LMU

LUDWIG-
MAXIMILIANS-
UNIVERSITÄT
MÜNCHEN

VOLKSWIRTSCHAFTLICHE FAKULTÄT

Fromenteau, Philippe; Schymik, Jan und Tscheke, Jan:

Import Competition and the Composition of Firm Investments

Munich Discussion Paper No. 2016-14

Department of Economics
University of Munich

Volkswirtschaftliche Fakultät
Ludwig-Maximilians-Universität München

Online at https://doi.org/10.5282/ubm/epub.29654

Import Competition and the Composition of Firm Investments

Philippe Fromenteau — LMU Munich
Jan Schymik — LMU Munich
Jan Tscheke — LMU Munich

October 12, 2016

Abstract

We study how foreign competition affects the composition of investments inside firms. A parsimonious model predicts that firms have an incentive to shift their investments towards more short-term assets when exposed to tougher competition. Using data on expenditures of listed US companies into various asset classes with different lifespans, we document empirical evidence that is consistent with this prediction. Over a fifteen year period between 1995 and 2009, the rise in import competition is associated with a reduction of the firm-specific asset lifespan by about 4.5% on average. We additionally exploit the Chinese WTO accession as an exogenous shock in firm expectations about future exposure to competition.

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

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

Department of Economics, LMU Munich, 80539 Munich
philippe.fromenteau@econ.lmu.de, jan.schymik@econ.lmu.de, jan.tscheke@econ.lmu.de.

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.[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. When competition lowers future price-cost margins and thereby reduces the quasi-rents from durable investments, import competition might discourage long-term firm investments leading to adjustments of the investment composition across different asset classes within firms.

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. When tougher competition from abroad reduces future price-cost margins, 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

[1] Hillary Clinton's US presidential election campaign is a prominent example for this policy debate about short-term corporate behavior. Creating stronger incentives for firms to plan for the long-run is part of the program of the Democratic Party for the upcoming legislative period: *"We need an economy where companies plan for the long run [...] - leading to higher productivity, better service, and larger profits."*, Hillary Clinton, 2016. Part of this debate also comes from business experts themselves. For example, Larry Fink, the CEO of the investment firm BlackRock stated: *"Over the past several years, I have written to the CEOs of leading companies urging resistance to the powerful forces of short-termism afflicting corporate behavior. Reducing these pressures and working instead to invest in long-term growth remains an issue of paramount importance for BlackRock's clients, most of whom are saving for retirement and other long-term goals, as well as for the entire global economy."*

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. We use data for the population of stock listed manufacturing firms in the US between 1995 and 2009 to test this prediction. Using data on listed firms has two major advantages for our empirical analysis. First, listed firms disclose investment expenditures across different asset categories which differ in their durability. Similar to Garicano and Steinwender (2016), we exploit variation in durability across asset groups to distinguish between short- and long-term investments.[2] Second, we can use the volatility of each firm's equity within a given year to control for time variation in the distance to firm insolvency and uncertainty.

With the data at hand, we estimate how changes in the sectoral degree of foreign competition lead to a shift of firms' investment composition. We find that between 1995 and 2009, firms became on average more short-term oriented when the level of sectoral import competition increased. Specifically, our estimates suggest that the average increase in import competition by 60% during our sample period has reduced the lifespan of firm assets by 71 days on average, which corresponds to 4.5% of the average asset lifespan. Presuming a refinancing rate of 3%, this would impose an additional interest cost of 6$ for each 1000$ invested.

We find this result to be robust to controlling for several alternative channels that could counteract our results. First, trade liberalization could be associated with a lower probability of firm survival as suggested by the selection mechanism in models of firm heterogeneity à la Melitz (2003). Alternatively, perceived uncertainty could increase due to a changing market environment. As both, a lower probability of firm survival or spikes in uncertainty could lead to a postponement of long-term investments,[3] we control for the probability of future firm survival. We find that a lower likelihood of firm survival cannot fully explain our effects, approximating a firm's distance to insolvency by the inverse of its equity volatility as proposed by Atkeson et al. (2013). Second, the level of import competition could be correlated with developments in the domestic industry. For example, if US industries become more productive over time, this

[2]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.

[3]See Aghion et al. (2010) and Garicano and Steinwender (2016) for the relation between firm liquidity risk and investments or Bloom (2009), Handley and Limão (2015) and Novy and Taylor (2014) for the relation between uncertainty, trade and investments.

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 skill-intensity of the US manufacturing industries. Third, we find our results to be robust to controlling for foreign inputs, financial frictions like credit constraints or the 2007-2009 financial crisis and alternative measures of asset lifespans or future competition. 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 smaller firms, we expect that the investment composition inside smaller firms adjusts more strongly to an increase in foreign competition. Thus, we expect that firm heterogeneity matters for the relative size of this effect. We investigate this role of firm heterogeneity on investment responses empirically and find support for that prediction. When comparing investment responses across the firm size distribution, we find that shifts in investments towards less durable assets as a response to foreign competition are more vigorous among smaller firms. Comparing a firm at the 10th percentile with a firm at the 90th percentile of the firm size distribution (in terms of assets), we find that the lifespan of assets decreases by about 17 days more in the smaller firm.

Lastly, we exploit the WTO accession of China in 2001 as a quasi-natural experiment to study how a change in firms' expectations about future competition shapes their investment composition. 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 *expected* exposure to competition from China from 2001 on, particularly for firms in industries that historically have been protected by high tariffs. In line with our model, we find that firms in industries with high pre-WTO tariffs shifted their investments towards less durable assets as a response to the rise in expected import competition from China. Our estimates suggest that between 1999 and 2003, firms with pre-WTO tariffs at the 75th percentile reduced the life span of investments by about 168 days more than a firm with pre-WTO tariffs at the 25th percentile.

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 (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.

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 describes the data, identification and the empirical results. Finally, section 4 concludes.

2 Theoretical Framework

To understand the impact of competition on firms' investment behavior, we lay out a framework which incorporates the inter-temporal investment decision of a firm with respect to short- and long-term investments. The main goal of the section is to guide our empirical work.

2.1 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 which derive their demand from a linear-quadratic utility function following Melitz and Ottaviano (2008). As a result, firms face a linear demand

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

where the intercept is given by $A_t \equiv \frac{\alpha L_t}{\eta N_t + \gamma} + \frac{\eta N_t}{\eta N_t + \gamma} \frac{L_t}{\gamma} \bar{p}_t$. 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. Linear demand implies an upper price bound $p_t^{max} = \frac{\alpha \gamma}{\eta N_t + \gamma} + \frac{\eta N_t}{\eta N_t + \gamma} \bar{p}_t$ at which demand for a variety 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.[4] Firms face a larger price elasticity of demand if they set higher prices or if the intensity of competition in the economy increases.[5]

2.2 Production and Investment Decision

Production in the differentiated goods sector occurs at constant returns to scale with marginal costs c^* representing the corresponding unit labor requirement. Most importantly, we assume that profit maximizing firms can opt for two types of investment in order to reduce their marginal costs of production c^*. 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 $\varphi > 1$.[6] Higher levels of investment relate to

[4]The parameters α and η are both positive and determine the pattern of substitution between a numéraire good and the differentiated varieties. An increase in α and a decrease in η induce an upward shift in the consumption levels of the differentiated varieties relative to the numéraire. If $\gamma = 0$, the varieties are 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 about the distribution of consumption levels across varieties.

[5]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.

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

lower unit costs with decreasing returns to scale.[7] 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.

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 firms 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, firms with lower marginal costs 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

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

[7]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.

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

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

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

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:

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

2.3 The Impact of Import Competition on Investment Composition

We now analyze the effect of import 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.[8] 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.

[8] 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.

In order to identify the investment distortion created by international 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

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

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 import competition

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

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.*

2.4 Heterogeneous Investment Responses across Firms

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 firms with lower unit costs. While all firms lose profits and market power, the relative change in profits across time decreases with firm size and productivity.[9] 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 larger firms. Thus, smaller 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 smaller firms.*

2.5 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).[10]

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. In Figure 2, this is depicted by an upward shift of the MR_z-curve as the marginal return of long-term investments increases for any level of z. 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.[11] In the empirical analysis, we therefore also take account of this market size effect to control confounding effects.

[9] In our theoretical framework, firm size and productivity are isomorph. We employ employment, assets, and sales as different empirical counterparts of firm size.

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

[11] 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.

3 Empirical Analysis

3.1 Identification

Baseline Estimation

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 investments by firm i in investment category c at time t

$$\ln\left(I_{isct}\right) = \beta_0 + \beta_1 \times \ln\left(ImpComp_{st}\right) \times Short\text{-}Term_c + \mathbf{X'_{isct}}\zeta + \lambda_c + \lambda_{it} + \varepsilon_{isct}, \tag{9}$$

where $ImpComp_{st}$ is our proxy for the exposure of import competition expected in year t which varies across industries s. $Short\text{-}Term_c$ reflects the duration 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. 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.[12] $\mathbf{X'_{isct}}$ is a vector of control variables. λ_c and λ_{it} are fixed effects for different investment types as well as for firm-year combinations in order to 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

[12]See Table 10 for the amount of zeros in investment categories. Furthermore, we also find support for our prediction when considering the extensive margin of investments across categories instead of using investment amounts.

by import competition and reflected in our theoretical model in equation (8).[13] Altogether, 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 ($\beta_1 > 0$).

In our theoretical framework, firms adjust their investments when they expect future competition to change as this differentially affects the return on long- and short-term investments. As we do not observe how firms shape their expectations about competition in the future and since survey evidence suggests that there is wide dispersion in the formation of macroeconomic beliefs across firms (see Coibion et al. (2015)), we use the contemporaneous level of import competition in our baseline estimation. In our data, changes in the level of import competition are very persistent (the correlation coefficient between $\ln(ImpComp_{st+1})$ and $\ln(ImpComp_{st})$ is larger than 0.9) and when firms compare the current level of competition with their past to infer their future exposure to competition, this is consistent with our theory. Alternatively, as competition expectations might be adaptive such that firms expect on average their true future exposure to competition, we also estimate our empirical model with future import competition and find support for our hypothesis. Lastly, we exploit the removal of the possibility of the US Congress to protect US industries with higher non-MFN tariffs vis-à-vis China after China's WTO accession as an expectation shock in future foreign competition.[14]

Besides changes in the effective market size, we are likely to capture an additional competition effect: when competition decreases current (and potentially also future) profits, firms might face a higher likelihood of insolvency in the future as their funds might not cover the claims by creditors. This lower probability of survival might also reduce the return on long-term investments and therefore induce a shift towards short-term assets.[15] We address this alternative mechanism by controlling for changes in the probability of firm survival. We follow the finance literature and construct an empirical proxy for each firm's *distance to insolvency* based on its equity volatility. Atkeson et al. (2013) derive from canonical structural models of credit risk, that the inverse of a firm's equity volatility is an upper bound of the true structural distance from firm insolvency. Moreover, they show that this bound is tight if creditors quickly force insolvent firms to default.

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

[14] We postpone the discussion of the experiment to subsection 3.6.

[15] Garicano and Steinwender (2016) quantify this effect in light of the Great Recession.

We use their measure to proxy for a changing probability of firm survival in order to differentiate the competition effect from the survival effect.

Throughout all estimation equations the within-firm identification strategy allows for a clean identification of the effect of competition on investments as potential firm-specific demand and supply shocks that symmetrically affect investment categories are captured by the firm-year fixed effects. Therefore, the specification mainly requires to control for investment determinants that vary at the firm or sector level and differentially affect a firm's short- and long-term investments.

Firm Heterogeneity

Transferring our approach to firm size and its impact on the effect of import competition on firm investments, we obtain a triple difference specification of the following form

$$\ln(I_{isct}) = \beta_0 + \beta_2 \times \ln(ImpComp_{st}) \times \textit{Short-Term}_c \times Size_i + \mathbf{X'_{isct}}\zeta + \lambda_c + \lambda_{it} + \varepsilon_{isct}. \quad (10)$$

The coefficient β_2 measures the distortion created by competition and its differential impact across the firm size distribution.[16] Again, the specification makes use of investment category as well as firm-year fixed effects such that identification rests upon variation across investment types within firm-year combinations. According to *Prediction 2* we expect import competition to have a more negative influence on short-term relative to long-term investments for larger firms. Thus, our coefficient of interest is expected to be negative ($\beta_2 < 0$) in order to be in line with the theoretical prediction.

3.2 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.

[16] $\beta_2 = \left\{[\ln(k) - \ln(z)]^{\triangle comp>0} - [\ln(k) - \ln(z)]^{\triangle comp=0}\right\}_{c^{*\prime}} - \left\{[\ln(k) - \ln(z)]^{\triangle comp>0} - [\ln(k) - \ln(z)]^{\triangle comp=0}\right\}_{c^*}$, $c^{*\prime} < c^*$

Measuring Firm Investment and Size

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 $Short\text{-}Term_c$:[17] 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). Tables 9 - 11 in the Data Appendix summarize information on the investment data.

To explore the second empirical prediction, we use three different measures of firm size ($Size_i$): a firm's total assets, employment and sales. Since firm size responds endogenously to the level of investments, we hold firm size constant throughout all our estimations and construct firm-specific averages over the years 1995 - 1999, winsorized at the top 1%.

Measuring Foreign Competition and Trade Exposure

We measure import competition at the sector level s for a given year t following Bernard et al. (2006) by

$$ImpComp_{st} = \frac{Imp_{st}}{Prod_{st} + Imp_{st} - Exp_{st}}, \quad (11)$$

where Imp_{st} and Exp_{st} represent the value of total US imports and exports 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. Along the same lines we compute a sector's share of export in domestic consumption

$$ExpMarket_{st} = \frac{Exp_{st}}{Prod_{st} + Imp_{st} - Exp_{st}}. \quad (12)$$

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

Finally, the sectoral degree of openness is given by the ratio of the sum of total US imports and exports over domestic shipments:

$$Openness_{st} = \frac{Imp_{st} + Exp_{st}}{Prod_{st}}. \tag{13}$$

We implicitly assume that all firms within an industry are subject to the same level of foreign competition as well as export market exposure and openness.

Firm and Sector Level Controls

Two alternative channels that can have an impact on the investment composition at the firm-level are changes in financial constraints and changes in the degree of uncertainty faced by firms. To control for changes in financial constraints, we use firms' current ratio, external financial dependence as well as capital cost. Since trade liberalization can also be associated with an increase in the degree of uncertainty or a higher probability of insolvency, we use the inverse of the annualized equity volatility to proxy for variation in the firms' distance to insolvency as suggested by Atkeson et al. (2013). Table 11 provides a detailed definition of these and the following variables.

Moreover, firms' 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.

3.3 Baseline Results

Table 1 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.

In discussing our results, we will focus on the sign of the interaction between import competition and duration in a log-log specification, 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 by one percent. According to *Prediction 1*, if import 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 higher import 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 and combinations of category, category-year, firm, year or firm-year fixed investments. We correct for two-way clustered standard errors throughout all specifications. We cluster at the firm-level and additionally, we cluster at the industry-year level, as our measure of import competition is the same for all firms in a given industry and in a given year. The level of import competition 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 would potentially be confounding our results. 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 our sectoral measure of 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. The inclusion of firm-year fixed effects will account for these confounding effects at the firm or sectoral level, as long as the change in investments is uniform across the different types of investment.

Insert Table 1 about here

In specification (1), we include firm, year and investment fixed effects. In line with the theory, tougher foreign competition is associated with lower investments. Furthermore, this effect is more pronounced for relatively long-term assets.

In specifications (2) to (6), we include firm-year fixed effects. These fixed effect specifications imply that identification, as well as potential confounding effects, all hinge on factors that vary across firms, years and investment categories. In specification (2), only the interaction of import competition with duration fulfills this requirement. No other controls are included. The coefficient is positive as predicted for both measures of depreciation but significant only for the ordered measure.

The problem with specification (2) is that a lot of systematic variation across the three dimensions is now potentially projected on the import channel. Thus, other sectoral developments with a direct impact on investment composition might interfere with our results provided that they are correlated with import competition. We therefore add interactions of the depreciation measure with the firm's distance to insolvency and various sector-level controls in specifications (3) to (5).

In specification (3), we add an interaction with our firm-level proxy of distance to insolvency. This is supposed to disentangle the import competition effect proposed in the theoretical framework from other effects due to a changed probability of firm survival or uncertainty. The coefficient for the interaction with our firm-level proxy of distance to insolvency is negative but only significant for the ordering measure. This is consistent with the results from Garicano and Steinwender (2016) who find that a lower probability of firm survival (*smaller* distance to insolvency) is associated with a shift towards relatively short-term investments. When we include the interaction with our firm-level proxy of distance to insolvency in columns (3) and (5), the size of our coefficient of interest β_1 somewhat decreases, suggesting that tougher import competition might affect investment composition in part due to a lower survival probability. However, as the order of magnitude of our coefficient of interest β_1 remains comparable and mostly significant, we conclude that import competition must have an impact on investment composition other than through changes in firms' probability of survival.

In column (4), we include sector-level controls. Specifically, we interact depreciation with time-varying measures of capital intensity, skill intensity and a tfp index. The import competition coefficient remains positive and now turns significant for both measures of depreciation.

Specification (5) is our preferred specification, where we include interactions with distance to insolvency and the sector-level controls. Consider the following example in order to understand the meaning of our coefficients: a higher level of import competition creates a wedge between investments into different investment categories. Suppose for example that the level of import competition increases by 10%. Then our coefficient in panel A implies that this wedge is equal to 0.342%. Thus, if an exemplary firm reduces its land investments (the most long-term category) by 10%, we would expect that firm to reduce its investments in buildings by 9.66%, its machinery investments by 9.32%, its transportation investments by 8.97%, its R&D investments by 8.63%, its computer investments by 8.29% and its advertising investments (the most short-term category) by 7.95%.

To evaluate the economic significance of our estimates, we invoke a simple thought experiment. We consider the average increase in import competition over the sample period 1995-2009, i.e. 60% over the 15-year period. Additionally, we assume that Land investments respond inelastically to an import competition shock.[18] Using the results from Table 1, panel B, specification (5), we can then calculate the change in the average depreciation rate that results from the increase in

[18]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.

import competition.[19] Our estimates suggest that the average increase in import competition by 60% during our sample period has reduced the lifespan of firm assets by 71 days on average, which corresponds to 4.5% of the average asset lifespan. Presuming a refinancing rate of 3%, this would impose an additional interest cost of 6$ for each 1000$ invested. Thus, import competition is associated with a significant shift towards relatively short-term investments.

In specification (6), we include category-year fixed effects instead of category fixed effects in order to control for investment specific time trends.[20] Our coefficient of interest remains significant and slightly increases.

3.4 Firm Heterogeneity

In our theoretical framework we show that the import competition effect on investment composition should be less pronounced for more productive firms as these firms have larger markups and less elastic residual demand. Since firm size and productivity are isomorph in our theoretical framework and since firm size is a good proxy for residual demand elasticity, we study the effect of foreign competition on investments for firms with different sizes.[21]

Insert Table 2 about here

In Table 2, we confront *Prediction 2* with the data, using a triple interaction with measures of firm size in order to see whether the effect of import competition on investment composition varies along the firm size distribution. We use total employment, net firm sales and total assets as measures of size. Adding the size interactions increases the coefficient on the original interaction (β_1) compared to the baseline. The interaction remains significant at the 1% level in all specifications. The triple interaction with size has the expected negative sign in all specifications, implying that the shift towards short-term investments is less pronounced for larger firms. Statistically, the effect is significant at the 1% level for total assets, independent of the depreciation measure chosen. The effects are less significant for sales and employment and on average stronger when we use the depreciation rate as our measure of duration. Using assets as

[19] See the Data Appendix for details on this calculation.

[20] As Figure 5 suggests, there is for example an upward trend in R&D expenditures over time.

[21] Based on survey data, Atkin et al. (2015) provide recent evidence for a positive relationship of the level of mark-ups and firm size. They therefore consider firm size to be the best proxy for the productivity parameter in heterogeneous firm models based on Melitz (2003).

a measure of size, the coefficients for the depreciation rank imply that for any two neighboring investment categories, a 10% higher import competition is associated with a 0.4% higher decrease in the long-term investment compared to the neighboring shorter-term investment for the median firm. Using an analogous back-of-the-envelope calculation as in the baseline with respect to the estimates from panel B, we compare a firm at the 10th percentile with a firm at the 90th percentile of the firm size distribution (in terms of assets). We find that the lifespan of assets decreases by about 17 days more in the small firm.

3.5 Robustness and Alternative Channels

In the following subsection, we assess the robustness of our baseline results.

Current and Future Import Competition

In our theory, firms adjust their investments due to expected changes in *future* competition as this differentially affects the return on long- and short-term investments. Since we do not observe firms' expectations about competition in the future and since changes in the level of import competition are very persistent in our data, we used the current level of foreign competition as a proxy in our baseline estimations. Alternatively, we exploit changes in future levels of import competition in Table 3. The idea here is that firms might on average anticipate their future exposure to foreign competition correctly, i.e. firm expectations are rational. Without making a claim on how firms form their expectations we want to explore whether our baseline results also hold when we exploit variation of import competition in the future.

Insert Table 3 about here

Specification (1) repeats our preferred specification from the baseline results in Table 1. In columns (2) to (4), we alternatively use the 1-, 3-, or 5-years ahead value of import competition instead of the current exposure for import competition. The coefficient of interest remains positive and significant throughout these specifications. Interestingly, the size of the coefficient increases when we use values for import competition in the more distant future, suggesting that the wedge between investments becomes larger when competition changes in the long-run. In column (5), we combine the current value of import competition with the 3-years ahead value of import competition. While the coefficient for the current value of import competition becomes negative yet insignificant, the coefficient for future import competition remains positive and becomes larger compared to specification (3). The coefficient is significant for the interaction with the ordering measure suggesting that future changes in foreign competition have indeed an effect on firms' investment composition today, even after controlling for the highly correlated level of import competition today.

Differentiating between Import Competition and Market Access

In subsection 2.5 in the theory, we argue that higher market access should have effects exactly opposed to the effects of import competition. Table 4 addresses this point. Because better market access implies higher demand in the future, we would expect firms to shift investments towards this future market. Accordingly, the results for import competition documented so far are probably biased in the opposite direction.

Specification (2) shows that our assumptions regarding the market access effects are confirmed in the data. When regressing investments on the interaction of depreciation with export market size, our estimates suggest that firms are shifting investments towards long-term categories when faced with better export opportunities. These effects for exports are highly significant. In specification (3) we add the export market interaction to the baseline specification to see how our original results are affected. Stable signs indicate that the impact of both imports and exports remain as the theory would predict. The increase in size of our coefficient of interest shows that failing to control for export opportunities biases our coefficient on import competition in the opposite direction.[22] Given these findings, we consider our previous results to represent a conservative estimate of the actual effect. Finally, in specification (4) we use an openness measure that incorporates both import competition and export opportunities and find that mixing up the two effects conceals much of the impact trade has on investment composition. Because the coefficient remains positive and significant for the ordering measure, we conclude that import competition might have slightly outweighed the effect of export opportunities for the firms in our sample.

Insert Table 4 about here

[22] The same holds *vice versa* for export opportunities.

Import Competition and Foreign Inputs

A larger exposure to imports can also affect firm investments by allowing to buy cheaper intermediate inputs and offshore parts of their production chain. Since input industries are often close to the firms' output industries, our measure of import competition could in part also capture a larger supply of foreign input goods. In Table 5, we aim to disentangle the effect of tougher competition from effects that arise due to an increased supply in foreign inputs. We investigate this 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 is

$$Offshoring_{st} = \frac{ImpInputs_{st}}{Prod_{st} + ImpInputs_{st} - Exp_{st}}, \tag{14}$$

where $ImpInputs_{st}$ are the imported 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. In column (2), we include the interaction of the measures of asset depreciation with the offshoring variable instead of the foreign competition variable. We do not find that offshoring significantly affects the investment composition within firms. In order to differentiate the effect of import competition from confounding effects due to larger input supply, we include both interaction terms in specification (3). While our coefficient of interest β_1 remains significantly positive, the coefficient for the interaction term with offshoring is negative and significant at the 10 percent level when using the depreciation rate as a measure of asset depretiation.

Insert Table 5 about here

Financial Constraints

In Table 6 we try to rule out some alternative stories that relate to the 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. In column (2), we add an interaction of the depreciation measure with the firms' current ratio in order to control for differences in firm liquidity. Specification

(3) includes an interaction of the depreciation measure with the firms' external dependence, i.e. the fraction of capital expenditures that are not financed by internal capital flows. Specification (4) interacts the depreciation measure with capital costs and specification (5) interacts the depreciation measure with a financial crisis dummy that indicates the years from 2007 until 2009. While some of these controls appear to have an effect on the investment composition, the results for our measure of import competition are not significantly altered. We therefore conclude that import competition is not just working through changes in firms' financial characteristics and probably better explained by changes in demand.

Insert Table 6 about here

Reordering and Omitting Investment Categories

In order to determine whether our results hinge on the assumed ordering of investment categories in terms of depreciation rates, we omit and regroup various categories for the ordered measure of depreciation in Table 7.[23] Specification (1) repeats our baseline regression. In specification (2) we omit investments into R&D 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.[24] 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. The inclusion of category fixed effects does not help us against this type of disturbances, as the unobservable effect varies over time and industries. Omitting R&D investments reduces the number of observations by more than a quarter and diminishes the size of our coefficient. But our results remain robust at the 5% level of significance, indicating that R&D is an important, but 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 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.

[23]Specifications (1) to (5) are robust to using the depreciation rate instead.

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

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.[25] 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 coefficent remains significantly positive and increases in magnitude.

Insert Table 7 about here

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 almost doubles in size and remains highly significant. 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 duration. 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. Again, 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 effect vanishes and we conclude that our original ordering is more coherent, given that R&D investments are not the sole driver of our results.

3.6 The Impact of China's WTO Accession on the Composition of Firm Investments in the US

In order to substantiate our claim that it is the surge in expected imports that induces a reallocation of investments towards long-term investments, we will exploit a quasi-natural experiment

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

based on the large competition effect caused by China's accession to the WTO in 2001. China's WTO accession is a useful 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.[26]

Second, China's accession to the WTO, and the dramatic increase of exports to the world that followed thereafter,[27] was driven mostly by the change in China's internal conditions and not by the rising import demand of receiving countries. 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 a 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.[28]

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 shock to firm expectations, reducing the dependence of our results on actual imports. Namely, 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.

[26] 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.

[27] 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). Additionally, see Figure 6 in the Data Appendix for the average share of imports from China in total US imports for the industries in our sample.

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

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. We argue that this led to an increase in the *expected* exposure to competition from China, as domestic industries effectively had lost the option to fight China's MFN status through Congress.[29]

We argue that this 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 three digit industries.[30]

Our econometric specification is given by

$$\ln(I_{isct}) = \beta_0 + \beta_3 \times Post2000_t \times Pre\text{-}WTO\text{-}Tariffs_s \times Short\text{-}Term_c + \mathbf{X'_{isct}}\zeta + \lambda_c + \lambda_{it} + \varepsilon_{isct}. \quad (15)$$

$Post2000_t$ 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 duration of an investment category (β_3). Again, we expect the coefficient of interest β_3 to be positive. 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.

Accordingly, we look at the differential change in investment behavior before and after the Chinese WTO accession in 2001, assuming that the *threat* of tariff reductions is larger in high-

[29] 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 (see Figure 7).

[30] The effectively applied tariff is defined as the lowest available tariff, given by preferential tariffs if existent and MFN tariffs otherwise.

tariff industries.[31] In our baseline specifications, we restrict our sample period to the years from 2000 to 2002. This minimizes the effect of actual imports and shifts the focus to a change in expectations. We show that the results become actually smaller when broadening the time frame by two years (1999 to 2003) and allowing actual imports to play a larger role.

While we argue that the results we are going to present in this section represent a causal effect of imports on the investment composition, we are aware that we cannot precisely determine the channel through which imports are affecting the investment choices of firms. Thus, while we claim that import competition is the driving force behind our results, part of the variation we are using might be due to a rise in imported intermediates rather than final goods. Yet, note that cheaper intermediates should have a positive effect on the future market potential of US firms as seen before in Table 5. Thus, if the surge in US imports to China was driven by a surge in intermediate imports, if anything, it would make it more difficult for us to detect a shift towards short-term investments.

Insert Table 8 about here

Table 8 shows the results for the two measures of depreciation. Again, we allow errors to be clustered at the firm level and include firm-year and category or category-year fixed effects in all specifications. We further control for distance to insolvency in all columns of table 8. We omit the time varying sector level controls due to the short time period under consideration but results are robust to their inclusion. Specifications (1) and (2) restrict the sample period to one year before till one year after China's WTO accession. Specifications (3) and (4) extends the sample period by two years. For each period, we show results with category or category-year fixed effects respectively. The triple interaction of interest is significant at the 5% or 10% level in all specifications, implying 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.[32] Specifically, using the results from specification (3) in panel B, we find that for a firm at the 25th

[31] Note that this identifying assumption is corroborated by the fact that we find industries with pre-WTO accession tariff levels above the median to have experienced a 66% larger increase in Chinese import competition than industries with pre-WTO accession tariffs below the median for the years 1999 to 2003.

[32] Note that the negative coefficient on the interaction of our measure of depreciation with the post-2000 dummy implies that on average firms invested relatively more long-term after 2000. This is a materialization of the general trend towards more long-term investments over time which can be seen in Figure 3.

percentile of our tariff measure, the average investment duration increased in the years after 2001 by roughly 168 days more than for firms at the 75th percentile of the pre-2000 tariff distribution.

4 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 size. 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. 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. In order to provide further supportive evidence of a causal effect, we exploit the rise in Chinese imports to the US due to China's accession to the WTO as quasi-natural experiment.

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

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.

Atkin, David, Azam Chaudhry, Shamyla Chaudhry, Amit K. Khandelwal, and Eric Verhoogen. Markup and Cost Dispersion across Firms: Direct Evidence from Producer Surveys in Pakistan. *American Economic Review*, 105(5):537–44, 2015.

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.

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. The Impact of Uncertainty Shocks. *Econometrica*, 77(3):623–685, 2009.

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.

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.

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*, forthcoming, 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.

Handley, Kyle and Nuno Limão. Trade and Investment under Policy Uncertainty: Theory and Firm Evidence. *American Economic Journal: Economic Policy*, 7(4):189–222, 2015.

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.

Novy, Dennis and Alan M. Taylor. Trade and Uncertainty. Working Paper 19941, National Bureau of Economic Research, 2014.

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

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.

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

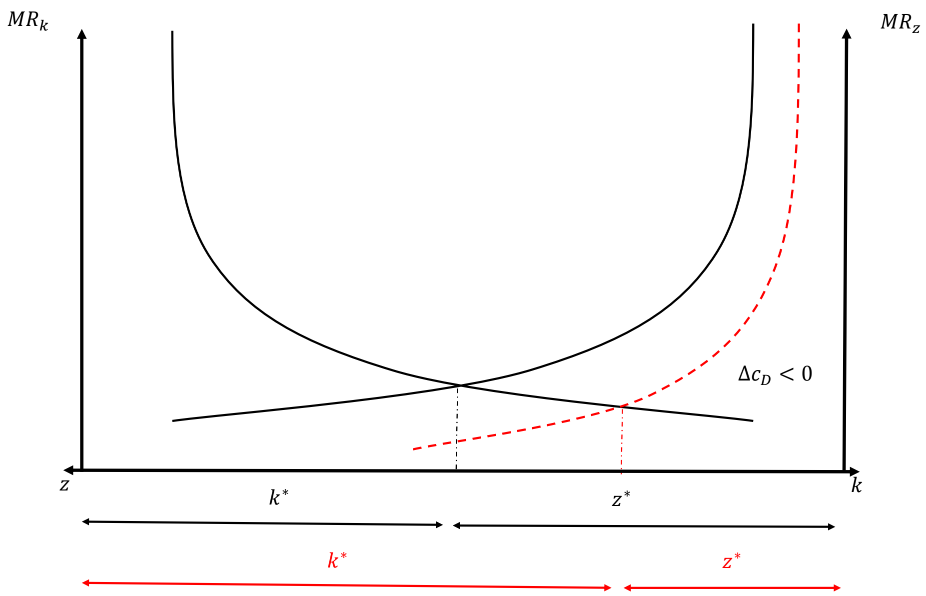


Figure 2: The Impact of an Increase in Market Size on the Composition of Investments

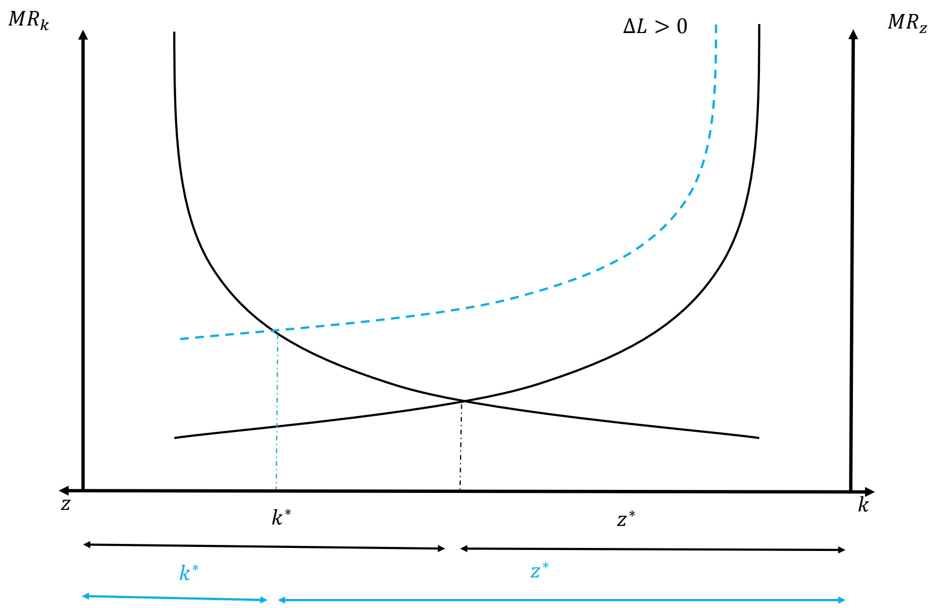
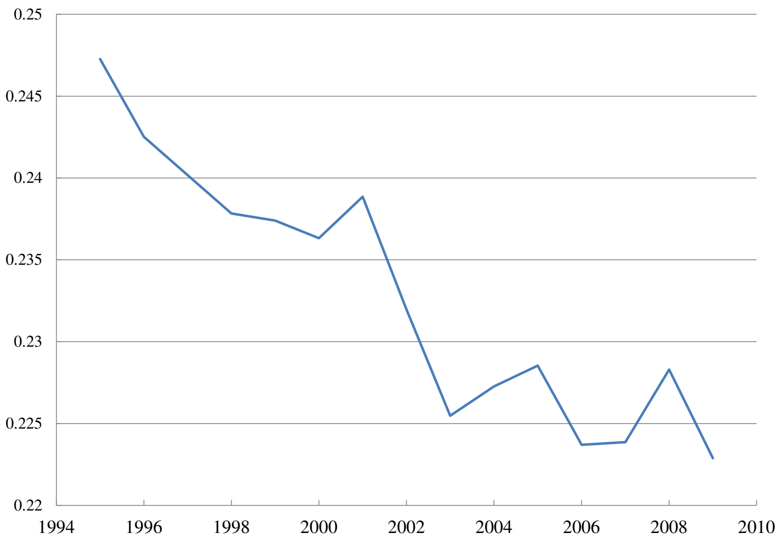


Figure 3: Average Rate of Depreciation over Time



Notes: The figure shows the average depreciation rate over the years for the firms in our sample. The average is constructed by weighting each investment specific depreciation rate with its average investment share across all firms in a specific year. Investment categories and assumed depreciation rates: Land (0%), Buildings (3%), Machines (12%), Transportation (16%), R&D (20%) Computer (30%), Advertising (60%). See the Data Appendix for a description how these average depreciation rates are calculated.

Table 1: Baseline Results

Dependent Variable: log(Investment)	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Measure of Depreciation: Ordering						
log(ImpComp) * Depreciation	0.0465***	0.0455***	0.0445***	0.0353***	0.0342***	0.0363***
	(0.00769)	(0.00813)	(0.00830)	(0.00879)	(0.00895)	(0.00865)
log(ImpComp)	-0.130***					
	(0.0380)					
Distance to Insolvency * Depreciation			-9.590***		-7.607***	-7.612***
			(2.948)		(2.779)	(2.776)
Capital Intensity * Depreciation				-0.000302***	-0.000316***	-0.000301***
				(9.18e-05)	(9.42e-05)	(9.41e-05)
Skill Intensity * Depreciation				0.480***	0.486***	0.503***
				(0.0610)	(0.0617)	(0.0606)
TFP * Depreciation				-0.00897	-0.00653	-0.00720
				(0.00912)	(0.00943)	(0.00939)
Panel B: Measure of Depreciation: Depreciation Rate						
log(ImpComp) * Depreciation	0.172**	0.143	0.141	0.250**	0.235**	0.283***
	(0.0848)	(0.0901)	(0.0921)	(0.0985)	(0.101)	(0.0978)
log(ImpComp)	-0.0220					
	(0.0345)					
Distance to Insolvency * Depreciation			-30.24		-40.27	-41.92
			(27.81)		(26.33)	(26.30)
Capital Intensity * Depreciation				-0.00381***	-0.00401***	-0.00307***
				(0.00102)	(0.00106)	(0.00111)
Skill Intensity * Depreciation				0.900	1.135	1.192*
				(0.700)	(0.719)	(0.699)
TFP * Depreciation				-0.348***	-0.319***	-0.317***
				(0.106)	(0.107)	(0.107)
Investment FE	yes	yes	yes	yes	yes	no
Investment-Year FE	no	no	no	no	no	yes
Firm-Year FE	no	yes	yes	yes	yes	yes
Firm FE	yes	no	no	no	no	no
Year FE	yes	no	no	no	no	no
Observations	95,222	89,735	81,708	89,436	81,430	81,427
Firm Clusters	3,657	3,533	3,356	3,521	3,343	3,343
Industry-Year Clusters	2,693	2,548	2,462	2,527	2,441	2,441

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 at the sectoral level, relative to domestic production plus imports minus exports. Distance to Insolvency is the inverse standard deviation of daily stock returns in a given year. Standard errors are twoway cluster-robust at the firm and at the industry-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 2: Heterogeneous Investment Responses Across Firms

Dependent Variable: log(Investment)				
		Size Measure		
		Employment	Sales	Assets
	(1)	(2)	(3)	(4)
Panel A: Measure of Depreciation: Ordering				
log(ImpComp) * Depreciation	0.0342***	0.0404***	0.0411***	0.0409***
	(0.00895)	(0.00999)	(0.00976)	(0.00957)
log(ImpComp) * Depreciation * Size		-0.000613	-3.40e-06*	-3.35e-06***
		(0.000391)	(1.76e-06)	(1.24e-06)
Depreciation * Size		-0.000881	-3.49e-06	-5.31e-06
		(0.000974)	(4.05e-06)	(3.47e-06)
Panel B: Measure of Depreciation: Depreciation Rate				
log(ImpComp) * Depreciation	0.235**	0.326***	0.339***	0.331***
	(0.101)	(0.111)	(0.108)	(0.107)
log(ImpComp) * Depreciation * Size		-0.00726*	-4.24e-05**	-3.99e-05***
		(0.00379)	(1.87e-05)	(1.22e-05)
Depreciation * Size		0.00145	1.37e-05	-1.54e-05
		(0.0103)	(4.60e-05)	(3.53e-05)
Distance to Insolvency * Depreciation	yes	yes	yes	yes
Industry Controls * Depreciation	yes	yes	yes	yes
Investment FE	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes
Observations	81,430	72,739	75,181	75,263
Firm Clusters	3,343	2,732	2,852	2,856
Industry-Year Clusters	2,441	2,353	2,381	2,381

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 at the sectoral level, relative to domestic production plus imports minus exports. Measures of size are from Compustat and represent firm averages over the years 1995 to 1999. Industry controls contain controls for capital-intensity, skill-intensity and tfp. Distance to Insolvency is the inverse standard deviation of daily stock returns in a given year. Standard errors are twoway cluster-robust at the firm and at the industry-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3: Current and Future Import Competition

Dependent Variable: log(Investment)					
	(1)	(2)	(3)	(4)	(5)
Panel A: Measure of Depreciation: Ordering					
log(ImpComp) * Depreciation	0.0342***				-0.0276
	(0.00895)				(0.0372)
log(ImpComp t+1) * Depreciation		0.0362***			
		(0.00909)			
log(ImpComp t+3) * Depreciation			0.0381***		0.0658*
			(0.00940)		(0.0378)
log(ImpComp t+5) * Depreciation				0.0395***	
				(0.00979)	
Panel B: Measure of Depreciation: Depreciation Rate					
log(ImpComp) * Depreciation	0.235**				-0.0628
	(0.101)				(0.341)
log(ImpComp t+1) * Depreciation		0.259**			
		(0.102)			
log(ImpComp t+3) * Depreciation			0.284***		0.347
			(0.106)		(0.344)
log(ImpComp t+5) * Depreciation				0.287**	
				(0.112)	
Distance to Insolvency * Depreciation	yes	yes	yes	yes	yes
Industry Controls * Depreciation	yes	yes	yes	yes	yes
Investment FE	yes	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes	yes
Observations	81,430	76,539	66,173	55,371	66,173
Firm Clusters	3,343	3,322	3,175	2,995	3,175
Industry-Year Clusters	2,441	2,297	2,007	1,704	2,007

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 at the sectoral level, relative to domestic production plus imports minus exports. Industry controls contain controls for capital-intensity, skill-intensity and tfp. Distance to Insolvency is the inverse standard deviation of daily stock returns in a given year. Standard errors are twoway cluster-robust at the firm and at the industry-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4: Import Competition and Access to Foreign Markets

Dependent Variable: log(Investment)				
	(1)	(2)	(3)	(4)
Panel A: Measure of Depreciation: Ordering				
log(ImpComp) * Depreciation	0.0342***		0.0774***	
	(0.00895)		(0.0121)	
log(ExpMarket) * Depreciation		-0.0339***	-0.0798***	
		(0.00908)	(0.0116)	
log(Openness) * Depreciation				0.0167***
				(0.00638)
Panel B: Measure of Depreciation: Depreciation Rate				
log(ImpComp) * Depreciation	0.235**		0.647***	
	(0.101)		(0.126)	
log(ExpMarket) * Depreciation		-0.496***	-0.854***	
		(0.0991)	(0.115)	
log(Openness) * Depreciation				0.0179
				(0.0735)
Distance to Insolvency * Depreciation	yes	yes	yes	yes
Industry Controls * Depreciation	yes	yes	yes	yes
Investment FE	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes
Observations	81,430	81,430	81,430	81,430
Firm Clusters	3,343	3,343	3,343	3,343
Industry-Year Clusters	2,441	2,441	2,441	2,441

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 at the sectoral level, relative to domestic production plus imports minus exports. Export market size (ExpMarket) are exports at the sectoral level, relative to domestic production plus imports minus exports. Openness is the sum of exports and imports at the sectoral level, relative to domestic production plus imports minus exports. Industry controls contain controls for capital-intensity, skill-intensity and tfp. Distance to Insolvency is the inverse standard deviation of daily stock returns in a given year. Standard errors are twoway cluster-robust at the firm and at the industry-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: Import Competition and Foreign Inputs

Dependent Variable: log(Investment)			
	(1)	(2)	(3)
Panel A: Measure of Depreciation: Ordering			
log(ImpComp) * Depreciation	0.0342***		0.0277***
	(0.00895)		(0.00935)
log(Offshoring) * Depreciation		0.0106	-0.0118
		(0.0196)	(0.0190)
Panel B: Measure of Depreciation: Depreciation Rate			
log(ImpComp) * Depreciation	0.235**		0.246**
	(0.101)		(0.111)
log(Offshoring) * Depreciation		-0.166	-0.371*
		(0.201)	(0.198)
Distance to Insolvency * Depreciation	yes	yes	yes
Industry Controls * Depreciation	yes	yes	yes
Investment FE	yes	yes	yes
Firm-Year FE	yes	yes	yes
Observations	81,430	73,738	73,452
Firm Clusters	3,343	2,963	2,950
Industry-Year Clusters	2,441	1,619	1,592

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 at the sectoral level, relative to domestic production plus imports minus exports. 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). Industry controls contain controls for capital-intensity, skill-intensity and tfp. Distance to Insolvency is the inverse standard deviation of daily stock returns in a given year. Standard errors are twoway cluster-robust at the firm and at the industry-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 6: Alternative Financial Channels

Dependent Variable: log(Investment)

	(1)	(2)	(3)	(4)	(5)
Panel A: Measure of Depreciation: Ordering					
log(ImpComp) * Depreciation	0.0342***	0.0310***	0.0330***	0.0327***	0.0343***
	(0.00895)	(0.00896)	(0.00908)	(0.00899)	(0.00893)
Current Ratio * Depreciation		0.00970***			
		(0.00224)			
External Dependence * Depreciation			0.000207**		
			(0.000102)		
Capital Cost * Depreciation				-0.195***	
				(0.0230)	
Crisis * Depreciation					-0.00394
					(0.0200)
Panel B: Measure of Depreciation: Depreciation Rate					
log(ImpComp) * Depreciation	0.235**	0.234**	0.227**	0.220**	0.239**
	(0.101)	(0.1000)	(0.102)	(0.0997)	(0.101)
Current Ratio * Depreciation		-0.000736			
		(0.0247)			
External Dependence * Depreciation			0.00150*		
			(0.000817)		
Capital Cost * Depreciation				-2.158***	
				(0.293)	
Crisis * Depreciation					-0.256
					(0.203)
Distance to Insolvency * Depreciation	yes	yes	yes	yes	yes
Industry Controls * Depreciation	yes	yes	yes	yes	yes
Investment FE	yes	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes	yes
Observations	81,430	78,653	78,551	78,558	81,430
Firm Clusters	3,343	3,218	3,218	3,220	3,343
Industry-Year Clusters	2,441	2,409	2,413	2,413	2,441

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 depreciations 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 at the sectoral level, relative to domestic production plus imports minus exports. Financial controls are time varying at the firm level derived from Compustat: 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. Crisis is an indicator equal to 1 for the years 2007-2009. Industry controls contain controls for capital-intensity, skill-intensity and tfp. Distance to Insolvency is the inverse standard deviation of daily stock returns in a given year. Standard errors are twoway cluster-robust at the firm and at the industry-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 7: 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	0.0342***	0.0188**	0.0221*	0.0353***	0.0433***	0.0679***	0.108***	0.0937***	-0.0170*
	(0.00895)	(0.00936)	(0.0128)	(0.00919)	(0.0154)	(0.0163)	(0.0277)	(0.0269)	(0.00916)
Distance to Insolvency * Depreciation	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry Controls * Depreciation	yes	yes	yes	yes	yes	yes	yes	yes	yes
Investment 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	Transportation / Computer	Land / Buildings	none	none	none	none
Number of Categories	7	6	5	5	5	4	3	3	7*
Observations	81,430	58,140	49,271	76,376	48,174	81,430	81,430	81,430	81,430
Firm Clusters	3,343	2,916	2,707	3,290	2,959	3,343	3,343	3,343	3,343
Industry-Year Clusters	2,441	2,369	2,310	2,400	2,155	2,441	2,441	2,441	2,441

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 at the sectoral level, relative to domestic production plus imports minus exports. Industry controls contain controls for capital-intensity, skill-intensity and tfp. Distance to Insolvency is the inverse standard deviation of daily stock returns in a given year. Standard errors are twoway cluster-robust at the firm and at the industry-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 8: The Impact of China's WTO Accession

Dependent Variable: log(Investment)				
	(1)	(2)	(3)	(4)
Panel A: Measure of Depreciation: Ordering				
Post2000 * Pre-WTO-Tariff * Depreciation	0.00798**	0.00940**	0.00540*	0.00730**
	(0.00403)	(0.00408)	(0.00299)	(0.00303)
Pre-WTO-Tariff * Depreciation	0.00223	0.00126	0.00510	0.00391
	(0.00432)	(0.00429)	(0.00349)	(0.00345)
Post2000 * Depreciation	-0.0227		-0.0284**	
	(0.0171)		(0.0140)	
Panel B: Measure of Depreciation: Depreciation Rate				
Post2000 * Pre-WTO-Tariff * Depreciation	0.0776**	0.0826**	0.0547*	0.0608**
	(0.0352)	(0.0353)	(0.0283)	(0.0283)
Pre-WTO-Tariff * Depreciation	0.0747*	0.0712*	0.106***	0.102***
	(0.0394)	(0.0393)	(0.0337)	(0.0335)
Post2000 * Depreciation	-0.420**		-0.563***	
	(0.171)		(0.153)	
Distance to Insolvency * Depreciation	yes	yes	yes	yes
Investment FE	yes	no	yes	no
Investment-Year FE	no	yes	no	yes
Firm-Year FE	yes	yes	yes	yes
Sample Time	2000 - 2002	2000 - 2002	1999 - 2003	1999 - 2003
Observations	16,537	16,535	27,651	27,648
Firm Clusters	2,091	2,091	2,403	2,403

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). Sample period 1999-2003. 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 1995-2000) of the effectively applied tariff on US imports from China as reported in the WITS/Comtrade data base. Distance to Insolvency is the inverse standard deviation of daily stock returns in a given year. Standard errors are cluster-robust at the firm level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix A: Data

Table 9: Depreciation Rates of Investments

Firm Investment:	***Applied Depreciation Rate:***	***Duration Rank:***
advertising	60%	7
computer	30%	6
R&D	20%	5
transportation equipment	16%	4
machines	12%	3
buildings	3%	2
land	0%	1

Notes: Applied depreciation rates are obtained from Garicano and Steinwender (2016) who derive the investment-specific depreciation rates from various sources of the accounting literature.

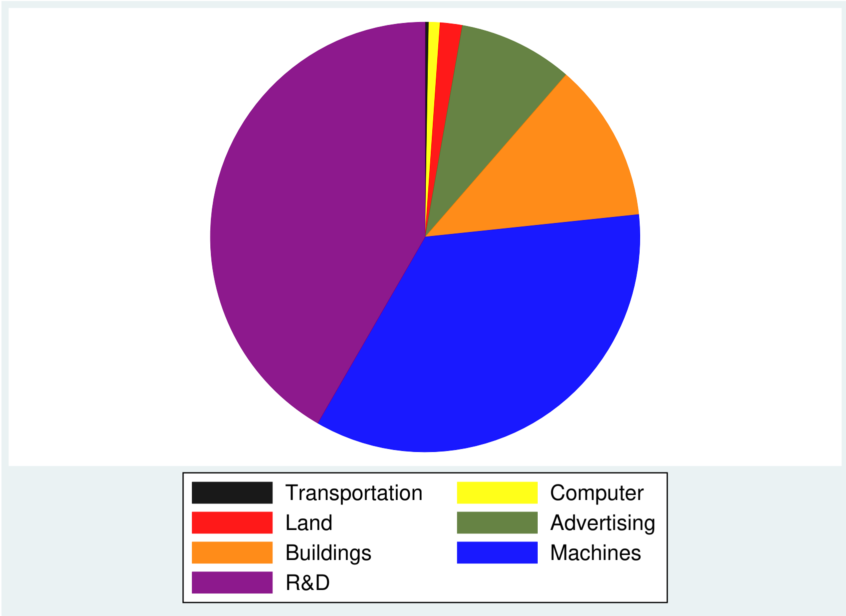
Table 10: Selected Summary Statistics

	N	*Mean*	*Std. Dev.*	*Min*	*Max*	*Obs. = 0*
Firm-Year Level						
advertising investments (millions USD)	41,351	358.1	1,618.7	0	53,775.0	2
computer investments (millions USD)	4,404	7.1	27.8	0	776.9	13
R&D investments (millions USD)	33,620	89.5	460.3	0	10,611.0	3,748
transportation equipment investments (millions USD)	4,758	1.6	18.3	0	1,088.5	1,497
machinery investments (millions USD)	30,287	81.8	429.3	0	43,764.8	27
building investments (millions USD)	22,013	38.9	173.3	0	11,104.6	258
land investments (millions USD)	18,258	6.7	66.5	0	7,150.9	289
distance to insolvency	32,413	0.06	0.002	0.0010	0.09	
current ratio	39,981	3.72	6.30	0.0000	503.31	
external dependence	17,610	53.77	493.17	0.0002	33683.50	
capital costs	39,879	0.15	0.50	0.0000	81.06	
Firm Level						
avg. employment (thousands)	3,090	4.1	11.0	0	76.3	
avg. sales (millions USD)	3,221	826.4	2,440.8	0	16,807.8	
avg. assets (millions USD)	3,225	866.3	2,809.2	0	21,122.8	
Industry-Year Level						
import competition	3,434	0.3	1.3	0.0001	49.4	
export market exposure	3,434	0.2	1.3	0.0002	48.4	
offshoring	1,851	0.3	0.2	0.0063	2.6	
capital intensity	3,432	154.9	193.3	8.74	1,450.5	
skill intensity	3,432	0.4	0.1	0.17	0.9	

Table 11: Variable Descriptions and Data Sources

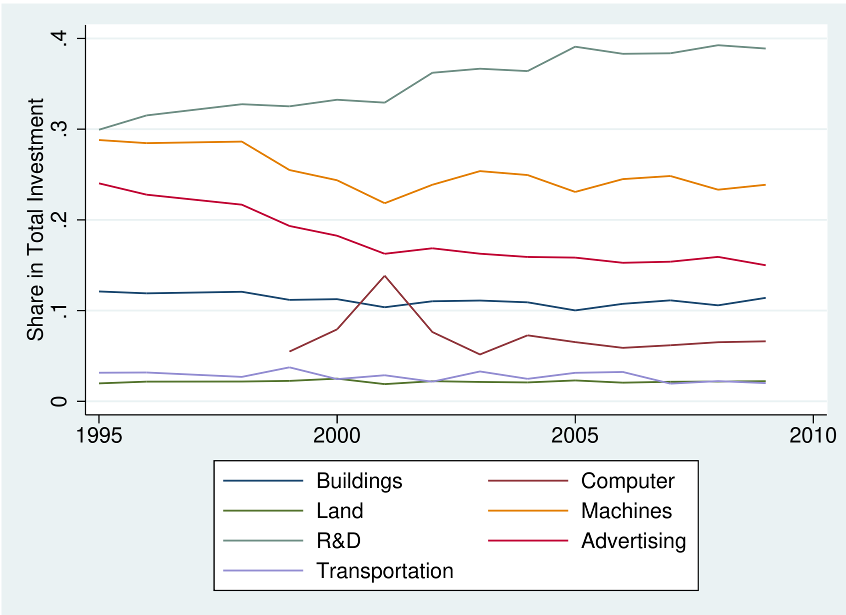
Variable:	*Description:*	*Source:*
Firm Investments		
advertising$_{it}$	*advertising* represents the cost of advertising media (i.e., radio, television, and periodicals) and promotional expenses in millions USD; Compustat variable name: XAD	Compustat
computer$_{it}$	*computer software & equipment* (period 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 Controls		
employment$_{i}$	average firm employment in thousands over the years 1995-1999, winsorized at the top 1%; Compustat variable name: EMP	Compustat
sales$_{i}$	average firm sales in millions USD over the years 1995-1999, winsorized at the top 1%; Compustat variable name: SALE	Compustat
assets$_{i}$	average firm assets in millions USD over the years 1995-1999, winsorized at the top 1%; Compustat variable name: AT	Compustat
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 capital expenditures over liabilities during a given year t; Compustat variable names: CAPX/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
Trade Variables		
import competition$_{st}$	*ImpComp* is defined as $ImpComp = imports^{World} / \left(domestic\,shipments + imports^{World} - exports^{World}\right)$; 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 defined as $ExpMarket = exports^{World} / \left(domestic\,shipments + imports^{World} - exports^{World}\right)$; at the 3-digit US SIC level during a given year t	NBER CES data for vship, UN Comtrade for exports and imports
openness$_{st}$	*Openness* is defined as $Openness = (exports^{World} + imports^{World})/domestic\,shipments$; at the 3-digit US SIC level during a given year t	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
offshoring$_{st}$	*Offshoring* is defined as $Offshoring = input\,imports^{World} / \left(domestic\,shipments + input\,imports^{World} - exports^{World}\right)$; at the 3-digit US SIC level during a given year t; $input\,imports^{World}$ are defined as the weighted average of imports, 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, US BEA for input-output table
Industry Controls		
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
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
Other Controls		
economic crisis	is an indicator equal to 1 for the years 2007-2009	
post 2000	is an indicator equal to 1 for the years 2001-2003 and equal to 0 for the years 1999-2000	

Figure 4: Shares of Investment Categories in Total Investments



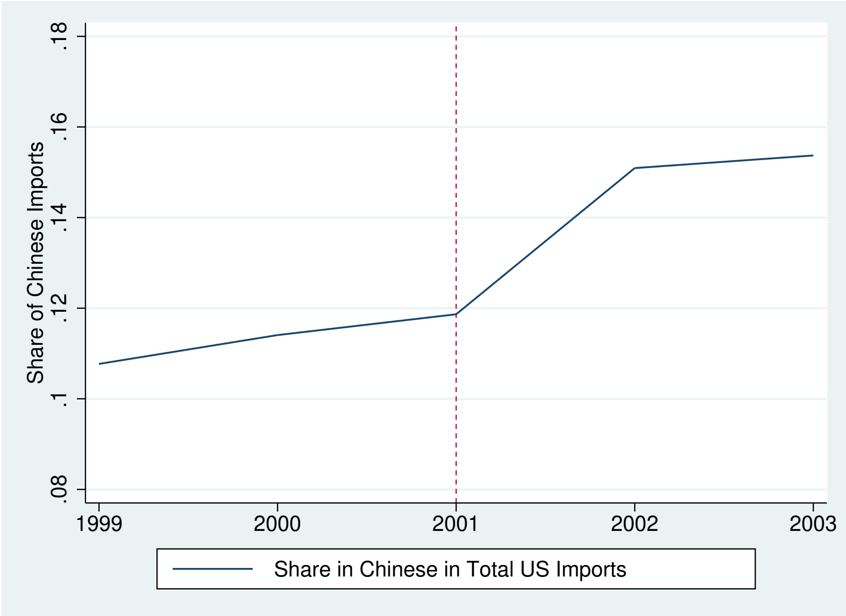
Notes: The figure shows the sample average composition of investment categories.

Figure 5: Shares of Investment Categories over Time



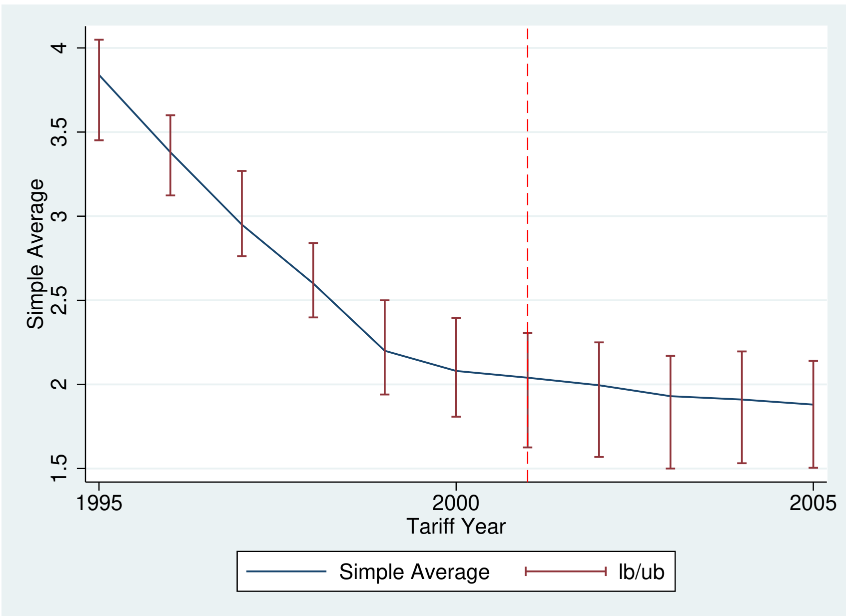
Notes: The figure shows the development of the composition of investment categories over time.

Figure 6: Share of Chinese in Total US Imports



Notes: The figure shows the average share of imports from China relative to total imports of the US for the US SIC 3-digit industries in our sample.

Figure 7: Median Ad-Valorem US Tariff on Imports from China



Calculation of the Marginal Effects

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] We use the resulting shares to construct an average depreciation rate, where we weight the category specific depreciation rates with the respective average share in investment. This way, we obtain an average sample depreciation rate of 23.1%, which implies that the average firm investment lasts 1579.8 days [$= (1/r) \times 365$].

Now we consider an increase in import competition of 60%. This corresponds to the increase of the import competition variable in our estimation sample (from 22.4% in 1995 to 35.7% in 2009). We use the regression results to calculate the relative change in each category. Because we do not know the level effect of import competition on investments, we additionally need to assume the investment elasticity in one base category. 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).

Applying the relative percentage changes in each category, we can then construct new after-trade-shock investment shares. As before, we use these shares to obtain the new average depreciation rate (24.19% for specification (5) in panel B of Table 1). Investments now fully depreciate after 1508.4 days, implying that import competition has reduced the duration of investments by about 71 days on average.

Note that these results depend on the critical values chosen for the increase in import competition and the elasticity of Land investments with respect to import competition. Thus, letting the percentage change in Land vary from -10% to +10% (holding constant the increase in import competition at 60%) changes the reduction in days from -78.4 to -65.6.

[33] See Figures 4 and 5 for the average investment composition in our sample.