Online Appendix

"The Impact of the 2018 Tariffs on Prices and Welfare"

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Estimating Welfare Losses of Higher Import Tariffs

Table 1 Results

A key first step to estimating the welfare effect of tariffs is an estimate of how the price received by foreign exporters moves in response to a tariff increase. We examine these effects by returning to our data on import quantities and total value. Specifically, we use observations from our Harmonized Tariff Schedule (HTS) data on 10-digit products imported from each country in each month for the period from January 2017 to December 2018. We estimate the following regression specification:

$$\Delta \ln(z_{ijt}) = \mu_j + \eta_{it} + \beta \Delta \ln(1 + \text{Tariff}_{ijt}) + u_{ijt} \tag{1}$$

where *i* indicates foreign countries, *j* denotes products and *t* corresponds to time; μ_j is a product fixed effect; η_{it} is a country-time fixed effect; and u_{ijt} is a stochastic error. All variables correspond to 12-month log differences.

We consider a range of left-hand side variables ($\Delta \ln(z_{ijt})$): (i) the log change in foreign exporter prices (unit values) before the US tariffs are imposed ($\Delta \ln(p_{ijt})$); (ii) the log change in US import quantities ($\Delta \ln(m_{ijt})$); (iii) the log change in US import values ($\Delta \ln(p_{ijt} \times m_{ijt})$). We treat the Trump administration's tariffs as exogenous and assume that they are uncorrelated with unobserved shocks to unit values. Under this assumption, the estimated coefficient β captures the impact of the tariffs on the prices received by foreign exporters.

Table 2 Results

Following the algebra in footnote 9 in the paper, we estimate the deadweight loss from the 2018 US tariffs for product *i* in month *t* as $D_{it} = \frac{1}{2}\left(p^{*}_{it}m_{it}\right)\tau_{it}\hat{\beta}\ln\left(\frac{1+\tau_{it}}{1+\tau_{i,t-12}}\right)$, where $\hat{\beta}$ is our estimated coefficient from Table 1. We then compute the overall deadweight loss in month *t* as $D_t = \sum_i D_{it}$. Tariff revenue in the month is computed as $(p^{*}_{it}m_{it})\tau_{it}$.

Table 3: Effects of Retaliatory Tariffs on US Exporters

We use an analogous specification to examine the effects of retaliatory tariffs on US exporters as for the effects of US tariffs above, but using US export data instead of US import data. Thus, the unit values we construct are for exports by US firms for each HTS10 product (before applying the foreign tariffs). We are again using monthly data, this time on exports of specific products to each country from January 2017 to December 2018. We estimate the following regression:

$$\Delta\ln\left(z^{US}_{ijt}\right) = \mu_j + \eta_{it} + \beta\Delta\ln\left(1 + \text{Tariff}_{ijt}\right) + u_{ijt} \qquad (2)$$

where *i* indicates foreign countries, *j* denotes products and *t* corresponds to time; μ_j is a product fixed effect; η_{it} is a country-time fixed effect; and u_{ijt} is a stochastic error. All variables correspond to 12-month log differences. We consider a range of left-hand side variables ($\Delta\ln\left(z^{US}_{ijt}\right)$): (i) the log change in US export prices before the foreign tariffs are imposed ($\Delta\ln\left(p^{US}_{ijt}\right)$); (ii) the log change in US export quantities ($\Delta\ln\left(x^{US}_{ijt}\right)$); (iii) the log change in US export values ($\Delta\ln\left(p^{US}_{ijt} \times x^{US}_{ijt}\right)$).

Assessing the Impact of Tariffs on Imported Varieties

To evaluate the effects of reduced variety from the tariffs introduced by the Trump administration in 2018, we compute variety-adjusted import price indexes for each HS-6-digit product. Following Feenstra (1994), the overall price index is the product of the common variety price index and the variety adjustment term. We construct these indexes using prices inclusive of the tariff to capture the prices paid by importers. A variety corresponds to a HS product from a particular country (e.g. French red wine). The common variety price index for each HS product is a Sato (1976) and Vartia (1976) price index for common varieties within that product:

$$\frac{P_{jt}^{*}}{P_{jt-1}^{*}} = \prod_{i \in \Omega_{j,t,t-1}^{*}} \left(\frac{p_{ijt}}{p_{ijt-1}}\right)^{s_{ijt}^{w}}, \tag{3}$$

where *i* indexes countries, *j* denotes products and *t* indicates time; p_{ijt} is the price of an individual variety at time *t* (the price of a HS product *j* from country *i* at time *t*); $\Omega_{j,t,t-1}^{*}$ is the set of countries that are common to periods *t* and *t* – 1 for product *j*; and s_{ijt}^{w} is the logarithmic mean of the country shares of common imports (s_{ijt}) for product *j* in periods *t* and *t* – 1:

$$s_{ijt}^{w} = \frac{\frac{s_{ijt} - s_{ijt-1}}{\ln s_{ijt} - \ln s_{ijt-1}}}{\sum_{k \in \Omega_{j,t,t-1}^{*}} \frac{s_{ikt} - s_{ikt-1}}{\ln s_{ikt} - \ln s_{ikt-1}}}. \tag{4}$$

The overall price index for each HS-6-digit product is the product of this common variety price index and the variety adjustment term:

$$\frac{P_{jt}}{P_{jt-1}} = \left(\frac{\lambda_{jt}}{\lambda_{jt-1}}\right)^{\frac{1}{\sigma-1}} \frac{P_{jt}^{*}}{P_{jt-1}^{*}}, \tag{5}$$

where this variety adjustment term ($\left(\lambda_{jt}/\lambda_{jt-1}\right)^{1/(\sigma-1)}$) depends on the elasticity of substitution (σ) and the share of expenditure on common varieties at time t (λ_{jt}) divided by the share of expenditure on common varieties at time $t-1$ (λ_{jt-1}):

$$\lambda_{jt} = \frac{\sum_{k\in\Omega_{j,t,t-1}^{*}} p_{ijt} m_{ijt}}{\sum_{k\in\Omega_{t}} p_{ijt} m_{ijt}}, \qquad \lambda_{jt-1} = \frac{\sum_{k\in\Omega_{j,t,t-1}^{*}} p_{ijt-1} m_{ijt-1}}{\sum_{k\in\Omega_{t-1}} p_{ijt-1} m_{ijt-1}}, \tag{6}$$

where m_{ijt} denotes the quantity imported of product *j* from country *i* at time *t*.

This variety adjustment term has an intuitive interpretation. If entering varieties are more attractive than exiting varieties (in the sense of having lower quality-adjusted prices), the share of common varieties in total expenditure will be smaller in period *t* than in period *t* – 1 ($\lambda_t < \lambda_{t-1}$), which reduces the cost of living in equation (5) (since varieties are substitutes and hence $\sigma > 1$). We assume an elasticity of substitution between varieties of 6, which is in line with the range of values from 4-8 considered in the international trade literature (e.g. Eaton and Kortum 2002, Broda and Weinstein 2006, and Simonovska and Waugh 2014), and is consistent with our estimate from Table 1 in the paper. We follow Feenstra (1994) in using the Sato-Vartia price index for common varieties, which assumes constant quality for each surviving variety. See Redding and Weinstein (2016, 2017) for an alternative price index for common varieties that allows for changes in quality within surviving varieties over time.

We examine the impact of the tariffs introduced by the Trump administration on import variety and the overall import price index by estimating the following regression specification:

$$\Delta \ln(z_{jt}) = \mu_j + \eta_t + \beta \Delta \ln(1 + \text{Tariff}_{jt}) + u_{ijt} \tag{7}$$

where *j* denotes products and *t* corresponds to time; μ_j is a product fixed effect; η_t is a time fixed effect; Tariff_{jt} is a weighted average of the changes in tariffs in the sector where the weights reflect the import shares from each country at the HTS10 level in the previous year; and u_{ijt} is a stochastic error. For the left-hand side variable ($\Delta \ln(z_{it})$), we consider: (i) the log change in the common variety import price index ($\Delta\ln(P_t^*/P_{t-1}^*)$); (ii) the log change in the variety adjustment term ($\frac{1}{\sigma-1}\Delta \ln(\lambda_t/\lambda_{t-1})$); and (iii) the log change in the overall import price index ($\Delta \ln(P_t/P_{t-1})$). All variables correspond to 12-month log differences.

Table A1 presents the results from these regressions. Consistent with our other findings in the paper, the tariffs appear to be passed through completely into domestic prices for common varieties. When the average tariff in an HS6 sector goes up by ten percent, the average domestic price for common varieties goes up by 9.96 percent. Once again, we cannot reject the hypothesis that pass through is complete, and U.S. importers bore the full cost of the tariffs. The next column provides the adjustment for these price indexes taking into account that the tariffs may cause the entry and exit of varieties. We obtain a coefficient on the variety adjustment term of 0.048, which implies that a ten-percent tariff not only raises the tariff-inclusive price of varieties that continue to be imported, but also raises import price indexes by an additional 0.5 percent because some varieties became prohibitively expensive as a result of the tariffs. If we sum these two terms together to form the overall price index as in the final column, we find that a 10 percent increase in tariffs causes domestic prices to rise by 10.5 percent through both effects. Therefore, the impact of the import tariffs on the overall import price index is somewhat larger than what the simple pass-through regressions suggest, because these import tariffs not only raise the price of common varieties but also reduce import variety.

References

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Table A1: Import Price Indexes and Tariffs

	(1)	(2)	(3)
	Δln(Common Variety Price Index$_{jt}$)	ln(Variety Adjustment$_{jt}$)	Δln(Price Index$_{jt}$)
Δln(1+Tariff$_{j,t}$)	0.996***	0.048***	1.044***
	(0.039)	(0.009)	(0.041)
N	91,150	91,150	91,150
R^2	0.177	0.092	0.177

Notes: A variety is defined at the HTS10-country-month level, aggregated up to the HS6-month level for January 2017 to December 2018 in 12 month changes. All regressions include HTS6-digit and time fixed effects. The elasticity of substitution in columns 1 and 3 is set equal to 5.89, from column 3 in Table 1 in the paper. Observations with a ratio of unit values in t relative to $t - 12$ greater than 3 or less than 1/3 are dropped. Observations with a variety adjustment ratio below the 5th percentile or above the 95th percentile are dropped. Standard errors, clustered at the HTS6 level, are reported in parentheses. *, ** and *** indicate significance levels of $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively.