Internet Appendix to

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

Theoretical Framework

Baseline Model (Prediction 1)

We consider a firm that invests in productive capacity. If the firm invests $i \in \mathbb{R}_+$ at cost $c(i)$, it can produce $f(i)$ units of output. For example, $f(i)$ could be the capacity of a factory built at cost $c(i)$.[1] The firm can produce each unit of output at cost k and sell it at price p, so the profit per unit of output is $\pi = p - k$. The firm thus chooses its investment i to maximize

$$\Pi = \pi f(i) - c(i). \tag{A1}$$

We assume $f'(i) > 0$ and $c'(i) > 0$ as well as $f''(i) \leq 0$ and $c''(i) \geq 0$, where at least one inequality is strict. We further assume $\lim_{i \to 0} \pi f'(i) > \lim_{i \to 0} c'(i)$ to guarantee that an interior optimum level of investment exists. This optimum, i^*, is given by the first order condition

$$\pi f'(i^*) = c'(i^*), \tag{A2}$$

i.e., the marginal benefit is equal to the marginal cost. Applying the implicit function theorem to (A2) shows that the optimal investment is increasing in the profit per unit of output:

$$\frac{di^*}{d\pi} = -\frac{f'(i^*)}{\pi f''(i^*) - c''(i^*)} > 0. \tag{A3}$$

Intuitively, a higher profit per unit of output increases the incentives to invest in productive capacity.

[1] In the simplest case, the cost of investment could just be the investment itself, i.e., $c(i) = i$. In general, however, the total cost $c(i)$ could exceed the amount i of the investment, for example, if the firm must raise external funds, which could be costly due to agency problems, asymmetric information, or an increase in the expected cost of financial distress, or if investing i necessitates foregoing alternative investment opportunities.

To assess the relation between upstream tariffs and downstream investment, we now assume that the profit π per unit of output is decreasing in the import tariff τ on some input supplied by an upstream industry and needed to produce the downstream output, i.e.,

$$\pi = \pi(\tau) \text{ with } \pi'(\tau) < 0. \tag{A4}$$

The negative relation between the profit per unit of output and the tariff could operate through multiple, non mutually exclusive channels. A lower upstream tariff could reduce the price at which the downstream firm can purchase its input from upstream suppliers and thereby lower the cost of producing its output (e.g., De Loecker et al. 2016; Blaum et al. 2018).[2] Further, a lower tariff could increase the quality and variety of the available input (e.g., Goldberg et al. 2010) and thereby increase the price at which the downstream firm can sell its output.

Using $\pi'(\tau) < 0$, we obtain

$$\frac{di^*}{d\tau} = \pi'(\tau)\frac{di^*}{d\pi} = -\frac{\pi'(\tau)f'(i^*)}{\pi(\tau)f''(i^*) - c''(i^*)} < 0, \tag{A5}$$

i.e., the optimal amount of investment is decreasing in the upstream tariff rate.

Share of Input Costs in Overall Production Costs (Prediction 2)

Suppose that producing one unit of downstream output requires $n > 0$ units of an input procured from upstream suppliers at unit-cost $y(\tau)$, with $y'(\tau) > 0$, and $m \geq 0$ units of other resources

[2] For example, a lower tariff reduces the cost at which the input can be imported. A lower tariff can also increase import competition, which can in turn lead to an increase in supplier productivity and thus a decrease in the marginal cost of producing the input (Melitz and Trefler 2012). Further, a lower tariff can reduce the markup that upstream suppliers charge. Consider, for instance, the case of monopolistic competition so that the markup is decreasing in the number of suppliers. A lower tariff that leads to an increase in the number of foreign suppliers that compete on the domestic market can then lead to a reduction in the markup.

(e.g., labor) with unit-cost z. Upstream tariff reductions thus reduce the cost of the input procured from the upstream suppliers but not the cost of the other resources.[3]

The downstream firm's profit per unit of output is now

$$\pi(\tau) = p - k = p - n \times y(\tau) - m \times z, \tag{A6}$$

and the relation between the optimal amount of investment and the upstream tariff rate becomes

$$\frac{di^*}{d\tau} = \frac{n \times y'(\tau) f'(i^*)}{\pi(\tau) f''(i^*) - c''(i^*)} < 0. \tag{A7}$$

For a given unit-cost of production $k = \bar{k}$, a firm's investment response to upstream tariff changes is thus more pronounced if its input costs are relatively more important. Specifically, using $\lambda = n \times y(\tau)/\bar{k}$ to denote the share of input costs in the overall production cost, we obtain

$$\frac{\partial \frac{di^*}{d\tau}}{\partial \lambda} = \frac{y'(\tau)}{y(\tau)} \times \frac{\bar{k} f'(i^*)}{\pi(\tau) f''(i^*) - c''(i^*)} < 0. \tag{A8}$$

Differentiated vs. Homogeneous Inputs (Prediction 3)

Suppose that the upstream supplier from whom the downstream firm plans to procure its input (after having invested in productive capacity) succumbs to foreign competition with probability $\phi(\tau) \in (0, 1)$, where $\phi'(\tau) < 0$. That is, a higher import tariff protects the supplier, and a lower tariff makes it more likely that the supplier goes out of business. If the supplier survives, then the downstream firm's payoff (gross of the investment expense) is $\pi(\tau) f(i)$, with $\pi'(\tau) < 0$, as before. If the supplier goes out of business, however, then the downstream firm's payoff is $\delta \times \pi(\tau) f(i)$. We assume $\delta = 1$ if the supplier produced a homogeneous input (e.g., cement) and can easily be replaced with another supplier. In that case, a supply chain disruption does not

[3] Potential increases in the input's quality (or variety) can be interpreted here as decreases in its quality-adjusted cost.

affect the downstream firm's payoff. If, instead, the supplier produced a differentiated input (e.g., industrial machinery), we assume $0 \leq \delta < 1$. The idea is that the use of differentiated inputs requires relationship-specific investments and therefore makes it costly to switch suppliers.[4] In this case, a supply chain disruption reduces the downstream firm's payoff.

In the former case, with homogeneous inputs, the downstream firm thus maximizes

$$E[\Pi] = [1 - \phi(\tau)]\,\pi(\tau)f(i) + \phi(\tau)\pi(\tau)f(i) - c(i) = \pi(\tau)f(i) - c(i), \tag{A9}$$

as before, and the optimal amount of investment is given by

$$\pi(\tau)f'(i^*) = c'(i^*) \text{ with } \frac{di^*}{d\tau} = -\frac{\pi'(\tau)f'(i^*)}{\pi(\tau)f''(i^*) - c''(i^*)} < 0. \tag{A10}$$

In the latter case, with differentiated inputs, the downstream firm instead maximizes

$$E[\Pi] = [1 - \phi(\tau)]\,\pi(\tau)f(i) + \phi(\tau)\delta\pi(\tau)f(i) - c(i) = [1 - (1-\delta)\,\phi(\tau)]\,\pi(\tau)f(i) - c(i), \tag{A11}$$

and the optimal amount of investment (assuming an interior optimum exists) is given by

$$[1 - (1-\delta)\,\phi(\tau)]\,\pi(\tau)f'(i^*) = c'(i^*) \tag{A12}$$

with

$$\frac{di^*}{d\tau} = \frac{\{(1-\delta)\,\phi'(\tau)\pi(\tau) - \pi'(\tau)\,[1 - (1-\delta)\,\phi(\tau)]\}\,f'(i^*)}{[1 - (1-\delta)\,\phi(\tau)]\,\pi(\tau)f''(i^*) - c''(i^*)}. \tag{A13}$$

We thus obtain $di^*/d\tau < 0$ if and only if

$$\frac{\pi'(\tau)}{\phi'(\tau)} > \frac{(1-\delta)\,\pi(\tau)}{1 - (1-\delta)\,\phi(\tau)} \;\Leftrightarrow\; \delta > \frac{\pi(\tau) - [1 - \phi(\tau)]\,\frac{\pi'(\tau)}{\phi'(\tau)}}{\pi(\tau) + \phi(\tau)\frac{\pi'(\tau)}{\phi'(\tau)}}. \tag{A14}$$

That is, in the case of differentiated inputs, an upstream tariff reduction leads to an increase in the downstream firm's investment only if the increase in the profit per unit of output is sufficiently

[4]Note that the need for relationship-specific investments is a common assumption in the literature on international sourcing decisions (e.g., Antràs 2003; Antràs and Helpman 2004; Antràs and Chor 2013; Alfaro et al. 2019).

large, relative to the increase in the probability that the upstream supplier goes out of business, or, equivalently, if the cost of a supply chain disruption is sufficiently small (i.e., δ sufficiently large).

Comparing the investment responses in the two cases, we further obtain

$$-\frac{\pi'(\tau)f'(i^*)}{\pi(\tau)f''(i^*)-c''(i^*)} < \frac{\{(1-\delta)\,\phi'(\tau)\pi(\tau)-\pi'(\tau)\,[1-(1-\delta)\,\phi(\tau)]\}\,f'(i^*)}{[1-(1-\delta)\,\phi(\tau)]\,\pi(\tau)f''(i^*)-c''(i^*)} \tag{A15}$$

if and only if

$$\pi'(\tau)\phi(\tau)c''(i^*)-\phi'(\tau)\pi(\tau)\,[\pi(\tau)f''(i^*)-c''(i^*)]<0, \tag{A16}$$

which is satisfied, all else equal, given the assumptions on π, ϕ, c, and f. That is, the investment response is more pronounced in the case of homogeneous, rather than differentiated, inputs.[5]

Bargaining Power (Prediction 4)

Let Σ denote the total gains from trade between an upstream supplier, the downstream firm, and its customer. That is, Σ is the total surplus that can be achieved if the supplier supplies the input, the downstream firm produces the output, and the customer buys the output. Assume further that $\Sigma=\Sigma(\tau)$ with $\Sigma'(\tau)<0$. That is, reducing the import tariff on the input increases the total surplus that can be achieved. As argued above, this could be the case because tariff reductions decrease the cost at which the input can be imported or increase the quality or variety of the input.

Assume further that, whatever the process through which the prices for the input and output are set, the final outcome is efficient in the sense that the upstream supplier, the downstream firm, and

[5]This result also holds if we assume that tariff reductions for differentiated goods have a smaller effect on the downstream firm's input costs – and, hence, marginal profit – than for homogeneous goods (e.g., because product differentiation could help to protect suppliers from price competition). Specifically, if we assume $0>\hat{\pi}'(\tau)>\pi'(\tau)$, where $\hat{\pi}'(\tau)$ is the effect for differentiated goods, then inequality (A16) becomes $\hat{\pi}'(\tau)\phi(\tau)c''(i^*)-\phi'(\tau)\pi(\tau)\,[\pi(\tau)f''(i^*)-c''(i^*)]<0<[\pi'(\tau)-\hat{\pi}'(\tau)]\,\frac{[1-(1-\delta)\phi(\tau)]\pi(\tau)f''(i^*)-c''(i^*)}{1-\delta}$.

the customer split the total surplus as follows: The supplier receives $\alpha\Sigma(\tau)$, the downstream firm $\beta\Sigma(\tau)$, and the customer $\gamma\Sigma(\tau)$, with $(\alpha,\beta,\gamma)\in[0,1]^3$ and $\alpha+\beta+\gamma=1$. That is, α, β, and γ can be interpreted as the supplier's, the downstream firm's, and the customer's bargaining power.

The price k at which the downstream firm buys the input from the supplier and the price p at which it sells its output to the customer (and hence the profit π per unit of output) must thus satisfy

$$p - k = \beta\Sigma(\tau) = \pi(\tau). \tag{A17}$$

All else equal, the downstream firm's investment response to a change in the upstream tariff,

$$\frac{di^*}{d\tau} = \pi'(\tau)\frac{di^*}{d\pi} = -\beta\Sigma'(\tau)\frac{f'(i^*)}{\pi(\tau)f''(i^*) - c''(i^*)} < 0, \tag{A18}$$

is therefore more pronounced if the downstream firm's bargaining power (β) is higher.

Financial Constraints (Prediction 5)

Suppose that the downstream firm chooses its investment $i \in \mathbb{R}_+$ to maximize

$$\Pi = \pi(\tau)f(i) - c(i) \tag{A19}$$

with π, f, and c, as before, but now also subject to the following financial constraint:

$$i \leq \lambda(\tau) \text{ with } 0 \leq \lambda(\tau_n) \leq \lambda(\tau_m) \text{ for any tariffs } \tau_m \text{ and } \tau_n \text{ such that } 0 \leq \tau_m \leq \tau_n. \tag{A20}$$

That is, upstream tariff reductions not only increase the downstream firm's profit per unit of output but may also relax the firm's financial constraint. This could be the case, for example, because lower upstream tariffs decrease the firm's input costs and thereby increase the profit per unit of output, which in turn translates into higher cash flows from existing operations.[6] It follows that the firm invests $i = \lambda(\tau)$ if the financial constraint is binding and otherwise invests $i = i^*$ given by

$$\pi(\tau)f'(i^*) = c'(i^*) \text{ with } \frac{di^*}{d\tau} < 0. \tag{A21}$$

Consider now two tariffs levels, τ_1 and $\tau_2 < \tau_1$, the corresponding investments, $i_1 \in \{\lambda(\tau_1), i_1^*\}$ and $i_2 \in \{\lambda(\tau_2), i_2^*\}$, and their differences $\Delta = i_2 - i_1$. There are four cases:

(a) The financial constraint is neither binding at τ_1 nor at τ_2: $\Delta_{(a)} = i_2^* - i_1^* > 0$.

(b) The financial constraint is not binding at τ_1 but is binding at τ_2: $\Delta_{(b)} = \lambda(\tau_2) - i_1^* > 0$.

(c) The financial constraint is binding at τ_1 but not at τ_2: $\Delta_{(c)} = i_2^* - \lambda(\tau_1) > 0$.

(d) The financial constraint is binding at τ_1 and at τ_2: $\Delta_{(d)} = \lambda(\tau_2) - \lambda(\tau_1) \geq 0$.

A tariff reduction thus implies an increase in investment – unless the tariff reduction does not relax the firm's binding financial constraint, in which case its investment does not change. Further, if the tariff reduction does not relax the constraint – i.e., if $\lambda(\tau_2) = \lambda(\tau_1)$, which in turn rules out case (c) and implies $\Delta_{(d)} = 0$ – then the increase in investment is largest for a firm that is unconstrained both before and after the tariff reduction: $\Delta_{(a)} > \Delta_{(b)} > \Delta_{(d)} = 0$. However, if the tariff reduction relaxes the constraint – i.e., if $\lambda(\tau_2) > \lambda(\tau_1)$ – then it is possible that the increase in investment for a firm that was initially constrained is larger than for an unconstrained firm: For example, $\Delta_{(c)} > \Delta_{(a)}$.[7] Hence, whether the presence of financial constraints reduces or increases the investment response, relative to the unconstrained case, is a priori an empirical question.

[6]Note, however, that a relaxation of the financial constraint is not a foregone conclusion: If the reason for the constraint is the limited pledgeability of the firms' income – e.g., due to moral hazard or adverse selection problems (Tirole 2006) – then an upstream tariff reduction is unlikely to substantially relax the constraint.

[7]Note that it is also possible that $\Delta_{(d)} > \Delta_{(a)}$ in that case.

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Supplemental Analyses and Robustness Tests

Table A.1: Summary Statistics for Industries' Most Important Customers and Suppliers

	(1)	(2)	(3)	(4)	(5)	(6)
	Obs.	Mean	SD	*p*1	*p*50	*p*99
Max Customer Weight (based on 1972 BEA Table)	121	0.068	0.088	0.000	0.031	0.462
Max Customer Weight (based on 1977 BEA Table)	119	0.070	0.090	0.000	0.036	0.486
Max Customer Weight (based on 1992 BEA Table)	128	0.067	0.087	0.000	0.042	0.436
Max Supplier Weight (based on 1972 BEA Table)	121	0.088	0.076	0.004	0.065	0.371
Max Supplier Weight (based on 1977 BEA Table)	119	0.094	0.084	0.005	0.064	0.360
Max Supplier Weight (based on 1992 BEA Table)	128	0.077	0.072	0.009	0.060	0.303

This table presents summary statistics for the fraction of an industry's total sales accounted for by the most important downstream (i.e., customer) industry in terms of sales volume (*Max Customer Weight*) as well as for the fraction of an industry's total purchases accounted for by the most important upstream (i.e., supplier) industry in terms of purchase volume (*Max Supplier Weight*).

Table A.2: Sensitivity of Downstream Investment to Upstream Tariffs

	(1)	(2)	(3)	(4)
Dependent Variable:	Capex/Assets	Capex/Assets	Capex/Assets	Capex/Assets
Up Tariff	-1.216***	-1.269***	-1.155***	-1.782***
	(-3.47)	(-3.02)	(-3.02)	(-2.78)
Own Tariff		0.035	0.015	0.012
		(0.87)	(0.56)	(0.53)
Down Tariff		0.005	0.141	0.052
		(0.02)	(0.62)	(0.13)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes
SIC4-Level Time Trends	No	No	No	Yes
Adjusted R^2	0.350	0.351	0.423	0.431
Observations	31,789	31,789	31,789	31,789

This table presents estimates from a panel regression of downstream firms' investment (*Capex/Assets*) on upstream import tariffs (*Up Tariff*), tariffs in the firms' own industries (*Own Tariff*), and downstream tariffs (*Down Tariff*): $\textit{Investment}_{i,j,t} = \beta \times \textit{Up Tariff}_{j,t} + \gamma \times \textit{Own Tariff}_{j,t} + \delta \times \textit{Down Tariff}_{j,t} + \theta' \textit{Controls}_{i,j,t-1} + \alpha_i + \lambda_t + \rho_j \times t + \varepsilon_{i,j,t}$. Firms, (SIC4-)industries, and years are indexed by i, j, and t. *Investment* is capital expenditures scaled by beginning of year assets. *Up Tariff*, *Own Tariff*, and *Down Tariff* are the tariffs in upstream, own, and downstream industries. To compute the import-value-weighted average tariff, $\textit{Import Tariff}_{j,t}$, we fix each country's weight at the 1972 import value, and to construct $\textit{Up Tariff}_{j,t}$ ($\textit{Down Tariff}_{j,t}$), we use the 1972 BEA input-output table to compute the industry-weights $\omega_{s,j}$ and $\nu_{j,s}$. Using weights from 1977 or 1992 yields very similar results. *Controls* are *Ln(Assets)*, *Tobin's Q*, *Cash/Assets*, *Debt/Assets*, *EBITDA/Assets*, *Sales Growth*, *Excess Return*, *Excess Volatility*, *Industry Sales Growth*, and *Industry Concentration*. α_i and λ_t are firm and year fixed effects. $\rho_j \times t$ is an industry specific time trend. The sample period is 1974 to 2001. All coefficient estimates are multiplied by 100 to improve readability. The standard errors are clustered by (SIC4-)industry. *t*-statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.3: Using Alternative Horizons to Compute Tariff Reductions

	(1)	(2)	(3)	(4)
Dependent Variable:	Capex/Assets	Capex/Assets	Capex/Assets	Capex/Assets
ΔUp Tariff from $t = -2$ to $t = 3 \times$ Post	2.327***	2.620***	2.003***	2.762***
	(3.88)	(3.94)	(2.99)	(2.78)
ΔUp Tariff from $t = -2$ to $t = 3 \times$ Imp	0.600	0.666	0.392	0.797
	(0.75)	(0.77)	(0.63)	(1.01)
Adjusted R^2	0.393	0.394	0.406	0.409
Observations	38,396	38,396	38,396	38,396
ΔUp Tariff from $t = -2$ to $t = 2 \times$ Post	2.569***	2.747***	2.140***	2.607***
	(3.82)	(3.81)	(2.97)	(2.63)
ΔUp Tariff from $t = -2$ to $t = 2 \times$ Imp	0.772	0.892	0.616	0.909
	(0.98)	(1.05)	(0.98)	(1.15)
Adjusted R^2	0.393	0.394	0.406	0.408
Observations	38,396	38,396	38,396	38,396
ΔUp Tariff from $t = -1$ to $t = 2 \times$ Post	3.494***	3.810***	3.148***	4.212***
	(3.81)	(3.83)	(3.20)	(3.11)
ΔUp Tariff from $t = -1$ to $t = 2 \times$ Imp	0.911	1.155	0.851	1.424
	(0.85)	(1.02)	(1.06)	(1.37)
Adjusted R^2	0.393	0.393	0.406	0.408
Observations	36,783	36,783	36,783	36,783
ΔUp Tariff from $t = -1$ to $t = 1 \times$ Post	2.289***	2.590***	2.120**	1.543
	(3.18)	(3.38)	(2.58)	(1.61)
ΔUp Tariff from $t = -1$ to $t = 1 \times$ Imp	0.911	0.903	0.994*	0.741
	(1.36)	(1.31)	(1.96)	(1.33)
Adjusted R^2	0.378	0.379	0.391	0.394
Observations	35,471	35,471	35,471	35,471
Trade Agreement×Firm Fixed Effects	Yes	Yes	Yes	Yes
Trade Agreement×Year Fixed Effects	Yes	Yes	Yes	Yes
ΔOwn Tariff (Interacted)	No	Yes	Yes	Yes
ΔDown Tariff (Interacted)	No	Yes	Yes	Yes
Pre-Treatment Controls (Interacted)	No	No	Yes	Yes
SIC4-Level Time Trends	No	No	No	Yes

This table presents estimates of the sensitivity of downstream firms' investment (*Capex/Assets*) to upstream tariff reductions (Δ*Up Tariff*) obtained from a difference-in-differences analysis around multinational trade agreements (GSP, 7th GATT round, and NAFTA/8th GATT round). The regressions are specified as in Table 3 (in the paper), except that the magnitude of the tariff reductions is computed over alternative horizons. All coefficient estimates are multiplied by 100 to improve readability. The standard errors are clustered by (SIC4-)industry. *t*-statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.4: Dropping Firms with Large Upstream Tariff Reductions in Prior Trade Agreements

	(1)	(2)	(3)	(4)
Dependent Variable:	Capex/Assets	Capex/Assets	Capex/Assets	Capex/Assets
(a) ΔUp Tariff $\times$ Post	2.719***	3.256***	2.603***	4.443***
	(3.14)	(3.40)	(2.75)	(3.41)
(b) ΔUp Tariff $\times$ Imp	0.986	1.319	0.534	1.419
	(1.00)	(1.35)	(0.70)	(1.48)
(c) ΔOwn Tariff $\times$ Post		-0.182*	-0.177*	-0.191*
		(-1.96)	(-1.90)	(-1.69)
(d) ΔOwn Tariff $\times$ Imp		-0.243***	-0.194***	-0.204***
		(-2.77)	(-2.74)	(-2.64)
(e) ΔDown Tariff $\times$ Post		-1.048**	-1.076**	-0.345
		(-2.33)	(-2.50)	(-0.64)
(f) ΔDown Tariff $\times$ Imp		0.476	0.470	0.814**
		(1.07)	(1.32)	(2.14)
Trade Agreement$\times$Firm Fixed Effects	Yes	Yes	Yes	Yes
Trade Agreement$\times$Year Fixed Effects	Yes	Yes	Yes	Yes
Pre-Treatment Controls (Interacted)	No	No	Yes	Yes
SIC4-Level Time Trends	No	No	No	Yes
Adjusted R^2	0.394	0.395	0.406	0.409
Observations	31,073	31,073	31,073	31,073
p-value of test of H_0: (a) = (b)	0.081	0.045	0.016	0.001
p-value of test of H_0: (c) = (d)	–	0.452	0.837	0.881
p-value of test of H_0: (e) = (f)	–	0.004	0.001	0.023
p-value of test of H_0: (a) + (b) = 0	0.020	0.007	0.038	0.006
p-value of test of H_0: (c) + (d) = 0	–	0.010	0.011	0.023
p-value of test of H_0: (e) + (f) = 0	–	0.435	0.346	0.552

This table presents estimates of the sensitivity of downstream firms' investment (*Capex/Assets*) to upstream tariff reductions (Δ*Up Tariff*) obtained from a difference-in-differences analysis around multinational trade agreements (GSP, 7th GATT round, and NAFTA/8th GATT round). The regressions are specified as in Table 3 (in the paper). The only difference is that, when constructing the regression sample by stacking the observations from the three panels that we create around the trade agreements, we first drop from each panel all observations pertaining to firms that experienced large upstream tariff reductions in prior trade agreements. Specifically, for each $k = 1, 2, 3$ and $h = 1, 2$ and $j = 1, 2, \ldots, J$, we drop from the panel around trade agreement k all observations pertaining to firms in industry j for which Δ*Up Tariff*$_{h,j} \geq 0.1$ for any $h < k$. All coefficient estimates are multiplied by 100 to improve readability. The standard errors are clustered by (SIC4-)industry. *t*-statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.5: DiD Analysis using Indicators for Upstream Tariff Reductions of Different Magnitudes

	(1)	(2)	(3)	(4)
Dependent Variable:	Capex/Assets	Capex/Assets	Capex/Assets	Capex/Assets
$\mathbb{1}\{0.5 \leq \Delta\text{Up Tariff} < \infty\} \times$ Post	2.462**	2.651***	2.344**	4.266***
	(2.46)	(2.68)	(2.36)	(4.16)
$\mathbb{1}\{0.3 \leq \Delta\text{Up Tariff} < 0.5\} \times$ Post	1.607*	1.814**	1.237	1.640*
	(1.72)	(2.03)	(1.37)	(1.85)
$\mathbb{1}\{0.1 \leq \Delta\text{Up Tariff} < 0.3\} \times$ Post	0.841	0.996	0.766	1.042
	(1.02)	(1.27)	(0.98)	(1.32)
$\mathbb{1}\{0.0 \leq \Delta\text{Up Tariff} < 0.1\} \times$ Post	0.442	0.460	0.341	0.967
	(0.52)	(0.57)	(0.42)	(1.21)
$\mathbb{1}\{0.5 \leq \Delta\text{Up Tariff} < \infty\} \times$ Imp	2.026***	2.178***	2.057***	3.068***
	(3.20)	(3.38)	(3.44)	(4.37)
$\mathbb{1}\{0.3 \leq \Delta\text{Up Tariff} < 0.5\} \times$ Imp	1.258**	1.311**	0.931*	1.182**
	(2.26)	(2.35)	(1.87)	(2.07)
$\mathbb{1}\{0.1 \leq \Delta\text{Up Tariff} < 0.3\} \times$ Imp	1.042**	1.138**	1.049**	1.226**
	(2.32)	(2.56)	(2.51)	(2.48)
$\mathbb{1}\{0.0 \leq \Delta\text{Up Tariff} < 0.1\} \times$ Imp	0.839*	0.804*	0.887**	1.243**
	(1.95)	(1.85)	(2.22)	(2.57)
Trade Agreement×Firm Fixed Effects	Yes	Yes	Yes	Yes
Trade Agreement×Year Fixed Effects	Yes	Yes	Yes	Yes
ΔOwn Tariff (Interacted)	No	Yes	Yes	Yes
ΔDown Tariff (Interacted)	No	Yes	Yes	Yes
Pre-Treatment Controls (Interacted)	No	No	Yes	Yes
SIC4-Level Time Trends	No	No	No	Yes
Adjusted R^2	0.393	0.394	0.406	0.409
Observations	38,445	38,445	38,445	38,445

This table presents estimates of the sensitivity of downstream firms' investment (*Capex/Assets*) to upstream tariff reductions in various size-based categories obtained from a difference-in-differences analysis around multinational trade agreements (GSP, 7th GATT round, and NAFTA/8th GATT round) using the following regression:

$$\begin{aligned} \textit{Investment}_{k,i,j,t} \quad = \quad & (\beta_{11}\mathbb{1}\{0.5 \leq \Delta\text{Up Tariff} < \infty\} + \beta_{12}\mathbb{1}\{0.3 \leq \Delta\text{Up Tariff} < 0.5\} \\ & + \beta_{13}\mathbb{1}\{0.1 \leq \Delta\text{Up Tariff} < 0.3\} + \beta_{14}\mathbb{1}\{0.0 \leq \Delta\text{Up Tariff} < 0.1\}) \times \textit{Imp}_{k,t} \\ & + (\beta_{21}\mathbb{1}\{0.5 \leq \Delta\text{Up Tariff} < \infty\} + \beta_{22}\mathbb{1}\{0.3 \leq \Delta\text{Up Tariff} < 0.5\} \\ & + \beta_{23}\mathbb{1}\{0.1 \leq \Delta\text{Up Tariff} < 0.3\} + \beta_{24}\mathbb{1}\{0.0 \leq \Delta\text{Up Tariff} < 0.1\}) \times \textit{Post}_{k,t} \\ & + \left(\gamma_1 \Delta \textit{Own Tariff}_{k,j} + \delta_1 \Delta \textit{Down Tariff}_{k,j} + \theta_1' \textit{Controls}_{k,i,j}\right) \times \textit{Imp}_{k,t} \\ & + \left(\gamma_2 \Delta \textit{Own Tariff}_{k,j} + \delta_2 \Delta \textit{Down Tariff}_{k,j} + \theta_2' \textit{Controls}_{k,i,j}\right) \times \textit{Post}_{k,t} \\ & + \alpha_{k,i} + \lambda_{k,t} + \rho_j \times t + \varepsilon_{k,i,j,t} \end{aligned}$$

The smallest tariff reductions (including increases) serve as the reference category, so we omit $\mathbb{1}\{\Delta\text{Up Tariff} < 0.0\}$. Trade agreements are indexed by k, and firms, (SIC4-)industries, and years by i, j, and t. All coefficient estimates are multiplied by 100 to improve readability. The standard errors are clustered by (SIC4-)industry. t-statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.6: Measuring Investment with Ln(Capex)

	(1)	(2)
Dependent Variable:	Ln(Capex)	Ln(Capex)
ΔUp Tariff $\times$ Post	55.935**	
	(2.24)	
ΔUp Tariff $\times$ Imp	20.707*	
	(1.74)	
ΔUp Tariff $\times \mathbb{1}\{t=-5\}$		-16.306
		(-1.14)
ΔUp Tariff $\times \mathbb{1}\{t=-4\}$		-5.572
		(-0.38)
ΔUp Tariff $\times \mathbb{1}\{t=-3\}$		-2.749
		(-0.22)
ΔUp Tariff $\times \mathbb{1}\{t=-2\}$		-2.535
		(-0.32)
ΔUp Tariff $\times \mathbb{1}\{t=0\}$		1.354
		(0.17)
ΔUp Tariff $\times \mathbb{1}\{t=1\}$		11.364
		(0.85)
ΔUp Tariff $\times \mathbb{1}\{t=2\}$		41.125**
		(2.55)
ΔUp Tariff $\times \mathbb{1}\{t=3\}$		59.303***
		(3.18)
ΔUp Tariff $\times \mathbb{1}\{t=4\}$		39.200*
		(1.78)
ΔUp Tariff $\times \mathbb{1}\{t=5\}$		56.672**
		(2.30)
ΔUp Tariff $\times \mathbb{1}\{t=6\}$		52.971*
		(1.85)
ΔUp Tariff $\times \mathbb{1}\{t=7\}$		57.001*
		(1.96)
Trade Agreement$\times$Firm Fixed Effects	Yes	Yes
Trade Agreement$\times$Year Fixed Effects	Yes	Yes
ΔOwn Tariff (Interacted)	Yes	Yes
ΔDown Tariff (Interacted)	Yes	Yes
Pre-Treatment Controls (Interacted)	Yes	Yes
SIC4-Level Time Trends	Yes	Yes
Adjusted R^2	0.906	0.909
Observations	38,337	38,337

This table presents estimates of the sensitivity of downstream firms' investment to upstream tariff reductions (Δ*Up Tariff*) obtained from a difference-in-differences analysis around multinational trade agreements (GSP, 7th GATT round, and NAFTA/8th GATT round). Column (1) corresponds to column (4) of Table 3 (in the paper), and column (2) corresponds to column (4) of Table 4 (in the paper), except that we use *Ln(Capex)* instead of capital expenditures scaled by the book value of total assets as the dependent variable. All coefficient estimates are multiplied by 100 to improve readability. The standard errors are clustered by (SIC4-)industry. *t*-statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.7: Controlling for SIC3×Year Fixed Effects

	(1)
Dependent Variable:	Capex/Assets
ΔUp Tariff × Post	2.590***
	(2.91)
ΔUp Tariff × Imp	2.169*
	(1.83)
ΔOwn Tariff × Post	-0.100
	(-0.77)
ΔOwn Tariff × Imp	-0.202
	(-1.45)
ΔDown Tariff × Post	-0.708
	(-1.03)
ΔDown Tariff × Imp	0.099
	(0.11)
Trade Agreement×Firm Fixed Effects	Yes
Trade Agreement×Year×SIC3 Fixed Effects	Yes
Pre-Treatment Controls (Interacted)	Yes
Adjusted R^2	0.417
Observations	38,261

This table presents estimates of the sensitivity of downstream firms' investment (*Capex/Assets*) to upstream tariff reductions (Δ*Up Tariff*) obtained from a difference-in-differences analysis around multinational trade agreements (GSP, 7th GATT round, and NAFTA/8th GATT round). The regression is specified as in column (4) of Table 3 (in the paper), except that we include Trade Agreement×Year×SIC3 Fixed Effects instead of Trade Agreement×Year Fixed Effects. All coefficient estimates are multiplied by 100 to improve readability. The standard errors are clustered by (SIC4-)industry. *t*-statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.8: Placebo Difference-in-Differences Using Only Observations in Pre-Treatment Periods

	(1)	(2)	(3)	(4)
Dependent Variable:	Capex/Assets	Capex/Assets	Capex/Assets	Capex/Assets
ΔUp Tariff $\times$ Placebo-Post	-0.539	-0.678	-0.679	-0.278
	(-0.86)	(-1.16)	(-1.17)	(-0.33)
Trade Agreement$\times$Firm Fixed Effects	Yes	Yes	Yes	Yes
Trade Agreement$\times$Year Fixed Effects	Yes	Yes	Yes	Yes
ΔOwn Tariff (Interacted)	No	Yes	Yes	Yes
ΔDown Tariff (Interacted)	No	Yes	Yes	Yes
Pre-Treatment Controls (Interacted)	No	No	Yes	Yes
SIC4-Level Time Trends	No	No	No	Yes
Adjusted R^2	0.476	0.477	0.479	0.481
Observations	15,619	15,619	15,619	15,619

This table presents estimates of the sensitivity of downstream firms' investment (*Capex/Assets*) to upstream tariff reductions (Δ*Up Tariff*) obtained from a placebo difference-in-differences analysis using only observations in the pre-treatment periods of the multinational trade agreements (GSP, 7th GATT round, and NAFTA/8th GATT round). The regressions are specified as in Table 3 (in the paper). However, before constructing the regression sample by stacking the observations from the three panels that we create around the trade agreements, for each $k = 1, 2, 3$, we drop from the panel around trade agreement k all observations pertaining to years $t = 0$ to $t = 7$ (and thus retain only observations pertaining to years $t = -5$ to $t = -1$), where $t = -1$ is the last year before the implementation of the trade agreement. We then estimate the following regression:

$$\begin{aligned} \textit{Investment}_{k,i,j,t} \quad = \quad & \left(\beta \Delta \textit{Up Tariff}_{k,j} + \gamma \Delta \textit{Own Tariff}_{k,j} + \delta \Delta \textit{Down Tariff}_{k,j}\right) \times \textit{Placebo-Post}_{k,t} \\ & + \theta' \textit{Controls}_{k,i,j} \times \textit{Placebo-Post}_{k,t} + \alpha_{k,i} + \lambda_{k,t} + \rho_j \times t + \varepsilon_{k,i,j,t}. \end{aligned}$$

Placebo-Post is an indicator equal to one in year t if $t \geq -3$ (i.e., in the later part of the pre-period before a trade agreement). Setting *Placebo-Post* equal to one if $t \geq -2$ yields similar results. All coefficient estimates are multiplied by 100 to improve readability. The standard errors are clustered by (SIC4-)industry. *t*-statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table A.9: Tariff Dynamics

	(1)
Dependent Variable:	Up Tariff
ΔUp Tariff $\times\ \mathbb{1}\{t=-5\}$	-0.143
	(-1.52)
ΔUp Tariff $\times\ \mathbb{1}\{t=-4\}$	0.020
	(0.38)
ΔUp Tariff $\times\ \mathbb{1}\{t=-3\}$	-0.082
	(-0.68)
ΔUp Tariff $\times\ \mathbb{1}\{t=-2\}$	-0.010
	(-0.26)
ΔUp Tariff $\times\ \mathbb{1}\{t=0\}$	-0.181***
	(-4.24)
ΔUp Tariff $\times\ \mathbb{1}\{t=1\}$	-0.250*
	(-1.87)
ΔUp Tariff $\times\ \mathbb{1}\{t=2\}$	-0.653***
	(-14.68)
ΔUp Tariff $\times\ \mathbb{1}\{t=3\}$	-0.824***
	(-19.44)
ΔUp Tariff $\times\ \mathbb{1}\{t=4\}$	-0.759***
	(-5.54)
ΔUp Tariff $\times\ \mathbb{1}\{t=5\}$	-0.919***
	(-5.50)
ΔUp Tariff $\times\ \mathbb{1}\{t=6\}$	-0.979***
	(-5.06)
ΔUp Tariff $\times\ \mathbb{1}\{t=7\}$	-1.048***
	(-4.75)
Trade Agreement$\times$Firm Fixed Effects	Yes
Trade Agreement$\times$Year Fixed Effects	Yes
ΔOwn Tariff (Interacted)	Yes
ΔDown Tariff (Interacted)	Yes
Pre-Treatment Controls (Interacted)	Yes
SIC4-Level Time Trends	Yes
Adjusted R^2	0,990
Observations	38,445

This table shows the decline in average upstream import tariffs following multinational trade agreements (GSP, 7th GATT round, and NAFTA/8th GATT round). Specifically, the table shows the estimated β_τ coefficients from the following regression:
$\mathit{Up\ Tariff}_{k,i,j,t} = \sum_{\tau=-5}^{7} \left(\beta_\tau \Delta \mathit{Up\ Tariff}_{k,j} + \gamma_\tau \Delta \mathit{Own\ Tariff}_{k,j} + \delta_\tau \Delta \mathit{Down\ Tariff}_{k,j} + \theta'_\tau \mathit{Controls}_{k,i,j}\right) \mathbb{1}\{t=\tau\}$ $+\alpha_{k,i} + \lambda_{k,t} + \rho_j \times t + \varepsilon_{k,i,j,t}$. Trade agreements are indexed by k, and firms, (SIC4-)industries, and years by i, j, and t. We use the last year before the tariff revisions as the reference year and thus omit $\mathbb{1}\{t=-1\}$. The standard errors are clustered by (SIC4-)industry. t-statistics are reported in parentheses. Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.