SUPPLEMENT TO "PRICES, MARKUPS, AND TRADE REFORM"

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APPENDIX E: RESULTS FROM THE STANDARD APPROACH

IN THIS APPENDIX, we compare our results to what would be obtained if one followed a standard approach of working with typical firm-level data that capture inputs and sales at the firm level. We aggregate our data to the firm level and repeat both the production function estimation and the main specifications that relate prices, markups, and costs to trade policy. In Table A.III, we report estimates of input elasticities from a Cobb–Douglas production function that uses a standard firm-level deflated revenue-based production function and a standard control function proxy. In Figure A.1, we plot these sectoral elasticities against the elasticities from our methodology reported in Table IV. Although there is a positive correlation for each of the factor elasticities (with the exception of capital), as well as the returns to scale, the estimates produced by the two approaches are not the same.

Qualitatively similar estimates from the two approaches suggest that the input-price bias is partly offset by the output-price bias when using standard firm-level data; that is, firms with higher input prices tend to have higher output prices. Thus, in estimation of production function based on standard firm-level revenue data, input-price bias occurs simultaneously with another bias—the output-price bias—which works in the opposite direction and makes the input-price bias less transparent. However, this does not mean that the two biases necessarily exactly cancel each other. The extent of the offset will depend on the setting (see De Loecker and Goldberg (2014) for an extensive discussion). And while the two biases are working in opposite directions to produce "reasonable" elasticities, we have no way of assessing the exact quantitative net bias. De Loecker and Goldberg (2014) discussed some conditions under which the two biases would exactly offset each other: (1) the industry is characterized by monopolistic competition; (2) firms produce a horizontally differentiated product and face the same CES demand system; (3) production is characterized by constant returns to scale; and (4) input price variation (across firms and time) is input neutral. These conditions are violated in our setting (as evidenced by the fact that our elasticities are not identical in the two approaches).

We next use the production function estimates from the "standard approach" to re-examine one of our main results: how do markups change with the trade liberalization? Once we have an estimate of the production function coefficient on materials (θ^M), we can compute markups at the firm level

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$\mu_{ft} = \frac{\theta^M}{\alpha_{ft}}$, where α_{ft} is the firm's expenditure on materials divided by total sales. While we can compute markups at the firm level, we cannot compute marginal costs because it is not possible to construct a firm-level price without further information on demand. This immediately points out another limitation of not having product-level data: a markup estimate at the firm level cannot be decomposed into prices and costs.

Nevertheless, we can still examine how firm-level markups adjust to the trade reform. We regress the (log of) firm-level markups on output and input tariffs, both defined at the firm level using the firm's initial main industry, and year and firm fixed effects. We cluster standard errors at the industry level. Our results, shown in Table A.IV, are qualitatively similar to our main results reported in Column 3 of Table IX. Output tariffs appear to have little effect on markups (recall that we cannot isolate pro-competitive effects in this regression since we cannot infer firm-level marginal costs). And although the estimates are somewhat noisy, we do find that a decline in input tariffs leads to an increase in markups. However, the standard errors are large, perhaps because we lose power by working at the firm level rather than at the firm–product level.

These additional robustness checks suggest two implications. First, in practice, the input and output price biases are likely to offset each other, at least to some extent. This is related to higher input prices being associated with higher output prices. Second, working at the firm level means that it is not possible to decompose changes in prices into costs and markups. Many firm-level data sets do not have information on prices, but even when information on prices is available, one would need to assume a demand system in order to create a firm-specific price index. Therefore, the standard practice of estimating revenue-based production functions using standard firm-level data is not sufficient for investigating how prices adjust to trade reforms and for explaining this adjustment by examining the response of marginal costs and markups.

APPENDIX F: TABLES AND FIGURES

TABLE A.I

CONTROLLING FOR DELICENSING[a]

	$\ln P_{fjt}$ (1)	$\ln mc_{fjt}$ (2)	$\ln \mu_{fjt}$ (3)
$\tau_{it}^{\text{output}}$	0.152***	0.042	0.110
	0.053	0.096	0.068
τ_{it}^{input}	0.344	1.158*	−0.813**
	0.506	0.693	0.402
Delicense_{it}	−0.012	0.010	−0.022
	0.046	0.093	0.072
Within R-squared	0.02	0.01	0.01
Observations	20,705	20,705	20,705
Firm–product FEs	yes	yes	yes
Sector–year FEs	yes	yes	yes

[a]The dependent variable is noted in the columns. This table controls for whether or not the industry is delicensed at time t. The sum of the coefficients from the markup and marginal costs regression equals their respective coefficient in the price regression. The regressions exclude outliers in the top and bottom 3rd percent of the markup distribution, and include firm–product fixed effects and sector–year fixed effects. The regressions are run from 1989–1997 and standard errors are clustered at the industry level. Significance: *10 percent, **5 percent, ***1 percent.

TABLE A.II

PRICES, MARKUPS, AND COSTS AND EFFECTIVE RATE OF PROTECTION[a]

	$\ln P_{fjt}$ (1)	$\ln mc_{fjt}$ (2)	$\ln \mu_{fjt}$ (3)
ERP_{it}	0.058***	0.024	0.034
	0.019	0.038	0.027
Within R-squared	0.02	0.01	0.01
Observations	21,246	21,246	21,246
Firm–product FEs	yes	yes	yes
Sector–year FEs	yes	yes	yes

[a]The dependent variable is noted in the columns. The sum of the coefficients from the markup and marginal costs regression equals their respective coefficient in the price regression. The regressions exclude outliers in the top and bottom 3rd percent of the markup distribution, and include firm–product fixed effects and sector–year fixed effects. The regressions use data from 1989–1997. Standard errors that are clustered at the industry level. Significance: *10 percent, **5 percent, ***1 percent.

TABLE A.III

OUTPUT ELASTICITIES USING FIRM-LEVEL REVENUE DATA AND COBB–DOUGLAS PRODUCTION FUNCTION[a]

	Control Function, Cobb–Douglas Coefficients, Firm-Level			
Sector	Labor	Material	Capital	RTS
15 Food products and beverages	0.25	0.71	0.06	1.02
17 Textiles, apparel	0.08	0.86	0.06	0.99
21 Paper and paper products	0.31	0.69	0.05	1.05
24 Chemicals	0.13	0.69	0.13	0.96
25 Rubber and plastic	0.19	0.78	0.10	1.07
26 Non-metallic mineral products	0.38	0.18	0.31	0.87
27 Basic metals	0.15	0.70	0.12	0.97
28 Fabricated metal products	0.17	0.76	0.03	0.96
29 Machinery and equipment	0.18	0.71	0.17	1.05
31 Electrical machinery and communications	0.22	0.69	0.15	1.05
34 Motor vehicles, trailers	0.21	0.68	0.22	1.11

[a]Table reports coefficients of a three-factor Cobb–Douglas production function: labor, materials, and capital. The estimations are run at the firm level using total revenues. Estimations are performed separately by sector using a control function approach (Levinsohn and Petrin (2003)).

TABLE A.IV

FIRM-LEVEL MARKUPS ON OUTPUT AND INPUT TARIFFS[a]

	$\ln \mu_{ft}$ (1)
$\tau_{ft}^{\text{output}}$	−0.007
	0.032
τ_{ft}^{input}	−0.212
	0.290
R-squared	0.03
Observations	12,827
Firm FEs	yes
Sector–year FEs	yes

[a]Table reports the regression of (log) markups on output and input tariffs. Markups are constructed at the firm level using the materials output elasticity estimated from a firm-level deflated revenue production function estimation. Input and output tariffs are matched to the firm's initial main industry. Standard errors clustered at the industry level. Significance: *10 percent, **5 percent, ***1 percent.

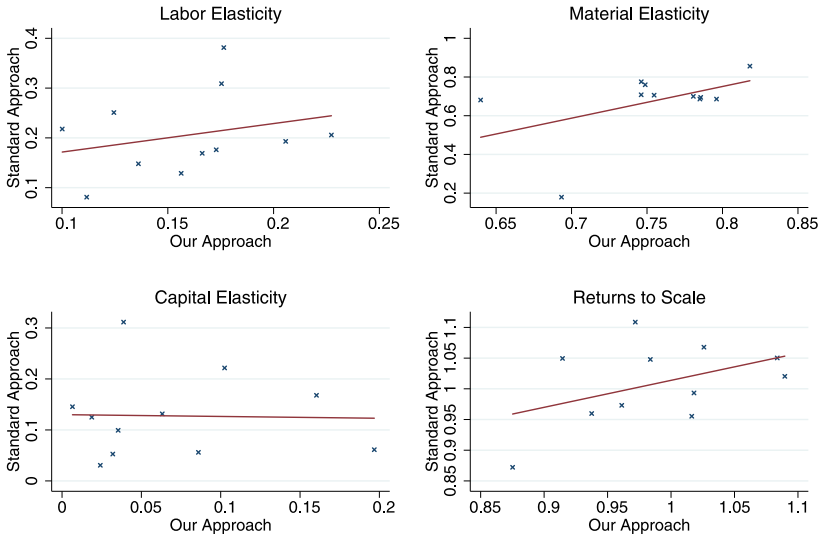

FIGURE A.1.—Output elasticities comparison. Our approach takes the elasticities reported in Table IV. Standard approach uses elasticities from estimating a Cobb–Douglas function on firm-level data.

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