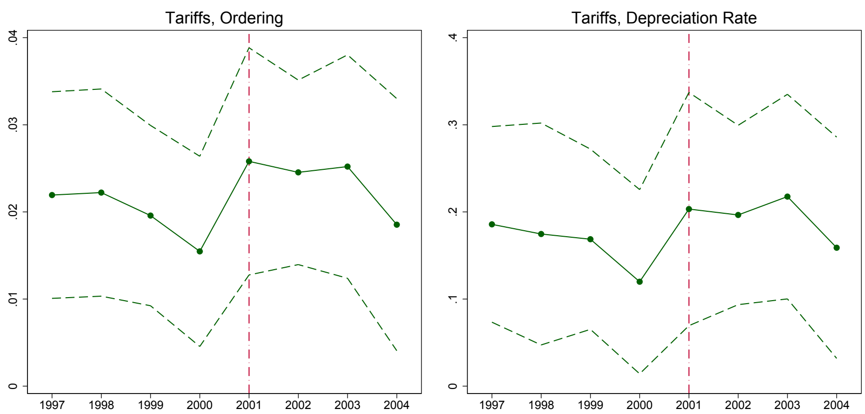


Figure 3: Shares of Investment Categories over Time



Notes: The figure plots the annual means of the investments into each category relative to total firm investments into all 7 categories for the firms in the sample.

Figure 4: The Impact of the Chinese WTO Accession on the Durability of Investments



Notes: The figure plots coefficient estimates of *Pre-WTO-Tariff * Depreciation * Year Dummies* from Table 5. The dashed lines correspond to 95% confidence intervals.

Table 3: The Impact of the Chinese WTO Accession on the Durability of Investments - Exploiting Sectoral Differences in Pre-WTO Tariff Rates

Dependent Variable: log(Investment)						
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Measure of Depreciation: Ordering						
Post2000 * Pre-WTO-Tariff * Depreciation	0.00920***	0.0107***	0.00957***	0.00636**	0.00815**	0.00743**
	(0.00300)	(0.00303)	(0.00334)	(0.00315)	(0.00320)	(0.00320)
Pre-WTO-Tariff * Depreciation	0.00187	0.000882	0.0136**	0.00489	0.00377	0.0166***
	(0.00611)	(0.00599)	(0.00553)	(0.00586)	(0.00571)	(0.00498)
Post2000 * Depreciation	-0.0295**			-0.0359***		
	(0.0125)			(0.0133)		
Panel B: Measure of Depreciation: Depreciation Rate						
Post2000 * Pre-WTO-Tariff * Depreciation	0.0848***	0.0894***	0.0793***	0.0642**	0.0692**	0.0604**
	(0.0267)	(0.0268)	(0.0270)	(0.0302)	(0.0301)	(0.0296)
Pre-WTO-Tariff * Depreciation	0.0764	0.0733	0.100*	0.105**	0.102**	0.135***
	(0.0529)	(0.0523)	(0.0549)	(0.0489)	(0.0481)	(0.0507)
Post2000 * Depreciation	-0.495***			-0.642***		
	(0.124)			(0.138)		
Industry Controls * Depreciation	no	no	yes	no	no	yes
Category FE	yes	no	no	yes	no	no
Category-Year FE	no	yes	yes	no	yes	yes
Firm-Year FE	yes	yes	yes	yes	yes	yes
Observations	18,302	18,301	18,047	30,949	30,947	30,515
No. Firms	2,345	2,345	2,310	2,695	2,695	2,655
Sample Time	2000 - 2002	2000 - 2002	2000 - 2002	1999 - 2003	1999 - 2003	1999 - 2003

Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). *Post2000* is an indicator that takes the value 1 if the year is 2001 or later. *Pre-WTO-Tariff* is the simple industry average (over the years 1995-1999) of the effectively applied tariff on US imports from China as reported in the WITS/Comtrade data base. Industry controls are capital-intensity, low-skill-intensity and a TFP index. Standard errors are cluster-robust at the SIC industry level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Chinese Import Competition and the Durability of Investments

Dependent Variable: log(Investment)						
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Measure of Depreciation: Ordering						
log(ImpComp) * Depreciation	0.0245***	0.0209**	0.0566***	0.0284***	0.0246**	0.0834***
	(0.00811)	(0.00883)	(0.0188)	(0.0101)	(0.00980)	(0.0315)
1st Stage IV Coefficient			0.236***			0.173***
			(0.0424)			(0.0614)
1st Stage F-Test			30.95			16.26
Panel B: Measure of Depreciation: Depreciation Rate						
log(ImpComp) * Depreciation	0.133	0.224**	0.382*	0.218**	0.287***	0.582*
	(0.0960)	(0.100)	(0.213)	(0.105)	(0.109)	(0.305)
1st Stage IV Coefficient			0.170***			0.172***
			(0.0640)			(0.0635)
1st Stage F-Test			21.89			13.83
Industry Controls * Depreciation	no	yes	yes	no	yes	yes
Category FE	yes	no	yes	yes	no	yes
Category-Year FE	no	yes	no	no	yes	no
Firm-Year FE	yes	yes	yes	yes	yes	yes
Observations	88,920	88,607	88,548	30,535	30,426	30,428
No. Firms	3,520	3,504	3,495	2,664	2,652	2,652
Sample Time	1995 - 2009	1995 - 2009	1995 - 2009	1999 - 2003	1999 - 2003	1999 - 2003

Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). Import competition (*ImpComp*) are imports from China at the sectoral level, relative to domestic absorption (domestic production + imports from China - exports to China). Industry controls are capital-intensity, low-skill-intensity and a TFP index. Standard errors are cluster-robust at the SIC industry level. Columns (3) and (6) present IV estimates using *Post2000*Pre-WTO-Tariff* to instrument for *log(ImpComp)*. The 1st Stage F-Test statistics correspond to Kleibergen-Paap rank tests. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: The Impact of the Chinese WTO Accession on the Durability of Investments - Difference-in-Differences by Year

Dependent Variable: log(Investment)		
	(1)	(2)
Measure of Depreciation:	**Ordering**	**Depreciation Rate**
Pre-WTO-Tariff * Depreciation * 1997	0.0219***	0.186***
	(0.00599)	(0.0567)
Pre-WTO-Tariff * Depreciation * 1998	0.0222***	0.175***
	(0.00601)	(0.0643)
Pre-WTO-Tariff * Depreciation * 1999	0.0196***	0.169***
	(0.00523)	(0.0522)
Pre-WTO-Tariff * Depreciation * 2000	0.0155***	0.120**
	(0.00551)	(0.0534)
Pre-WTO-Tariff * Depreciation * 2001	0.0258***	0.203***
	(0.00659)	(0.0676)
Pre-WTO-Tariff * Depreciation * 2002	0.0245***	0.197***
	(0.00535)	(0.0520)
Pre-WTO-Tariff * Depreciation * 2003	0.0252***	0.218***
	(0.00648)	(0.0593)
Pre-WTO-Tariff * Depreciation * 2004	0.0185**	0.159**
	(0.00731)	(0.0641)
p-Value: H_0: $\beta_{2000} = \beta_{2001}$	0.0166	0.0311
Industry Controls * Depreciation	yes	yes
Category-Year FE	yes	yes
Firm-Year FE	yes	yes
Observations	49,192	49,192
No. Firms	3,092	3,092
Sample Time	1997 - 2004	1997 - 2004

Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). *Pre-WTO-Tariff* is the simple industry average (over the years 1995-1999) of the effectively applied tariff on US imports from China as reported in the WITS/Comtrade data base. Industry controls are capital-intensity, low-skill-intensity and a TFP index. The reported coefficients are plotted in Figure 4. Standard errors are cluster-robust at the SIC industry level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 6: Heterogeneous Impact on the Durability of Investments

Dependent Variable: log(Investment)		
	(1)	(2)
Panel A: Measure of Depreciation: Ordering		
Q1 * log(ImpComp) * Depreciation	0.0376***	0.0865***
	(0.0117)	(0.0297)
Q2 * log(ImpComp) * Depreciation	0.0298***	0.0756**
	(0.0110)	(0.0309)
Q3 * log(ImpComp) * Depreciation	0.0219*	0.0865**
	(0.0113)	(0.0342)
Q4 * log(ImpComp) * Depreciation	0.0196*	0.0545*
	(0.0101)	(0.0281)
Q5 * log(ImpComp) * Depreciation	0.0133	0.0626**
	(0.0103)	(0.0271)
p-Value: H_0: $Q_1 = Q_5$	0.016	0.043
p-Value: H_0: identical Q_i	0.137	0.146
1st Stage F-Test		3.343
Panel B: Measure of Depreciation: Depreciation Rate		
Q1 * log(ImpComp) * Depreciation	0.464***	0.639**
	(0.108)	(0.274)
Q2 * log(ImpComp) * Depreciation	0.310***	0.476
	(0.113)	(0.297)
Q3 * log(ImpComp) * Depreciation	0.242**	0.648*
	(0.121)	(0.355)
Q4 * log(ImpComp) * Depreciation	0.215*	0.276
	(0.115)	(0.264)
Q5 * log(ImpComp) * Depreciation	0.149	0.422
	(0.121)	(0.263)
p-Value: H_0: $Q_1 = Q_5$	< 0.001	0.026
p-Value: H_0: identical Q_i	0.004	0.04
1st Stage F-Test		2.843
Industry Controls * Depreciation	yes	yes
Category FE	yes	yes
Firm-Year FE	yes	yes
Observations	24,342	24,342
No. Firms	2,401	2,401
Sample Time	1999 - 2003	1999 - 2003

Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). Import competition (*ImpComp*) are imports from China at the sectoral level, relative to domestic absorption (domestic production + imports from China - exports to China). *Qi* corresponds to the within-industry total factor productivity quintile where the firm is sorted in (1 is the lowest, 5 is the highest). Column (2) presents IV estimates using *Post2000*Pre-WTO-Tariff* to instrument for *log(ImpComp)*. Industry controls are capital-intensity, low-skill-intensity and a TFP index. The reported coefficients are plotted in Figure 5. Standard errors are cluster-robust at the SIC industry level.*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 7: Heterogeneous Impact on the Durability of Investments - Exploiting Sectoral Differences in Pre-WTO Tariff Rates

Dependent Variable: log(Investment)		
	(1)	(2)
Measure of Depreciation:	**Ordering**	**Depreciation Rate**
Qi * Post2000 * Pre-WTO-Tariff * Depreciation		
Q1	0.0171**	0.236***
	(0.00746)	(0.0661)
Q2	0.0104	0.0539
	(0.00718)	(0.0699)
Q3	-0.00228	-0.00248
	(0.00650)	(0.0516)
Q4	0.00725	0.0572
	(0.00766)	(0.0676)
Q5	-0.0391*	-0.337*
	(0.0198)	(0.183)
Qi * Pre-WTO-Tariff * Depreciation		
Q1	-0.00137	0.00340
	(0.00728)	(0.0706)
Q2	0.0100	0.171***
	(0.00673)	(0.0562)
Q3	0.00866	0.125**
	(0.00590)	(0.0615)
Q4	0.0138*	0.192***
	(0.00817)	(0.0732)
Q5	0.0216**	0.300***
	(0.00947)	(0.0903)
Qi * Post2000 * Depreciation		
Q1	-0.132***	-1.762***
	(0.0433)	(0.425)
Q2	-0.0973**	-0.927**
	(0.0381)	(0.415)
Q3	-0.0435	-0.751**
	(0.0394)	(0.299)
Q4	-0.0231	-0.477
	(0.0396)	(0.362)
Q5	0.118*	0.513
	(0.0628)	(0.561)
p-Value: H_0: $Q_1 = Q_5$	0.0122	0.00482
p-Value: H_0: identical Q_i	0.133	0.0494
Industry Controls * Depreciation	no	no
Category FE	yes	yes
Firm-Year FE	yes	yes
Observations	24,703	24,703
No. Firms	2,440	2,440
Sample Time	1999 - 2003	1999 - 2003

Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). *Post2000* is an indicator that takes the value 1 if the year is 2001 or later. *Pre-WTO-Tariff* is the simple industry average (over the years 1995-1999) of the effectively applied tariff on US imports from China as reported in the WITS/Comtrade data base. *Qi* corresponds to the within-industry total factor productivity quintile where the firm is sorted in (1 is the lowest, 5 is the highest). The reported coefficients are plotted in Figure 6. Standard errors are cluster-robust at the SIC industry level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 8: The Impact of the Chinese WTO Accession on the Durability of Investments - Exploiting Sectoral Differences in Low-Skill Intensity

Dependent Variable: log(Investment)				
	(1)	(2)	(3)	(4)
Panel A: Measure of Depreciation: Ordering				
Post2000 * Low-Skill-Intensity * Depreciation	0.166***	0.180***	0.177***	0.204***
	(0.0545)	(0.0588)	(0.0580)	(0.0627)
Low-Skill-Intensity * Depreciation	-0.579***	-0.317	-0.596***	-0.0672
	(0.135)	(0.877)	(0.130)	(0.746)
Post2000 * Depreciation	-0.0794***		-0.102***	
	(0.0235)		(0.0286)	
Panel B: Measure of Depreciation: Depreciation Rate				
Post2000 * Low-Skill-Intensity * Depreciation	1.672***	1.478**	1.896***	1.734**
	(0.555)	(0.616)	(0.644)	(0.704)
Low-Skill-Intensity* Depreciation	-1.019	0.373	-1.246	3.498
	(1.538)	(8.634)	(1.563)	(7.540)
Post2000 * Depreciation	-1.015***		-1.343***	
	(0.240)		(0.299)	
Industry Controls * Depreciation	no	yes	no	yes
Category FE	yes	no	yes	no
Category-Year FE	no	yes	no	yes
Firm-Year FE	yes	yes	yes	yes
Observations	18,439	18,184	31,206	30,772
No. Firms	2,364	2,329	2,720	2,680
Sample Time	2000 - 2002	2000 - 2002	1999 - 2003	1999 - 2003

Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). *Post2000* is an indicator that takes the value 1 if the year is 2001 or later. *Low-Skill-Intensity* is the simple industry average (over the years 1995-1999) of the share of compensation for non-production workers in total compensation. Industry Controls are capital-intensity, low-skill-intensity and a TFP index. Standard errors are cluster-robust at the SIC industry level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 9: Robustness: Chinese Import Competition and the Durability of Investments - Estimates by Investment Category

Dependent Variable: log(Investment)		
	(1)	(2)
Land * log(ImpComp)	-0.0560	-0.221
	(0.0585)	(0.214)
Buildings * log(ImpComp)	-0.0313	-0.211
	(0.0566)	(0.201)
Machinery * log(ImpComp)	-0.0428	-0.251
	(0.0600)	(0.186)
Transportation Equipment * log(ImpComp)	-0.0756	-0.170
	(0.0673)	(0.231)
R&D * log(ImpComp)	0.136	-0.162
	(0.0838)	(0.288)
Computer Equipment * log(ImpComp)	0.228**	0.0817
	(0.0931)	(0.208)
p-Value: H_0: $\beta_c = 0$	< 0.001	0.537
Industry Controls * Depreciation	no	no
Category FE	yes	yes
Firm-Year FE	yes	yes
Observations	88,920	88,859
No. Firms	3,520	3,511
Sample Time	1995 - 2009	1995 - 2009

Notes: The ordering of categories resembles the ordering of depreciation rates. Omitted Category is Advertising. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). Import competition (*ImpComp*) are imports from China at the sectoral level, relative to domestic absorption (domestic production + imports from China - exports to China). Column (2) presents IV estimates using *Post2000*Pre-WTO-Tariff* to instrument for *log(ImpComp)*. The reported coefficients are plotted in Figure 7. Standard errors are cluster-robust at the SIC industry level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10: Robustness: Altering and Omitting Investment Categories

Dependent Variable: log(Investment)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Measure of Depreciation: Ordering									
log(ImpComp) * Depreciation	0.0209**	0.0213**	0.0200***	0.0214**	0.0220*	0.0301*	0.0604**	0.0506*	0.0166*
	(0.00883)	(0.00832)	(0.00727)	(0.00903)	(0.0111)	(0.0172)	(0.0279)	(0.0274)	(0.00908)
Industry Controls * Depreciation	yes	yes	yes	yes	yes	yes	yes	yes	yes
Category-Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Excluded Categories	none	R&D	R&D / Advertising	Transport / Computer	Land / Buildings	none	none	none	none
No. of Categories	7	6	5	5	5	4	3	3	7*
Observations	88,607	62,410	52,656	82,776	74,138	88,607	88,607	88,607	88,607
No. Firms	3,504	3,035	2,808	3,448	3,483	3,504	3,504	3,504	3,504
Sample Time	1995 - 2009	1995 - 2009	1995 - 2009	1995 - 2009	1995 - 2009	1995 - 2009	1995 - 2009	1995 - 2009	1995 - 2009

Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates in specification (1)-(5). Specification (6) groups Land, Buildings and Machinery into one category and R&D and Computer into another. Specification (7) additionally takes Transportation into the category with Land, Buildings and Machinery, while specification (8) takes it into the category with R&D and Computer. In specification (9), R&D is ordered as the most long-term investment. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). Import competition (*ImpComp*) are imports from China at the sectoral level, relative to domestic absorption (domestic production + imports from China - exports to China). Industry Controls are capital-intensity, low-skill-intensity and a TFP index. Standard errors are cluster-robust at the SIC industry level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 11: Robustness: Alternative Channels - Foreign Inputs, Export Markets and Financial Frictions

Dependent Variable: log(Investment)				
	(1)	(2)	(3)	(4)
Panel A: Measure of Depreciation: Ordering				
log(ImpComp) * Depreciation	0.0435***	0.139***	0.0227**	0.0581***
	(0.00855)	(0.0434)	(0.00899)	(0.0188)
log(Offshoring) * Depreciation	-0.0366**	-0.117***		
	(0.0181)	(0.0435)		
log(ExpMarket) * Depreciation	-0.0448***	-0.0658***		
	(0.00972)	(0.0147)		
Current Ratio * Depreciation			0.0860***	0.00726***
			(0.00310)	(0.00316)
External Dependence * Depreciation			0.000207***	0.000214***
			(0.0000181)	(0.0000182)
Capital Cost * Depreciation			0.159	0.301**
			(0.0136)	(0.0151)
1st Stage F-Test		13.89		29.16
Panel B: Measure of Depreciation: Depreciation Rate				
log(ImpComp) * Depreciation	0.496***	1.006**	0.244**	0.440**
	(0.0950)	(0.415)	(0.103)	(0.212)
log(Offshoring) * Depreciation	-0.394***	-0.902**		
	(0.150)	(0.430)		
log(ExpMarket) * Depreciation	-0.535***	-0.642***		
	(0.0865)	(0.116)		
Current Ratio * Depreciation			-0.0213	-0.0305
			(0.0269)	(0.0272)
External Dependence * Depreciation			0.00155*	0.00157*
			(0.000857)	(0.000868)
Capital Cost * Depreciation			0.709*	1.061*
			(0.396)	(0.576)
1st Stage F-Test		11.00		20.23
Industry Controls * Depreciation	yes	yes	yes	yes
Category FE	no	yes	no	yes
Category-Year FE	yes	no	yes	no
Firm-Year FE	yes	yes	yes	yes
Observations	88,476	88,417	76,249	76,222
No. Firms	3,480	3,471	3,206	3,201
Sample Time	1995 - 2009	1995 - 2009	1995 - 2009	1995 - 2009

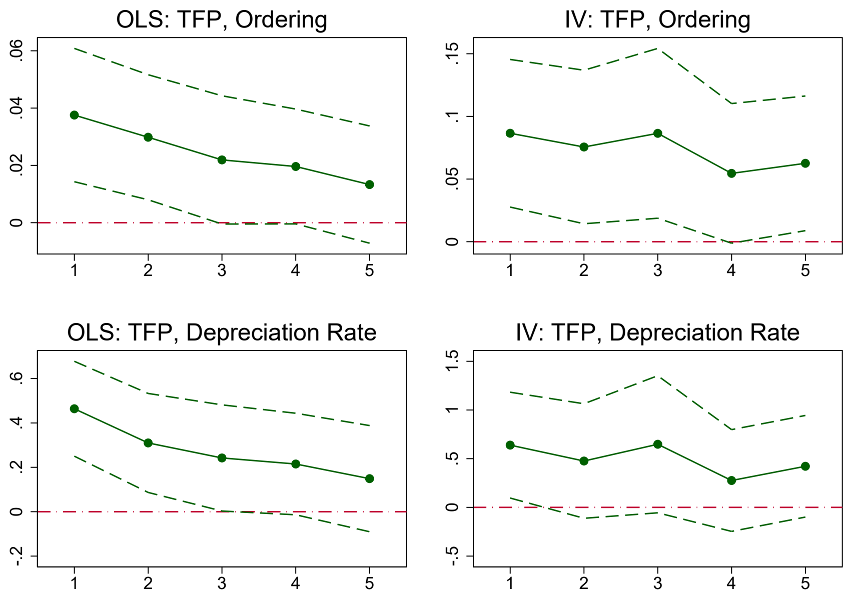
Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). Import competition (*ImpComp*) are imports from China at the sectoral level, relative to domestic absorption (domestic production + imports from China - exports to China). *Offshoring* is the level of import competition at the input industry level; input industry shares are estimated on a similar basis to Feenstra and Hanson (1999). Export market size (*ExpMarket*) are exports to China relative to Chinese domestic absorption. Financial controls are time varying at the firm level: *Current Ratio* is the total of current assets over current liabilities, *External Dependence* is capital expenditure net of EBIT over total capital expenditure, *Capital Cost* is capital expenditure over total liabilities. Industry Controls are capital-intensity, low-skill-intensity and a TFP index. Standard errors are cluster-robust at the SIC industry level. Columns (2) and (4) present IV estimates using *Post2000*Pre-WTO-Tariff* to instrument for *log(ImpComp)*. The 1st Stage F-Test statistics correspond to Kleibergen-Paap rank tests. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 12: Robustness: Investment Shares, Zeros and Missing Investments

Dependent Variable:	**Investment Share**			**Investments (IHS Transf.)**			**Investments (IHS Transf., miss. as 0s)**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Measure of Depreciation: Ordering									
Post2000 * Pre-WTO-Tariff * Depreciation	0.00141*			0.00447			0.00163**		
	(0.000831)			(0.00294)			(0.000802)		
Pre-WTO-Tariff * Depreciation	0.00343***			0.0128***			0.00587***		
	(0.000877)			(0.00371)			(0.00191)		
log(ImpComp) * Depreciation		0.00462***	0.0271***		0.0146**	0.0959***		0.0110***	0.0409***
		(0.00169)	(0.00852)		(0.00729)	(0.0319)		(0.00312)	(0.0128)
1st Stage F-Test			7.762			7.755			8.447
Panel B: Measure of Depreciation: Depreciation Rate									
Post2000 * Pre-WTO-Tariff * Depreciation	0.0121			0.0412			0.0142		
	(0.00908)			(0.0266)			(0.00864)		
Pre-WTO-Tariff * Depreciation	0.0312***			0.117***			0.0762***		
	(0.0109)			(0.0408)			(0.0245)		
log(ImpComp) * Depreciation		0.0636***	0.240***		0.194**	0.866**		0.131***	0.488***
		(0.0223)	(0.0871)		(0.0872)	(0.342)		(0.0362)	(0.173)
1st Stage F-Test			7.380			7.379			8.447
Industry Controls * Depreciation	yes	yes	yes	yes	yes	yes	yes	yes	yes
Category-Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	31,549	31,456	31,456	31,559	31,466	31,466	146,720	146,167	146,167
No. Firms	2,694	2,691	2,691	2,695	2,692	2,692	4,192	4,188	4,188
Sample Time	1999 - 2003	1999 - 2003	1999 - 2003	1999 - 2003	1999 - 2003	1999 - 2003	1999 - 2003	1999 - 2003	1999 - 2003

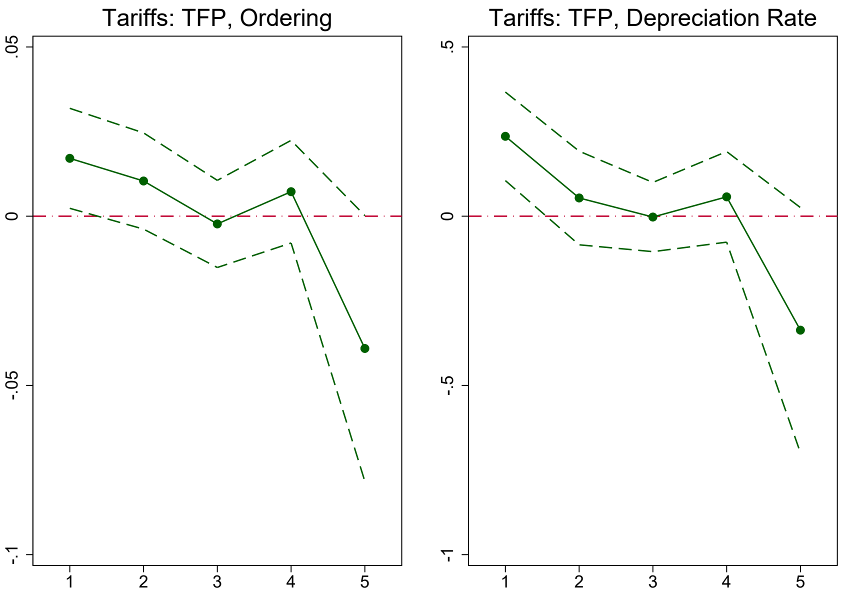
Notes: Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). The ordering of categories resembles the ordering of depreciation rates. Investment expenses are either derived from balance sheet data on assets (Land, Buildings, Machines, Transportation and Computer) or taken from the income statement (R&D and Advertising). *Investment Share* divides the individual category investments by the sum of investments within each firm-year (columns (1) - (3)). *Investments (IHS Transf.)* uses the inverse hyperbolic sine transformation instead of taking logarithms to include zeros (columns (4) - (6)). *Investments (IHS Transf., miss. as 0s)* also uses the inverse hyperbolic sine transformation but treats all missing investments as zeros (columns (7) - (9)). *Post2000* is an indicator that takes the value 1 if the year is 2001 or later. *Pre-WTO-Tariff* is the simple industry average (over the years 1995-1999) of the effectively applied tariff on US imports from China as reported in the WITS/Comtrade data base. Import competition (*ImpComp*) are imports from China at the sectoral level, relative to domestic absorption (domestic production + imports from China - exports to China). Industry Controls are capital-intensity, low-skill-intensity and a TFP index. Standard errors are cluster-robust at the SIC industry level. Columns (3), (6) and (9) present IV estimates using *Post2000*Pre-WTO-Tariff* to instrument for *log(ImpComp)*. The 1st Stage F-Test statistics correspond to Kleibergen-Paap rank tests. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Figure 5: Heterogeneous Impact on the Durability of Investments



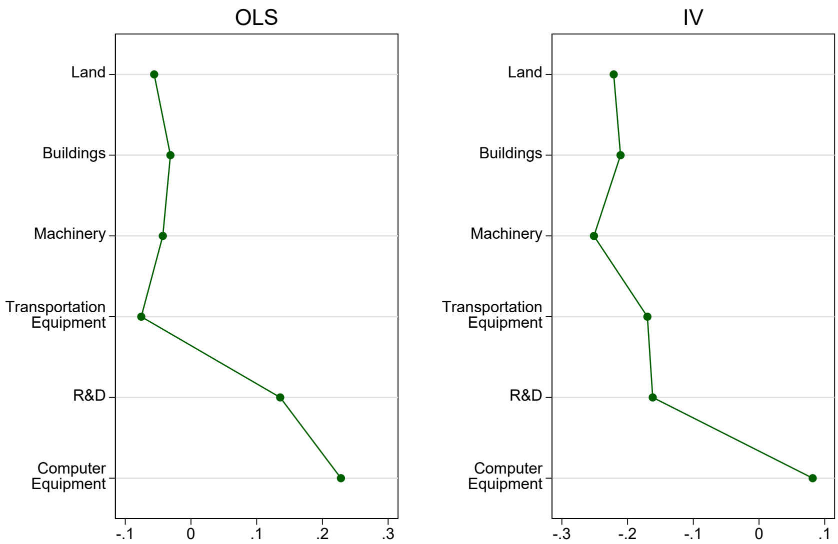
Notes: The figure plots coefficient estimates of *Qi * log(ImpComp) * Depreciation* from Table 6. The dashed lines correspond to 95% confidence intervals.

Figure 6: Heterogeneous Impact on the Durability of Investments - Exploiting Sectoral Differences in Pre-WTO Tariff Rates



Notes: The figure plots coefficient estimates of *Qi * Post2000 * Pre-WTO-Tariff * Depreciation* from Table 7. The dashed lines correspond to 95% confidence intervals.

Figure 7: Robustness: Chinese Import Competition and the Durability of Investments - Estimates by Investment Category



Notes: The figure plots coefficient estimates of *log(ImpComp) * Category* from Table 9. The omitted category is Advertising.

A Theoretical Appendix

A.1 Quality-Increasing Investments

We outlined the theoretical framework by stating that short- and long-term investments reduce production costs in $t = 0$ or $t = 1$. Here, we show that our results are similar when we assume that investments are increasing the perceived-quality of products. Consumers maximize the following utility function over the consumption and quality levels of a set of differentiated products and an outside good H:

$$U_t = H_t + \int_i (1 + d_{it})\, q_{it} - \frac{\gamma}{2} \int_i (q_{it})^2 - \frac{1}{2} \left(\int_i q_{it} \right)^2,$$

where d_{it} is the perceived-quality of firm i and q_{it} is the consumed quantity. Dropping the index i for the individual firm, profits can be written as $\pi_t = \frac{L_t}{\gamma} \left(c_t^D + d_t - c^* \right)^2$, where $c_t^D = \frac{\gamma + N_t \bar{p}_t - N_t \kappa \bar{d}_t}{N_t + \gamma}$ is our inverse measure of competition. Suppose that firm has costs c^* and that investments increase the firm's perceived quality in the following way: $d_0 = k^{0.5}$ and $d_1 = \varphi z^{0.5}$. The firm chooses k and z to maximize $\pi(c_0) + (1 - \delta)\, \pi(c_1) - rk - rz$. Taking the f.o.c. with respect to k and z and taking logs results in the same difference-in-differences equation identifying the shift in the relative composition of investments induced by tougher competition as in equation (8).

A.2 The Impact of Market Size on Investment Composition

Given that trade liberalization is typically associated with both, higher import competition and larger export markets, we also study what an increase in market size would imply for our difference-in-differences estimator. From equations (4) and (5) it becomes clear that a larger market size L_t generates additional demand such that the marginal return of short- and long-term investments increases resulting in a higher level of firm investments for a given level of c_t^D (for both types of investments).[31]

An increase in market size $L_1 > L_0$ in period 1 raises demand and profits and thus the relative value of long-term investments, such that firms become less short-term oriented. Hence, the market size effect works in the opposite direction to the competition effect. As a result, the new intersection of the marginal return of short- and long-term investments shifts to the left implying a reduction in the fraction of short-term investments while the fraction of long-term investments increases.[32] In the empirical analysis, we therefore also take account of this market size effect to control confounding effects.

[31] These effects of trade liberalization on the investment *volume* of firms have been studied empirically by Lileeva and Trefler (2010) and Bustos (2011).

[32] The magnitude of the effect depends again on firm productivity c^*. However, the role of productivity is ambiguous and depends on the sign of the parameter θ which determines the impact of firm productivity on the efficiency of investments. If $\theta > 0$, less productive firms are more efficient in cutting costs and thus they face relatively larger incentives to engage in long-term investments. If $\theta < 0$, high productive firms are more effective in lowering unit costs such that an increase in market size in period 1 creates larger incentives for high productive firms to shift investment expenditures towards long-term investments. As long as $\theta = 0$, firm productivity has no impact on the magnitude of cost reductions.

B Empirical Appendix

B.1 Calculation of the Marginal Effects

Economic Magnitudes based on Chinese Import Competition:

Consider an increase in import competition of 57.4%. This corresponds to the increase of the import competition variable in our estimation sample from 1999 to 2003. We use the regression results from Table 4, Panel B to calculate the relative change in each category. The OLS coefficient estimate of 0.218 in specification (4), Panel B translates to a 17.64% larger reduction of land investments compared to advertising investments.

In order to assess a counterfactual where we compare the average investment duration of firms before and after the competition shock, we need to assume the investment elasticity in one base category because we do not know the level effect of import competition on investments, just the distortion across categories. Here, we use a 0% change in Land investments with respect to a trade shock (when regressing import competition on Land investments and adding firm and year fixed effects, we find Land investments to be inelastic with respect to import competition).

For every firm in our sample, we calculate the sum of expenses in each year. Then we express the individual category investment as share of total firm investments for each year. Next, we use these shares to calculate the average investment share of each category across all firms and years in the sample. Because the resulting average shares do not add up to one, we re-weight the shares accordingly.[33] The resulting investment shares are 2.2% for land investments, 11.2% for building investments, 25.5% for machinery investments, 2.8% for transport equipment investments, 34.8% for R&D investments, 6% for computer investments and 17.5% for advertising investments. Using these shares, we obtain an average sample depreciation rate of 23.1% from multiplying each share with the depreciation rate for the respective category. The calculated average sample depreciation rate of 23.1% then implies that the average firm investment lasts 1579.8 days [$= (1/r) \times 365$].

Applying the relative percentage changes in each category based on the coefficient estimate of 0.218 (or 0.582 for the IV), we can then construct new counterfactual after-trade-shock investment shares. As before, we use these shares to obtain the new average depreciation rate. Investments now fully depreciate after 1515.6 days (or 1432.8 days for the IV), implying that import competition has reduced the duration of investments by about 64 days on average (147 days for the IV).

Next, suppose that this shorter investment life-span of 64 days needs to be financed. If the corresponding interest rate is 3% per annum (365 days), this translates to an additional cost of $0.03 \times \$1.000 \times \frac{64}{365} = \$5.26$.

Economic Magnitudes based on pre-WTO Tariffs:

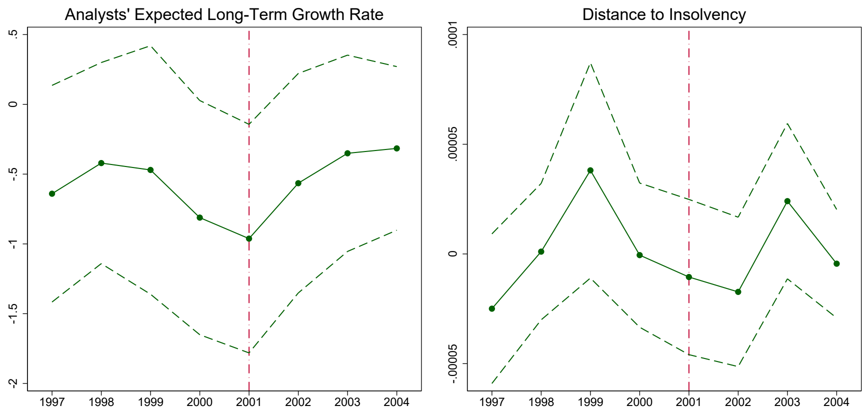
We can consider the following alternative counterfactual based on the difference-in-differences estimations with pre-WTO tariffs. Compare two hypothetical firms: one firm is in an industry with low pre-WTO tariffs at the 25th percentile of the tariff distribution with an ad valorem tariff rate of

[33] See Figure 3 for the average investment composition in our sample.

1.914%; the other firm is in an industry with high pre-WTO tariffs at the 75th percentile of the tariff distribution with an ad valorem tariff rate of 3.786%. During 1999 and 2003, The DiD coefficient estimates in Table 3, specification (4), Panel B translates to a 17 percentage points larger reduction of land investments compared to advertising investments (73.20% for the high-tariff firm compared to 56.25% for the low-tariff firm).

Based on the idea that we keep land investments fixed as we did when calculating the economic magnitudes based on Chinese import competition above, this translates to a 195 days shorter investment life-span. If the corresponding interest rate is 3% per annum (365 days), this translates to an additional cost of $0.03 \times \$1.000 \times \frac{195}{365} = \$16.03$ for the high-tariff firm.

Figure 8: Chinese WTO Accession, Analyst Expectations and Distance to Insolvency



Notes: The figure plots coefficient estimates of *Pre-WTO-Tariff * Year Dummies* on firm-level *Analysts' Expected Long-term Growth Rates* (left graph) and firm-level *Distance to Insolvency* (right graph). The dashed lines correspond to 95% confidence intervals. The *Analysts' Expected Long-term Growth Rate* represents an expected annual increase in operating earnings over the firm's next full business cycle. These forecasts refer to a period of between 3-5 years and are expressed as a percentage. *Distance to Insolvency* is the inverse of the annual mean of a firm's daily squared stock returns.

Table 13: Variable Descriptions and Data Sources

Variable	Description	Source
Investment Variables		
advertising$_{it}$	*advertising* represents the cost of advertising media (i.e., radio, television, and periodicals) and promotional expenses in millions USD; Compustat variable name: XAD	Compustat
computer$_{it}$	*computer software & equipment* (period t) - 0.95 × *computer software & equipment* (period $t-1$); *computer software & equipment* (gross property plant and equipment) represents computer equipment and the information a computer uses to perform tasks in millions USD	Worldscope
R&D$_{it}$	*research & development expenses* (period t) represent all direct and indirect costs related to the creation and development of new processes, techniques, applications and products with commercial possibilities in millions USD	Worldscope
transportation equipment$_{it}$	*transportation equipment* (period t) - 0.95 × *transportation equipment* (period $t-1$); *transportation equipment* (gross property plant and equipment) represents the cars, ships, planes or any other type of transportation equipment in millions USD	Worldscope
machines$_{it}$	*machinery & equipment* (period t) - 0.95 × *machinery & equipment* (period $t-1$); *machinery & equipment* (gross property plant and equipment) represent the machines and machine parts needed by the company to produce its products in millions USD	Worldscope
buildings$_{it}$	*buildings* (period t) - 0.95 × *buildings* (period $t-1$); *buildings* (gross property plant and equipment) represent the architectural structure used in a business such as a factory, office complex or warehouse in millions USD	Worldscope
land$_{it}$	*land* (period t) - 0.95 × *land* (period $t-1$); *land* (gross property plant and equipment) represents the real estate without buildings held for productive use, is recorded at its purchase price plus any costs related to its purchase such as lawyer's fees, escrow fees, title and recording fees in millions USD	Worldscope
Firm Variables		
TFP Quintile$_i$	obtain the set of firm fix effects μ_i from the regression $\ln(y_{it}) = \mu_i + \mu_t + \alpha_k \ln(k_{it}) + \alpha_n \ln(n_{it}) + \varepsilon_{it}$, where y_{it} is real sales (SALE deflated by BEA GDP deflator), k_{it} is a constructed real capital stock (deflated by BEA nonresidential fixed investment good deflator) and n_{it} is employment (EMP); capital stock is approximated with a perpetual inventory method, where we use the book value of the capital stock (PPEGT) in 1990 (or the first available year thereafter) as initial value and iterate forward by computing net investments (PPENT$_{it}$-PPENT$_{it-1}$), where missing values of PPENT are replaced by a linear interpolation of its neighboring values; finally, we rank firm fix effects μ_i within each 3-digit US SIC level and sort these into 5 bins of equal size	Compustat, BEA for price deflators
current ratio$_{it}$	*current ratio* is an indication of a firm's market liquidity and ability to meet creditor's demands; defined as current assets divided by current liabilities during a given year t (banker's rule: >2 for creditworthiness); Compustat variable names: ACT/LCT	Compustat
external dependence$_{it}$	*external dependence* is the fraction of capital expenditures that are not financed by internal capital flows during a given year t; Compustat variable names: (CAPX − EBIT)/CAPX	Compustat
capital cost$_{it}$	*capital cost* is defined as interest expenditures (net) over liabilities during a given year t; Compustat variable names: INTPN/LT	Compustat
distance to insolvency$_{it}$	*distance to insolvency* is the inverse of the annual mean of a firm's daily squared stock returns $([P_d/P_{d-1}]^2)$ multiplied with $\sqrt{252}$ (252 is the average number of trading days per year) during a given year t; based on Atkeson et al. (2013)	CRSP
analyst expectations$_{it}$	*analyst expectations* are analysts' annual mean long-term growth forecasts from the I/B/E/S database. Long-term growth forecasts are the expected *annual* increase in operating earnings over the firm's next full business cycle. These forecasts refer to a period of between 3-5 years and are expressed as a percentage.	I/B/E/S
Industry Variables		
import competition$_{st}$	*ImpComp* is import competition from China defined as $ImpComp = imports^{CHN} / \left(domestic\,shipments + imports^{CHN} - exports^{CHN}\right)$; at the 3-digit US SIC level during a given year t	NBER CES data for vship, UN Comtrade for exports and imports
export market exposure$_{st}$	*ExpMarket* is export market exposure to China defined as $ExpMarket = exports^{CHN} / \left(domestic\,shipments + imports^{CHN} - exports^{CHN}\right)$; at the 3-digit US SIC level during a given year t	NBER CES data for vship, UN Comtrade for exports and imports
offshoring$_{st}$	*Offshoring* is defined as $Offshoring = input\,imports^{CHN} / \left(domestic\,shipments + input\,imports^{CHN} - exports^{CHN}\right)$; at the 3-digit US SIC level during a given year t; $input\,imports^{CHN}$ are defined as the weighted average of imports from China, where weights are constructed using a input-output table following Feenstra and Hanson (1999)	NBER CES data for vship, UN Comtrade for exports and imports
pre-WTO tariff$_s$	simple industry average tariff over the years 1995-2000 of the effectively applied US tariff on imports from China; at the 3-digit US SIC level	UN Comtrade
low-skill-intensity$_s$	simple industry *average* low-skill intensity over the years 1995-2000 of the share of compensation for non-production workers in total compensation; NBER CES variable names: (PAY − PRODW)/PAY; at the 3-digit US SIC level	NBER CES data
capital-intensity$_{st}$	total real capital stock in thousands USD per employee; at the 3-digit US SIC level during a given year t; NBER CES variable names: CAP/EMP	NBER CES data
low-skill-intensity$_{st}$	share of compensation for non-production workers in total compensation; at the 3-digit US SIC level during a given year t; NBER CES variable names: (PAY − PRODW)/PAY	NBER CES data
tfp$_{st}$	5-factor NBER TFP index with base year 1995; $tfp_{'95} = 1$	NBER CES data