The Downstream Impact of Upstream Tariffs: Evidence from Investment Decisions in Supply Chains*

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Abstract

Using data on import tariffs and investment in U.S. manufacturing industries between 1974 and 2012, we show that upstream tariff reductions are followed by increased downstream investment. We test different possible explanations. The results are most consistent with tariff reductions improving downstream customers' incentives to invest by mitigating the risk of ex post hold-up from upstream suppliers. In particular, we find that the investment response is stronger if the customers have little bargaining power and are not vertically integrated with their suppliers, if the suppliers produce specific inputs, and if high uncertainty inhibits the use of long-term contracts.

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1 Introduction

After several decades of trade liberalization, protectionist policies to shelter domestic industries from foreign competition experience a resurgence in popularity both in the U.S. and in Europe. The economic consequences of protectionism versus liberalization have been an important topic of political and academic debate for a long time, and the majority view for many years has been that free trade is net beneficial. This view is backed by abundant empirical evidence from developing countries. Yet, it is unclear which empirical patterns extend from developing to industrialized economies. Furthermore, while the existing literature has focused on the direct effects within a given industry, there is surprisingly little evidence on the indirect effects on other, related industries. This lack of evidence on the propagation across industries is important because the long-run gains from free trade – access to cheaper, imported goods – are likely to be dispersed throughout the whole economy. The short-run adjustment costs, instead, are typically concentrated on a smaller number of directly affected firms and workers. Indeed, recent literature focuses on the negative effects of increased trade liberalization on employment and investment in directly affected U.S. industries.[1] Much less is known about the potentially positive consequences for other, related industries.

We aim to make a first step towards filling this gap by studying one important channel through which trade liberalizations – in particular, import tariff reductions – in one industry impact economic activity in other industries: Using data on tariffs and investment in U.S. manufacturing industries between 1974 and 2012, we trace out the impact of tariff reductions in upstream industries on downstream firms' investment in productive capacity. We find that downstream firms increase capital expenditures following tariff reductions in their suppliers' industries. Specifically, our estimates imply that downstream customers increase investment by 5% to 6% if the fraction

[1] See, for example, Autor, Dorn, and Hanson (2013) and Pierce and Schott (2016, 2017). An exception are Acemoglu, Autor, Dorn, Hanson, and Price (2016), who document negative effects on upstream employment.

of upstream suppliers that have experienced large tariff reductions increases by one standard deviation (7%). At the aggregate level, the estimates imply an increase of total investment in the U.S. manufacturing sector by USD 5 to 6 billion per year and an increase in output and employment by 5%. To the best of our knowledge, we are the first to document these results.

A concern is that tariff cuts may be due to industrial lobbying and that firms' lobbying efforts may depend on their growth opportunities. Krugman, Obstfeld, and Melitz (2015) argue that multilateral trade negotiations are less likely to be captured by lobbying groups than the decision making process behind unilateral policy changes. We thus confirm that our findings are robust to relying only on tariff cuts resulting from multilateral trade agreements.[2] We also show that the relation between upstream tariff cuts and downstream investment is weaker if upstream shipping costs are high. This finding is consistent with high shipping costs acting as a barrier to international trade and thus muting the effect of tariff reductions. If upstream tariff cuts had no effect on downstream investment but were merely correlated with unobserved growth opportunities, then we would not expect the response in downstream investment to vary with upstream shipping costs.

After documenting the empirical finding that downstream investment increases following upstream tariff reductions, we ask why this is the case. Arguably the most natural explanation is that import tariff reductions lead to lower input prices for downstream firms. Lower input prices, in turn, make it more profitable to invest in additional productive capacity. The data support this view. In contrast, we do not find support for other possible explanations: There is no evidence that the increase in investment is driven by a reduction in uncertainty about input prices or a by relaxation of the downstream firms' financial constraints.

Next, we examine the channel through which tariff reductions impact prices and investment. One possibility is that lower tariffs simply imply lower import duties and thus lower costs when

[2]The GSP introduction in 1976, completion of GATT rounds in 1979 and 1994, and start of NAFTA in 1994.

buying from foreign suppliers. Another possibility is that domestic suppliers reduce their prices in response to increased competition from foreign rivals (or the threat thereof): If prices are set through monopolistic competition, a larger number of competing suppliers goes hand in hand with lower prices (e.g., Melitz and Ottaviano (2008)). Alternatively, if prices are set through bilateral bargaining, tariff reductions can alleviate hold-up problems: When import tariffs in upstream industries are lowered, downstream customers' bargaining position vis-à-vis their domestic suppliers improves as the cost of procuring inputs from abroad decreases. This, in turn, reduces the suppliers' ability to hold-up their customers ex post, leads to lower prices, and increases the customers' incentives to invest in productive capacity (e.g., Hart (1995)).

The above channels are not mutually exclusive. All are likely to play some role in the increase in investment we observe. To gauge their relative importance, we exploit differences in the cross-sectional variation they imply. Specifically, we consider that tariff cuts may affect the marginal cost of supplying the input (e.g., because of lower import duties) or the markup that suppliers charge (e.g., because of increased competition). We further consider two different price-setting mechanisms: monopolistic competition among the suppliers and bilateral bargaining between suppliers and customers. We then test the different cross-sectional implications in the data.

We begin by distinguishing between customers and suppliers with high and low bargaining power. In case of monopolistic competition, suppliers post prices at which they are willing to sell to any customer. As a consequence, an individual customer's bargaining power does not play a role. In case of bilateral bargaining, instead, a customer's bargaining power vis-à-vis the supplier is naturally important. In particular, the direction in which differences in bargaining power influence the investment response depends on whether tariff cuts reduce the supplier's marginal cost of production or improve the customer's outside option. If tariff cuts reduce the cost at which upstream firms can supply their downstream customers, then customers with higher bargaining power should

increase their investment more because they should be able to demand larger price reductions. Alternatively, if tariff cuts alleviate hold-up problems by improving the customers' outside option, then the investment response should be stronger for customers with lower bargaining power (for whom hold-up problems are more important). Using industry concentration and firm size as proxies for bargaining power, we find that this is indeed the case.

The finding that customers' investment response is negatively related to their bargaining power is a first piece of evidence pointing towards hold-up problems between suppliers and customers. Key ingredients to such problems are that suppliers and customers are not vertically integrated, that investments are relationship-specific, and that contracts are incomplete. Consistent with these premises, we find a significant relation between upstream tariff reductions and downstream investment only for non-integrated customers and suppliers producing specific rather than generic inputs (as proxied by high R&D expenditures). Further, the relation is stronger if a high level of uncertainty about future contingencies (as proxied by customers' sales volatility) makes the use of comprehensive, long-term contracts more difficult.

A mere reduction in the cost of importing goods from abroad (i.e., a reduction in the marginal cost of supplying the input) does not predict that the investment response varies with vertical integration, input specificity, or uncertainty about future contingencies. Similarly, this cross-sectional variation is difficult to reconcile with a pure competition effect to which domestic suppliers respond by lowering prices (i.e., the absence of hold-up problems associated with bilateral bargaining). In that case, the relation between upstream tariff cuts and downstream investment should be weaker if the suppliers produce specific rather than generic inputs. The reason is that product specificity should shield domestic suppliers from foreign competition (Hombert and Matray (2017)). Further, a simple decrease in prices due to increased competition neither explains why we find an increase in investment only for customers that are not vertically integrated with their suppliers, nor why

the increase is larger if uncertainty about future contingencies is high.

In summary, the notion that import tariff reductions alleviate hold-up problems between upstream suppliers and downstream customers can explain all our findings. In contrast, the alternative explanations that tariff reductions lower the marginal cost of supplying the input or induce monopolistically competing suppliers to lower their prices in response to increased competition are difficult to reconcile with the evidence. In particular, these explanations do generally not predict the observed cross-sectional variation or even predict the opposite results. Hence, while we cannot *perfectly* distinguish between the different channels through which upstream tariff reductions can impact downstream investment, our findings are most consistent with the idea that prices are set through bilateral bargaining and that import tariff reductions mitigate hold-up problems between suppliers and customers by improving customers' outside option (i.e., buying from abroad).

Our paper makes two main contributions. First, we document a new empirical fact: Upstream tariff reductions are followed by increased downstream investment. Using data from the NBER-CES Manufacturing Industry Database, we confirm that this finding holds not only at the firm but also at the industry level. Moreover, we show that upstream tariff reductions are also associated with an increase in aggregate output and employment in the downstream industries. This is a first step towards a more holistic assessment of the consequences of import tariff reductions, which are likely to impact not only the directly affected but also other, related industries.[3] Our analysis thus adds to our understanding of the intricate effects of trade liberalizations in developed economies with highly interconnected firms. This is all the more important as the existing evidence on the effects of trade liberalizations is primarily based on data from emerging economies (e.g., Tybout, de Melo, and Corbo (1991), Tybout and Westbrook (1995), and Pavcnik (2002)), and it is not clear

[3]In that regard, our results also shed additional light on the propagation of economic shocks through production networks (e.g., Barrot and Sauvagnat (2015)).

ex ante which findings extend to developed economies (Trefler (2004)).

Second, our paper contributes to the literature on corporate investment by providing empirical evidence of the impact that hold-up problems have on investment decisions. Our results thus speak to a key building block of both transaction cost economics (Williamson (1975), Klein, Crawford, and Alchian (1978)) and the property rights theory of the firm (Grossman and Hart (1986), Hart and Moore (1990)). An implication is that firms' organization along the supply chain does not eliminate all hold-up problems. Hence, our results point towards significant barriers to firms' ability to overcome hold-up problems through, for example, contractual arrangements (e.g., Iyer and Sautner (2016)) or vertical integration (see Lafontaine and Slade (2007) for a review).

Most closely related to our paper is the study by Fresard and Valta (2016), who show that firms reduce investment when the threat of competition from foreign rivals intensifies.[4] A key difference is that we study how firms adjust their investment after tariff reductions in their suppliers' industries, while they investigate firms' investment decisions after tariff reductions in the firms' own industries.[5] Put differently, Fresard and Valta (2016) show how tariff reductions affect investment through the relation between firms and their competitors: Tariff reductions increase the threat of competition

[4]More generally, our paper is related to the literature on the consequences of trade liberalizations (e.g., Tybout, de Melo, and Corbo (1991), Tybout and Westbrook (1995), Pavcnik (2002), Melitz (2003), Amiti and Konings (2007), Melitz and Ottaviano (2008), Topalova and Khandelwal (2011), and Halpern, Koren, and Szeidl (2015)). Given that our findings highlight the importance of hold-up problems in supply chains, it is also related to the empirical literature on transaction cost and property rights based explanations for vertical integration (see Lafontaine and Slade (2007), Joskow (2008), and Klein (2008) for reviews). Through this channel, our work is also related to a small number of empirical papers that examine how hold-up problems affect investment decisions (e.g., Ciliberto (2006), Vukina and Leegomonchai (2006), Geng, Hau, and Lai (2016), and Cookson (2018).

[5]Other papers that examine the consequences of tariff reductions and import competition in firms' own industries on corporate actions and outcomes include Guadalupe (2007), Guadalupe and Cuñat (2009), Fresard (2010), Guadalupe and Wulf (2010), and Valta (2012).

from rival firms within the same industry, and the threat of increased competition reduces the firms' incentives to invest. We instead examine how tariff reductions impact investment through the relation between firms and their suppliers: Upstream tariff cuts reduce downstream firms' risk of being held up by their suppliers, and a lower risk of ex post hold-up improves the firms' incentives to invest. Our paper thus examines a different phenomenon, but to make sure that our results are not confounded by the effect documented in Fresard and Valta (2016), we show that our findings remain unchanged when controlling for tariff reductions in firms' own industries.

2 Data

2.1 Import Tariffs

We obtain data on U.S. imports in manufacturing industries (SIC codes 2000 to 3999) between 1974 and 2012 from Peter Schott's website and the Center for International Data at UC Davis.[6] Throughout the paper, we define industries at the four-digit SIC code level and compute the import tariff rate for each industry-year combination as the total value of duties collected divided by the total value of imports. Figure 1 shows the (equally weighted) average import tariff rate across all industries in our data for each year between 1974 and 2012. As is well known, the average import tariff has steadily declined over the past 40 years, from 8.23% in 1974 to 1.86% in 2012.

[Figure 1 around here.]

2.2 Large Tariff Reductions

We follow the literature and focus on "large" tariff reductions (e.g., Fresard (2010), Valta (2012), Fresard and Valta (2016)). Specifically, we classify a tariff reduction in year t as large if it is more

[6] `http://faculty.som.yale.edu/peterschott/` and `http://cid.econ.ucdavis.edu/`, respectively.

than three times as large as the average absolute year-on-year tariff change in the industry.[7] Our findings, however, do not depend on this definition and are robust to using alternative measures of tariff reductions (see Table A.3 in the Appendix).

Focusing on large (rather than any) tariff reductions has two main benefits. First, it facilitates comparing our findings with the existing literature. Second, investments in productive capacity (e.g., building a factory) are likely to be discrete and to have a fixed cost component. Hence, firms are likely to react only to tariff reductions that are sufficiently large.

[Figure 2 around here.]

Figure 2 shows the number of large tariff reductions across industries from 1974 to 2012 and reveals two distinct features. First, large tariff reductions occur in almost all years.[8] Second, there are three noticeable spikes in the number of large tariff reductions, corresponding to major events in international trade policy: the implementation of the Generalized System of Preferences (GSP) in 1976, which eliminated import tariffs on several thousand types of products when imported from a number of designated beneficiary countries, the completion of the seventh and eighth General Agreement on Tariffs and Trade (GATT) rounds in 1979 and 1994 – the so called "Tokyo round" and the "Uruguay round," which led to the creation of the World Trade Organization (WTO) – and the start of the North American Free Trade Agreement (NAFTA) in 1994.[9]

[7]Because we are not interested in transitory changes we also require that the implied tariff reductions from years $t-1$ to $t+1$, $t-2$ to $t+2$, and $t-3$ to $t+3$ are larger than three times the average absolute tariff change. Further, because tariff reductions are unlikely to have an economically significant effect if the tariff rate is very small to begin with, we do not classify a tariff reduction as large if the tariff rate before the reduction is already smaller than 1%.

[8]Large tariff *increases*, instead, are much less frequent: In total, we observe 493 large tariff reductions but only 55 large increases. Including these increases in our analysis does not change our findings (see column (4) of Table 2).

[9]While the general pattern is the same, the precise number of large tariff reductions in each year does not exactly match that in Fresard and Valta (2016), primarily because we are using a longer sample period – 1974 to 2012 vs.

[Figure 3 around here.]

Figure 3 shows how the average tariff rate evolves during the five years before and after large reductions. On average, such reductions imply a decrease in the tariff rate by 1.74 percentage points, corresponding to a 27% decrease relative to the average rate of 6.43% before the reduction. Tariff reductions of this magnitude are generally considered important events in the literature and have been shown to have significant economic effects (e.g., Trefler (2004); Fresard and Valta (2016)).

2.3 Customer-Supplier Relations

Following Acemoglu, Autor, Dorn, Hanson, and Price (2016), we identify customer-supplier relations at the industry level based on the gross flows of goods between industries reported in the 1992 U.S. Bureau of Economic Analysis (BEA) input-output table. An advantage of this approach – compared to identifying customer-supplier relations at the firm level – is that relations at the industry level are more likely to be determined by the industries' innate production technologies than an individual firm's choice to buy from a particular supplier. As a consequence, customer-supplier relations at the industry level are more likely to be exogenous to unobserved firm level characteristics than relations at the firm level.

2.4 Fraction of Supplier Industries that Experienced Large Tariff Reductions

Based on the customer-supplier relations derived from the 1992 BEA input-output table, we compute for each industry-year combination the (gross-flow-weighted) fraction of upstream industries that have experienced large tariff reductions in the past. The resulting variable, denoted *Supplier Tariff Reduction*, is the main regressor of interest in our analysis. *Supplier Tariff Reduction* ranges

1974 to 2005 – so that the cutoff defining "large" tariff changes (three times the average tariff change in an industry during the sample period) is not exactly the same in the two samples.

from zero to one. It is equal to zero if none of the upstream industries have experienced a large tariff reduction. It is equal to one if large tariff reductions have occurred in all upstream industries.

Formally, for customer industry j and year t, we have

$$\textit{Supplier Tariff Reduction}_{j,t} = \sum_{s \in S_{-j}} \omega_{s,j} \times \textit{Post Tariff Reduction}_{s,t} \tag{1}$$

where

$$\omega_{s,j} = \frac{\textit{Gross flow of goods from industry } s \textit{ to industry } j}{\textit{Total gross flow of goods from all industries to industry } j}. \tag{2}$$

Post Tariff Reduction$_{s,t}$ is an indicator equal to one if industry s has experienced a large tariff reduction prior to year t, and S_{-j} is the set of all industries other than j.[10]

To give an example, consider an industry j that obtains 50% of its inputs from industry $s = 1$ and 30% from industry $s = 2$. The remaining 20% of inputs are produced by j itself. Suppose now that prior to year t there has been a large tariff reduction in industry $s = 1$ but not in $s = 2$. *Supplier Tariff Reduction*$_{j,t}$ would then be equal to 0.5 because industry j obtains 50% of its inputs from supplier industries that have experienced a large tariff reduction prior to year t.

2.5 Investment and Control Variables

We measure investment by capital expenditures in year t scaled by the book value of total assets at the end of year $t-1$ (e.g., Baker, Stein, and Wurgler (2003)).[11] We also compute *Ln(Assets)*, *Tobin's Q*, *Cash/Assets*, *Debt/Assets*, *EBITDA/Assets*, *Cash Flow/Assets*, *Sales Growth*, *Excess Return*, and *Excess Volatitlity* for each firm-year combination and *Industry Sales Growth* and *Industry Concentration* for each industry-year combination in our sample. All data are obtained from

[10] If an industry experiences a large tariff increase after having previously experienced a large tariff reduction, for the years following the large tariff increase, we treat the industry as if it had not previously experienced a large tariff reduction. That is, we assume that large tariff increases "cancel out" large tariff reductions.

[11] We show in the Appendix that our results are robust to using $Ln(Capex)$ as an alternative measure (Table A.1).

Compustat and CRSP, and all variables are winsorized at the 1st and 99th percentile as in Baker, Stein, and Wurgler (2003).[12] Detailed definitions are provided in the Appendix.

2.6 Summary Statistics

Table 1 shows summary statistics. Our sample comprises 44,590 firm-year observations from 1974 to 2012.[13] The mean value of *Supplier Tariff Reduction* indicates that, on average, firms obtain 11% of their inputs from upstream industries that have previously experienced large tariff reductions.

[Table 1 around here.]

The summary statistics for the different firm- and industry-level variables are similar to the corresponding statistics for all firms in Compustat during the sample period (unreported). The average book value of assets is USD 1 billion. Our sample, however, spans firms with assets of USD 2 million to firms with assets of more than USD 25 billion. The average value of our measure of investment, *Capex/Assets*, is 0.06. As for the value of total assets, the variation across observations is large, and *Capex/Assets* ranges from a minimum value of 0.001 to a maximum of 0.347.

3 Supplier Tariff Reductions and Customer Investment

We now examine the relation between large import tariff reductions in upstream industries and the subsequent investment decisions of downstream firms. Specifically, we estimate by OLS:

$$\frac{Customer\ Capex_{i,j,t}}{Customer\ Assets_{i,j,t-1}} = \beta \times Supplier\ Tariff\ Reduction_{j,t} + \gamma' X_{i,j,t-1} + \delta_i + \eta_t + \varepsilon_{i,j,t} \qquad (3)$$

where i indexes firms, j industries (defined at the four-digit SIC code level), and t years.

[12] We show in the Appendix that using non-winsorized variables leads to very similar results (Table A.2).

[13] The number of observations in some of our subsequent analyses can be smaller than 44,590 because the information required for some regression specifications is not always available for all observations in the sample.

For each firm i in industry j in year t, *Supplier Tariff Reduction*$_{j,t}$ is the (gross-flow-weighted) fraction of supplier industries that experienced large tariff reductions in the past. $X_{i,j,t-1}$ is a vector of lagged firm- and industry-level controls: *Ln(Assets)*, *Tobin's Q*, *Cash/Assets*, *Debt/Assets*, *EBITDA/Assets*, *Cash Flow/Assets*, *Sales Growth*, *Excess Return*, *Excess Volatility*, *Industry Sales Growth*, and *Industry Concentration*. We further control for firm fixed effects (δ_i) and year fixed effects (η_t). All standard errors are clustered in two ways, by industry×year and by firm.[14]

[Table 2 around here.]

Table 2 presents the results. In column (1), we only control for firm and year fixed effects (δ_i and η_t). In column (2), we add the different firm- and industry-level control variables ($X_{i,j,t-1}$). The coefficient estimate on *Supplier Tariff Reduction* is positive and statistically significant in both specifications (at the 1% level in column (1) and at the 5% level in column (2)). The point estimates imply an increase in customer investment by 5% to 6% for a one-standard-deviation increase in *Supplier Tariff Reduction* (relative to the average level of *Capex/Assets* of 0.06).

A concern is that tariff changes are not randomly assigned and may coincide with unobserved changes in investment opportunities. In particular, tariff changes (or a lack thereof) may be the result of industrial lobbying. Firms in industries with lucrative growth opportunities may lobby for a reduction in import tariffs in their suppliers' industries. Similarly, suppliers to industries with declining growth opportunities may lobby for an increase in import tariffs to be protected from foreign competitors in times of declining demand.

Krugman, Obstfeld, and Melitz (2015) argue that multilateral trade negotiations are less likely to be captured by lobbying groups than the decision making process behind unilateral policy changes.[15] Tariff changes due to multilateral trade agreements are therefore more likely exoge-

[14]We show in the Appendix that our results are robust to alternative clustering choices (Table A.4).

[15]The key argument is as follows: Unilateral trade liberalizations may face opposition from import-competing

nous to changes in customers' investment opportunities. In column (3), we thus only rely on large tariff reductions occurring in 1976, 1980, and 1995, following the implementation of the Generalized System of Preferences (GSP), the completion of the seventh and eighth General Agreement on Tariffs and Trade (GATT) rounds, and the start of the North American Free Trade Agreement (NAFTA) (see also Fresard and Valta (2016)). As in columns (1) and (2), we find a positive coefficient estimate on *Supplier Tariff Reduction* that is statistically significant at the 5% level.

The magnitude of the coefficient estimate in column (3), 0.054, is very similar to the magnitude of the estimates in columns (1) and (2), 0.055 and 0.042, respectively. This finding suggests that a potential correlation between tariff cuts in upstream industries and unobserved growth opportunities of downstream customers that may be due to industrial lobbying is unlikely to generate a quantitatively important bias. At the same time, relying only on large tariff reductions in 1976, 1980, and 1995 ignores variation stemming from tariff changes in other years. For this reason, throughout the paper, we exploit all large tariff reductions during the entire sample period.[16]

In column (4), we add *Supplier Tariff Increase* as an explanatory variable, the (gross-flow weighted) fraction of supplier industries that have experienced large tariff *increases* in the past.[17] The point estimate of the coefficient on *Supplier Tariff Increase* is negative but not statistically significant. The coefficient on *Supplier Tariff Reduction* remains positive and significant at the 5% level. In column (5), we include two additional control variables: an indicator for large tariff

domestic producers, who stand to lose from a tariff reduction and are typically better informed and organized than the domestic consumers that stand to gain. In multilateral trade negotiations, domestic exporters provide a counterweight: They stand to gain from a liberalization of trade between the involved countries and are arguably as well informed and organized as the import-competing producers.

[16] Unreported analyses confirm that our findings are generally robust to using only large tariff reductions following multilateral trade agreements (as we do in column (3) of Table 2) in all our analyses.

[17] *Supplier Tariff Increase* is constructed analogously to *Supplier Tariff Reduction*.

reductions in a firm's *own* industry (*Own Industry Tariff Reduction*) and the gross-flow weighted fraction of *downstream* industries that have experienced large tariff reductions (*Downstream Tariff Reduction*). The coefficient estimate on *Supplier Tariff Reduction* is not affected by these controls.

4 Why does Downstream Investment Increase?

We now turn towards distinguishing between potential reasons for the increase in downstream investment. Arguably the most natural explanation is that tariff reductions in upstream industries lead to lower input prices for downstream firms, and that lower input prices make it profitable to add productive capacity. Another possibility is that import tariff reductions reduce the uncertainty surrounding future input prices, and a reduction in uncertainty may spur additional investment (Pindyck (1993)). Further, downstream firms may increase their investment if upstream tariff reductions alleviate the firms' financial constraints (Fazzari, Hubbard, and Petersen (1988)). For example, tariff reductions that lead to lower input prices may make downstream customers more profitable and through this channel improve the customers' ability to finance additional investment.

4.1 Reduction in Input Prices

We begin by examining the relation between import tariff reductions and prices. Using industry-specific price indices for U.S. manufacturing industries (SIC codes 2000-3999) from the NBER-CES Manufacturing Industry Database,[18] we estimate the following OLS regression:

$$Ln(Price\ Index)_{s,t} = \beta \times Post\ Tariff\ Reduction_{s,t} + \delta_s + \eta_t + \varepsilon_{s,t}. \quad (4)$$

[18]The data are provided jointly by the National Bureau of Economic Research (NBER) and U.S. Census Bureau's Center for Economic Studies (CES) and available at `http://www.nber.org/nberces/`.

Ln(Price Index)$_{s,t}$ is the natural logarithm of the price index for industry s in year t.[19] *Post Tariff Reduction*$_{s,t}$ is an indicator equal to one if industry s has experienced a large tariff reduction prior to year t. δ_s are industry and η_t year fixed effects. Standard errors are clustered by year.

[Table 3 around here.]

Table 3 presents the results. The sample period is 1974 to 2011 (the last year in the NBER-CES data). We find a negative and statistically significant coefficient estimate on *Post Tariff Reduction*, showing that import tariff reductions indeed lead to lower prices. This result is consistent with downstream firms facing lower input prices after tariff reductions in their upstream suppliers' industries and increasing productive capacity in response.

To further corroborate the above interpretation, we examine how the relation between tariff reductions and prices and the relation between tariff reductions and investment vary with shipping costs. The idea is that shipping costs inhibit international trade (e.g., Krugman, Obstfeld, and Melitz (2015)), so that tariff cuts are likely to have a smaller impact on prices – and thus, on investment – if shipping costs are high.

[Table 4 around here.]

Table 4 presents the results. Panel A shows that the relation between tariff reductions and prices is indeed weaker if shipping costs are high: The coefficient estimate on the interaction between *Post Tariff Reduction* and *Shipping Costs* is positive and statistically significant at the 5% level. In Panel B, we re-examine the relation between upstream tariff cuts and downstream investment while distinguishing between supplier industries with high versus low shipping costs. Specifically, we classify an industry-year combination as having high shipping costs if the shipping costs are larger than the median and otherwise as having low shipping costs. We find a significant relation between

[19] Using *Price Index* as the dependent variable yields very similar results (untabulated).

upstream tariff reductions and downstream investment only for supplier industries with low shipping costs. Taken together, Tables 3 and 4 are consistent with the interpretation that downstream investment increases after upstream tariff reductions because such tariff reductions entail lower input prices to which the downstream firms respond by investing in additional productive capacity.

4.2 Reduction in Price Uncertainty

An alternative channel through which upstream tariff cuts may impact downstream investment is a reduction in uncertainty about input prices (Pindyck (1993)). To examine this possibility, we explore the relation between tariff cuts and the variability of prices. Relying on information from the NBER-CES Manufacturing Industry Database as before, we compute the standard deviation of the industry-specific price indices before and after large tariff reductions. We retain only two observations per industry and large tariff cut – one before and one after – and estimate

$$\textit{Std(Price Index)}_{s,t} = \beta \times \textit{Post Tariff Reduction}_{s,t} + \delta_s + \varepsilon_{s,t}. \tag{5}$$

$\textit{Std(Price Index)}_{s,t}$ is the standard deviation of the price index in industry s before ($t = 0$) or after ($t = 1$), and $\textit{Post Tariff Reduction}_{s,t}$ is an indicator equal to one after the tariff reduction ($t = 1$). δ_s are industry fixed effects.

[Table 5 around here.]

Table 5 presents the results. We do not find any evidence of a significant relation between import tariff reductions and the variability of prices. This result suggests that a reduction of uncertainty about future input prices is unlikely to be the main driver for the increase in downstream investment.

4.3 Reduction in Financial Constraints

Finally, to check whether upstream tariff reductions lead to increased downstream investment through a relaxation of financial constraints, we examine sub-samples of customers that are unlikely

to be financially constrained to begin with. Specifically, we restrict attention to (1) firms that pay dividends, (2) firms with a KZ-index (Kaplan and Zingales (1997)) that is smaller than the sample median, and (3) firms with a WW-index (Whited and Wu (2006)) that is smaller than the sample median. If large tariff reductions in their suppliers' industries impact customers' investment decisions because they alleviate the customers' financial constraints, then we should not find any investment response when focusing on sub-samples of presumably unconstrained firms.

[Table 6 around here.]

Table 6 shows that we find positive coefficient estimates on *Supplier Tariff Reduction* in all three sub-samples of financially unconstrained customers (statistically significant at the 1% level in column (1) and at the 5% level in columns (2) and (3)). The magnitude of the coefficients is similar to the magnitude of the coefficients reported in Table 2. This result suggests that a reduction of financial constraints is unlikely to be the main reason for the increase in investment.[20]

5 What is the Mechanism?

5.1 Theoretical Framework

We now examine the mechanism through which upstream tariff reductions translate into lower input prices and increased downstream investment. To structure this analysis, we rely on the following framework. Consider a firm that invests in productive capacity. If the firm invests $i \in \mathbb{R}_+$ at $t = 0$, it can produce $f(i)$ units of output at $t = 1$, where f is an increasing and concave function. For example, $f(i)$ could be the capacity of a factory built at cost i. Each unit of output is produced using one unit of input and thereafter sold at a normalized price of one. The (quality adjusted)

[20] Further, in unreported analyses, we find no evidence of a relation between upstream tariff reductions and the three measures of downstream firms' financial constraints.

price per unit of input is $p < 1$, so that the firm's profit is[21]

$$\Pi = (1-p)f(i) - i. \tag{6}$$

The optimal investment i^* is given by the first order condition[22]

$$f'(i^*) = \frac{1}{1-p}, \tag{7}$$

and it follows that the optimal amount of investment is decreasing in the price of the input, i.e.,

$$\frac{di^*}{dp} = \frac{f'(i^*)^2}{f''(i^*)} < 0. \tag{8}$$

Intuitively, a higher price per unit of input reduces the firm's profit per unit of output and thus lowers its incentives to invest in productive capacity.

We now ask how the input price p – and thus ultimately the investment i^* – depend on the import tariff τ that is levied on the input. Without loss of generality, we can write the price as the sum of the marginal cost k of supplying the input and a markup m:

$$p = k + m. \tag{9}$$

Doing so highlights two channels through which the tariff can affect the input price.

First, the import tariff may affect the marginal cost of supplying the input. For example, lower import duties imply lower costs for foreign suppliers that sell to domestic customers. Another possibility is that lower tariffs (and higher import competition) may lead to an increase in supplier productivity and thus a decrease in the marginal cost of production (Melitz and Trefler (2012)).

Second, the import tariff may affect the markup that suppliers charge. To analyze this possibility, we consider two standard settings: (1) monopolistic competition among the suppliers and (2)

[21] For simplicity, there is no discounting and no uncertainty.

[22] We assume $f'(0) > 1/(1-p) > f'(\infty)$ to guarantee that an interior optimum exists.

bilateral bargaining between suppliers and customers. Note that under perfect competition, the price would equal the marginal cost, and the markup would be zero irrespective of the tariff.

In case of monopolistic competition, the markup is a decreasing function of the number of competing suppliers. Krugman, Obstfeld, and Melitz (2015), for example, present a simple version of this case in which

$$m = \frac{a}{n}, \tag{10}$$

where a is a positive constant that captures the sensitivity of each supplier's market share to the price it charges, and n is the number of suppliers. Tariff reductions that lead to an increase in the number of competing suppliers therefore entail lower markups (and hence lower prices).

In case of bilateral (Nash) bargaining, we follow Hart (1995) and assume that complete, long-term contracts are not feasible. Bargaining thus occurs after investing, and the markup is[23]

$$m = (1 - \beta)(\omega - k), \tag{11}$$

where $\beta \in (0, 1)$ denotes the firm's bargaining power, and $\omega \in (k, 1)$ denotes its outside option – the cost at which the input can be bought from an alternative source. Note that $\omega > k$ implies a hold-up problem: The fact that the supplier's marginal cost of producing the input is lower than the (quality adjusted) cost of the input when bought from an alternative (e.g., foreign) source implies that the marginal return from investing in productive capacity is larger if trade with the supplier occurs than if it does not. This condition makes the investment "relationship-specific" in the sense of Hart (1995). A consequence of the hold-up problem is that the firm's incentives to invest are reduced. The reason is that the supplier can extract some of the surplus during the bargaining process. Tariff reductions that improve the firm's outside option (e.g., lower the price at which the

[23]Intuitively, the markup (m) is set so that the price (p) equals the firm's outside option (ω) minus a fraction β of the gains from trade ($\omega - k$). We thus obtain $p = \omega - \beta(\omega - k) = k\beta + \omega(1 - \beta)$, which implies $m = p - k = (\omega - k)(1 - \beta)$.

input can be bought from abroad) decrease the difference between ω and k and thus mitigate the hold-up problem. In turn, they lead to lower markups (and hence lower prices).

To summarize, we consider that upstream tariff reductions may affect input prices and thus downstream investment through the following channels: First, tariff reductions may reduce the marginal cost of supplying the input. Second, tariff reductions may reduce the markup charged by suppliers. This markup may be determined through monopolistic competition among the suppliers or through bilateral bargaining between suppliers and customers. In the latter case, we assume that contracts are incomplete, which exposes the downstream firms to the risk of ex post hold-up. Note that these channels are not mutually exclusive and may all play a role in the increase in downstream investment that we observe in the data. However, the different channels yield different cross-sectional implications that can be tested to gauge the channels' relative importance.

5.2 Variation in Bargaining Power

We begin by examining variation in customers' bargaining power vis-à-vis their suppliers. First, note that an individual customer's bargaining power does not play a role if the price of the input is determined by monopolistic competition among the suppliers. The reason is that suppliers in that case simply post prices at which they are willing to sell to any customer – there is no bargaining over prices. As a consequence, differences in individual customers' bargaining power do not matter, i.e., downstream firms' investment response should not vary depending on their bargaining power.

Instead, if the input price is determined through bilateral bargaining, we have

$$m = (1-\beta)(\omega - k) \;\Leftrightarrow\; p = \beta k + (1-\beta)\omega. \tag{12}$$

In that case, if import tariff reductions translate into a lower marginal cost of supplying the input (i.e., $k = k(\tau)$ with $k'(\tau) > 0$), we have

$$p'(\tau) = \beta k'(\tau) > 0 \tag{13}$$

and

$$\frac{di^*}{d\tau} = \frac{di^*}{dp} \times p'(\tau) = \frac{f'(i^*)^2}{f''(i^*)} \times \beta k'(\tau) < 0. \tag{14}$$

This, in turn, implies

$$\frac{\partial \frac{di^*}{d\tau}}{\partial \beta} = \frac{f'(i^*)^2}{f''(i^*)} \times k'(\tau) < 0. \tag{15}$$

That is, if tariff reductions decrease the marginal cost of supplying the input, then downstream firms' investment response should be stronger if their bargaining power is high.

If import tariff reductions translate into a better outside option for the downstream firms (i.e., $\omega = \omega(\tau)$ with $\omega'(\tau) > 0$), we have

$$p'(\tau) = (1 - \beta)\omega'(\tau) > 0 \tag{16}$$

and

$$\frac{di^*}{d\tau} = \frac{di^*}{dp} \times p'(\tau) = \frac{f'(i^*)^2}{f''(i^*)} \times (1 - \beta)\omega'(\tau) < 0. \tag{17}$$

This, in turn, implies

$$\frac{\partial \frac{di^*}{d\tau}}{\partial \beta} = -\frac{f'(i^*)^2}{f''(i^*)} \times \omega'(\tau) > 0. \tag{18}$$

That is, if tariff reductions improve the downstream firms' outside option, then their investment response should be weaker if their bargaining power is high.

Empirically, we distinguish between customers with high and low bargaining power by measuring the concentration in the customers' industries (using the Herfindahl-Hirschman Index (HHI) of sales) as well as the size of each customer (using the natural logarithm of total assets). The idea is that both industry concentration and size increase a customer's bargaining power. We then add interaction terms between *Supplier Tariff Reduction* and *Customer Industry Concentration* and *Customer Size* to the regressions.

As an alternative approach, we distinguish between tariff reductions in supplier industries that are concentrated and in supplier industries that are dispersed. The idea is that suppliers in more

concentrated industries have more bargaining power (and customers thus less). At one end of the spectrum would be maximum concentration: an industry with a single, monopolistic supplier that has all the bargaining power vis-à-vis its customers. The polar opposite would be maximum dispersion: an industry populated by atomistic suppliers with zero bargaining power. Based on this intuition, we assess the suppliers' bargaining power by computing the HHI of sales for each industry-year combination in the Compustat database between 1974 and 2012. We then classify an industry-year combination as "concentrated" if its HHI is larger than the median HHI. Otherwise, the industry is classified as "dispersed."

[Table 7 around here.]

Table 7 presents the results. All regressions include the full set of firm and industry level controls ($X_{i,j,t-1}$) specified in Equation (3).[24] To conserve space, we do not report the associated coefficient estimates and t-statistics. In columns (1) and (2), we interact *Supplier Tariff Reduction* with *Customer Industry Concentration* and *Customer Size*. In line with our earlier results (Table 2), we find positive coefficient estimates on *Supplier Tariff Reduction* that are statistically significant at the 1% level in both columns. Further, we find negative coefficients on the interactions with *Customer Industry Concentration* and *Customer Size* (both statistically significant at the 5% level).

Column (3) shows the estimation results obtained from the regression in which we distinguish between large tariff reductions in concentrated and in dispersed supplier industries. We also control for the average level of concentration across all of a customer's supplier industries (*Supplier Industry Concentration*). The regression reveals a positive relation between customers' capital expenditures and large tariff reductions in concentrated supplier industries (statistically significant at the 1% level). In contrast, the coefficient estimate for large tariff reductions in dispersed supplier industries

[24]Note that $X_{i,j,t-1}$ includes both proxies of customers' bargaining power, *Industry Concentration* and *Ln(Assets)*.

is close to zero and not statistically significant. The null-hypothesis that the coefficient on large tariff reductions in dispersed supplier industries is the same as for concentrated supplier industries is rejected at the 1% level by a Wald test (unreported). This result is consistent with columns (1) and (2): The investment response is stronger if *suppliers* have more bargaining power and thus weaker if *customers* have more bargaining power.

Overall, we find that customers with high bargaining power vis-à-vis their suppliers (as proxied by size and industry concentration) increase their investment less following large tariff reductions in upstream industries than customers with low bargaining power. This result is consistent with input prices being determined through bilateral bargaining between suppliers and customers and tariff reductions improving the customers' outside option (e.g., lowering the price at which the input can be bought from abroad). In contrast, the evidence is at odds with prices being determined through monopolistic competition among the suppliers or tariff reductions lowering the marginal cost at which the input can be supplied. In the former case, we would expect no difference between customers with high and low bargaining power. In the latter case, we would expect that customers with high bargaining power increase their investment more, not less.

5.3 Variation in Vertical Integration, Input Specificity, and Uncertainty

The finding that upstream tariff reductions entail lower input prices and increased investment downstream and that the investment response is weaker for customers with more bargaining power is consistent with the presence of hold-up problems between suppliers and customers: When import tariffs in upstream industries are lowered, downstream customers' bargaining position vis-à-vis their domestic suppliers improves as the cost of procuring inputs from foreign sources decreases. This, in turn, reduces the domestic suppliers' ability to hold-up their customers ex post, leads to lower prices, and increases the customers' incentives to invest in productive capacity.

To provide further evidence in support of this interpretation, we now consider cross-sectional variation in vertical integration, input specificity, and uncertainty about future contingencies. The idea is that hold-up problems do not arise if customers and suppliers are vertically integrated, if the input is generic and can be supplied at the same marginal cost by many alternative suppliers, and if customers and suppliers can write complete contracts.

We thus distinguish between customers that are vertically integrated into their suppliers' industries and those that are not. We also distinguish between suppliers that produce specific inputs and those that produce generic inputs. Further, we examine whether customers' response to tariff reductions in their suppliers' industries is stronger if a higher level of uncertainty about future contingencies makes the use of comprehensive, long-term contracts more difficult.

[Table 8 around here.]

Table 8 presents the results. In panel A, for each customer, we distinguish between large tariff reductions in supplier industries into which the customer is vertically integrated and large tariff reductions in supplier industries into which the customer is not vertically integrated.[25] We expect that customers increase their investments following tariff reductions if they are not vertically integrated with their suppliers. In contrast, we expect no reaction to tariff reductions if suppliers and customers are vertically integrated because, in that case, there is no hold-up problem to begin with. In line with this argument, we find a significant relation between upstream tariff reductions and downstream investment only for customers that are not vertically integrated into their suppliers' industries. The difference between the coefficient estimates for customers that are not integrated and customers that are integrated is statistically significant at the 5% level (unreported).

In panel B, we distinguish between supplier industries that produce specific inputs and those that

[25]Specifically, we consider a customer integrated into a given supplier industry if the customer reports activities in that industry in the Compustat Segments data.

produce generic inputs. We expect an increase in customers' investment following tariff reductions if the suppliers produce specific inputs – but not if the inputs are generic. The intuition is as follows: Ex post bargaining about the price of specific inputs creates a hold-up problem that can be mitigated by import tariff reductions. If, instead, the inputs are perfectly generic and can be bought from a large number of suppliers at the same (quality adjusted) price, then there is no hold-up problem to begin with.

In the spirit of Barrot and Sauvagnat (2015), in each year, we classify a supplier industry as producing specific goods if the ratio of aggregate R&D expenditures to aggregate sales in the industry is higher than the median R&D-to-sales ratio in Compustat from 1974 to 2012. Otherwise, the industry is classified as producing generic goods. Using this classification, we find a significant relation between upstream tariff cuts and downstream investment only if the suppliers produce specific inputs. In contrast, we find no relation for suppliers producing generic inputs.[26]

In panel C, we examine how the investment response varies with the volatility of the customers' sales. The idea is as follows. There is no hold-up problem if a customer and supplier can write a complete contract. Such a contract is arguably more difficult to write if there is more uncertainty about the relevant future contingencies. Hence, a high level of uncertainty is likely to inhibit the use of comprehensive, long-term contracts as a means to overcome hold-up problems.

We thus expect the relation between tariff reductions in upstream industries and downstream customers' investment to be stronger if the level of uncertainty about future contingencies is high. Using *Customer Sales Volatility* as a proxy for such uncertainty, we find strong support for this prediction. The coefficient estimate on the interaction term between *Supplier Tariff Reduction* and

[26]The regression coefficient for suppliers producing generic inputs is estimated with low precision. As a consequence, despite a point estimate close to zero, the hypothesis that the coefficient for suppliers producing generic inputs does not differ from that for suppliers producing specific inputs cannot be rejected at conventional levels (unreported).

Customer Sales Volatility is positive and statistically significant at the 1% level.[27]

All of the cross-sectional findings presented in Table 8 are predicted by the presence of hold-up problems between suppliers and customers. In contrast, a simple reduction in the cost of importing goods from abroad does not predict that the investment response should vary with vertical integration (i.e., the legal relation between the supplier and customer), input specificity, or uncertainty about future contingencies. Similarly, in the absence of hold-up problems, a mere increase in competition from foreign rivals to which domestic suppliers respond by lowering prices would predict that the relation between tariff cuts and investment is weaker if the suppliers produce specific rather than generic inputs. The reason is that product specificity should shield domestic suppliers from foreign competition (Hombert and Matray (2017)). Further, a simple decrease in prices due to increased competition neither explains why we find an increase in investment only for customers that are not vertically integrated with their suppliers, nor why the increase is larger if uncertainty about future contingencies is high. The presence of hold-up problems between suppliers and customers, however, predicts both findings.

6 Outcomes at the Aggregate Level

We now explore the relation between upstream tariff reductions and downstream outcomes at the aggregate level. Specifically, we obtain information on the total amount of investment, output, and employment of all private and public U.S. manufacturing firms (SIC codes 2000 to 3999) in the NBER-CES Manufacturing Industry Database between 1974 and 2011 (the last year in the database). We then estimate industry-level regressions that relate the aggregate amount of investment, output, and employment to the fraction of upstream suppliers that have experienced

[27]Note that *Customer Sales Volatility* is estimated using the time-series of a customer's annual sales during the sample period. Hence, it is a constant for a given customer, and its main effect is absorbed by the firm fixed effects.

large import tariff reductions in the past.

[Table 9 around here.]

Table 9 displays the results. Column (1) presents the findings regarding the aggregate amount of investment in the downstream industries.[28] The coefficient estimate on *Supplier Tariff Reduction* is positive and statistically significant at the 5% level, showing that the increase in downstream investment that we document at the firm-level extends also to the aggregate, industry level. In terms of economic magnitude, the point estimate implies an increase of total investment in the U.S. manufacturing sector by USD 5 to 6 billion per year for a one-standard-deviation (7%) increase in the fraction of upstream industries that have experienced large tariff reductions.[29] Columns (2) and (3) show that this increase in investment is accompanied by an increase in aggregate output and employment. Specifically, our estimates imply that an increase in the fraction of upstream suppliers that have experienced large tariff reductions by one standard deviation translates into an increase in total output and employment by about 5%.

7 Conclusion

We document that upstream tariff reductions are followed by increased downstream investment, output, and employment. Specifically, our estimates imply an increase of total investment in the U.S. manufacturing sector by USD 5 to 6 billion per year and an increase in aggregate output and employment by about 5% for a one-standard-deviation increase in the fraction of upstream indus-

[28] *Capex/Capital Stock* is the total amount of capital expenditures in year t scaled by the total amount of capital stock at the end of year $t-1$. The book value of assets is not available in the NBER-CES Manufacturing Industry Database, so we cannot compute the ratio of capital expenditures to book assets as in the firm-level analysis.

[29] During our sample period, the average aggregate investment per year of all public and private firms in the NBER-CES Manufacturing Industry Database is about USD 100 billion.

tries that have experienced large import tariff reductions. In light of the ongoing debate about protectionist trade policies around the world, these findings contribute towards a more comprehensive understanding of the intricate effects that import tariffs can have on industrialized economies, in which highly interconnected firms operate in complex supply chains.

The cross-sectional variation of our findings is most consistent with the idea that upstream tariff reductions impact downstream investment by alleviating hold-up problems between suppliers and customers. Our results thus highlight the empirical importance of hold-up problems for firms' investment decisions and speak to a key building block of both transaction cost economics and the property rights theory of the firm. An implication is that firms' organization along the supply chain does not eliminate all hold-up problems. As such, our findings point towards significant barriers to firms' ability to overcome hold-up problems through contractual arrangements or vertical integration.

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Figure 1: Average Import Tariff Rate in U.S. Manufacturing Industries from 1974 to 2012

This figure shows the (equally weighted) average import tariff rate (in percent) across all U.S. manufacturing industries in our data (SIC codes 2000 to 3999) in each year from 1974 to 2012. Import tariff rates for each industry-year combination are computed as the total value of duties collected divided by the total value of imports. Data on the value of imports and duties are from Peter Schott's website (`http://faculty.som.yale.edu/peterschott/`) and the Center for International Data at UC Davis (`http://cid.econ.ucdavis.edu/`).

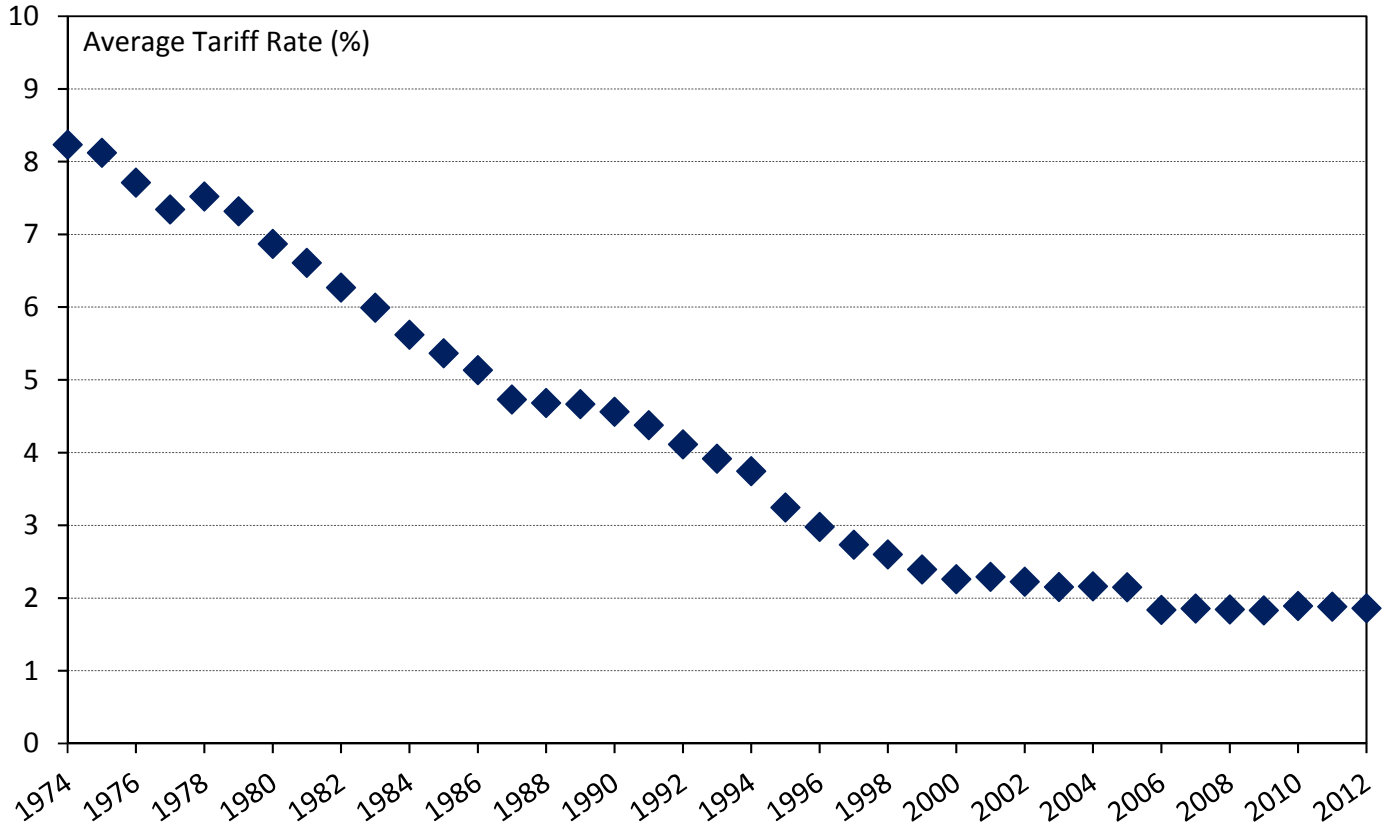

Figure 2: Number of Large Tariff Reductions in U.S. Manufacturing Industries from 1974 to 2012

This figure shows the number of large import tariff reductions in manufacturing industries in the U.S. (SIC codes 2000 to 3999) for each year during the sample period from 1974 to 2012. Tariff rates for each industry-year combination are computed as the total value of duties collected divided by the total value of imports. Year-on-year tariff reductions are classified as "large" if they are more than three times as large as the average absolute year-on-year tariff change in the industry. Data on the value of imports and duties are from Peter Schott's website (`http://faculty.som.yale.edu/peterschott/`) and the Center for International Data at UC Davis (`http://cid.econ.ucdavis.edu/`).

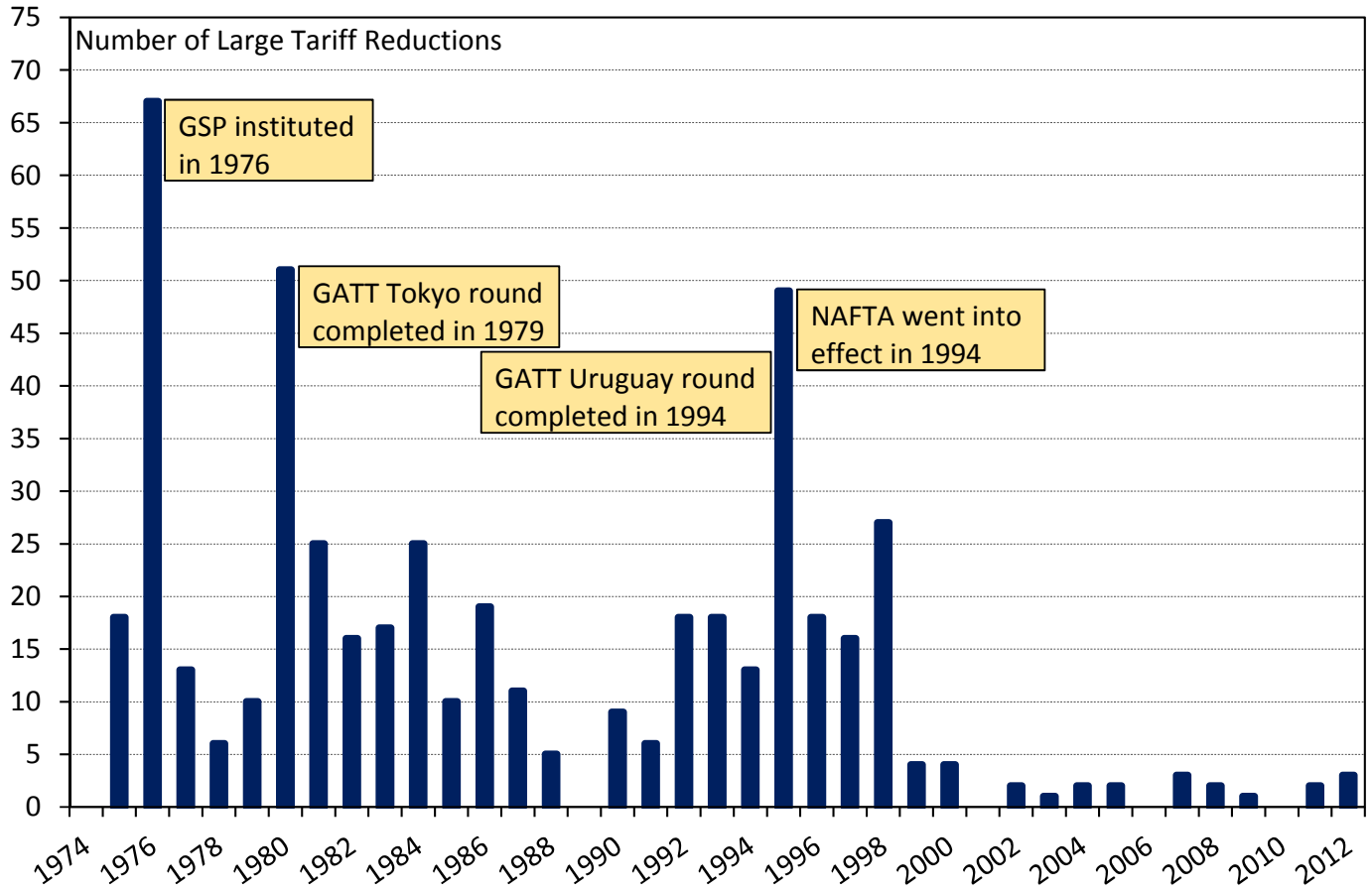

Figure 3: Average Tariff around Large Tariff Reductions in U.S. Manufacturing Industries from 1974 to 2012

This figure shows the (equally weighted) average import tariff rate (in percent) around large tariff reductions in U.S. manufacturing industries (SIC codes 2000 to 3999) during the sample period from 1974 to 2012. Tariff rates for each industry-year combination are computed as the total value of duties collected divided by the total value of imports. Year-on-year tariff reductions are classified as "large" if they are more than three times as large as the average absolute year-on-year tariff change in the industry. Data on the value of imports and duties are from Peter Schott's website (`http://faculty.som.yale.edu/peterschott/`) and the Center for International Data at UC Davis (`http://cid.econ.ucdavis.edu/`).

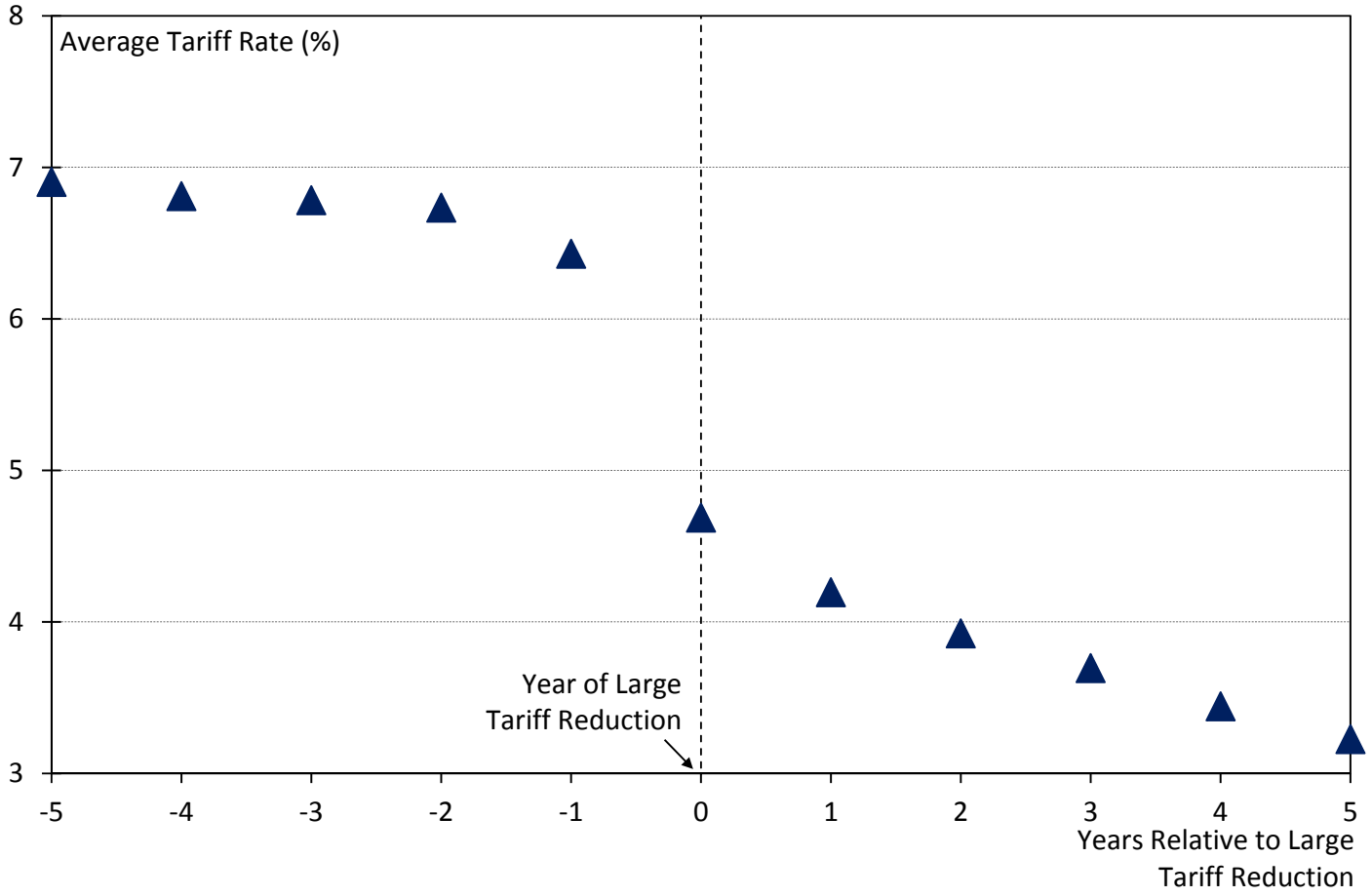

Table 1: Summary Statistics

This table presents summary statistics for our sample of 44,590 firm-year observations over the period from 1974 to 2012. For a given firm-year combination, *Supplier Tariff Reduction* is the fraction of supplier industries that have experienced large tariff reductions in the past. Detailed definitions of all variables are provided in the Appendix.

Variable	Observations	Mean	Std. Dev.	Min.	25%	Median	75%	Max.
Supplier Tariff Reduction	44,590	0.113	0.072	0.000	0.056	0.109	0.153	0.503
Capex/Assets	44,590	0.061	0.061	0.001	0.022	0.043	0.079	0.347
Assets (in USD million)	44,590	1,031	3,445	2	24	87	397	25,636
Ln(Assets)	44,590	4.676	2.061	0.688	3.179	4.466	5.984	10.152
Tobin's Q	44,590	1.985	1.732	0.560	1.015	1.391	2.191	11.010
Cash/Assets	44,590	0.190	0.221	0.001	0.030	0.097	0.270	0.911
Debt/Assets	44,590	0.201	0.180	0.000	0.039	0.172	0.312	0.783
EBITDA/Assets	44,590	0.060	0.226	-1.022	0.031	0.117	0.180	0.380
Cash Flow/Assets	44,590	-0.030	0.234	-1.226	-0.034	0.040	0.082	0.235
Sales Growth	44,590	0.195	0.564	-0.731	-0.023	0.101	0.254	3.939
Excess Return	44,590	0.037	0.713	-0.939	-0.376	-0.101	0.224	3.782
Excess Volatility	44,590	0.028	0.020	0.001	0.013	0.023	0.037	0.103
Industry Sales Growth	44,590	0.095	0.174	-0.399	0.012	0.090	0.164	0.815
Industry Concentration	44,590	0.274	0.193	0.055	0.135	0.217	0.362	0.922

Table 2: Large Import Tariff Reductions in Supplier Industries and Customers' Investment

This table presents coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures. The sample period is 1974 to 2012. *Supplier Tariff Reduction (Increase)* is the fraction of supplier industries that have experienced large tariff reductions (increases) in the past. *Own Industry Tariff Reduction* is an indicator equal to one if there has been a large tariff reduction in a customer's own industry. *Downstream Tariff Reduction* is the fraction of downstream industries that have experienced large tariff reductions. *Capex/At* is a customer's capital expenditures in year t scaled by the book value of total assets at the end of year t-1. Detailed variable definitions are provided in the Appendix. Column (3) uses only large tariff reductions in 1976, 1980, and 1995, following the GSP implementation, completion of the seventh and eighth GATT rounds, and start of NAFTA. *t*-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Capex/At	Capex/At	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.055***	0.042**	0.054**	0.040**	0.041**
	(2.87)	(2.27)	(2.34)	(2.14)	(2.19)
Supplier Tariff Increase				-0.115	
				(-1.45)	
Own Industry Tariff Reduction					0.002
					(1.01)
Downstream Tariff Reduction					0.014
					(1.27)
Ln(Assets)		-0.011***	-0.011***	-0.011***	-0.011***
		(-13.02)	(-13.13)	(-13.07)	(-13.02)
Tobin's Q		0.007***	0.007***	0.007***	0.007***
		(15.33)	(15.36)	(15.32)	(15.34)
Cash/Assets		-0.006*	-0.006*	-0.006*	-0.006*
		(-1.86)	(-1.82)	(-1.85)	(-1.87)
Debt/Assets		-0.038***	-0.038***	-0.038***	-0.038***
		(-11.57)	(-11.59)	(-11.56)	(-11.58)
EBITDA/Assets		0.044***	0.044***	0.044***	0.044***
		(9.64)	(9.60)	(9.64)	(9.64)
Cash Flow/Assets		-0.004	-0.004	-0.004	-0.004
		(-1.34)	(-1.29)	(-1.34)	(-1.33)
Sales Growth		0.004***	0.004***	0.004***	0.004***
		(5.53)	(5.54)	(5.53)	(5.51)
Excess Return		0.004***	0.004***	0.004***	0.004***
		(8.91)	(8.90)	(8.92)	(8.91)
Excess Volatility		-0.258***	-0.256***	-0.258***	-0.259***
		(-10.32)	(-10.26)	(-10.34)	(-10.37)
Industry Sales Growth		0.010***	0.010***	0.010***	0.010***
		(5.16)	(5.21)	(5.12)	(5.14)
Industry Concentration		0.002	0.004	0.003	0.003
		(0.55)	(0.96)	(0.59)	(0.58)
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.417	0.475	0.475	0.475	0.475
Observations	44,590	44,590	44,590	44,590	44,590

Table 3: Large Import Tariff Reductions and Prices

This table presents coefficient estimates for the relation between large import tariff reductions and prices at the industry level. The data are obtained from the NBER-CES Manufacturing Industry Database (`http://www.nber.org/nberces/`) and cover U.S. manufacturing industries (SIC codes 2000-3999). The sample period is 1974 to 2011 (the last year in the NBER-CES data). Individual industries are identified by their four-digit SIC codes. *Post Tariff Reduction* is an indicator equal to one if the industry has experienced a large tariff reduction in the past. *Ln(Price Index)* is the natural logarithm of the price index for each industry. Standard errors are clustered by year, and t-statistics are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)
Dependent Variable:	Ln(Price Index)
Post Tariff Reduction	-0.040**
	(-2.60)
Industry & Year Fixed Effects	Yes
R^2	0.482
Observations	4,706

Table 4: Cross-Sectional Variation Depending on Shipping Costs

This table presents coefficient estimates for the relation between large import tariff reductions, prices, and downstream investment. Panel A shows coefficient estimates for the relation between large import tariff reductions and prices at the industry level. The data are obtained from the NBER-CES Manufacturing Industry Database (`http://www.nber.org/nberces/`) and cover U.S. manufacturing industries (SIC codes 2000-3999). The sample period is 1974 to 2011 (the last year in the NBER-CES data). Individual industries are identified by their four-digit SIC codes. *Ln(Price Index)* is the natural logarithm of the price index for each industry. *Post Tariff Reduction* is an indicator equal to one if the industry has experienced a large tariff reduction in the past. *Shipping Costs* is the value of shipping costs in the industry (as a percentage of the customs value). Standard errors are clustered by year, and t-statistics are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively. Panel B shows coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures. We distinguish between tariff reductions in supplier industries with high shipping costs and in supplier industries with low shipping costs. The sample period is 1974 to 2012. In each year, a supplier industry is classified as having high shipping costs if its shipping costs (as a percentage of the customs value of the imports) are larger than the median and as having low shipping costs otherwise. *Shipping Costs* is the average value of the shipping costs (as a percentage of the customs value of the imports) across the customer's different supplier industries. *Control Variables* is a vector of all firm- and industry-level control variables as specified in Equation (3). All other variables are defined as in Table 2. Detailed variable definitions are provided in the Appendix. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Panel A: Prices		Panel B: Downstream Investment	
Dependent Variable:	Ln(Price Index)	Dependent Variable:	Capex/At
Post Tariff Reduction	-0.064***	Supplier Tariff Reduction	0.043**
	(-3.99)	(Low Shipping Costs)	(2.00)
Post Tariff Reduction	0.005**	Supplier Tariff Reduction	0.034
× Shipping Costs	(2.20)	(High Shipping Costs)	(1.57)
Shipping Costs	-0.008***	Shipping Costs	-0.001
	(-3.16)		(-1.22)
		Control Variables	Yes
Industry & Year Fixed Effects	Yes	Firm & Year Fixed Effects	Yes
R^2	0.763	R^2	0.476
Observations	4,034	Observations	43,779

Table 5: Large Import Tariff Reductions and Price Uncertainty

This table presents coefficient estimates for the relation between large import tariff reductions and price uncertainty at the industry level. The data are obtained from the NBER-CES Manufacturing Industry Database (`http://www.nber.org/nberces/`) and cover U.S. manufacturing industries (SIC codes 2000-3999). The sample period is 1974 to 2011 (the last year in the NBER-CES data). Individual industries are identified by their four-digit SIC codes. *Post Tariff Reduction* is an indicator equal to one if the industry has experienced a large tariff reduction in the past. *Std(Price Index)* is the standard deviation of the price index in a given industry. We retain only two observations per industry and large tariff reduction – one before and one after. t-statistics are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)
Dependent Variable:	Std(Price Index)
Post Tariff Reduction	0.034
	(0.97)
Industry Fixed Effects	Yes
R^2	0.414
Observations	148

Table 6: Large Import Tariff Reductions and Investment of Financially Unconstrained Customers

This table presents coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures for three samples of customers that are unlikely to be financially constrained. In column (1), we focus on customers that pay out dividends. In column (2), we focus on customers whose Kaplan and Zingales (1997) index is smaller than the sample median. In column (3), we focus on customers whose Whited and Wu (2006) index is smaller than the sample median. The sample period is 1974 to 2012. *Control Variables* is a vector of all firm- and industry-level control variables as specified in Equation (3). All other variables are defined as in Table 2. Detailed variable definitions are provided in the Appendix. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)
Sample:	Dividend Payers	KZ-Index < Median	WW-Index < Median
Dependent Variable:	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.056***	0.049**	0.046**
	(2.58)	(2.18)	(2.12)
Control Variables	Yes	Yes	Yes
Firm & Year Fixed Effects	Yes	Yes	Yes
R^2	0.511	0.532	0.560
Observations	17,904	21,067	21,837

Table 7: Cross-Sectional Variation Depending on Customers' and Suppliers' Bargaining Power

This table presents coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures. The sample period is 1974 to 2012. *Customer Size* is the natural logarithm of the book value of the customer's total assets. *Customer Industry Concentration* is the Herfindahl-Hirschman Index (HHI) of sales in the customer's industry. In column (3), we distinguish between tariff reductions in concentrated and in dispersed supplier industries. In each year, a supplier industry is classified as concentrated if the Herfindahl-Hirschman Index (HHI) of sales in the industry is larger than the median and as dispersed otherwise. *Supplier Industry Concentration* is the weighted average industry concentration across a customer's supplier industries. *Control Variables* is a vector of all firm- and industry-level control variables as specified in Equation (3) and includes *Customer Industry Concentration* and *Customer Size*. All other variables are defined as in Table 2. Detailed variable definitions are provided in the Appendix. *t*-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)
Dependent Variable:	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.082***	0.113***	
	(3.24)	(3.23)	
Supplier Tariff Reduction	-0.119**		
× Customer Industry Concentration (HHI)	(-2.53)		
Supplier Tariff Reduction		-0.011**	
× Customer Size (Ln(Assets))		(-2.11)	
Supplier Tariff Reduction			0.073***
(Concentrated Supplier Industry)			(3.41)
Supplier Tariff Reduction			-0.003
(Dispersed Supplier Industry)			(-0.13)
Supplier Industry Concentration			0.077
			(1.03)
Control Variables	Yes	Yes	Yes
Firm & Year Fixed Effects	Yes	Yes	Yes
R^2	0.475	0.475	0.476
Observations	44,590	44,590	43,779

Table 8: Cross-Sectional Variation Depending on Vertical Integration, Input Specificity, and Contingency Uncertainty

This table presents coefficient estimates for the relation between large import tariff reductions in supplier industries and customers' capital expenditures. The sample period is 1974 to 2012. In panel A, we distinguish between tariff reductions in supplier industries into which the customer is vertically integrated and in supplier industries into which the customer is not vertically integrated. *Customer Integration* is the fraction of supplier industries into which the customer is vertically integrated. In panel B, we distinguish between tariff reductions in supplier industries producing specific inputs and in supplier industries producing generic inputs. In each year, a supplier industry is classified as producing specific inputs if the ratio of aggregate R&D expenditures divided by aggregate sales in the industry is larger than the median and as producing generic inputs otherwise. *Supplier Specificity* is the fraction of a customer's supplier industries that are classified as producing specific inputs. In panel C, we interact *Supplier Tariff Reduction* with *Customer Sales Volatility*, the demeaned standard deviation of the customer's annual sales over the sample period scaled by the customer's average sales. *Control Variables* is a vector of all firm- and industry-level control variables as specified in Equation (3). All other variables are defined as in Table 2. Detailed variable definitions are provided in the Appendix. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

Panel A: Vertical Integration		Panel B: Input Specificity		Panel C: Contingency Uncertainty	
Dependent Variable:	Capex/At	Dependent Variable:	Capex/At	Dependent Variable:	Capex/At
Supplier Tariff Reduction	0.052**	Supplier Tariff Reduction	0.043**	Supplier Tariff Reduction	0.048**
(Customer Not Integrated)	(2.44)	(Specific Input)	(2.22)		(2.49)
Supplier Tariff Reduction	-0.070	Supplier Tariff Reduction	-0.009	Supplier Tariff Reduction	0.186***
(Customer Integrated)	(-1.20)	(Generic Input)	(-0.16)	× Customer Sales Volatility	(4.39)
Customer Integration	0.164***	Supplier Specificity	-0.065		
	(3.22)		(-1.50)		
Control Variables	Yes	Control Variables	Yes	Control Variables	Yes
Firm & Year Fixed Effects	Yes	Firm & Year Fixed Effects	Yes	Firm & Year Fixed Effects	Yes
R^2	0.479	R^2	0.476	R^2	0.476
Observations	41,145	Observations	43,779	Observations	44,590

Table 9: Aggregate Outcomes at the Industry Level

This table presents coefficient estimates for the relation between large import tariff reductions in upstream industries and aggregate outcomes in downstream industries. The data are obtained from the NBER-CES Manufacturing Industry Database and cover U.S. manufacturing industries (SIC codes 2000-3999) from 1974 to 2011 (the last year in the NBER-CES data). Individual industries are identified by their four-digit SIC codes. *Capex/Capital Stock* is the aggregate amount of capital expenditures in year t scaled by the aggregate amount of capital stock at the end of year t-1. *Ln(Total Output)* is the natural logarithm of the total value of shipments (deflated by the price index). *Ln(Employment)* is the natural logarithm of the total number of employees. *Supplier Tariff Reduction* is the fraction of supplier industries that have experienced large tariff reductions in the past. All control variables are equally weighted averages across all firms in a given year and industry in the CRSP/Compustat merged database. Detailed variable definitions are provided in the Appendix. Standard errors are clustered by year, and t-statistics are reported in parentheses. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)
Dependent Variable:	Capex/Capital Stock	Ln(Total Output)	Ln(Employment)
Supplier Tariff Reduction	0.044**	0.676***	0.651***
	(2.49)	(3.65)	(6.96)
Own Industry Tariff Reduction	-0.006**	0.091***	0.053***
	(-2.24)	(3.43)	(3.24)
Ln(Assets)	-0.000	0.118***	0.035***
	(-0.25)	(9.85)	(3.28)
Tobin's Q	0.010***	-0.008	0.019**
	(6.80)	(-0.45)	(2.26)
Cash/Assets	-0.055***	1.620***	0.103
	(-4.72)	(8.85)	(0.99)
Debt/Assets	-0.009	-0.899***	-0.358***
	(-1.61)	(-5.75)	(-5.88)
EBITDA/Assets	-0.021	0.085	-0.200
	(-1.48)	(0.28)	(-0.72)
Cash Flow/Assets	0.050***	-0.744***	-0.250
	(3.46)	(-3.02)	(-0.88)
Sales Growth	0.004***	0.043***	0.042***
	(2.97)	(3.90)	(3.84)
Excess Return	-0.000	0.022	-0.009
	(-0.11)	(0.82)	(-0.49)
Excess Volatility	-0.028	1.631	-0.002
	(-0.22)	(1.48)	(-0.00)
Industry Concentration	-0.015***	-0.537***	-0.395***
	(-4.75)	(-9.11)	(-9.12)
Industry & Year Fixed Effects	Yes	Yes	Yes
R^2	0.471	0.891	0.904
Observations	4,296	4,296	4,296

Appendix to "The Downstream Impact of Upstream Tariffs: Evidence from Investment Decisions in Supply Chains"

Variable Definitions

Variable	Definition
Assets	Total assets (at). Source: Compustat.
Average Supplier Tariff Rate	(Gross-flow weighted) average import tariff rate in all supplier industries. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Capex/Assets	Capital expenditures (capx) in year t / total assets (at) at the end of year $t-1$. Source: Compustat.
Capex/Capital Stock	Aggregate capital expenditures in year t / aggregate capital stock at the end of year $t-1$. Source: NBER-CES database.
Cash/Assets	Total cash holdings (che) / total assets (at). Source: Compustat.
Cash Flow/Assets	Income before extraordinary items (ibc) / total assets (at). Source: Compustat.
Customer Integration	(Gross-flow weighted) fraction of supplier industries into which a customer is vertically integrated. Source: Compustat, 1992 BEA input-output table.
Customer Sales Volatility	Standard deviation of a customer's annual sales scaled by the customer's average sales. Demeaned. Source: Compustat.
Debt/Assets	Total long-term and short-term debt (dllt + dlc) / total assets (at). Source: Compustat.
Dividend Payer	Indicator equal to one if a firm pays dividends. Source: Compustat.
Downstream Tariff Reduction	(Gross-flow weighted) fraction of downstream industries that have experienced large tariff reductions in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
EBITDA/Assets	EBITDA (ebitda) / total assets (at). Source: Compustat.
Excess Return	Stock Return ([prcc_f / prcc_f$_{t-1}$] - 1) - Market Return ([usdval / usdval$_{t-1}$] - 1). Source: Compustat, CRSP.
Excess Volatility	Yearly standard deviation of daily returns - yearly standard deviation of daily market returns. Source: CRSP.
Growth of Capital Stock	(Aggregate capital stock at the end of year t / aggregate capital stock at the end of year $t-1$) - 1. Source: NBER-CES database.
Industry Concentration	Herfindahl-Hirschman Index (HHI) of sales in a given industry and year. Source: Compustat.
Industry Sales Growth	Growth rate of aggregate sales in a given industry and year. Source: Compustat.
Kaplan-Zingales (KZ) Index	$-1.001909 \cdot [(ib+dp)/ppent_{t-1}] + 0.2826389 \cdot [(at+csho \cdot prcc\_f - ceq - txdb)/at] + 3.139193 \cdot [(dltt+dlc)/(dltt+dlc+seq)] - 39.3678 \cdot [(dvc+dvp/ppent_{t-1})] - 1.314759 \cdot [che/ppent_{t-1}]$. (Formula based on Lamont, Polk, and Saá-Requejo (2001)). Source: Compustat.
Ln(Assets)	Natural logarithm of total assets (at). Source: Compustat.

Variable	Definition
Own Industry Tariff Reduction	Indicator equal to one if the industry has experienced a large tariff reduction in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Post Tariff Reduction	Indicator equal to one if the industry has experienced a large tariff reduction in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Sales Growth	[Sales (sale) in year t / Sales in year t-1] - 1. Source: Compustat.
Shipping Costs	Shipping costs in percent of customs value. Source: Peter Schott's website, Center for International Data at UC Davis,1992 BEA input-output table.
Supplier Specificity	(Gross-flow weighted) fraction of supplier industries whose R&D expenditures scaled by sales are larger than the Compustat median. Source: 1992 BEA input-output table, Compustat.
Supplier Industry Concentration	(Gross-flow weighted) average of the Herfindahl-Hirschman Index (HHI) of sales in upstream industries. Source: Compustat, 1992 BEA input-output table.
Supplier Tariff Increase	(Gross-flow weighted) fraction of supplier industries that have experienced large tariff increases in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Supplier Tariff Reduction	(Gross-flow weighted) fraction of supplier industries that have experienced large tariff reductions in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Supplier Tariff Reduction ($3 \times$ Median Tariff Change)	"Supplier Tariff Reduction" using three times the median (instead of the mean) avg. tariff change as the cutoff defining "large" reductions. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
$\mathbb{1}$ {Supplier Tariff Reduction} (Important Suppliers Only)	Indicator equal to one if at least one upstream industry supplying at least 10% of the customer industry's inputs has experienced a large tariff reduction in the past. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table.
Supplier Tariff Reduction (Concentrated Supplier Industry)	"Supplier Tariff Reduction" based only on supplier industries whose Herfindahl-Hirschman index of sales is larger than the Compustat median. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Supplier Tariff Reduction (Customer Integrated)	"Supplier Tariff Reduction" based only on supplier industries into which a customer is integrated. We consider a customer integrated into a given supplier industry if the customer reports activities in that industry in the Compustat Segments data. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Supplier Tariff Reduction (Customer Not Integrated)	"Supplier Tariff Reduction" based only on supplier industries into which a customer is not integrated. We consider a customer not integrated into a given supplier industry if the customer does not report any activity in that industry in the Compustat Segments data.Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.

Variable	Definition
Supplier Tariff Reduction (Specific Input)	"Supplier Tariff Reduction" based only on supplier industries whose R&D expenditures scaled by sales are larger than the Compustat median. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Supplier Tariff Reduction (Dispersed Supplier Industry)	"Supplier Tariff Reduction" based only supplier industries whose Herfindahl-Hirschman index of sales is smaller than or equal to the Compustat median. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Supplier Tariff Reduction (Generic Input)	"Supplier Tariff Reduction" based only on supplier industries whose R&D expenditures scaled by sales are smaller than or equal to the Compustat median. Source: Peter Schott's website, Center for International Data at UC Davis, 1992 BEA input-output table, Compustat.
Tobin's Q	[Total assets (at) - book value of equity (ceq) + market value of equity (chso*prcc_f)] / total assets (at). Source: Compustat.
Whited-Wu (WW) Index	$-0.091 \cdot$ [ibc/at] $- 0.044 \cdot \ln$(at) $+ 0.102 \cdot$ industry sales growth $- 0.035 \cdot$ sales growth $- 0.062 \cdot$ dividendpayer $+ 0.021 \cdot$ [dltt/at]. (Formula based on Whited and Wu (2006)) Source: Compustat.

Table A.1: Regression Results Using *Ln(Capex)* as the Dependent Variable

This table presents the results for the regressions reported in Table 2 when using *Ln(Capex)* instead of *Capex/At* as the dependent variable. All regressions (variables) are otherwise specified (defined) as in Table 2. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Ln(Capex)	Ln(Capex)	Ln(Capex)	Ln(Capex)	Ln(Capex)
Supplier Tariff Reduction	0.223	0.884***	0.760**	0.823***	0.852***
	(0.46)	(3.25)	(2.34)	(3.01)	(3.17)
Supplier Tariff Increase				-3.463**	
				(-2.26)	
Own Industry Tariff Reduction					0.020
					(0.76)
Downstream Tariff Reduction					0.296*
					(1.79)
Ln(Assets)		0.890***	0.889***	0.889***	0.890***
		(64.86)	(64.86)	(64.92)	(64.78)
Tobin's Q		0.128***	0.128***	0.128***	0.128***
		(19.75)	(19.80)	(19.71)	(19.74)
Cash/Assets		-0.280***	-0.278***	-0.279***	-0.281***
		(-4.32)	(-4.27)	(-4.30)	(-4.33)
Debt/Assets		-0.721***	-0.719***	-0.720***	-0.721***
		(-11.95)	(-11.90)	(-11.94)	(-11.95)
EBITDA/Assets		0.805***	0.802***	0.804***	0.805***
		(9.04)	(9.01)	(9.04)	(9.05)
Cash Flow/Assets		0.040	0.043	0.040	0.040
		(0.63)	(0.67)	(0.64)	(0.64)
Sales Growth		0.079***	0.080***	0.079***	0.079***
		(6.60)	(6.61)	(6.60)	(6.59)
Excess Return		0.076***	0.076***	0.076***	0.076***
		(10.11)	(10.09)	(10.12)	(10.10)
Excess Volatility		-5.519***	-5.489***	-5.533***	-5.540***
		(-11.23)	(-11.16)	(-11.28)	(-11.29)
Industry Sales Growth		0.141***	0.143***	0.139***	0.140***
		(4.73)	(4.80)	(4.66)	(4.69)
Industry Concentration		0.063	0.093	0.069	0.064
		(0.85)	(1.25)	(0.93)	(0.86)
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.869	0.919	0.919	0.919	0.919
Observations	44,590	44590	44,590	44,590	44,590

Table A.2: Regression Results Using Non-Winsorized Variables

This table presents the results for the regressions reported in Table 2 when using non-winsorized variables. t-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Capex/At	Capex/At	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.053***	0.042**	0.065**	0.039*	0.040**
	(2.62)	(2.07)	(2.51)	(1.90)	(1.97)
Supplier Tariff Increase				-0.174*	
				(-1.93)	
Own Industry Tariff Reduction					0.002
					(1.07)
Downstream Tariff Reduction					0.017
					(1.41)
Ln(Assets)		-0.013***	-0.013***	-0.013***	-0.013***
		(-11.58)	(-11.65)	(-11.61)	(-11.58)
Tobin's Q		0.006***	0.006***	0.006***	0.006***
		(10.73)	(10.75)	(10.72)	(10.73)
Cash/Assets		-0.004	-0.003	-0.004	-0.004
		(-0.81)	(-0.78)	(-0.80)	(-0.83)
Debt/Assets		-0.040***	-0.040***	-0.039***	-0.040***
		(-8.10)	(-8.10)	(-8.09)	(-8.10)
EBITDA/Assets		0.026***	0.026***	0.026***	0.026***
		(3.43)	(3.42)	(3.43)	(3.43)
Cash Flow/Assets		-0.001	-0.001	-0.001	-0.001
		(-0.31)	(-0.28)	(-0.30)	(-0.30)
Sales Growth		-0.000**	-0.000**	-0.000**	-0.000**
		(-2.36)	(-2.39)	(-2.37)	(-2.34)
Excess Return		0.001	0.001	0.001	0.001
		(1.56)	(1.56)	(1.56)	(1.56)
Excess Volatility		-0.204***	-0.203***	-0.205***	-0.205***
		(-5.33)	(-5.31)	(-5.34)	(-5.35)
Industry Sales Growth		0.001	0.001	0.001	0.001
		(1.57)	(1.56)	(1.56)	(1.58)
Industry Concentration		0.001	0.003	0.001	0.001
		(0.13)	(0.50)	(0.18)	(0.16)
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.349	0.388	0.388	0.388	0.388
Observations	44,590	44,590	44,590	44,590	44,590

Table A.3: Regression Results Using Alternative Measures of Tariff Reductions

This table presents coefficient estimates using alternative tariff reduction measures. The sample period is 1974 to 2012. *Supplier Tariff Reduction (3 × Median Tariff Change)* is based on the median (instead of the mean) year-on-year tariff change in an industry. $\mathbb{1}\{$*Supplier Tariff Reduction*$\}$*(Important Suppliers Only)* is an indicator equal to one if at least one upstream industry supplying at least 10% of a customer industry's total inputs has experienced a large tariff reduction in the past. *Average Supplier Tariff Rate* is the weighted average import tariff rate across supplier industries. *t*-statistics are reported in parentheses. Standard errors are clustered in two ways, by (SIC4-)industry×year and by firm. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)
Dependent Variable:	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.047***		
(3 × Median Tariff Change)	(2.75)		
$\mathbb{1}\{$Supplier Tariff Reduction$\}$		0.011**	
(Important Suppliers Only)		(2.24)	
Average Supplier Tariff Rate			-0.006*
			(-1.92)
Ln(Assets)	-0.011***	-0.012***	-0.011***
	(-13.01)	(-4.48)	(-13.04)
Tobin's Q	0.007***	0.007***	0.007***
	(15.37)	(2.85)	(15.38)
Cash/Assets	-0.006*	-0.005	-0.006*
	(-1.88)	(-0.39)	(-1.83)
Debt/Assets	-0.038***	-0.029***	-0.038***
	(-11.52)	(-2.70)	(-11.54)
EBITDA/Assets	0.044***	0.103***	0.044***
	(9.62)	(4.98)	(9.63)
Cash Flow/Assets	-0.004	-0.017	-0.004
	(-1.30)	(-1.36)	(-1.31)
Sales Growth	0.004***	0.006***	0.004***
	(5.52)	(2.80)	(5.54)
Excess Return	0.004***	0.007***	0.004***
	(8.90)	(4.44)	(8.90)
Excess Volatility	-0.260***	-0.390***	-0.258***
	(-10.39)	(-4.47)	(-10.33)
Industry Sales Growth	0.010***	0.006	0.010***
	(5.17)	(1.30)	(5.20)
Industry Concentration	0.002	-0.024**	0.002
	(0.57)	(-2.46)	(0.54)
Firm & Year Fixed Effects	Yes	Yes	Yes
R^2	0.475	0.464	0.475
Observations	44,590	5,661	44,590

Table A.4: Regression Results Using Alternative Clustering Levels

This table presents the key coefficient estimates reported in Table 2 and the associated t-statistics for alternative clustering levels (in parentheses). The first t-statistic reported under each coefficient estimate is based on standard errors that are clustered by (SIC4-)industry×year. The second t-statistic is based on standard errors that are clustered by firm. The third is based on standard errors that are clustered in two ways, by firm and by year. The fourth is based on standard errors that are clustered by (SIC4-)industry. The fifth is based on standard errors that are clustered in two ways, by (SIC4-)industry and by year. All regressions are specified as in Table 2. We only report the key coefficients and the associated t-statistics to conserve space. Statistical significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Capex/At	Capex/At	Capex/At	Capex/At	Capex/At
Supplier Tariff Reduction	0.055	0.042	0.054	0.04	0.041
(Cluster: Industry×Year)	(4.31)***	(3.64)***	(3.71)***	(3.43)***	(3.52)***
(Cluster: Firm)	(3.12)***	(2.42)**	(2.42)**	(2.28)**	(2.32)**
(Cluster: Firm & Year)	(2.97)***	(2.41)**	(2.43)**	(2.29)**	(2.30)**
(Cluster: Industry)	(2.42)**	(1.90)*	(2.47)**	(1.79)*	(1.78)*
(Cluster: Industry & Year)	(2.47)**	(1.99)*	(2.59)**	(1.87)*	(1.84)*
Supplier Tariff Increase				-0.115	
(Cluster: Industry×Year)				(-2.35)**	
(Cluster: Firm)				(-1.50)	
(Cluster: Firm & Year)				(-1.39)	
(Cluster: Industry)				(-1.44)	
(Cluster: Industry & Year)				(-1.39)	
Own Industry Tariff Reduction					0.002
(Cluster: Industry×Year)					(1.36)
(Cluster: Firm)					(1.08)
(Cluster: Firm & Year)					(0.96)
(Cluster: Industry)					(0.99)
(Cluster: Industry & Year)					(0.94)
Downstream Tariff Reduction					0.014
(Cluster: Industry×Year)					(2.02)**
(Cluster: Firm)					(1.35)
(Cluster: Firm & Year)					(1.15)
(Cluster: Industry)					(0.77)
(Cluster: Industry & Year)					(0.74)
Control Variables	No	Yes	Yes	Yes	Yes
Firm & Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
R^2	0.417	0.475	0.475	0.475	0.475
Observations	44,590	44,590	44,590	44,590	44,590