# Trade Adjustment and Productivity in Large Crises

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## Online Appendix

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# Appendix A: Derivation of Equations for Productivity

## Derivation of Equation (8)

The derivation is very similar to Basu and Fernald (2002) with the distinction that we have labor that is used in fixed costs. The production function for each firm is given by equation (3). Since firms are price takers in the primary factor and intermediate input markets and set prices as a constant markup $1/\theta$ over marginal cost, we have:

$$p_i \frac{\partial Y_i}{\partial L_{p,i}} = \frac{w}{\theta}, p_i \frac{\partial Y_i}{\partial K_i} = \frac{r}{\theta}, p_i \frac{\partial Y_i}{\partial X_i} = \frac{P_{X_i}}{\theta}.$$

To measure the growth rate of value added we use the convention divisia index formula:

$$\Delta \ln Y_i^{VA} = \frac{\Delta \ln Y_i - s_X^Y \Delta \ln X_i}{1 - s_X^Y} = \Delta \ln Y_i - \frac{s_X^Y}{1 - s_X^Y} \left( \Delta \ln X_i - \Delta \ln Q_i \right),$$

where $s_X^Y$ is the *revenue* share of intermediates, $s_X^Y = \frac{P_{X_i} X_i}{P_i Y_i}$, which is equal to the constant $\mu\theta$. We can then write:

$$\Delta Y_i = \frac{\partial Y_i}{\partial K_i} \Delta K_i + \frac{\partial Y_i}{\partial L_{p,i}} \Delta L_i^p + \frac{\partial Y_i}{\partial X_i} \Delta X_i + \frac{\partial Y_i}{\partial A_i} \Delta A_i,$$

$$\Delta \ln Y_i = \frac{\left(1 - s_{X_i}^Y\right)}{\theta} s_{k,i} \Delta \ln K_i + \frac{\left(1 - s_{X_i}^Y\right)}{\theta} \omega_{L^p} s_{Li} \Delta \ln L_i^p + \frac{s_{X,i}^Y}{\theta} \Delta \ln X_i + \frac{F_{A_i} A_i}{Y_i P i} \Delta \ln A_i.$$

This follows from the relation $s_{k,i} = \frac{s_{k,i}^Y}{\left(1 - s_{X_i}^Y\right)}$ and $\omega_{L^p} \equiv \frac{L_i^p}{L_i}$. Rearranging, we get:

$$\Delta \ln Y_i^{VA} \equiv \Delta \ln Y_i - \frac{s_X^Q}{1 - s_X^Q} \left( \Delta \ln X_i - \Delta \ln Y_i \right)$$

$$= \frac{(1 - \mu\theta)}{\theta (1 - \mu)} \left[ s_{k,i} \Delta \ln K_i + w_{L^p} s_{Li} \Delta \ln L_i^p \right]$$

$$+ \frac{\mu\theta}{1 - \mu\theta} \left[ \frac{(1 - \mu\theta)}{\theta (1 - \mu)} - 1 \right] \left( \Delta \ln X_i - \Delta \ln Y_i \right) + \frac{F_{A_i} A_i}{(1 - \mu) Y_i p i} \Delta \ln A_i.$$

Finally, define the welfare relevant firm-level productivity using the modified Solow Residual:

$$
\begin{aligned}
\Delta \ln \mathbf{PR}_{it} &= \Delta \ln Y_i^{VA} - s_{k,i}\Delta \ln K_i - s_{l,i}\Delta \ln L_i \\
&= \Delta \ln Y_i^{VA} - s_{k,i}\Delta \ln K_i - s_{l,i}\omega_{L^P}\Delta \ln L_i^P - s_{l,i}\left(1 - \omega_{L^P}\right)\Delta \ln L_i^F.
\end{aligned}
$$

Substituting for $\Delta \ln Y_i^{VA}$, we arrive immediately at equation (8).

## Derivation of Expressions (9)-(12)

We present the derivation in the following steps:

**Step 1**: We express $\Delta \ln X_i - \Delta \ln Y_i$ as a function of $\gamma_i$. It follows from equations (4), (5), and $p_i = C_i/\theta$, given fixed $w$ and $r$, that:

$$
\Delta \ln X_i - \Delta \ln Y_i = \Delta \ln p_i - \Delta \ln P_{X_i} = (\mu - 1)\Delta \ln P_{X_i}.
$$

Following the definition of $\gamma_i$, we write:

$$
\gamma_i = \frac{P_Z Z_i}{P_{X_i} X_i} = \left(\frac{P_Z}{P_{X_i}}\right)^{\frac{\rho}{\rho-1}},
$$

$$
P_{X_i} = P_Z \gamma_i^{\frac{1-\rho}{\rho}},
$$

and

$$
\begin{aligned}
P_Z &= \left[\int_i p_i^{\frac{\theta}{\theta-1}} di\right]^{\frac{\theta-1}{\theta}} = \left[\int_i \left(\frac{C_i}{\theta}\right)^{\frac{\theta}{\theta-1}} di\right]^{\frac{\theta-1}{\theta}} = \left[\int_i \left(\frac{(r^\alpha w^{1-\alpha})^{1-\mu} P_{X_i}^\mu}{\epsilon \theta A_i}\right)^{\frac{\theta}{\theta-1}} di\right]^{\frac{\theta-1}{\theta}} \\
&= \frac{(r^\alpha w^{1-\alpha})^{1-\mu}}{\epsilon\theta}\left[\int_i \left(P_Z \gamma_i^{\frac{1-\rho}{\rho}}\right)^{\frac{\mu\theta}{\theta-1}} A_i^{\frac{\theta}{1-\theta}} di\right]^{\frac{\theta-1}{\theta}} \\
&= \frac{(r^\alpha w^{1-\alpha})^{1-\mu} P_Z^\mu}{\epsilon\theta}\underbrace{\left[\int_i \gamma_i^{\mu\left(\frac{\rho-1}{\rho}\right)\frac{\theta}{1-\theta}} A_i^{\frac{\theta}{1-\theta}} di\right]^{\frac{\theta-1}{\theta}}}_{Q_{\gamma\theta\rho}^{-1}},
\end{aligned}
$$

where $\epsilon = \mu^\mu(1-\mu)^{1-\mu}\left(\alpha^\alpha(1-\alpha)^{1-\alpha}\right)^{1-\mu}$. We can then write:

$$
P_Z = \frac{(r^\alpha w^{1-\alpha})}{(\epsilon\theta)^{\frac{1}{1-\mu}}}Q_{\gamma\theta\rho}^{-\frac{1}{1-\mu}},
$$

$$
P_{X_i} = \frac{(r^\alpha w^{1-\alpha})}{(\epsilon\theta)^{\frac{1}{1-\mu}}}Q_{\gamma\theta\rho}^{-\frac{1}{1-\mu}}\gamma_i^{\frac{1-\rho}{\rho}},
$$

and

$$
\Delta \ln P_{X_i} = \frac{1}{\mu - 1}\Delta \ln Q_{\gamma\theta\rho} + \frac{1-\rho}{\rho}\Delta \ln \gamma_i. \tag{13}
$$

**Step 2**: The firms decision for use of $L^F$ is related to its decision on $\Omega$. The firm

maximizes:

$$\widetilde{\Pi}_i = \Pi_i - wL^F$$
$$= (1-\theta)P_iY_i - wL^F,$$

subject to:

$$Y_i = g_i + \int_j z_{ji} dj = \left(\frac{p_i}{P_G}\right)^{\frac{1}{\theta-1}} G + \int_j \left(\frac{p_i}{P_Z}\right)^{\frac{1}{\theta-1}} \left(\frac{P_Z}{P_{X_j}}\right)^{\frac{1}{\rho-1}} X_j dj.$$

We define:

$$\widetilde{D} \equiv \left(\frac{1}{P_G}\right)^{\frac{1}{\theta-1}} G + \int_j \left(\frac{1}{P_Z}\right)^{\frac{1}{\theta-1}} \left(\frac{P_Z}{P_{X_j}}\right)^{\frac{1}{\rho-1}} X_j dj,$$

and write:

$$\Pi_i = (1-\theta)\, p_i Y_i = (1-\theta)\, p_i^{\frac{\theta}{\theta-1}} \widetilde{D}.$$

The FOC for $\Omega_i$ is:

$$\frac{\partial \Pi_i}{\partial \Omega_i} = w\frac{\partial L^F}{\partial \Omega_i},$$

which gives the following expressions:

$$\ln \Pi_i = \ln(1-\theta) + \frac{\theta}{\theta-1}\ln p_i + \ln \widetilde{D},$$

$$\frac{1}{\Pi_i}\frac{\partial \Pi_i}{\partial \Omega_i} = \frac{\theta}{\theta-1}\frac{\partial \ln p_i}{\partial \Omega_i} = \mu\frac{\partial \ln P_{X_i}}{\partial \Omega_i} = \frac{\theta-1}{\theta}\left(\frac{P_{M_i}}{P_{X_i}}\right)^{\frac{\rho}{\rho-1}}\frac{1}{\Omega_i},$$

$$\frac{\partial \Pi_i}{\partial \Omega} = \frac{\Pi_i\mu(1-\gamma_i)}{\Omega} = wf_v\lambda\Omega_i^{\lambda-1},$$

$$\Pi_i\mu(1-\gamma_i) = wf_v\lambda\Omega_i^{\lambda} = w\lambda L_i^F,$$

$$wL_i^F = \lambda^{-1}(1-\theta)P_iY_i\mu(1-\gamma_i),$$

$$wL_i^P = (1-\mu)(1-\alpha)\theta P_iY_i,$$

$$\frac{wL_i^P}{wL_i^F} = \frac{L_i^P}{L_i^F} = \frac{(1-\mu)(1-\alpha)\theta P_iY_i}{\lambda^{-1}(1-\theta)P_iY_i\mu(1-\gamma_i)} = \frac{(1-\mu)(1-\alpha)\theta}{\lambda^{-1}(1-\theta)\mu(1-\gamma_i)},$$

and

$$\frac{L_i^P}{L_i^F} = \frac{(1-\mu)(1-\alpha)\theta}{\lambda^{-1}(1-\theta)\mu(1-\gamma_i)}.$$

As $\gamma_i$ and $\lambda$ increase, so does the share of labor that is used for production. This is used to arrive at the expression for $\omega_{L_i^P}$:

$$1 - \omega_{lp} = \frac{L_F}{L} = \frac{wL_i^F}{wL_i^F + wL_i^P} = \frac{\lambda^{-1}(1-\theta)\mu(1-\gamma_i)}{\lambda^{-1}(1-\theta)\mu(1-\gamma_i) + (1-\mu)(1-\alpha)\theta}.$$

**Step 3**: Express $\Delta \ln F$ as a function of $P_{X_i}$. We write:

$$\Delta \ln L^F = \lambda \Delta \ln \Omega_i = \lambda \frac{\theta}{\theta - 1} \left( \Delta \ln P_{M_i} - \Delta \ln p_m \right),$$

$$\ln(1 - \gamma_i) = \frac{\rho}{\rho - 1} \left[ \ln P_{M_i} - \ln P_{X_i} \right],$$

$$\ln P_{M_i} = \ln P_{X_i} - \frac{1 - \rho}{\rho} \ln(1 - \gamma_i),$$

$$\Delta \ln L^F = \lambda \Delta \ln \Omega_i = \lambda \frac{\theta}{\theta - 1} \left( \Delta \ln P_{X_i} - \frac{1 - \rho}{\rho} \Delta \ln(1 - \gamma_i) - \Delta \ln p_m \right),$$

$$s_{L,i} = \frac{wL_i^P + wL_i^F}{P_i^{VA} Y_i^{VA}} = \frac{\lambda^{-1}(1 - \theta)\mu(1 - \gamma_i) + (1 - \mu)(1 - \alpha)\theta}{(1 - \mu\theta)},$$

$$s_{li} \left( 1 - \omega_{lp} \right) \Delta \ln L^F = \frac{\lambda^{-1}(1 - \theta)\mu(1 - \gamma_i)}{(1 - \mu\theta)} \Delta \ln L^F,$$

and

$$\begin{aligned}
\frac{(1 - \mu\theta)}{\theta(1 - \mu)} s_{li} \left( 1 - \omega_{lp} \right) \Delta \ln L^F &= \frac{(1 - \mu\theta)}{\theta(1 - \mu)} \frac{\lambda^{-1}(1 - \theta)\mu(1 - \gamma_i)}{(1 - \mu\theta)} \Delta \ln L^F \\
&= -\frac{\mu(1 - \gamma_i)}{(1 - \mu)} \left[ \Delta \ln P_{X_i} - \frac{1 - \rho}{\rho} \Delta \ln(1 - \gamma_i) - \Delta \ln p_m \right].
\end{aligned}$$

**Step 4**: Replace the expression for $\Delta \ln P_{X_i}$ from equation (13) in the preceding equation. Replacing the above terms in the expression for firm-level productivity, equation (8), and aggregating over all $i$ using firm value-added shares $\omega_i$, we arrive at an expression for aggregate productivity.

The last step is to relate changes in $\Delta \ln Q_{\gamma\theta\rho}$ to changes in $\omega_i$ and $\gamma_i$. We start with an expression for the value-added weights (which should relate market shares of each firm to technologies and trade shares:

$$\omega_i = \left( \frac{p_i}{\left( \int_j (p_j)^{\frac{\theta}{\theta - 1}} dj \right)^{\frac{\theta - 1}{\theta}}} \right)^{\frac{\theta}{\theta - 1}} = \left( \frac{(\gamma_i)^{\mu \frac{1 - \rho}{\rho}} (A_i)^{-1}}{\left( \int_j (\gamma_j)^{\mu \frac{1 - \rho}{\rho} \frac{\theta}{\theta - 1}} (A_j)^{-\frac{\theta}{\theta - 1}} dj \right)^{\frac{\theta - 1}{\theta}}} \right)^{\frac{\theta}{\theta - 1}}.$$

We then substitute in using our expression for $Q$:

$$Q_{\gamma\theta\rho} = \left[ \int_i \gamma_i^{\mu \frac{\theta}{\theta - 1} \frac{1 - \rho}{\rho}} (A_i)^{\frac{\theta}{1 - \theta}} di \right]^{\frac{1 - \theta}{\theta}} = (\omega_i)^{\frac{\theta - 1}{\theta}} A_i (\gamma_i)^{\mu \frac{\rho - 1}{\rho}},$$

and write:

$$\Delta \ln Q_{\gamma\theta\rho} = \frac{\theta - 1}{\theta} \sum_i \omega_i \Delta \ln \omega_i + \mu \frac{\rho - 1}{\rho} \sum_i \omega_i \Delta \ln \gamma_i,$$

given $\Delta \ln A_i = 0$.

The final expressions (9)-(12) are arrived at through substitution and regrouping these terms and using the approximation $\Delta \ln(1 - \gamma_i) = -\frac{\gamma_i}{1 - \gamma_i} \Delta \ln \gamma_i$, which is valid for small shocks. In the simulation section we do not use this approximation because we study large shocks.

# Appendix B: Numerical Algorithm

The algorithm works as follows. Firms start with an initial assumption about the prices of the domestic input bundle $P_Z^0$ and the final good $P_G^0$. Since the importing behavior of each firm determines its marginal cost and thereby influences $P_Z$ and $P_G$, this assumption is effectively equivalent to taking as given all other firms' importing decisions. Holding these price aggregates fixed, each firm $i$ simultaneously chooses the optimal number of imported varieties $|\Omega_i^1|$.[48] With this new set of import variety choices $\{\Omega_i^1\}$, we must solve a fixed point problem to find a consistent set of new prices $\{p_i^1\}$ because each firm's marginal cost is a function of all other firms' prices due to roundabout production. In particular, we iterate the system:

$$
p_i^1 = \frac{1}{A_i} \frac{1}{\theta} \frac{P_V^{1-\mu}}{\mu^\mu (1-\mu)^{1-\mu}} \left[ \left( P_Z^1 \right)^{\frac{\theta-1}{\theta}} + \left( p_m \left| \Omega_i^1 \right|^{\frac{\theta-1}{\theta}} \right)^{\frac{\rho}{\rho-1}} \right]^{\mu \frac{\rho-1}{\rho}}
$$

$$
P_Z^1 = \left( \int_i \left( p_i^1 \right)^{\frac{\theta}{\theta-1}} di \right)^{\frac{\theta-1}{\theta}},
$$

for all firms $i$ until the set of prices $\{p_i^1\}$ is consistent with the domestic input price index $P_Z^1$ and with all firms' choices of imported varieties $\{\Omega_i^1\}$. We then repeat this algorithm, with firms taking as given the price indices $P_Z^1$ and $P_G^1$, and generate a new set of prices and import varieties $\{p_i^2, \Omega_i^2\}$ and price indices $\{P_Z^2, P_G^2\}$. We continue this process until $\{p_i^j, \Omega_i^j\} = \{p_i^{j-1}, \Omega_i^{j-1}\}$ up to a very small tolerance.

# Appendix C: Comparative Statics of the Firm's Trade Response

In this appendix, we evaluate how each firm's response to the terms of trade shock will differ based on its pre-shock level of total imports. The intent here is to derive an expression that provides some intuition for the results in the text and as such we do not provide a formal proof. We have shown that as long as $\lambda$ is sufficiently high, the number of imported varieties is increasing in the firm's exogenous technology $A_i$. Given their relative cost advantage, firms with higher $A_i$ have lower prices $p_i$ and consequently sell more and have higher $Y_i$. These are also the firms with the lowest $\gamma_i$ (since $P_{M_i}/P_Z$ is lower) and the highest $M_i$.

The elasticity of the response in $\gamma_i$ to the import price change is a function of the initial

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[48]Though our firms have finite market shares, they ignore the impact of their own price changes on the aggregate price index. This is not problematic because the largest firm in our benchmark calibration has a market share of only 5 percent.

$\gamma_i$. Using the definition of $\gamma_i$ we can show that:

$$
\begin{aligned}
\frac{\partial \ln \gamma_i}{\partial \ln p_m} &= \frac{\rho\left(1-\gamma_i\right)}{1-\rho}\left(\frac{\partial \ln P_{M_i}}{\partial \ln p_m}-\frac{\partial \ln P_Z}{\partial \ln p_m}\right) \\
&= \frac{\rho\left(1-\gamma_i\right)}{1-\rho}\left(1-\frac{\partial \ln P_Z}{\partial \ln p_m}+\frac{\theta-1}{\theta} \frac{\partial \ln \Omega_i}{\partial \ln p_m}\right)>0,
\end{aligned}
$$

and

$$
\frac{\partial \ln \Omega_i}{\partial \ln p_m}=\frac{\left(\frac{\theta \mu}{\theta-1}-\frac{\rho}{\rho-1}\right)\left[\gamma_i \frac{\partial \ln P_Z}{\partial \ln p_m}+\left(1-\gamma_i\right)\right]+\frac{\rho}{\rho-1}+\frac{\partial \ln \widetilde{D}}{\partial \ln p_m}}{\left(\lambda-\mu+\left(\mu-\frac{\rho}{1-\rho} \frac{1-\theta}{\theta}\right) \gamma_i\right)}.
$$

For the second order conditions for an interior solution to $\Omega_i$ to hold, the denominator must satisfy $\left(\lambda-\mu+\left(\mu-\frac{\rho}{1-\rho} \frac{1-\theta}{\theta}\right) \gamma_i\right)>0$. As long as the numerator is negative and $\frac{\partial \ln P_Z}{\partial \ln p_m}<1$ (which is not always the case), firms increase the share spent on domestic inputs, $\gamma_i$, when import prices increase. To see how this elasticity varies across existing importers, we write:

$$
\frac{\partial\left(\frac{\partial \ln \gamma_i}{\partial \ln p_m}\right)}{\partial \gamma_i}=-\frac{\rho}{1-\rho}\left(1-\frac{\partial \ln P_Z}{\partial \ln p_m}+\frac{\theta-1}{\theta}\left[\frac{\partial \ln \Omega_i}{\partial \ln p_m}-\left(1-\gamma_i\right) \frac{\partial\left(\frac{\partial \ln \Omega_i}{\partial \ln p_m}\right)}{\partial \gamma_i}\right]\right).
$$

As long as the parameters are such that $\frac{\partial \ln P_Z}{\partial \ln p_m}<1$ and $\frac{\partial \ln \Omega_i}{\partial \ln p_m}<0$, the sign of this expression depends on $\partial\left(\frac{\partial \ln \Omega_i}{\partial \ln p_m}\right) / \partial \gamma_i$, which measures how the elasticity of the sub-extensive margin varies with $\gamma_i$. If $\partial\left(\frac{\partial \ln \Omega_i}{\partial \ln p_m}\right) / \partial \gamma_i>0$, indicating that the elasticity of the sub-extensive margin decreases with the initial $\gamma_i$, then we know that $\partial\left(\frac{\partial \ln \gamma_i}{\partial \ln p_m}\right) / \partial \gamma_i<0$, implying that larger importers will change their import share by a greater percentage following an import price shock. If on the other hand $\partial\left(\frac{\partial \ln \Omega_i}{\partial \ln p_m}\right) / \partial \gamma_i<0$, then the net effect depends on whether the direct effect of a lower $\gamma$ on raising the percent change in $\gamma$ exceeds the indirect effect that raises the relative price of the optimal import bundle relative to domestic inputs by less.

We can write $\partial\left(\frac{\partial \ln \Omega_i}{\partial \ln p_m}\right) / \partial \gamma_i$ as:

$$
\frac{\partial\left(\frac{\partial \ln \Omega_i}{\partial \ln p_m}\right)}{\partial \gamma_i}=\frac{1}{\varkappa_i^2}\left(\frac{\rho}{1-\rho}-\frac{\mu \theta}{1-\theta}\right)\left[(\mu-\lambda)\left(1-\frac{\partial \ln P_Z}{\partial \ln p_m}\right)+\frac{1-\theta}{\theta}\left(\frac{\mu \theta}{\theta-1}+\frac{\partial \ln \widetilde{D}}{\partial \ln p_m}\right)\right],
$$

where

$$
\varkappa_i \equiv\left(\lambda-\mu+\left(\mu-\frac{\rho}{1-\rho} \frac{1-\theta}{\theta}\right) \gamma_i\right).
$$

$\frac{\partial \ln P_Z}{\partial \ln p_m}$ and $\frac{\partial \ln \widetilde{D}}{\partial \ln p_m}$ do not vary with $\gamma_i$. As long as $\frac{\partial \ln P_Z}{\partial \ln p_m}<1$ and $\lambda$ is sufficiently large, the sensitivity to $\gamma_i$ depends on whether $\left(\frac{\rho}{1-\rho}-\frac{\theta \mu}{1-\theta}\right)$ is positive or negative.

# Appendix D: Additional Empirical Analyses

In this appendix, we consider two additional empirical analyses. First, we study the cross-section of manufacturing industries. Next, we consider changes in the frequency with which dropped input varieties are permanently dropped.

Starting with the cross-sectional analysis, we focus on within-manufacturing variation because trade may plausibly account for important variation in productivity. Differences in the productivity declines of the finance and government sectors, for example, would likely have little to do with trade. The Argentine Annual Manufacturing Census includes information on value-added and the number of salaried workers in roughly 20 2-digit industries.

We combine this with information (also from the Argentine national statistics) on producer prices in those same 2-digit industries to construct growth in real value-added per worker. This is a proxy for total factor productivity at the sector level. Next, we use the information from the Capital IQ database on each firms Primary Sector to classify some of them as belonging to these 2-digit industries (some sectors do not match and are excluded). Finally, we combine (1) the implied growth in imports for each manufacturing subsector from our data with (2) information on initial sector levels of $\gamma$ from the 1997 input-output table and with (3) growth in total sectoral intermediate spending from the census to obtain a time-series for sectoral $\gamma$. This is essentially the same method used to determine changes in $\gamma$ for the overall manufacturing sector in our calibration.

Figures 14(a) and 14(b) show the resulting relationship between changes in this measure of productivity and in the share of input spending on imports $(1 - \gamma)$ for the period 2000-2002. Figure 14(a) shows this plot for all sub-sectors with available data, but we note that some of these data points can reflect as few as two firms each.

Figure 14(b) shows this relationship when including only those sectors with at least 20 matched firms. Both figures suggest that shifts in intermediate spending from imported inputs toward domestic inputs correlate with measured productivity declines, though the relationship is clearly noisy and sensitive to rules on the treatment of outliers. Given this sensitivity, and given this is not our preferred welfare-relevant productivity measure, we consider this evidence less compelling and robust than the results in the primary paper and for that reason only include them in this Appendix.

Next, we consider the share of dropped varieties that are permanently dropped as a way to address concerns that inventoried varieties are used for production. In the paper, in part to deal with this concern, we focus on a 2 year period. This is a horizon much longer than that typically used by forecasters to describe the inventory cycle. But we additionally find it useful here to measure the share of all firm and import variety combinations from the previous period that are permanently dropped (i.e. permanent sub-extensive margin adjustment) in the current period.

A variety is defined as HTS10xCountry and is considered to be permanently dropped if the firm does not again import it through 2008 (we cannot go back earlier in the analysis due to the gaps in our data in 1999, as discussed in the paper.) In this analysis, we only consider firms that imported at least 1 dollar of some good sometime after 2006 and therefore exclude all firms which permanently exited trade. This is a conservative treatment of these extensive margin adjusters, which, if included, would increase the set of permanently dropped goods.

The share of varieties that are permanently dropped is plotted in Figure 15. Early in the crisis, the line jumps above 0.2, indicating that more than one-fifth of all previous
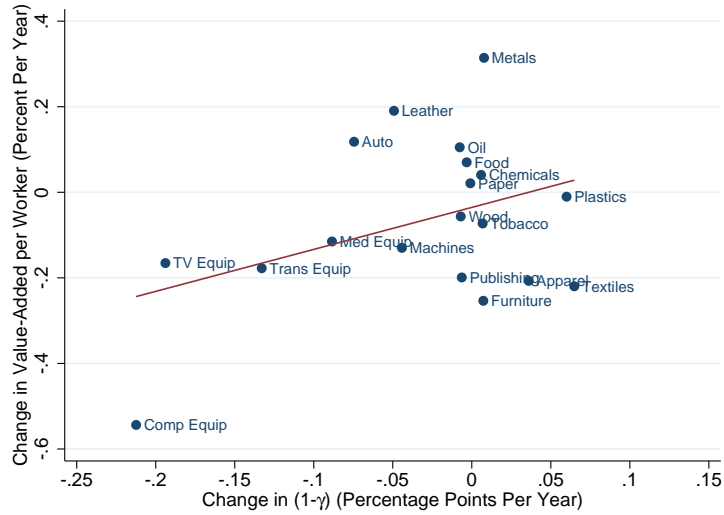
(a) All Sectors
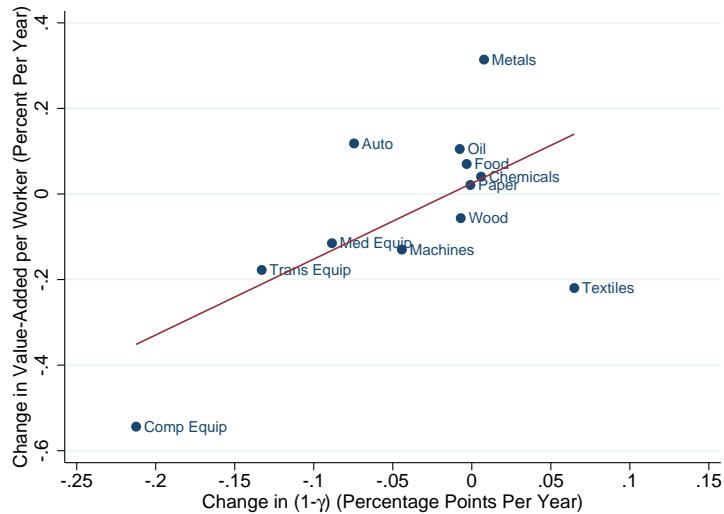


(b) Sectors with at Least 20 Firms

Figure 14: Sectoral Input Sourcing and Productivity, 2000-2002

importer-variety combinations are permanently dropped, a level far in excess of anything seen before or after the crisis. Our analysis does not require that varieties are permanently dropped, but this nonetheless confirms that not only did the number of dropped varieties spike dramatically upward during the beginning quarters of the crisis (as shown in the paper), but many of those dropped varieties are permanently dropped. While this does not eliminate a possible role for inventories in smoothing the use of input varieties, it limits the extent to which inventories could have substituted for these dropped varieties.
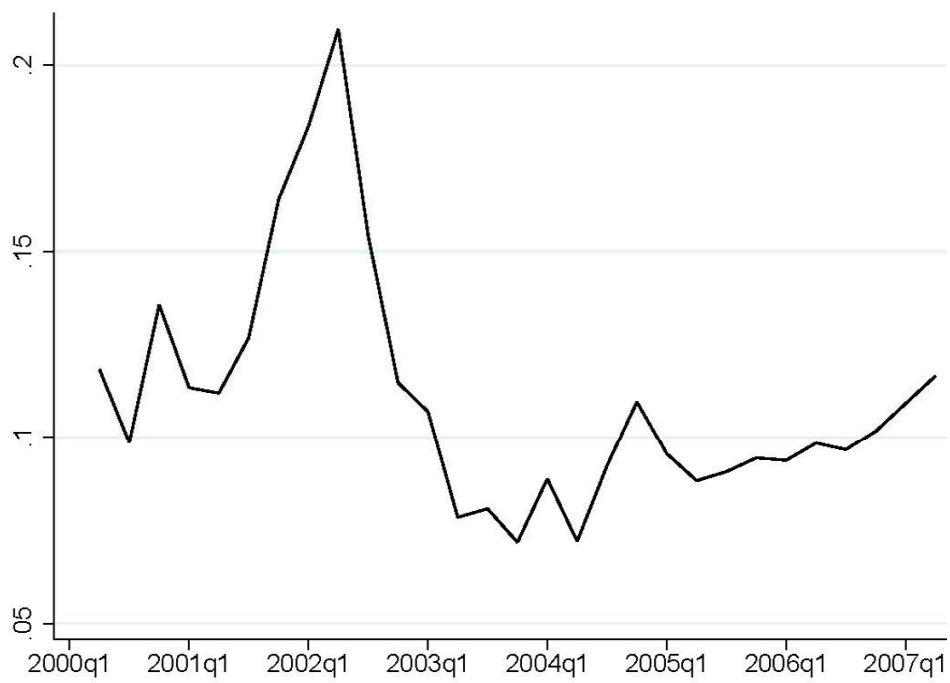
Figure 15: Share of Varieties that are Permanently Dropped by Continuing Firms