

The Macroeconomics of the Greek Depression

Online Appendix

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A Model Appendix

Appendix A.1 shows how the assumption of random walk of individual income simplifies the model with heterogeneity. Appendix A.2 lists the equilibrium conditions of the model. Appendix A.3 describes how we incorporate rare disasters into the model.

A.1 Heterogeneity

We focus on workers in household o because workers in household r are identical in income. We impose the conjecture $W_{it}^o = W_t$ to ease the notation. The first-order conditions of worker i in household o are:

$$\begin{aligned} \frac{c_{T,it}^o}{c_{N,it}^o} &= \frac{\omega_c}{1 - \omega_c} \left(\frac{P_{N,t}}{P_{T,t}} \right)^\phi, \\ \frac{c_{H,it}^o}{c_{F,it}^o} &= \frac{\gamma}{1 - \gamma} \left(\frac{P_{H,t}}{P_{F,t}^*} \right)^{-\eta}, \\ \frac{\varepsilon_w}{\varepsilon_w - 1} \frac{\chi c_{it}^o (\ell_{it}^o)^{\frac{1}{\varepsilon}}}{\rho + (1 - \rho) \frac{\chi (\ell_{it}^o)^{1 + \frac{1}{\varepsilon}}}{1 + \frac{1}{\varepsilon}}} &= \frac{1 - \tau_t^\ell \theta_{it}^o W_t}{1 + \tau_t^c \frac{P_{c,t}}{P_{c,t}}} \times \\ &\left[1 + \frac{\psi_w}{\varepsilon_w - 1} \left(\left(\frac{(1 - \tau_t^\ell) W_t}{(1 - \tau_{t-1}^\ell) W_{t-1}} - 1 \right) \frac{(1 - \tau_t^\ell) W_t}{(1 - \tau_{t-1}^\ell) W_{t-1}} \right. \right. \\ &\quad \left. \left. - \mathbb{E}_t \Lambda_{it,t+1}^o \frac{\theta_{it+1}^o}{\theta_{it}^o} \left(\frac{(1 - \tau_{t+1}^\ell) W_{t+1} \ell_{t+1}^o}{(1 - \tau_t^\ell) W_t \ell_t^o} \right) \left(\frac{(1 - \tau_{t+1}^\ell) W_{t+1}}{(1 - \tau_t^\ell) W_t} - 1 \right) \frac{(1 - \tau_{t+1}^\ell) W_{t+1}}{(1 - \tau_t^\ell) W_t} \right) \right], \\ (1 + \tau_t^c) P_{c,t} c_{it}^o + (1 + \bar{i}_t) e^{-\mu} B_{it}^o - B_{it+1}^o + Q_t^c \varsigma_{it+1}^o & \\ = \theta_{it}^o \left[(1 - \tau_t^\ell) \int W_t \ell_{it}^o dt - \int AC_{w,it}^o dt + T_t^o + \frac{\Pi_t^b + T_t^l}{1 - \zeta} \right] + (Q_t^c + \Pi_t^f) \varsigma_{it}^o, & \\ AC_{w,it}^o = \frac{\psi_w}{2} \left(\frac{(1 - \tau_t^\ell) W_t}{(1 - \tau_{t-1}^\ell) W_{t-1}} - 1 \right)^2 (1 - \tau_t^\ell) W_t \ell_{it}^o, & \\ c_{it}^o = \left(\omega_c^{\frac{1}{\phi}} (c_{T,it}^o)^{\frac{\phi-1}{\phi}} + (1 - \omega_c)^{\frac{1}{\phi}} (c_{N,it}^o)^{\frac{\phi-1}{\phi}} \right)^{\frac{\phi}{\phi-1}}, & \\ c_{T,it}^o = \left(\gamma^{\frac{1}{\eta}} (c_{H,it}^o)^{\frac{\eta-1}{\eta}} + (1 - \gamma)^{\frac{1}{\eta}} (c_{F,it}^o)^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}, & \end{aligned}$$

$$\Lambda_{it,t+1}^o = \beta^o e^{-\frac{1}{\rho}\mu} (1 - \pi_t^a + \pi_t^a e^{-\varphi^a(1-\sigma)})^{\frac{1-\frac{1}{\rho}}{1-\sigma}} (ce_{it}^o)^{\sigma-\frac{1}{\rho}} (v_{it+1}^o)^{\frac{1}{\rho}-\sigma} \times$$

$$\frac{(c_{it+1}^o)^{-\frac{1}{\rho}} \left(1 + \left(\frac{1}{\rho} - 1\right) \frac{\chi(\ell_{it+1}^o)^{1+\frac{1}{\epsilon}}}{1+\frac{1}{\epsilon}}\right)^{\frac{1}{\rho}}}{(c_{it}^o)^{-\frac{1}{\rho}} \left(1 + \left(\frac{1}{\rho} - 1\right) \frac{\chi(\ell_{it}^o)^{1+\frac{1}{\epsilon}}}{1+\frac{1}{\epsilon}}\right)^{\frac{1}{\rho}}} \frac{(1 + \tau_t^c)P_{c,t}}{(1 + \tau_{t+1}^c)P_{c,t+1}},$$

$$1 = \mathbb{E}_t \Lambda_{it,t+1}^o (1 + \bar{i}_{t+1}),$$

$$Q_t^s = \mathbb{E}_t \Lambda_{it,t+1}^o e^\mu \left(\Pi_{t+1}^f + Q_{t+1}^s \right),$$

$$(v_{it}^o)^{1-\frac{1}{\rho}} = (c_{it}^o)^{1-\frac{1}{\rho}} \left(1 + \left(\frac{1}{\rho} - 1\right) \frac{\chi(\ell_{it+1}^o)^{1+\frac{1}{\epsilon}}}{1+\frac{1}{\epsilon}}\right)^{\frac{1}{\rho}}$$

$$+ \beta^o e^{(1-\frac{1}{\rho})\mu} (1 - \pi_t^a + \pi_t^a e^{-\varphi^a(1-\sigma)})^{\frac{1-\frac{1}{\rho}}{1-\sigma}} (ce_{it}^o)^{1-\frac{1}{\rho}},$$

$$ce_{it}^o = \left(\mathbb{E}_t (v_{it+1}^o)^{1-\sigma} \right)^{\frac{1}{1-\sigma}}.$$

Next, we conjecture that individual-level variables are related to household-level variables:

$$c_{it}^o = \theta_{it}^o c_t^o,$$

$$c_{T,it}^o = \theta_{it}^o c_{T,t}^o,$$

$$c_{H,it}^o = \theta_{it}^o c_{H,t}^o,$$

$$c_{F,it}^o = \theta_{it}^o c_{F,t}^o,$$

$$c_{N,it}^h = \theta_{it}^o c_{N,t}^o,$$

$$\ell_{it}^o = \ell_t^o,$$

$$v_{it}^h = \theta_{it}^o v_t^o,$$

$$ce_{it}^h = \theta_{it}^o ce_t^o$$

and that

$$B_{it+1}^o - (1 + \bar{i}_t) e^{-\mu} B_{it}^o + (Q_t^s + \Pi_t^f) \varsigma_{it}^o - Q_t^s \varsigma_{it+1}^o =$$

$$\theta_{it}^o \left[B_{t+1}^o - (1 + \bar{i}_t) e^{-\mu} B_t^o + (Q_t^s + \Pi_t^f) \varsigma_t^o - Q_t^s \varsigma_{t+1}^o \right],$$

for household-level $\{c_t^o, c_{T,t}^o, c_{N,t}^h, \ell_t^o, B_{t+1}^o, \varsigma_{t+1}^o, v_t^o, ce_t^o\}$ characterized in Appendix A.2. The final step is to verify that an allocation solving the equilibrium conditions in Appendix A.2 necessarily solves the first-order conditions of the individual worker, thus validating the conjecture.

A.2 Equilibrium Conditions

We present the equilibrium conditions in blocks.

A.2.1 Households (24 equations)

The first-order conditions for household $h \in \{o, r\}$ are:

$$\begin{aligned}
\frac{c_{T,t}^h}{c_{N,t}^h} &= \frac{\omega_c}{1 - \omega_c} \left(\frac{P_{N,t}}{P_{T,t}} \right)^\phi, \\
\frac{c_{H,t}^h}{c_{F,t}^h} &= \frac{\gamma}{1 - \gamma} \left(\frac{P_{H,t}}{P_{F,t}^*} \right)^{-\eta}, \\
\frac{\varepsilon_w}{\varepsilon_w - 1} \frac{\chi c_t^h (\ell_t^h)^{\frac{1}{\epsilon}}}{\rho + (1 - \rho) \frac{\chi (\ell_t^h)^{1 + \frac{1}{\epsilon}}}{1 + \frac{1}{\epsilon}}} &= \frac{1 - \tau_t^\ell W_t}{1 + \tau_t^c P_{c,t}} \times \\
&\left[1 + \frac{\psi_w}{\varepsilon_w - 1} \left(\left(\frac{(1 - \tau_t^\ell) W_t}{(1 - \tau_{t-1}^\ell) W_{t-1}} - 1 \right) \frac{(1 - \tau_t^\ell) W_t}{(1 - \tau_{t-1}^\ell) W_{t-1}} \right. \right. \\
&\quad \left. \left. - \mathbb{E}_t \Lambda_{t,t+1}^h \left(\mathbb{I}(h = o) e^{\nu_{it+1}^\theta} + \mathbb{I}(h = r) \right) \times \right. \right. \\
&\quad \left. \left. \left(\frac{(1 - \tau_{t+1}^\ell) W_{t+1} \ell_{t+1}^h}{(1 - \tau_t^\ell) W_t \ell_t^h} \right) \left(\frac{(1 - \tau_{t+1}^\ell) W_{t+1}}{(1 - \tau_t^\ell) W_t} - 1 \right) \frac{(1 - \tau_{t+1}^\ell) W_{t+1}}{(1 - \tau_t^\ell) W_t} \right) \right], \\
(1 + \tau_t^c) P_{c,t} c_t^h + (1 + i(B_t^h)) e^{-\mu} B_t^h + Q_t^\zeta \varsigma_{t+1}^h + AC_{w,t}^h & \\
= (1 - \tau_t^\ell) W_t \ell_t^h + T_t^h + \mathbb{I}(h = o) \frac{\Pi_t^b + T_t^l}{1 - \zeta} + B_{t+1}^h + (Q_t^\zeta + \Pi_t^f) \varsigma_t^h, & \\
AC_{w,t}^h = \frac{\psi_w}{2} \left(\frac{(1 - \tau_t^\ell) W_t^h}{(1 - \tau_{t-1}^\ell) W_{t-1}^h} - 1 \right)^2 (1 - \tau_t^\ell) W_t^h \ell_t^h, & \\
c_t^h = \left(\omega_c^{\frac{1}{\phi}} (c_{T,t}^h)^{\frac{\phi-1}{\phi}} + (1 - \omega_c)^{\frac{1}{\phi}} (c_{N,t}^h)^{\frac{\phi-1}{\phi}} \right)^{\frac{\phi}{\phi-1}}, & \\
c_{T,t}^h = \left(\gamma^{\frac{1}{\eta}} (c_{H,t}^h)^{\frac{\eta-1}{\eta}} + (1 - \gamma)^{\frac{1}{\eta}} (c_{F,t}^h)^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}, & \\
\Lambda_{t,t+1}^h = \beta^h e^{-\frac{1}{\rho} \mu} \left(\mathbb{I}(h = o) e^{-\sigma \nu_{it+1}^\theta} + \mathbb{I}(h = r) \right) (1 - \pi_t^a + \pi_t^a e^{-\varphi^a(1-\sigma)})^{\frac{1-\frac{1}{\rho}}{1-\sigma}} (c_t^h)^{\sigma - \frac{1}{\rho}} (v_{t+1}^h)^{\frac{1}{\rho} - \sigma} \times & \\
\frac{(c_{t+1}^h)^{-\frac{1}{\rho}} \left(1 + \left(\frac{1}{\rho} - 1 \right) \frac{\chi (\ell_{t+1}^h)^{1 + \frac{1}{\epsilon}}}{1 + \frac{1}{\epsilon}} \right)^{\frac{1}{\rho}}}{(c_t^h)^{-\frac{1}{\rho}} \left(1 + \left(\frac{1}{\rho} - 1 \right) \frac{\chi (\ell_t^h)^{1 + \frac{1}{\epsilon}}}{1 + \frac{1}{\epsilon}} \right)^{\frac{1}{\rho}}} \frac{(1 + \tau_t^c) P_{c,t}}{(1 + \tau_{t+1}^c) P_{c,t+1}}, &
\end{aligned}$$

where

$$\begin{aligned}
(v_t^h)^{1-\frac{1}{\rho}} &= (c_t^h)^{1-\frac{1}{\rho}} \left(1 + \left(\frac{1}{\rho} - 1 \right) \frac{\chi (\ell_{t+1}^h)^{1+\frac{1}{\epsilon}}}{1 + \frac{1}{\epsilon}} \right)^{\frac{1}{\rho}} \\
&\quad + \beta^h e^{(1-\frac{1}{\rho})\mu} (1 - \pi_t^a + \pi_t^a e^{-\varphi^a(1-\sigma)})^{\frac{1-\frac{1}{\rho}}{1-\sigma}} (ce_t^h)^{1-\frac{1}{\rho}}, \\
ce_t^h &= \left(\mathbb{E}_t \left(\mathbb{I}(h=o) e^{(1-\sigma)\nu_{it+1}^\theta} + \mathbb{I}(h=r) \right) (v_{t+1}^h)^{1-\sigma} \right)^{\frac{1}{1-\sigma}},
\end{aligned}$$

and for household o :

$$\begin{aligned}
1 &= \mathbb{E}_t \Lambda_{t,t+1}^o (1 + \bar{i}_{t+1}), \\
Q_t^s &= \mathbb{E}_t \Lambda_{t,t+1}^o e^\mu \left(\Pi_{t+1}^f + Q_{t+1}^s \right),
\end{aligned}$$

and for household r :

$$\begin{aligned}
B_{t+1}^r &= \bar{B}_{t+1}^r, \\
\zeta_{t+1}^r &= 0.
\end{aligned}$$

A.2.2 Firms (27 equations)

Production. Let μ_t be the multiplier on the borrowing constraint (12) and λ_t be the multiplier on the firm's flow of funds constraint (13).

$$\begin{aligned}
\Pi_t^f &= \frac{P_{F,t}}{P_F} \Pi^f + \left(\frac{P_{F,t}}{\psi_\pi} \right) \left(\frac{1 - \lambda_t}{\lambda_t} \right), \\
\frac{(1-\alpha)P_{H,t}^f y_{H,t}}{\ell_{H,t}} + \mathbb{E}_t \Lambda_{t,t+1}^o e^\mu \left(\frac{\lambda_{t+1}}{\lambda_t} \right) W_{t+1} \frac{\psi_\ell}{2(1-\tau_{H,t}^k)} \left(\left(\frac{\ell_{t+1}}{\ell_t} \right)^2 - 1 \right) \\
&= W_t \left(1 - \frac{q_\ell}{1-\tau_{H,t}^k} + \frac{\kappa_\ell \mu_t}{(1-\tau_{H,t}^k)\lambda_t} + \frac{\psi_\ell}{1-\tau_{H,t}^k} \left(\frac{\ell_t}{\ell_{t-1}} - 1 \right) \right), \\
\frac{(1-\alpha)P_{N,t}^f y_{N,t}}{\ell_{N,t}} + \mathbb{E}_t \Lambda_{t,t+1}^o e^\mu \left(\frac{\lambda_{t+1}}{\lambda_t} \right) W_{t+1} \frac{\psi_\ell}{2(1-\tau_{N,t}^k)} \left(\left(\frac{\ell_{t+1}}{\ell_t} \right)^2 - 1 \right) \\
&= W_t \left(1 - \frac{q_\ell}{1-\tau_{N,t}^k} + \frac{\kappa_\ell \mu_t}{(1-\tau_{N,t}^k)\lambda_t} + \frac{\psi_\ell}{1-\tau_{N,t}^k} \left(\frac{\ell_t}{\ell_{t-1}} - 1 \right) \right), \\
u_{H,t} &= \left(\frac{(1-\tau_{H,t}^k)P_{H,t}^f y_{H,t}}{\bar{\xi}_H Q_t^k s_t e^{-\mu} k_t} \right)^{\frac{1}{\xi_H}}, \\
u_{N,t} &= \left(\frac{(1-\tau_{N,t}^k)P_{N,t}^f y_{N,t}}{\bar{\xi}_N Q_t^k (1-s_t) e^{-\mu} k_t} \right)^{\frac{1}{\xi_N}},
\end{aligned}$$

$$\begin{aligned}
& \left(\frac{(1 - \tau_{H,t}^k) \alpha P_{H,t}^f y_{H,t}}{s_t e^{-\mu} k_t} - \frac{(1 - \tau_{N,t}^k) \alpha P_{N,t}^f y_{N,t}}{(1 - s_t) e^{-\mu} k_t} \right) \\
&= [Q_t^k (\delta_{H,t} - \delta_{N,t}) - Q_t^k (\tau_{H,t}^k \bar{\delta}_H - \tau_{N,t}^k \bar{\delta}_N)], \\
Q_t^k &= (1 + \tau_t^x) P_{x,t} \left(1 + \kappa_x \frac{\mu_t}{(1 + \tau_t^x) \lambda_t} \right) + \\
& \quad \psi_x \left[P_{F,t} \left(e^\mu \frac{x_t}{x_{t-1}} - e^\mu \right) - \frac{1}{2} \mathbb{E}_t \Lambda_{t,t+1}^o \frac{\lambda_{t+1}}{\lambda_t} P_{F,t+1} \left(\left(e^\mu \frac{x_{t+1}}{x_t} \right)^2 - (e^\mu)^2 \right) \right], \\
\frac{x_{T,t}}{x_{N,t}} &= \frac{\omega_x}{1 - \omega_x} \left(\frac{P_{N,t}}{P_{T,t}} \right)^\phi, \\
Q_t^k &= \mathbb{E}_t \Lambda_{t,t+1}^o \left(\frac{\lambda_{t+1}}{\lambda_t} \right) \left[\left(\frac{(1 - \tau_{H,t+1}^k) \alpha P_{H,t+1}^f y_{H,t+1} + (1 - \tau_{N,t+1}^k) \alpha P_{N,t+1}^f y_{N,t+1}}{e^{-\mu} k_{t+1}} \right) \right. \\
& \quad \left. + (1 - \delta_{t+1} + \tau_{H,t+1}^k s_{t+1} \bar{\delta}_H + \tau_{N,t+1}^k (1 - s_{t+1}) \bar{\delta}_N) Q_{t+1}^k \right], \\
\lambda_t + \mu_t &= \mathbb{E}_t \Lambda_{t,t+1}^o [\lambda_{t+1} (1 + (1 - (s_{t+1} \tau_{H,t+1}^k + (1 - s_{t+1}) \tau_{N,t+1}^k)) i_{t+1}) + \mu_{t+1} (1 + i_{t+1})], \\
y_{H,t} &= z_{H,t} u_{H,t} (e^{-\mu} s_t k_t)^\alpha (\ell_{H,t})^{1-\alpha}, \\
y_{N,t} &= z_{N,t} u_{N,t} (e^{-\mu} (1 - s_t) k_t)^\alpha (\ell_{N,t})^{1-\alpha}, \\
\delta_{H,t} &= \bar{\delta}_H + \frac{\bar{\xi}_H}{\xi_H} (u_{H,t}^{\xi_H} - 1), \\
\delta_{N,t} &= \bar{\delta}_N + \frac{\bar{\xi}_N}{\xi_N} (u_{N,t}^{\xi_N} - 1), \\
\delta_t &= s_t \delta_{H,t} + (1 - s_t) \delta_{N,t}, \\
\Pi_t^f &= (1 - \tau_{H,t}^k) (P_{H,t}^f y_{H,t} - W_t \ell_{H,t} + \Pi_{H,t}) + (1 - \tau_{N,t}^k) (P_{N,t}^f y_{N,t} - W_t \ell_{N,t} + \Pi_{N,t}) - \text{AC}_{\ell,t}^f \\
& \quad - (1 + \tau_t^x) P_{x,t} x_t - \text{AC}_{x,t}^f + B_{t+1}^f - e^{-\mu} (1 + i_t) B_t^f + q_\ell W_t (\ell_t - \ell) - T_t^q \\
& \quad + \tau_{H,t}^k s_t e^{-\mu} (\bar{\delta}_H Q_t^k k_t + i_t B_t^f) + \tau_{N,t}^k (1 - s_t) e^{-\mu} (\bar{\delta}_N Q_t^k k_t + i_t B_t^f) - \text{AC}_{\pi,t}^f, \\
\text{AC}_{\pi,t}^f &= \frac{\psi_\pi}{2} \left(\frac{\Pi^f}{P_{F,t}} - \frac{\Pi^f}{P_F} \right)^2 P_{F,t}, \\
\text{AC}_{\ell,t}^f &= \frac{\psi_\ell}{2} \left(\frac{\ell_t}{\ell_{t-1}} - 1 \right)^2 W_t \ell_{t-1}, \\
\text{AC}_{x,t}^f &= e^\mu \frac{\psi_x}{2} \left(\frac{x_t}{x_{t-1}} - 1 \right)^2 P_{F,t} x_{t-1}, \\
T_t^q &= q_\ell W_t (\ell_t - \ell), \\
B_{t+1}^f + \kappa_y (P_{H,t} y_{H,t} + P_{N,t} y_{N,t}) &= \kappa_x (1 + \tau_t^x) P_{x,t} x_t + \kappa_\ell W_t \ell_t
\end{aligned}$$

$$\begin{aligned}
& + \kappa_{\tau,t} \left[\tau_{H,t}^k \left(P_{H,t}^f y_{H,t} - W_t \ell_{H,t} + \Pi_{H,t} - s_t e^{-\mu} \left(\bar{\delta}_H Q_t^k k_t + i_t B_t^f \right) \right) \right. \\
& \left. + \tau_{N,t}^k \left(P_{N,t}^f y_{N,t} - W_t \ell_{N,t} + \Pi_{N,t} - (1 - s_t) e^{-\mu} \left(\bar{\delta}_N Q_t^k k_t + i_t B_t^f \right) \right) \right] + (1 + i_t) e^{-\mu} B_t^f.
\end{aligned}$$

Price setting. For price setting firm in sector $i \in \{H, N\}$:

$$\begin{aligned}
& P_{i,t} - \left(\frac{\varepsilon_p}{\varepsilon_p - 1} \right) P_{i,t}^f \\
& + \frac{\psi_{i,p}}{\varepsilon_p - 1} P_{i,t} \left(\left(\frac{P_{i,t}}{P_{i,t-1}} - 1 \right) \frac{P_{i,t}}{P_{i,t-1}} - \mathbb{E}_t \Lambda_{t,t+1}^o e^{\mu} \frac{P_{i,t+1} y_{i,t+1}}{P_{i,t} y_{i,t}} \left(\frac{P_{i,t+1}}{P_{i,t}} - 1 \right) \frac{P_{i,t+1}}{P_{i,t}} \right) = 0, \\
& \Pi_{i,t} = (P_{i,t} - P_{i,t}^f) y_{i,t} - \text{AC}_{i,t}, \\
& \text{AC}_{i,t} = \frac{\psi_{i,p}}{2} \left(\frac{P_{i,t}}{P_{i,t-1}} - 1 \right)^2 P_{i,t} y_{i,t}.
\end{aligned}$$

A.2.3 Banks (9 equations)

We first conjecture $J_t^b = e^{-\mu} \iota_t^b N_t$, where ι_t^b is banks' marginal value of net worth. Letting μ_t^b be the multiplier on banks' incentive compatibility constraint (18), we then obtain the first-order conditions below.

$$\begin{aligned}
& J_t^b = e^{-\mu} \iota_t^b N_t, \\
& \kappa_b \mu_t^b = \mathbb{E}_t \Lambda_{t,t+1}^o \left[\delta_b + (1 - \delta_b) \iota_{t+1}^b \right] (i_{t+1} - \bar{i}_{t+1}), \\
& \iota_t^b = \frac{\mathbb{E}_t \Lambda_{t,t+1}^o \left[\delta_b + (1 - \delta_b) \iota_{t+1}^b \right] (1 + \bar{i}_{t+1})}{1 - \mu_t^b}, \\
& \kappa_b \left(B_{t+1}^f + \zeta B_{t+1}^r \right) = e^{-\mu} \iota_t^b N_t, \\
& N_t = e^{\mu} \left(B_{t+1}^f + \zeta B_{t+1}^r - B_{t+1}^b \right), \\
& N_t = (1 - \delta_b) N_t^c + N_t^e + e^{\mu} T_{G,t}^b + e^{\mu} T_{W,t}^b, \\
& N_t^e = \omega_b P_{y,t-1} y_{t-1}, \\
& N_t^c = (1 + \bar{i}_t) e^{-\mu} N_{t-1} + (i_t - \bar{i}_t) \left(B_t^f + \zeta B_t^r \right), \\
& \Pi_t^b = e^{-\mu} (\delta_b N_t^c - N_t^e).
\end{aligned}$$

A.2.4 Government (2 equations)

$$g_t^x = \left(\omega_x^{\frac{1}{\phi}} \left(g_{T,t}^x \right)^{\frac{\phi-1}{\phi}} + (1 - \omega_x)^{\frac{1}{\phi}} \left(g_{N,t}^x \right)^{\frac{\phi-1}{\phi}} \right)^{\frac{\phi}{\phi-1}},$$

$$\begin{aligned}
& T_t^g + \tau_t^c P_{c,t} (\zeta c_t^r + (1 - \zeta) c_t^o) + \tau_t^x P_{x,t} x_t + \tau_t^l (\zeta W_t \ell_t^r + (1 - \zeta) W_t \ell_t^o) \\
& + \tau_{H,t}^k \left(P_{H,t}^f y_{H,t} - W_t \ell_{H,t} + \Pi_{H,t} - e^{-\mu} s_t \left(\bar{\delta}_H Q_t^k k_t + i_t B_t^f \right) \right) \\
& + \tau_{N,t}^k \left(P_{N,t}^f y_{N,t} - W_t \ell_{N,t} + \Pi_{N,t} - e^{-\mu} (1 - s_t) \left(\bar{\delta}_N Q_t^k k_t + i_t B_t^f \right) \right) \\
& = (1 + \bar{r}_t) e^{-\mu} \bar{B}_t^g - \bar{B}_{t+1}^g + T_{G,t}^b + P_{T,t} (g_{T,t}^c + g_{T,t}^x) + P_{N,t} (g_{N,t}^c + g_{N,t}^x) + \zeta T_t^r + (1 - \zeta) T_t^o.
\end{aligned}$$

A.2.5 Market Clearing (5 equations)

$$\begin{aligned}
& \zeta \zeta_{t+1}^r + (1 - \zeta) \zeta_{t+1}^o = 1, \\
& k_{t+1} = e^{-\mu} (1 - \delta_t) k_t + x_t + g_t^x, \\
& \ell_{H,t} + \ell_{N,t} = \zeta \ell_t^r + (1 - \zeta) \ell_t^o, \\
& y_{N,t} = \zeta c_{N,t}^r + (1 - \zeta) c_{N,t}^o + x_{N,t} + g_{N,t}^c + g_{N,t}^x, \\
& y_{H,t} = \gamma \left(\frac{P_{H,t}}{P_{T,t}} \right)^{-\eta} (\zeta c_{T,t}^r + (1 - \zeta) c_{T,t}^o + x_{T,t} + g_{T,t}^c + g_{T,t}^x) + (1 - \gamma) \left(\frac{P_{H,t}}{P_{F,t}} \right)^{-\eta} \bar{a}_{T,t}.
\end{aligned}$$

A.2.6 Auxiliary (25 equations)

Aggregate consumption and its associated price index are:

$$\begin{aligned}
& c_t = \zeta c_t^r + (1 - \zeta) c_t^o, \\
& P_{c,t} = \left(\omega_c P_{T,t}^{1-\phi} + (1 - \omega_c) P_{N,t}^{1-\phi} \right)^{\frac{1}{1-\phi}}.
\end{aligned}$$

Aggregate traded consumption and its associated price index are:

$$\begin{aligned}
& c_{T,t} = \zeta c_{T,t}^r + (1 - \zeta) c_{T,t}^o, \\
& P_{T,t} = \left(\gamma (P_{H,t})^{1-\eta} + (1 - \gamma) (E_t P_{F,t}^*)^{1-\eta} \right)^{\frac{1}{1-\eta}}.
\end{aligned}$$

Aggregate investment and its associated price index are:

$$\begin{aligned}
& x_t = \left(\omega_x^{\frac{1}{\phi}} (x_{T,t})^{\frac{\phi-1}{\phi}} + (1 - \omega_x)^{\frac{1}{\phi}} (x_{N,t})^{\frac{\phi-1}{\phi}} \right)^{\frac{\phi}{\phi-1}}, \\
& P_{x,t} = \left(\omega_x P_{T,t}^{1-\phi} + (1 - \omega_x) P_{N,t}^{1-\phi} \right)^{\frac{1}{1-\phi}}.
\end{aligned}$$

Aggregate output and its associated Paasche index are:

$$y_t = \frac{P_{H,t} y_{H,t} + P_{N,t} y_{N,t}}{P_{y,t}},$$

$$\frac{P_{y,t}}{P_{y,t-1}} = \left(\frac{P_{H,t}}{P_{H,t-1}} \right)^{\frac{P_{H,t}y_{H,t}}{P_{H,t}y_{H,t} + P_{N,t}y_{N,t}}} \left(\frac{P_{N,t}}{P_{N,t-1}} \right)^{\frac{P_{N,t}y_{N,t}}{P_{H,t}y_{H,t} + P_{N,t}y_{N,t}}}.$$

Nominal GDP, net exports, the Paasche price index of GDP, and real GDP are defined as:

$$\text{GDP}_t = (1 + \tau_t^c)P_{c,t}c_t + (1 + \tau_t^x)P_{x,t}x_t + P_{T,t}(g_{T,t}^c + g_{T,t}^x) + P_{N,t}(g_{N,t}^c + g_{N,t}^x) + \text{NX}_t,$$

$$\text{NX}_t = P_{H,t}y_{H,t} - P_{T,t}c_{T,t} - P_{T,t}x_{T,t} - P_{T,t}(g_{T,t}^c + g_{T,t}^x)$$

$$- \zeta \text{AC}_{w,t}^r - (1 - \zeta) \text{AC}_{w,t}^o - \text{AC}_{H,t} - \text{AC}_{N,t} - \text{AC}_{\pi,t}^f - \text{AC}_{x,t}^f - \text{AC}_{\ell,t}^f,$$

$$\begin{aligned} \frac{P_{\text{gdp},t}}{P_{\text{gdp},t-1}} &= \left(\frac{(1 + \tau_t^c)P_{c,t}}{(1 + \tau_{t-1}^c)P_{c,t-1}} \right)^{\frac{(1 + \tau_t^c)P_{c,t}c_t}{\text{GDP}_t}} \left(\frac{(1 + \tau_t^x)P_{x,t}}{(1 + \tau_{t-1}^x)P_{x,t-1}} \right)^{\frac{(1 + \tau_t^x)P_{x,t}x_t}{\text{GDP}_t}} \left(\frac{P_{T,t}}{P_{T,t-1}} \right)^{\frac{P_{T,t}(g_{T,t}^c + g_{T,t}^x)}{\text{GDP}_t}} \times \\ &\left(\frac{P_{N,t}}{P_{N,t-1}} \right)^{\frac{P_{N,t}(g_{N,t}^c + g_{N,t}^x)}{\text{GDP}_t}} \left(\frac{P_{H,t}}{P_{H,t-1}} \right)^{\frac{P_{H,t}y_{H,t}}{\text{GDP}_t}} \times \\ &\left(\frac{P_{T,t}}{P_{T,t-1}} \right)^{-\frac{P_{T,t}c_{T,t}}{\text{GDP}_t}} \left(\frac{P_{T,t}}{P_{T,t-1}} \right)^{-\frac{P_{T,t}x_{T,t}}{\text{GDP}_t}} \left(\frac{P_{T,t}}{P_{T,t-1}} \right)^{-\frac{P_{T,t}(g_{T,t}^c + g_{T,t}^x)}{\text{GDP}_t}}, \end{aligned}$$

$$\text{gdp}_t = \frac{\text{GDP}_t}{P_{\text{gdp},t}}.$$

Aggregate labor is:

$$\ell_t = \ell_{H,t} + \ell_{N,t}.$$

Sectoral and aggregate capital as measured in the national accounts is:

$$\tilde{k}_{H,t+1} = e^{-\mu}(1 - \bar{\delta}_H)\tilde{k}_{H,t} + s_t(k_t - e^{-\mu}(1 - \delta_{H,t})k_{t-1}),$$

$$\tilde{k}_{N,t+1} = e^{-\mu}(1 - \bar{\delta}_N)\tilde{k}_{N,t} + (1 - s_t)(k_t - e^{-\mu}(1 - \delta_{N,t})k_{t-1}),$$

$$\tilde{k}_t = \tilde{k}_{H,t} + \tilde{k}_{N,t}.$$

Aggregate TFP (inclusive of utilization) is defined as:

$$\frac{\text{TFP}_t}{\text{TFP}_{t-1}} = \frac{y_t}{y_{t-1}} \left(\frac{\ell_t}{\ell_{t-1}} \right)^{-\left(\frac{1}{2}\text{lsh}_t + \frac{1}{2}\text{lsh}_{t-1}\right)} \left(\frac{\tilde{k}_t}{\tilde{k}_{t-1}} \right)^{-\left(1 - \left(\frac{1}{2}\text{lsh}_t + \frac{1}{2}\text{lsh}_{t-1}\right)\right)},$$

$$\text{lsh}_t = \frac{W_t \ell_t}{P_{H,t}y_{H,t} + P_{N,t}y_{N,t}}.$$

TFP in each sector $i \in \{H, N\}$ is:

$$\frac{\text{TFP}_{i,t}}{\text{TFP}_{i,t-1}} = \frac{y_{i,t}}{y_{i,t-1}} \left(\frac{\ell_{i,t}}{\ell_{i,t-1}} \right)^{-\left(\frac{1}{2}\text{lsh}_{i,t} + \frac{1}{2}\text{lsh}_{i,t-1}\right)} \left(\frac{\tilde{k}_{i,t}}{\tilde{k}_{i,t-1}} \right)^{-\left(1 - \left(\frac{1}{2}\text{lsh}_{i,t} + \frac{1}{2}\text{lsh}_{i,t-1}\right)\right)},$$

$$\text{lsh}_{i,t} = \frac{W_t \ell_{i,t}}{P_{i,t} y_{i,t}}.$$

Quantities of imports and exports are defined as:

$$\begin{aligned} \text{im}_t &= (1 - \gamma) \left(\frac{P_{F,t}}{P_{T,t}} \right)^{-\eta} (\zeta c_{T,t}^r + (1 - \zeta) c_{T,t}^o + x_{T,t} + g_{T,t}^c + g_{T,t}^x) \\ &\quad + \left[\zeta \text{AC}_{w,t}^r + (1 - \zeta) \text{AC}_{w,t}^o + \text{AC}_{H,t} + \text{AC}_{N,t} + \text{AC}_{\pi,t}^f + \text{AC}_{x,t}^f + \text{AC}_{\ell,t}^f \right] / P_{F,t}, \\ \text{ex}_t &= y_{H,t} - \gamma \left(\frac{P_{H,t}}{P_{T,t}} \right)^{-\eta} (\zeta c_{T,t}^r + (1 - \zeta) c_{T,t}^o + x_{T,t} + g_{T,t}^c + g_{T,t}^x). \end{aligned}$$

so that $\text{NX} = P_{H,t} \text{ex}_t - P_{F,t} \text{im}_t$. The current account is defined as the change in the net foreign assets held by the country:

$$\begin{aligned} \text{CA}_t &\equiv e^{-\mu} [(1 - \zeta) B_t^o + B_t^b + \bar{B}_t^g] - [(1 - \zeta) B_{t+1}^o + B_{t+1}^b + \bar{B}_{t+1}^g] \\ &= \text{NX}_t + T_{W,t}^b - e^{-\mu} [\bar{i}_t (1 - \zeta) B_t^o + \bar{i}_t B_t^b + \bar{r}_t \bar{B}_t^g] + T_t^g + T_t^l. \end{aligned}$$

Note that B_t^f and ζB_t^r are debt that domestic firms and workers in the rule-of-thumb household owe to domestic banks and, therefore, are not part of the current account. The second line shows that the current account equals net exports, net foreign income from abroad $T_{W,t}^b - e^{-\mu} [\bar{i}_t (1 - \zeta) B_t^o + \bar{i}_t B_t^b + \bar{r}_t \bar{B}_t^g]$, and net current transfers $T_t^g + T_t^l$. The realized T_t^l is always zero because it does not reflect an actual transfer or resource. Finally, $T_{G,t}^b$, T_t^o , and T_t^r are transfers between domestic agents and, therefore, they are also not part of the current account.

A.2.7 Summary

We have 92 equations in 92 unknowns:

$$\begin{aligned} &c_t^o, c_{T,t}^o, c_{N,t}^o, c_{H,t}^o, c_{F,t}^o, \ell_t^o, B_{t+1}^o, \varsigma_{t+1}^o, \text{AC}_{w,t}^o, \Lambda_{t,t+1}^o, v_t^o, \text{ce}_t^o, \\ &c_t^r, c_{T,t}^r, c_{N,t}^r, c_{H,t}^r, c_{F,t}^r, \ell_t^r, B_{t+1}^r, \varsigma_{t+1}^r, \text{AC}_{w,t}^r, \Lambda_{t,t+1}^r, v_t^r, \text{ce}_t^r, \\ &P_{H,t}^f, y_{H,t}, \ell_{H,t}, u_{H,t}, \delta_{H,t}, P_{N,t}^f, y_{N,t}, \ell_{N,t}, u_{N,t}, \delta_{N,t}, \delta_t, \Pi_t^f, s_t, x_{T,t}, x_{N,t}, k_{t+1}, B_{t+1}^f, \text{AC}_{\pi,t}^f, \text{AC}_{x,t}^f, \text{AC}_{\ell,t}^f, T_t^g \\ &\lambda_t, \mu_t, P_{H,t}, P_{N,t}, \Pi_{H,t}, \Pi_{N,t}, \text{AC}_{H,t}, \text{AC}_{N,t}, N_t, N_t^e, N_t^c, \Pi_t^b, J_t^b, \ell_t^b, \mu_t^b, i_t, B_{t+1}^b, g_t^x, T_t^o, W_t, Q_t^k, Q_t^\varsigma, \\ &c_t, P_{c,t}, c_{T,t}, P_{T,t}, x_t, P_{x,t}, y_t, P_{y,t}, \text{GDP}_t, \text{gdp}_t, P_{\text{gdp},t}, \text{NX}_t, \ell_t, \tilde{k}_{H,t+1}, \tilde{k}_{N,t+1}, \tilde{k}_{t+1}, \\ &\text{TFP}_t, \text{lsh}_t, \text{TFP}_{H,t}, \text{lsh}_{H,t}, \text{TFP}_{N,t}, \text{lsh}_{N,t}, \text{im}_t, \text{ex}_t, \text{CA}_t. \end{aligned}$$

A.3 Aggregate Disaster Risk

In this appendix we discuss how we incorporate aggregate disasters into the model. As described in the main text, a time-varying probability of a rare disaster π_t^a enters multiplicatively with the discount factor in the intertemporal optimality conditions of the model. This simplifies significantly the solution and estimation of the model with time-varying disasters because it allows us to use standard perturbation techniques. This result, adapted from [Gourio \(2012\)](#), is a consequence of the assumptions that all endogenous and exogenous state variables scale with the cumulative realization of disasters over time. Owing to this assumption, we can reformulate the economy with disaster risk into a transformed economy in which the probability of disaster only enters into the intertemporal optimality conditions.

We denote by \hat{n} some variable in the primitive formulation of the economy and by n the same variable in the transformed economy. We assume here that the primitive variables also grow at trend rate μ . The disaster process is:

$$\hat{\varphi}_{t+1}^a = \begin{cases} 0 & \text{with probability } 1 - \pi_t^a, \\ \varphi^a & \text{with probability } \pi_t^a, \end{cases}$$

and the permanent level of productivity is:

$$\log \hat{\Phi}_t = \log \hat{\Phi}_{t-1} - \hat{\varphi}_t^a + \mu.$$

The exogenous state variables affected by disasters are given by:

$$\log \hat{z}_{H,t} = \log z_{H,t} + (1 - \alpha) \log \hat{\Phi}_t,$$

$$\log \hat{z}_{N,t} = \log z_{N,t} + (1 - \alpha) \log \hat{\Phi}_t,$$

$$\log \hat{g}_{T,t}^c = \log g_{T,t}^c + \log \hat{\Phi}_t,$$

$$\log \hat{g}_{N,t}^c = \log g_{N,t}^c + \log \hat{\Phi}_t,$$

$$\log \hat{g}_{T,t}^x = \log g_{T,t}^x + \log \hat{\Phi}_t,$$

$$\log \hat{g}_{N,t}^x = \log g_{N,t}^x + \log \hat{\Phi}_t,$$

$$\log \hat{T}_t^r = \log T_t^r + \log \hat{\Phi}_t,$$

$$\log \hat{a}_{T,t} = \log \bar{a}_{T,t} + \log \hat{\Phi}_t,$$

$$\log \hat{T}_t^g = \log T_t^g + \log \hat{\Phi}_t,$$

$$\begin{aligned}
\log \hat{T}_t^l &= \log T_t^l + \log \hat{\Phi}_t, \\
\log \hat{B}_{t+1}^g &= \log \bar{B}_t^g + \log \hat{\Phi}_t, \\
\log \hat{B}_{t+1}^r &= \log \bar{B}_t^r + \log \hat{\Phi}_t, \\
\log \hat{T}_{W,t}^b &= \log T_{W,t}^b + \log \hat{\Phi}_t, \\
\log \hat{T}_{G,t}^b &= \log T_{G,t}^b + \log \hat{\Phi}_t.
\end{aligned}$$

The endogenous state variables affected by a disaster are given by:

$$\begin{aligned}
\hat{k}_{t+1} &\equiv \hat{k}'_{t+1} e^{-\hat{\varphi}_{t+1}^a} = ((1 - \delta)\hat{k}_t + \hat{x}_t) e^{-\hat{\varphi}_{t+1}^a}, \\
\hat{x}_t &\equiv \hat{x}'_t e^{-\hat{\varphi}_{t+1}^a}, \\
\hat{B}_{t+1}^o &\equiv (\hat{B}'_{t+1}) e^{-\hat{\varphi}_{t+1}^a}, \\
\hat{B}_{t+1}^f &\equiv (\hat{B}'_{t+1}) e^{-\hat{\varphi}_{t+1}^a}, \\
\hat{N}_{t+1} &\equiv (\hat{N}'_{t+1}) e^{-\hat{\varphi}_{t+1}^a}, \\
\hat{W}_t &\equiv (\hat{W}'_t) e^{-\hat{\varphi}_{t+1}^a}.
\end{aligned}$$

In the last set of equations, primes denote choice variables at the end of the period which — due to a disaster — may differ from the endogenous state variables the next period.

For any endogenous variable n_t in a period we then define:

$$n_t \equiv \frac{\hat{n}_t}{\hat{\Phi}_t}, \tag{A.1}$$

except for the certainty equivalent for which we define:¹

$$ce_t \equiv (\mathbb{E}_t v_{t+1}^{1-\sigma})^{\frac{1}{1-\sigma}}. \tag{A.2}$$

Solving for the equilibrium conditions of the original economy and then making use of equations (A.1) and (A.2) repeatedly, we obtain the equilibrium conditions of the transformed economy.

¹In particular, equations (A.1) and (A.2) imply that:

$$\begin{aligned}
\frac{1}{\hat{\Phi}_t} \hat{c}e_t &= \frac{1}{\hat{\Phi}_t} (\mathbb{E}_t (\hat{v}_{t+1})^{1-\sigma})^{\frac{1}{1-\sigma}} = \left(\mathbb{E}_t \left(v_{t+1} \left(\frac{\hat{\Phi}_{t+1}}{\hat{\Phi}_t} \right) \right)^{1-\sigma} \right)^{\frac{1}{1-\sigma}} = e^\mu \left(\mathbb{E}_t \left(v_{t+1} e^{-\hat{\varphi}_{t+1}^a} \right)^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \\
&= e^\mu \left(1 - \pi_t^a + \pi_t^a e^{-\varphi^a(1-\sigma)} \right)^{\frac{1}{1-\sigma}} (\mathbb{E}_t v_{t+1}^{1-\sigma})^{\frac{1}{1-\sigma}} = e^\mu \left(1 - \pi_t^a + \pi_t^a e^{-\varphi^a(1-\sigma)} \right)^{\frac{1}{1-\sigma}} ce_t.
\end{aligned}$$

B Data Appendix

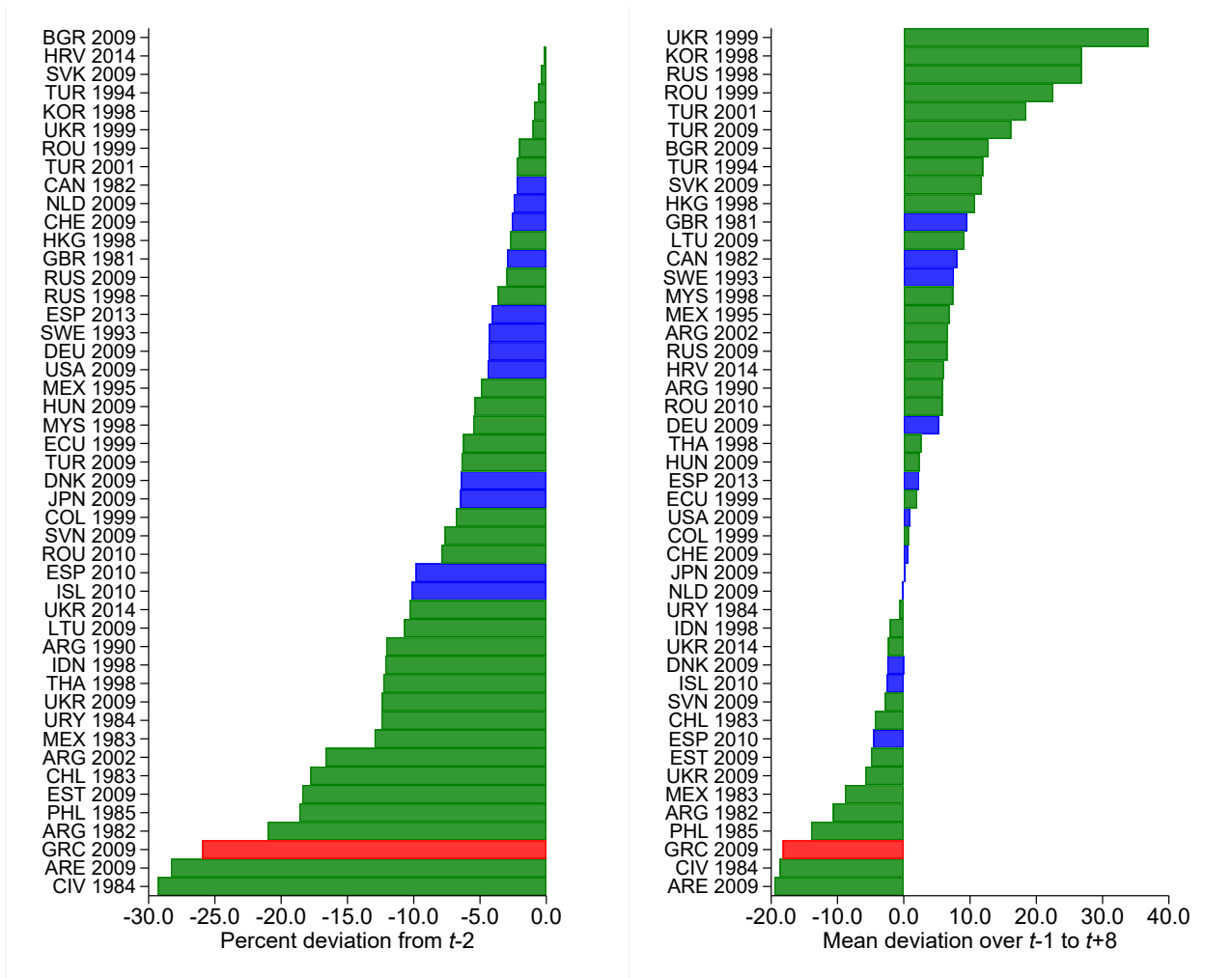
Appendix B.1 compares the Greek depression to other episodes. Appendix B.2 presents evidence on the decline in value added and employment by firm size and decomposes the decline in aggregate labor productivity. Appendix B.3 details the growth accounting methodology and the measurement of utilization. Appendix B.4 presents alternative measures of wages and wage rigidity. Appendix B.5 presents alternative measures of value-added exports and external demand and decomposes the change in exports in the bust by industry. Appendix B.6 provides additional details on the estimation of disaster probabilities using options data. Appendix B.7 provides additional details on the measurement of effective tax rates. Appendix B.8 describes the estimation of the trade elasticity. Appendix B.9 summarizes the data sources for all of the variables used in the estimation of the model.

B.1 Greece Relative to Other Episodes

This appendix compares the experience of Greece to sudden stop episodes in other countries. The comparison cases come from [Gourinchas, Philippon, and Vayanos \(2016\)](#) who build on [Calvo, Izquierdo, and Talvi \(2006\)](#) and [Korinek and Mendoza \(2014\)](#). An episode qualifies as a sudden stop when net capital inflows fall more than two standard deviations away from the mean and the country experiences a decline in output that exceeds the median among its country group (advanced or emerging market). Figure 1(a) shows the maximum decline in annual per capita output relative to two years before the sudden stop. Figure 1(b) shows the average annual output deviation from one year before to eight years after the sudden stop occurs, which combines both the severity and persistence of the episode. Bars in Green are emerging markets, bars in blue are advanced economies, and the Greece 2009 episode is in red. The vertical axis lists the World Bank country code and year of the sudden stop. By either metric, the Greek episode is larger than any other episode except Cote d'Ivoire in 1984 and the United Arab Emirates in 2009.

B.2 Value Added, Employment, and Productivity by Size Class

In this appendix we use data between 2009 and 2014 from the Structural Business Statistics to analyze the declines in value added, employment, and labor productivity for firms of different size



(a) Maximum Deviation

(b) Mean Deviation

Figure B.1: Output Declines in Sudden Stop Episodes

The figure plots real per capita output (World Development Indicators code NY.GDP.PCAP.KN) around sudden stop episodes as defined in [Gourinchas, Philippon, and Vayanos \(2016\)](#). The left panel shows the maximum decline in annual output relative to two years before the sudden stop. The right panel shows the average annual output deviation from one year before to eight years after the sudden stop occurs. Bars in Green are emerging markets, bars in blue are advanced economies, and the Greece 2009 episode is in red.

classes. The Structural Business Statistics provide value added and employment aggregates for firms belonging to different employment sizes, ranging from firms with 1-9 employees to firms with more than 250 employees. The data are available at the industry level for up to four digits of disaggregation.

Figure B.2 presents value added and employment trends by firm size class. The decline in value added and employment is observed throughout the size distribution.

Figure B.3 decomposes the decline in labor productivity into a within-firm size component and a between-firm size component. Each industry is represented by a dot in the figure. For almost all industries, the decline in labor productivity is accounted for by declines in labor productivity within firms belonging to a particular size class rather than by a reallocation of economic activity across firms with different size classes and different levels of productivity.

B.3 Growth Accounting

This appendix details the construction of total factor productivity (TFP) and utilization.

B.3.1 Total Factor Productivity

We measure TFP as the Solow residual. Data on value-added and total hours worked come directly from Eurostat. We construct capital services by aggregating four types of capital (structures, machinery and equipment, cultivated biological resources, and intellectual property assets) using user cost weights based on actual depreciation and a required 5 percent net return.² Capital type-by-industry data come from the Eurostat non-financial asset accounts. Under the assumptions of competitive output markets and constant-returns-to-scale production, we calculate the hours elasticity by multiplying total labor compensation by the ratio of total to employee hours in each industry and obtain the capital elasticity as a residual.³

²We have experimented with thresholds for the required return up to 20 percent and an internal return based on capital income payments with little change in the results.

³As is well known, with non-competitive output markets the output elasticities equate to factor cost shares rather than factor revenue shares. It follows immediately that a time-invariant markup scales TFP growth by the markup. Time-varying markups pose additional difficulties which we do not pursue since we lack independent evidence on this margin.

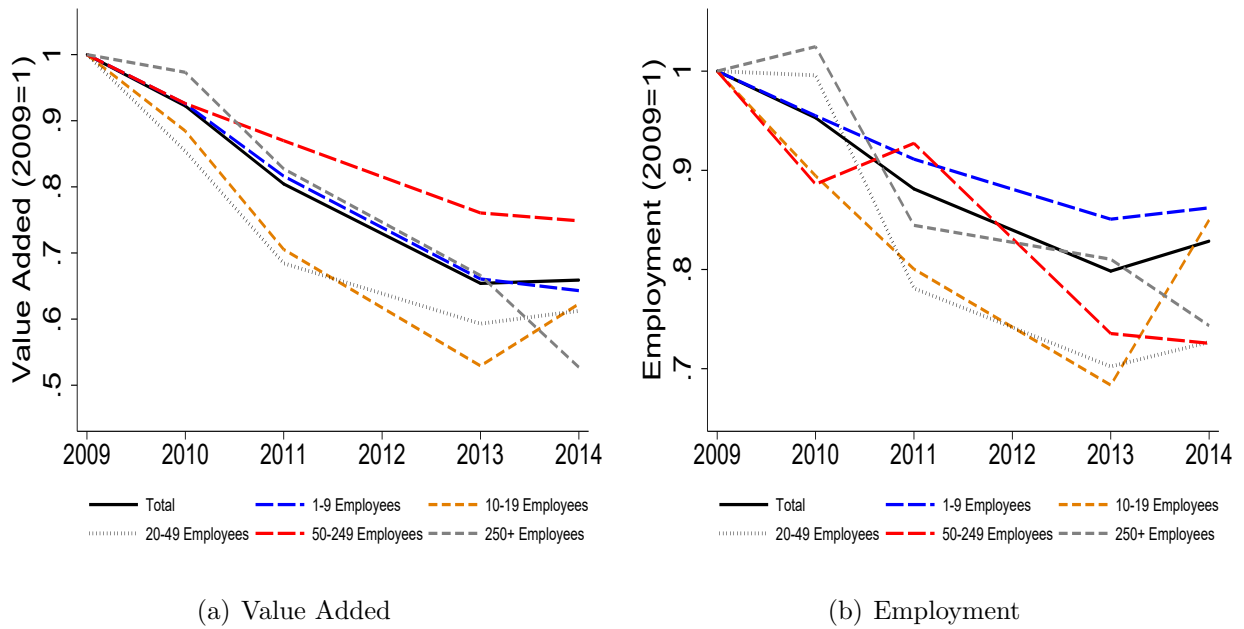


Figure B.2: Value Added and Employment Trends by Size Class

Figure B.2 plots value-added and employment by firm size class based on data from the Structural Business Statistics.

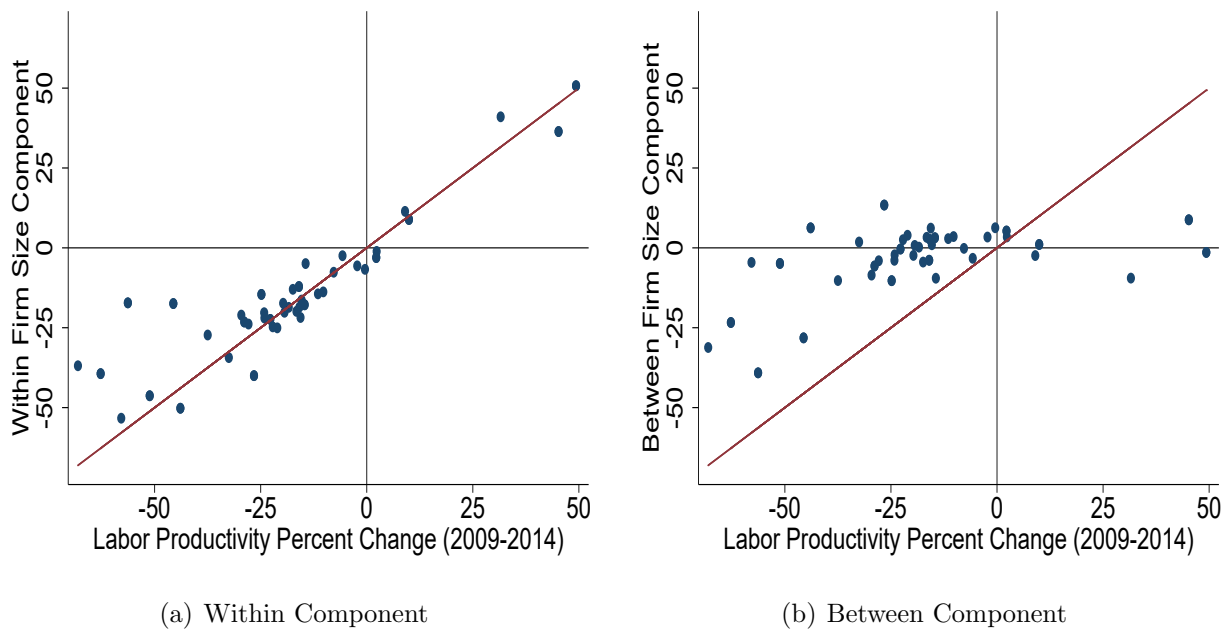


Figure B.3: Labor Productivity Decomposition

Figure B.3 plots the within-firm size and between-firm size components of labor productivity growth based on data from the Structural Business Statistics.

B.3.2 Utilization Measurement

Our main measures of utilization come from the Joint Harmonised European Union Industry Survey and the Joint Harmonised European Union Services Survey. Both surveys are administered quarterly by the European Commission and are representative of firms in their respective sectors. Since 1985, The Industry Survey has asked the question (INDU13QPS):

At what capacity is your company currently operating (as a percentage of full capacity)?

We average the quarterly responses to obtain annual utilization for the manufacturing sector. In 2011 the Services Survey added the question (SERV8QPS):

If the demand expanded, could you increase your volume of activity with your present resources? If so, by how much?"

For 2011 forward, we use the annual average of responses to this question to obtain utilization for the services sector. We extend the measure of utilization in the services sector further back in time using the fraction of respondents reporting “None” to the question (SERV7F1S):

What main factors are currently limiting your business?

Specifically, a regression over the period 2012Q3-2017Q4 of the four quarter change to question SERV8QPS, $\Delta_4\text{SERV8QPS}$, on the four quarter change in this fraction, $\Delta_4\text{SERV7F1S}$, yields:

$$\Delta_4\text{SERV8QPS} = -0.72 + 0.54\Delta_4\text{SERV7F1}, N = 22.$$

The Newey-West standard error with bandwidth of 4 on the coefficient for $\Delta_4\text{SERV7F1}$ is 0.11 and the R^2 of the regression is 0.58, making the question a plausible proxy for the utilization question asked starting in 2011. We use the fitted values from this regression to impute SERV8QPS for quarters prior to 2011 and then take annual averages and cap the resulting measure at 100. Finally, as no survey measures exist covering agriculture or mining and quarrying, we assume no utilization margin exists in these industries.

We construct an alternative measure of utilization by building on the framework of [Basu \(1996\)](#). Suppressing superscripts for simplicity, this approach starts by specializing the production function for gross output to a CES aggregate of value-added $V(\cdot)$ and materials m :

$$z \left[\xi_v^{\frac{1}{\sigma}} V(u_k k, u_\ell \ell)^{\frac{\sigma-1}{\sigma}} + \xi_m^{\frac{1}{\sigma}} m^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}},$$

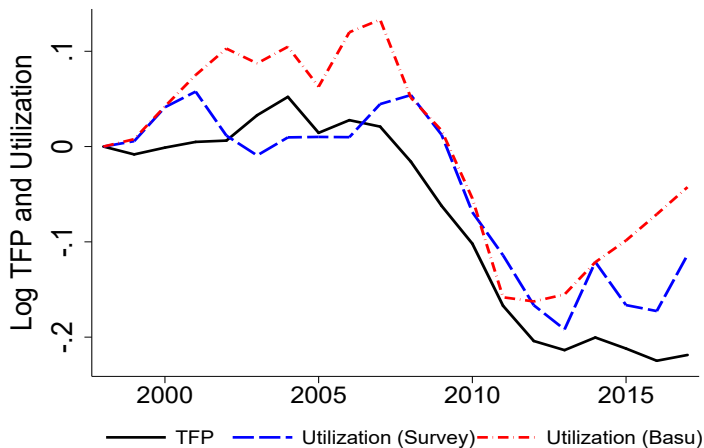


Figure B.4: Aggregate TFP and Alternative Measures of Utilization

where u_k and u_ℓ denote utilization of capital k and labor ℓ , ξ_v and ξ_m are distribution parameters, and σ is the elasticity of substitution between value added and materials. Letting R_v and R_m be the shadow costs of a unit of value-added and materials, cost minimization implies:

$$d \log u \equiv \alpha_\ell d \log u_\ell + \alpha_k d \log u_k = d \log m - (\alpha_\ell d \log \ell + \alpha_k d \log k) - \sigma (d \log R_v - d \log R_m). \quad (\text{B.1})$$

Equation (B.1) says that when the growth of materials exceeds the weighted average growth of labor and capital, either the cost of materials must have risen by less than the cost of value-added or unobserved utilization of capital and labor must have risen. When production is Leontief between value-added and materials ($\sigma = 0$), any excess growth of materials over labor and capital must reflect unobserved utilization. We implement equation (B.1) in the Leontief case. Figure B.4 plots aggregate TFP along with the two measures of utilization. As the figure shows, the survey measure of utilization displays a similar drop between 2007 and 2011 with the drop observed in the Basu (1996) measure of utilization.

B.4 Alternative Measures of Wages and Wage Rigidity

Appendix B.4 reports alternative wage series. The wage data in this figure have not been detrended. The solid black line reports the measure used in the main analysis, equal to the ratio of total employee compensation to total employee hours worked. The dashed blue lines show the same wage concept separately for non-traded and traded industries. The dashed green line shows the labor cost index series for the total economy. The green triangles and diamonds show the labor

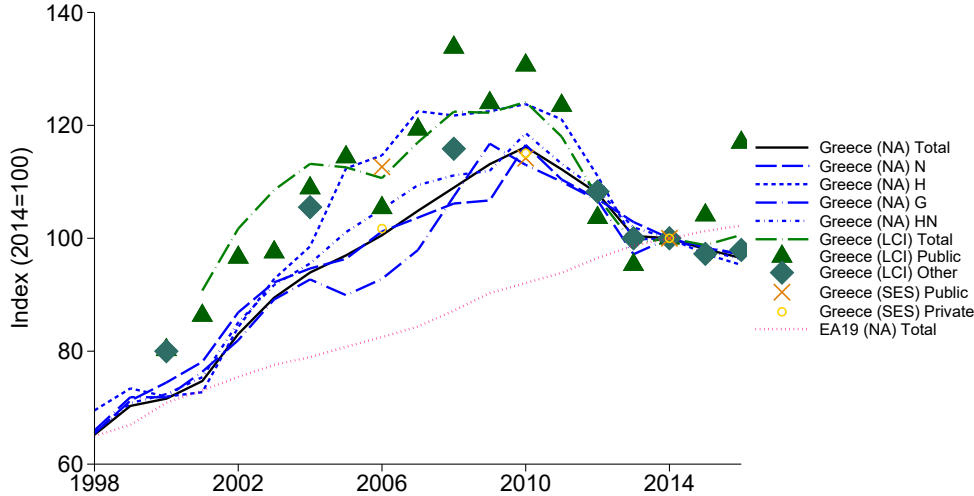


Figure B.5: Alternative Wage Series

Notes: The solid black line reports the ratio of total national accounts employee compensation to total employee hours worked. The dashed blue lines show the same wage concept separately for non-traded and traded industries. The dashed green line shows the labor cost index series for the total economy. The green triangles and diamonds show the labor cost indexes separately for public sector and private sector employees, respectively. The orange X and yellow o report public and private sector wages from the quadrennial Structure of Earnings Survey. The dotted pink line shows the national accounts wage measure for the total euro area.

cost indexes separately for public sector and private sector employees, respectively. The orange X and yellow o report public and private sector wages from the quadrennial Structure of Earnings Survey. Finally, for comparison the dotted pink line shows the national accounts wage measure for the total euro area.

We next examine changes in hourly wages (not detrended) in the bust for different types of workers. These changes come from the Structure of Earnings Survey, a large sample enterprise-level survey conducted every four years by Eurostat. The sampling frame includes all establishments with at least 10 employees, excluding public administration. Table B.1 reports hourly wage changes between 2010 and 2014, by worker age, skill, and position in the within age-skill wage distribution. Strikingly, nominal wage declines occur across age groups, skill categories, and in all parts of the wage distribution. These patterns militate against interpretations of the aggregate data focused only on compositional effects or changes specific to certain parts of the wage distribution that arise, for example, from changes in the statutory minimum wage.⁴

⁴However, we caution readers that higher frequency movements in aggregate wages could be more sensitive to compositional changes because lower-wage workers are the first to be laid off. For example, the EU KLEMS

Table B.1: Hourly Earnings Changes by Group

Category	2010 emp. share	2010 mean wage	Percent change by mean/quantile, 2010-2014:			
			Mean	Decile 1	Median	Decile 9
<i>All ages</i>						
Non manual workers	74.4	11.6	12.6	15.4	- 7.1	- 8.4
Skilled manual workers	15.4	10.3	14.8	17.9	11.6	14.4
Elementary occupations	10.3	7.4	18.9	22.8	27.2	- 7.6
Total	100.0	11.0	13.6	31.0	11.6	10.1
<i>Age less than 30</i>						
Non manual workers	78.7	7.4	22.5	40.7	24.2	18.0
Skilled manual workers	12.6	7.4	18.4	41.3	28.2	14.3
Elementary occupations	8.7	6.3	21.8	36.8	16.0	15.2
Total	100.0	7.3	22.8	40.4	24.1	24.2
<i>Age 30-39</i>						
Non manual workers	77.6	10.1	16.6	16.7	- 8.8	15.4
Skilled manual workers	13.9	9.1	14.0	32.7	17.5	16.3
Elementary occupations	8.5	6.9	18.0	22.5	24.5	- 9.1
Total	100.0	9.7	16.7	31.7	17.1	18.5
<i>Age 40-49</i>						
Non manual workers	73.6	12.8	14.1	25.4	14.5	11.9
Skilled manual workers	15.9	11.1	17.0	25.9	16.1	14.0
Elementary occupations	10.5	7.5	17.0	23.4	14.5	10.4
Total	100.0	12.0	14.7	21.6	13.8	14.0
<i>Age 50-59</i>						
Non manual workers	66.2	15.8	12.7	17.8	13.2	15.7
Skilled manual workers	19.6	12.5	17.0	28.5	14.6	20.2
Elementary occupations	14.2	8.2	19.6	27.1	18.9	13.6
Total	100.0	14.1	13.0	24.5	10.8	18.1
<i>Age greater than 59</i>						
Non manual workers	72.3	19.9	16.5	10.3	13.7	21.9
Skilled manual workers	14.6	9.5	- 6.1	39.0	15.6	7.7
Elementary occupations	13.1	7.8	19.9	29.0	15.0	19.6
Total	100.0	16.8	15.8	25.1	- 8.7	23.9

B.5 Alternative Measures of Exports and External Demand

This appendix reports alternative measures of value-added exports and external demand $\bar{a}_{T,t}$.

We first document why value-added and gross exports differ in Greece and show that value-added exports closely follow shipping exports. Figure B.6 plots several measures of Greek trade. Panel (a) compares value-added exports (VAX) as implied by equation (22) of the main text (the solid blue line) to two alternative measures of exports: value-added exports using the procedure of Johnson and Noguera (2012) applied to the World Input-Output Database (WIOD), as described in detail in Appendix B.8 (the dashed red line), and gross exports as reported in the national accounts (the dotted green line). Gross exports in the bust grow much faster than either measure of value-added exports.

Panel (b) plots gross exports in the shipping industry (dashed purple line) against our preferred measure of VAX (solid blue line). (For readability, VAX are shifted down relative to the axis labels by €17 billion.) The boom and bust in VAX closely follows the boom and bust in shipping exports. As described in the main text, Greece is a major global freight shipper and the global shipping industry experienced a substantial boom in the 2000s and bust beginning around 2008.

Panel (c) shows that gross and value-added exports differ quantitatively because of trade in oil. The panel splits gross exports into refined petroleum (CPA code 1920) and other, using COMEXT data from Eurostat. Total non-oil gross exports closely track the path of value-added exports in the bust. Thus, the difference between the performance of value-added and gross exports in the bust comes entirely from gross exports of refined petroleum.

Panel (d) shows why gross and value-added exports in the oil sector differ. Greece has a number of oil refineries that import crude and export refined petroleum. As a result, the €7.1 billion increase in Greek exports of refined petroleum between 2007 and the series peak in 2012 (solid gold line) is nearly matched by a €6.1 billion increase in crude imports (dashed orange line). Total nominal value added in the petroleum refining sector (NACE C19) rose by only €0.4 billion over this period (dotted black line). Thus, only a small part of the boom in exports of refined petroleum translated into demand for Greek capital and labor in the refining sector.

We next compare alternative measures of external demand \bar{a}_T . We can slightly rewrite the data shows in increase of 3.4 percent in labor quality between 2008 and 2010, which is characterized by a lack of aggregate wage decline.

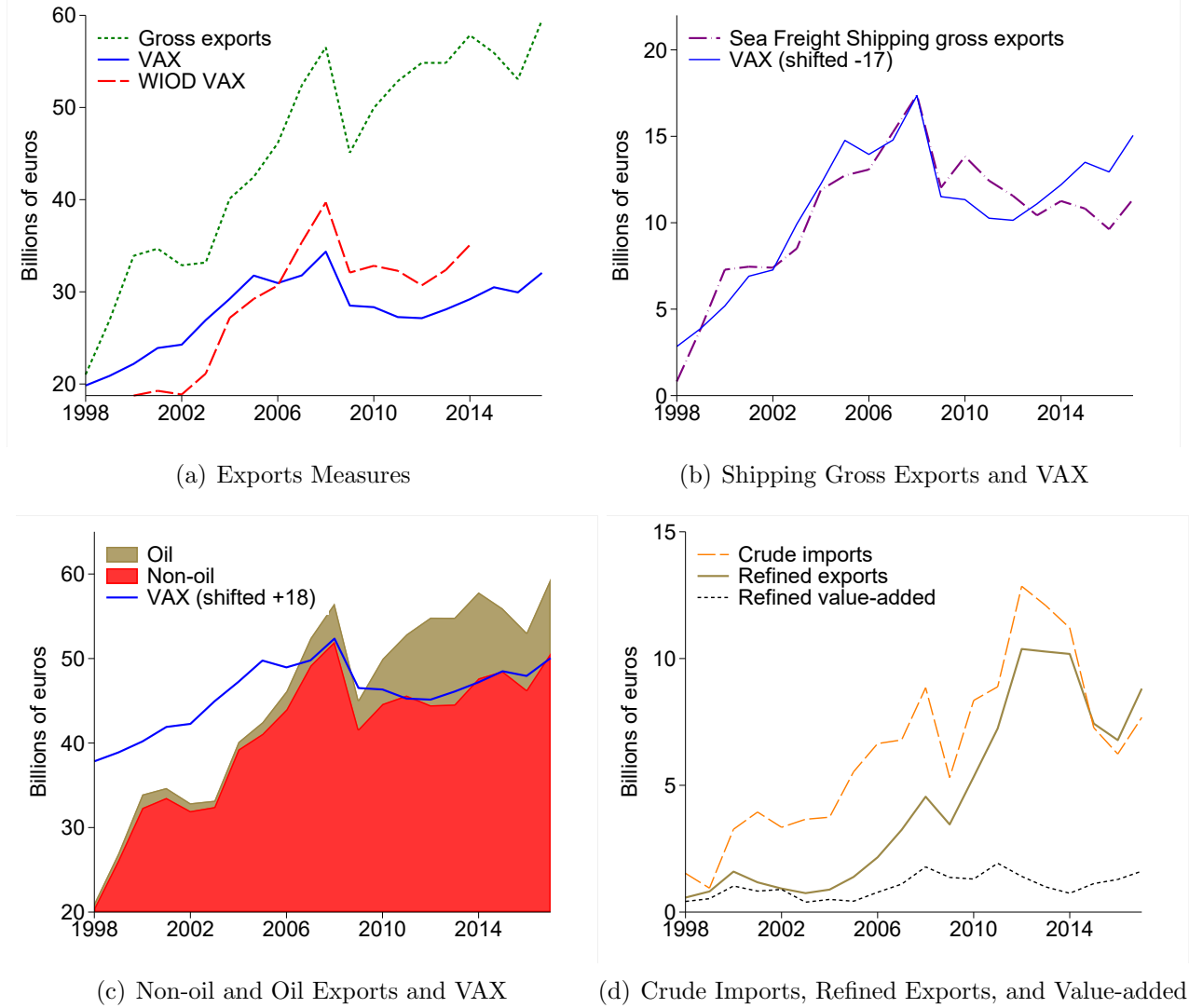


Figure B.6: Subcomponents of Exports

VAX stands for value-added exports and WIOD for the World Input-Output Database. Panel (a) compares VAX using the procedure described in equation (22) of the main text to the VAX obtained from applying the [Johnson and Noguera \(2012\)](#) procedure to the WIOD and to gross exports as reported in the national accounts. Panel (b) compares our preferred measure of VAX (shifted down relative to the axis labels by €17 billion for readability) to gross sea shipping exports. Panel (c) compares our preferred measure of VAX (shifted up relative to the axis labels by €18 billion for readability) to gross exports other than refined petroleum and exports of refined petroleum. Panel (d) plots gross imports of crude petroleum, gross exports of refined petroleum, and value-added in the oil refining sector.

measurement equation for \bar{a}_T as:

$$\bar{a}_{T,t} = \left[(1 - \gamma) \left(\frac{P_{H,t}}{P_{F,t}} \right)^{1-\eta} P_{F,t} \right]^{-1} EX_t, \quad (\text{B.2})$$

where $P_{H,t}$ is the price of Greek tradable goods, $P_{F,t}$ is the price of foreign tradable goods and also the foreign composite tradable good (since Greece is small), and EX_t is nominal Greece

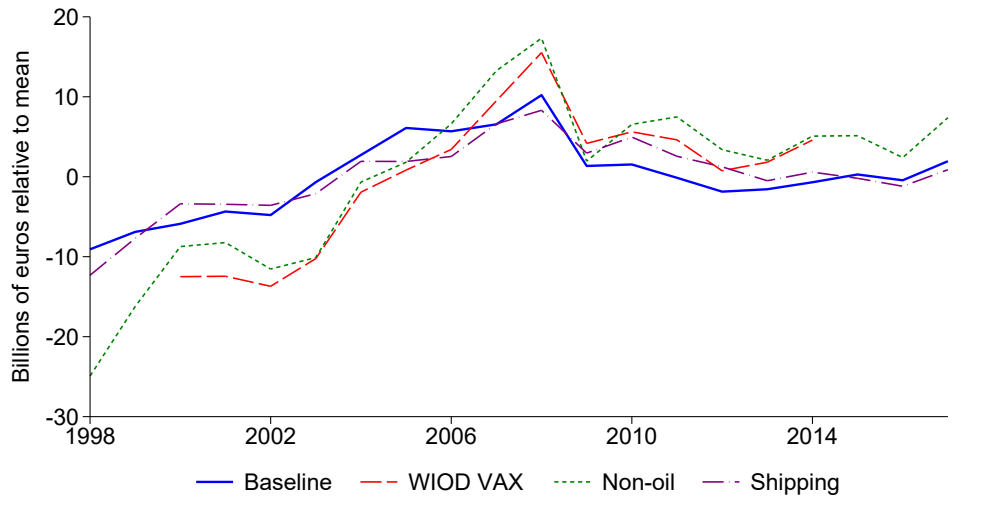


Figure B.7: Alternative Measures of \bar{a}_T

exports. This formula extends straightforwardly to the case of multiple types of traded goods. If we assume a common elasticity of substitution between domestic and foreign varieties η and that foreign sectoral prices remain in fixed proportion (so that we can ignore the elasticity of substitution across good types), we have that for any good i :

$$\bar{a}_{T,t} = \left[(1 - \gamma_i) \left(\frac{P_{H,t}(i)}{P_{F,t}(i)} \right)^{1-\eta} P_{F,t}(i) \right]^{-1} EX_t(i). \quad (\text{B.3})$$

Thus, we can alternatively obtain log deviations of \bar{a}_T from subsectors of tradables.

Figure B.7 plots four alternative measures of \bar{a}_T . The solid blue line shows the baseline measure. The dashed red line shows \bar{a}_T using value-added exports from the WIOD. The dotted green line shows \bar{a}_T using non-oil gross exports. The dashed purple line shows \bar{a}_T using gross exports of freight shipping and the relative price of shipping output.⁵ All four of these measures display similar behavior in the bust. Our baseline measure if anything minimizes the contribution of external demand in the boom, as it rises less than the measure based on non-oil exports or the WIOD.

B.6 Estimation of the Aggregate Disaster Probability

We follow Barro and Liao (2021) to recover the time series of disaster probabilities π_t^a from prices of far-out-of-the-money put options. Important assumptions in the Barro and Liao (2021) model

⁵Eurostat does not report a price index for shipping output for the euro area. Instead, we equate $P_F(\text{ship})$ with the output price of shipping in the Netherlands, another major European shipper.

are: (i) a representative agent with Epstein-Zin preferences; (ii) a downward jump component in the process for output; and (iii) a power law distribution of output loss conditional on a downward jump occurring.

Let $\Omega_{i,t}$ denote the price, expressed as a ratio to the date t stock price, of put option i at date t with strike S_i and remaining maturity $T_{i,t}$ in days. Let “moneyness” $M_{i,t}$ denote the ratio of S_i to the date t stock price. Equation (25) of Barro and Liao (2021) prices a put option with short enough maturity $T_{i,t}$ and low enough moneyness $M_{i,t}$ such that drift and diffusion components of the process for output growth have negligible effect on the option’s price:

$$\Omega_{i,t} = \left[\frac{\alpha L_0^\alpha}{(\alpha - \sigma)(1 + \alpha - \sigma)} \right] T_{i,t} M_{i,t}^{1+\alpha-\sigma} \pi_t^\alpha, \quad (\text{B.4})$$

where α is the Pareto coefficient for loss conditional on a disaster occurring, L_0 is the minimum disaster size, σ is the coefficient of relative risk aversion, and π_t^α is the daily disaster probability. Thus, the model predicts a unit elasticity of the option price with respect to time-to-maturity and an elasticity with respect to moneyness which is a function of the Pareto coefficient and risk aversion.

Our data contain the universe of put options traded on the Athens Stock Exchange between 2001 and 2017.⁶ Starting from the universe of transactions (53,121 observations), we keep only options on the FTSE/Athex Large Cap Index (renamed from FTSE/ATHEX 20 on December 3, 2012, 49,154 observations) and further follow Barro and Liao (2021) in restricting the estimation sample to options with maturity remaining of less than six months and moneyness less than 0.9 (4,025 observations). The estimation is robust to restricting maturity remaining to less than 60 or 30 days and to restricting to options at least 15 percent out of the money.

We take logs of equation (B.4) and estimate using OLS the log-linear equation:

$$\ln \Omega_{i,t} = b_T \ln T_{i,t} + b_M \ln M_{i,t} + d_{t_m} + \text{error}_{i,t}, \quad (\text{B.5})$$

where b_T and b_M are coefficients to be estimated and d_{t_m} is a month fixed effect.⁷ The model fits the data well. We estimate $\hat{b}_T = 1.16$, $\hat{b}_M = 5.82$, and obtain an $R^2 = 0.83$ and a “within” R^2

⁶These data are available for purchase from the exchange: <https://bit.ly/2S5g0dA> (last accessed November 29, 2018).

⁷With more data, we could estimate a date fixed effect d_t rather than a month fixed effect d_{t_m} . The month fixed effect constrains the date fixed effects to be the same for every day in a month.

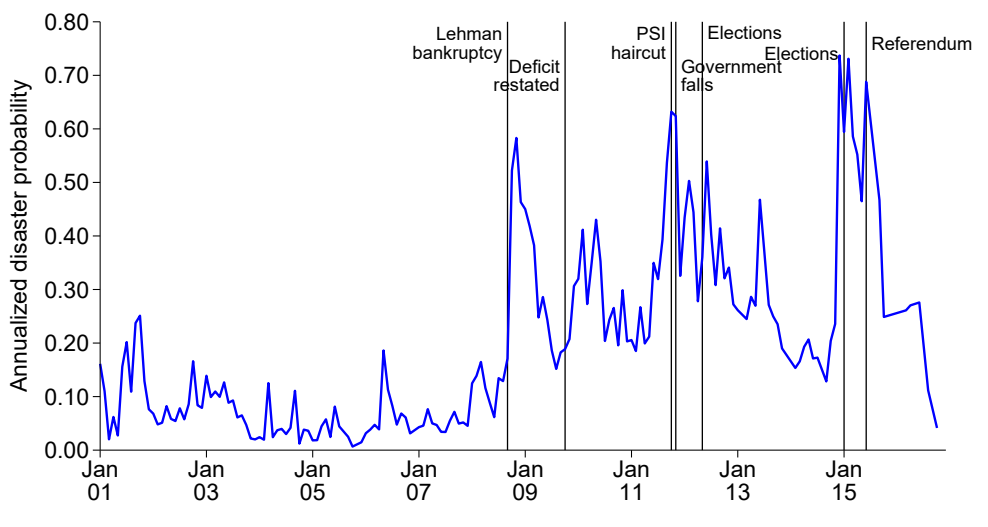


Figure B.8: Monthly Probability of Disaster

of 0.71. The estimate of \hat{b}_T is close to the theory-predicted value of one and our recovered time series of π_t^a changes little if we impose $b_T = 1$ in the estimation. The estimate of $\hat{b}_M = 5.82$ is nearly identical to the estimate reported in Barro and Liao (2021) of 5.83 pooling across the nine countries in their data (none of which is Greece).

The exponentiated fixed effect $\exp(d_{t_m})$ pins down changes over time but not the level of the disaster probability. To obtain the level requires parameterizing the term in brackets in equation (B.4). We follow Barro and Liao (2021) and assume a minimum size of disaster L_0 of 10 percent and a coefficient of risk aversion $\sigma = 3$. Matching coefficients in equation (B.4) and equation (B.5), we obtain $\alpha = \hat{b}_M + \sigma - 1 = 7.82$. Given this estimate of α , we then recover the bracketed term in equation (B.4) and back out monthly averages of daily disaster probability as $\pi_t^a = \exp(d_{t_m}) / \left[\frac{\alpha L_0^\alpha}{(\alpha - \sigma)(1 + \alpha - \sigma)} \right]$. We annualize these daily disaster probabilities and average across months in a year to arrive at the disaster probability series used in our analyses. Figure B.8 reports the monthly probabilities along with markers of important political and economic events. Finally, given the minimum size of disaster L_0 and our estimate of α , we recover a mean decline in output conditional on a disaster occurring equal 21 percent.

B.7 Measurement of Tax Rates

Greece levies taxes on transactions, individuals, corporations, and property. We allocate all tax receipts and actual social contributions into taxes on consumption, investment, labor, and capital.

The two largest revenue categories are taxes on production and imports (code D.2) that account for roughly 60 percent of tax receipts and current taxes on income and wealth (D.5) that account for roughly 40 percent of tax receipts. Taxes on production and imports less subsidies are allocated to consumption and investment, with the exception of property taxes paid by enterprises (D.29) which are allocated to capital income. From taxes on production and imports net of property taxes, we allocate to consumption the taxes that unambiguously fall into consumption such as excise duties, taxes on entertainment, lotteries, and gambling, taxes on insurance premiums, and other taxes on specific services. We then allocate the residual to consumption taxes and investment taxes in proportion to their expenditure shares and calculate the tax rates as:

$$\tau^c = \frac{\text{consumption taxes}}{\text{consumption} - \text{consumption taxes}}, \quad \tau^x = \frac{\text{investment taxes}}{\text{investment} - \text{investment taxes}}. \quad (\text{B.6})$$

The denominators subtract taxes from spending because in national accounts spending is at market prices and includes taxes.

Current taxes on individual's income fall on both labor and capital and current taxes on the income of corporations fall on capital. We measure the labor income tax rate τ^ℓ as the sum of the tax rate on social security contributions τ^{SS} and the tax rate on labor income net of social security contributions τ^{NL} , where:

$$\tau^{\text{SS}} = \frac{\text{social security contributions}}{\text{labor income}}, \quad \tau^{\text{NL}} = \tau^y \left(1 - \frac{\text{social security contributions}}{\text{labor income}} \right). \quad (\text{B.7})$$

Labor income in the denominators equals compensation of employees, which includes social security contributions, adjusted for the income of the self-employed that we allocate proportionally between labor and capital. For τ^{SS} , we use an average tax rate because contribution rates are generally flat within each occupation up to a cap that, according to the Statistics of Income (SOI), affects less than two percent of tax payers.

The tax rate τ^{NL} equals the fraction of labor income not subject to social security contributions taxed at the individual income tax rate τ^y , where:

$$\tau^y = \frac{2.08 \times (\text{taxes on individual income} - \text{taxes on dividends and interest})}{\text{GDP} - \text{production, imports taxes, contributions, depreciation, dividends, interest}}. \quad (\text{B.8})$$

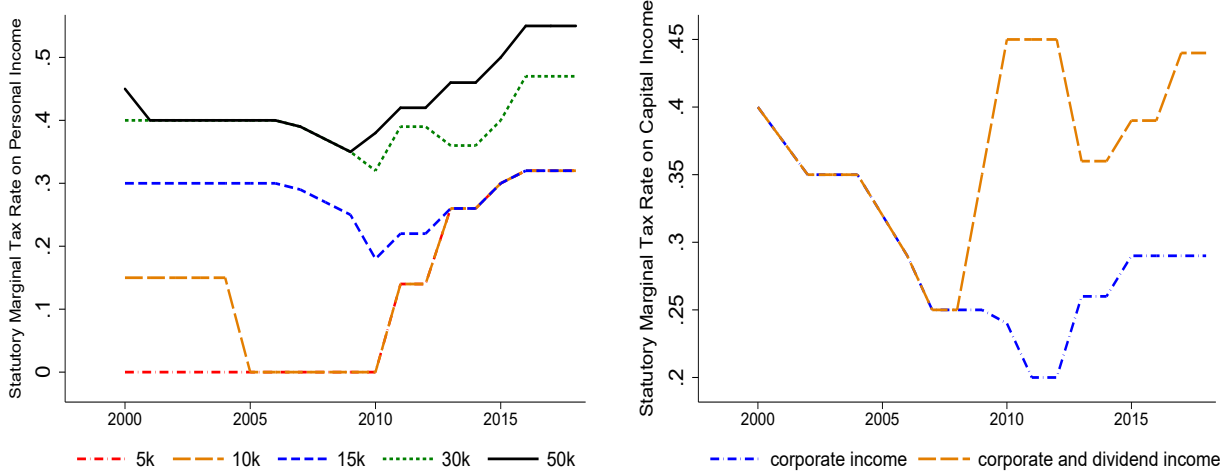
In Greece taxes are levied on individual income which consists of unambiguous labor income (such as income from salaried workers), unambiguous capital income (such as dividends, interest, and

rentals), and ambiguous income (such as income from self-employment, agriculture, and liberal professions). The denominator of equation (B.8) denotes taxable income which, in addition to taxes on production and imports, contributions, and depreciation, excludes dividends and interest because for those types of capital income we have independent information on their taxes and allocate them directly to capital taxes. The factor 2.08 represents our estimate of the gap between the average marginal tax rate and the average average tax rate.⁸

We measure capital tax rates τ_H^k and τ_N^k as capital tax payments divided by taxable capital income generated in each sector. There are six types of capital tax payments. Property taxes paid by households are allocated to the non-traded sector. Property taxes paid by corporations are allocated to each sector in proportion to its share of non-residential structures used in production. The other four categories, taxes on dividends and interest, income and capital gains taxes paid by corporations, taxes on capital income paid by households, and other capital taxes, are allocated to each sector in proportion to its share of capital income net of depreciation. Dividend and interest taxes are calculated as the product of their respective time-varying statutory tax rates with the size of dividends and interests from the national accounts. Income and capital gains taxes paid by corporations come directly from national accounts (in code D.51). Capital income taxes paid by individuals equals the product of the individual income tax rate τ^y in equation (B.8) with the share of net income accruing to capital. Other capital taxes (code D.91) include inheritance taxes, death duties, taxes on gifts, and capital levies. Finally, taxable capital income equals the capital share of GDP less net taxes on products and imports less depreciation.

In Figure B.9 we document the time series of statutory measures of taxes. Statutory tax rates on corporate income increased from 20 percent to 26 percent in 2013 and to 29 percent in 2017. Taxes for properties with objective values above 400,000 euros in 2011 and 200,000 in 2012 were introduced as part of the fiscal adjustment programs. In 2014, Greece introduced taxes on the unified property owned by individuals (ENFIA) without exemptions.

⁸To estimate this ratio, we use binned up data from the Statistics of Income (SOI) between 2006 and 2011. This ratio is relatively stable over time. The SOI data has not been publicly disclosed after 2011. Corporate income taxes are generally flat in Greece and, so, we focus on average capital tax rates. Using the SOI, we have confirmed that the ratio of marginal to average corporate income tax is close to one.



(a) Personal Income Tax Rates by Income Level

(b) Capital Tax Rates

Figure B.9: Statutory Labor and Capital Tax Rates

B.8 Estimation of the Trade Elasticity of Substitution

Aggregating equation (14) across retailers and using the corresponding expression for the demand for the foreign traded good, we obtain an expression relating relative expenditure on domestic and foreign traded goods and the relative prices of these bundles:

$$\ln(P_{H,t}a_{H,t}/P_{F,t}a_{F,t}) = \ln(\gamma/(1-\gamma)) + (1-\eta)\ln(P_{H,t}/P_{F,t}), \quad (\text{B.9})$$

where $a_{H,t}$ and $a_{F,t}$ denote Greek expenditure on the domestic and foreign traded goods, respectively. First differencing equation (B.9) and allowing for a normalizing constant and measurement error in relative absorption yields the estimating equation:

$$\Delta \ln(P_{H,t}a_{H,t}/P_{F,t}a_{F,t}) = b_0 + b_1\Delta \ln(P_{H,t}/P_{F,t}) + e_t, \quad (\text{B.10})$$

where $\eta = 1 - b_1$. The identifying assumption is that preferences for Greek versus foreign goods, γ in our notation, are stable over time and hence do not appear in the linearized equation (B.10).

We estimate equation (B.10) using Eurostat data and identifying F with the euro area. Since our model abstracts from intermediate inputs in production, the price indexes and quantities in equation (B.10) correspond to a value-added concept. Value-added price indexes for the Greek (H) and euro area (F) traded goods sector come directly from the national accounts. However, national accounts do not report either value-added exports or imports. We extend the procedure in [Johnson and Noguera \(2012\)](#) and apply it to the World Input-Output Database (WIOD) described to

recover Greek value-added exports to and imports from the euro area.⁹ Estimating equation (B.10) over the period 2000-14, the maximum sample for which we have data from the WIOD, yields $\eta = 1.65$ with standard error equal to 0.25.

We now describe the [Johnson and Noguera \(2012\)](#) procedure for obtaining value-added exports to and imports from the euro area. The key equation is the (nominal) market-clearing condition:

$$\mathbf{Q} = \sum_j (\mathbf{I} - \mathbf{M})^{-1} \mathbf{c}_j, \quad (\text{B.11})$$

where \mathbf{Q} is an $NS \times 1$ vector of nominal gross output in each industry $s \in S$ and country $j \in N$, \mathbf{c}_j is an $NS \times 1$ vector of final demand in country j of output from each country-sector, \mathbf{M} is a global input-output matrix with generic entry given by the share of intermediate goods produced in sector s in country j used in sector s' of country i as a share of output of sector s' in country i , and we have dropped time subscripts for simplicity since the relationship in equation (B.11) holds statically. Under the assumption that the value-added content of an industry does not depend on whether the output is used domestically or exported, one can pre-multiply both sides by a diagonal matrix \mathbf{R} of value-added shares of gross output in each country-sector to obtain:

$$\mathbf{P}\mathbf{y} = \mathbf{R} \sum_j (\mathbf{I} - \mathbf{M})^{-1} \mathbf{c}_j, \quad (\text{B.12})$$

where $\mathbf{P}\mathbf{y}$ is the vector of nominal value-added. Total value-added exports from Greece are then:

$$P_H a_H^* = \iota'_{Greece} \mathbf{R} \sum_{j \neq Greece} (\mathbf{I} - \mathbf{M})^{-1} \mathbf{c}_j, \quad (\text{B.13})$$

where ι_j is an $NS \times 1$ selection vector with a value of one in the rows corresponding to the traded sectors in country j and zeros elsewhere.¹⁰ Greek value-added absorption of Greek traded goods is:

$$P_H a_H = P_H y_H - P_H a_H^*. \quad (\text{B.14})$$

Similarly, we obtain Greek value-added imports from the euro area as:

$$P_F a_F = \sum_{j \in euro \text{ area}} \iota'_j \mathbf{R} (\mathbf{I} - \mathbf{M})^{-1} \mathbf{c}_{Greece}. \quad (\text{B.15})$$

⁹For a description of the WIOD, see Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R. and de Vries, G. J. (2015), "An Illustrated User Guide to the World InputOutput Database: the Case of Global Automotive Production", *Review of International Economics* 23: 575605.

¹⁰In practice, we sum over the sectors which we include in the traded sector aggregate, even though other sectors may have small but positive value-added exports.

We make five remarks on the estimation of η . First, most Greek trade occurs with partners outside of the euro area. This fact does not invalidate the above procedure, because equation (B.9) follows directly from a first order condition for the relative expenditure between any two bundles of goods available to Greeks. Second, our model assumes the same elasticity governs both imports and exports. In that case, one can also estimate η using relative absorption of Greek and euro area products by euro area residents. Using the WIOD data, we obtain an almost identical coefficient of 1.64 for this specification (standard error 0.80). Third, two recent papers have raised criticisms of regressions designed to uncover the Armington elasticity. Imbs and Mejean (2015) argue that elasticity estimates based on aggregate data may understate the true elasticity because most aggregate variation comes from sectors with volatile prices which may also have low elasticities.¹¹ In our data, however, the aggregate elasticity exceeds the weighted mean sectoral elasticity, which is almost exactly unity. Feenstra, Luck, Obstfeld, and Russ (2018) argue the relevant elasticity in most models is that between domestic goods and imports but many papers instead estimate an elasticity across exports from different countries.¹² Equation (B.10) directly estimates the appropriate elasticity as advocated by Feenstra, Luck, Obstfeld, and Russ (2018). Fourth, we prefer the first-differenced specification (B.10) because any changes to preferences likely accumulate over time, making the levels specification (B.9) more vulnerable to mis-specification. Nonetheless, estimating the equation in levels implies a slightly lower estimate of η of 1.25 (standard error 0.15). Fifth, the WIOD does not measure local purchases by non-residents and hence the WIOD VAX measure excludes tourism exports. Effectively, we impute the same elasticity to the tourism sector as we obtain for other traded sectors.

We obtain γ as the sample average ratio of domestic absorption of domestic traded to domestic absorption of all traded, where we first normalize each variable by domestic output:

$$\gamma = \left[\left(\frac{P_{H,t} y_{H,t}}{P_t y_t} \right) - \left(\frac{\overline{a_{H,t^*}}}{P_t y_t} \right) \right] / \left(\frac{P_{H,t} a_{H,t}}{P_t y_t} \right).$$

Here, since γ depends on properly measuring the level of Greek absorption of Greek traded value-added, we add to the WIOD VAX Greek tourism exports reported in the Balance of Payments

¹¹Imbs, J., and I. Mejean (2015): “Elasticity Optimism,” *American Economic Journal: Macroeconomics*, 7(3), 43-83.

¹²Feenstra, R. C., P. Luck, M. Obstfeld, and K. N. Russ (2018): “In Search of the Armington Elasticity,” *The Review of Economics and Statistics*, 100(1), 135-150.

scaled by the ratio of value-added to gross output in accommodation and food services to arrive at a measure of value-added exports.

B.9 Summary of Data Sources

Table B.2 describes the construction of the variables used as observables in the estimation. Table B.3 describes the construction of the driving forces. Table B.4 provides sources of some auxiliary variables used in the construction of the observables and driving forces.

C Additional Results

In this appendix we present additional results from the model.

- Table C.1 presents the persistence and standard deviation of the exogenous stochastic processes. Due to rounding some processes are displayed with a persistence of one in the table. We set to 0.999 the persistence of processes estimated to be above 0.999.
- Table C.2 presents the priors used in the estimation and various other statistics of the parameter estimates.
- Table C.3 presents parameter estimates under a higher prior mean for the adjustment costs of prices and wages. Figure C.1 shows the model-generated paths of variables under the parameters estimated with these higher mean priors.
- Figure C.2 reports time series of outcomes when we decrease the prior mean and prior standard deviation of the variance of the measurement error uniformly for all observables by a factor of 5. Figure C.3 reports time series of outcomes when we decrease the prior mean and prior standard deviation of the variance of the measurement error of only prices and wages by a factor 5. Figure C.4 reports time series of outcomes when we decrease the prior mean and prior standard deviation of the variance of the measurement error of only wages by a factor 5.
- Table C.4 reports parameter estimates when we estimate the model allowing for serially correlated measurement error on observables. Figure C.5 reports time series of outcomes when

Table B.2: Observable Outcomes

Variable	Description	Source
ℓ_H, ℓ_N	Sectoral labor	Eurostat nama_10_a64_e, item EMP_DC (total employment, domestic concept), thousands of hours worked
TFP_H, TFP_N	Sectoral TFP	$y_i / (\ell_i^{1-\alpha} K S_i^\alpha)$, $i \in \{H, N\}$ (see Appendix B.3)
u_H, u_N	Sectoral utilization	Joint Harmonised European Union Industry Survey and Joint Harmonised European Union Services Survey, questions INDU13QPS, SERV8QPS, SERV7F1S. See Appendix B.3.
\tilde{s}	Capital share in tradeable sector	$\tilde{k}_H / (\tilde{k}_H + \tilde{k}_N)$
c	Real consumption	Eurostat nama_10_gdp, item P31.S14.S15 (household and NPISH final consumption expenditure)
$P_N c_N$	Nominal non-tradeable consumption expenditure	$P_N y_N - (P_N g_N^c + P_N g_N^x + P_N x_N)$
x_N	Private purchases of non-tradeable investment	Construction investment (Eurostat nama_10_nfa_fl, asset N11KG) scaled by the value-added share of gross output in the construction sector (Eurostat nama_10_a64, NACE_r2 F, item B1G divided by item P1)
x_T	Private purchases of tradeable investment	Total private investment (Eurostat nama_10_gdp, item P51G less gov_10a_main, sector S13, item P51G) less construction investment (Eurostat nama_10_nfa_fl, asset N11KG) scaled by the value-added share of gross output in the construction sector (Eurostat nama_10_a64, NACE_r2 F, item B1G divided by item P1)
P_H, P_N	Sectoral producer price	Eurostat nama_10_a64, item B1G
W	Wage	National account wages and salaries (Eurostat nama_10_a10, NACE_r2 TOTAL, item D1) divided by total employment hours (Eurostat nama_10_a10_e, NACE_r2 TOTAL, item SAL_DC)
$\Pi^f / (P_y y)$	Profits/GDP	Bank of Greece financial accounts, non-financial corporates, dividends paid minus equity issuances over value added by non-financial corporates
N	Net worth in banking sector	Bank of Greece financial accounts, monetary financial institutions excluding Bank of Greece, net financial assets + listed shares + unlisted shares and other equity + investment fund shares

Table B.3: Driving Forces

Variable	Description	Source
z_H, z_N	Sectoral productivity	$TFP_i/u_i, i \in \{H, N\}$
\bar{a}_T	External demand	$\left[(1 - \gamma) \left(\frac{P_H}{P_F} \right)^{1-\eta} P_F \right]^{-1} EX$
P_F	Foreign price level	Eurostat nama_10_a64, geography EA19, item B1G
T^g	Capital transfers from structural funds	Historic EU payments, https://bit.ly/2RLZk6d
T^l	Debt misperception	General government Maastricht Treaty definition gross debt at the end of year t as reported in April of $t + 1$ to the European Commission and the value reported for year t in 2019, https://bit.ly/3vtDHG1 and OECD Economic Outlook variable GGFLM
\bar{B}^g	Government debt held by rest of the world	$B^g - (B^g - \bar{B}^g)$
\bar{B}^r	Borrowing limit of r agents	Bank of Greece financial accounts, Households and Non-profit Institutions, short-term loans + accounts payable
\bar{r}	Interest rate on government debt	Net interest payments (Eurostat gov_10a_main, sector S13, item D41PAY less D41REC)/ B^g
\bar{i}	Bank deposit rate	Time deposits with maturity up to 1 year (ECB key MIR.M.GR.B.L22.F.R.A.2230.EUR.N)
T_W^b	Capital gain/loss on banks' rest-of-world assets	Bank of Greece financial accounts, Monetary Financial Institutions Excluding Bank of Greece, Assets, sector rest of world, short-term debt + long-term debt + short-term loans + long-term loans + listed shares + unlisted shares and other equity + investment fund shares, first difference in asset levels less asset-flows
$T_{G,d}^b$	Capital gain/loss on banks' holdings of sovereign debt	Change in market minus book value of sovereign holdings plus realized write-downs. Market value: $B^g - \bar{B}^g$. Book value: Bank of Greece, Monetary and Banking Statistics, Aggregate Balance Sheet of MFIs excluding Bank of Greece, Claims on non MFIs, Domestic, General Government. Write-downs: August 2011, 4 billion euro, January 2012, 5.8 billion euro, March 2012, 15.2 billion euro, April 2012, 4.1 billion euro.
$T_{G,e}^b$	Equity injections from government to banks	Bank of Greece financial accounts, Monetary Financial Institutions Excluding Bank of Greece, Liabilities-Flows, General government listed shares + unlisted shares and other equity

Driving Forces, continued

Variable	Description	Source
g_T^c	Real government purchases of tradeable consumption	Government intermediate consumption expenditure (Eurostat gov_10a_main, sector S13, item P2) deflated by intermediate inputs price index for O-Q and scaled by share of intermediate inputs from H sector in NACE_r2 O-Q in 2010-2012 input-output table naio_10_cp16
g_N^c	Real government purchases of non-tradeable consumption	Total government final consumption expenditure (Eurostat nama_10_gdp, item P3_S13) less g_T^c
g_T^x	Real government purchases of tradeable investment	Total government investment expenditure (gov_10a_main, sector S13, item P51G) deflated by investment price index, less g_N^x
g_N^x	Real government purchases of non-tradeable investment	$P_N g_N^x$ deflated by construction investment price index
T^r	Government transfers to r households	Government social benefits (Eurostat gov_10a_main, sector S13, item P62PAY)
τ^c	Consumption tax	Annual national accounts Tables 1 and 10
τ^x	Investment tax	Annual national accounts Tables 1 and 10
τ^ℓ	Labor income tax	Annual national accounts Tables 10 and 14
τ_H^K	Capital income tax in the tradeable sector	Annual national accounts Tables 10 and 14
τ_N^K	Capital income tax in the non-tradeable sector	Annual national accounts Tables 10 and 14
κ_τ	Firm tax pre-payment	Tax laws 2238/1994, 3697/2008, and 4334/2015
π^θ	Idiosyncratic disaster risk probability	12 month plus unemployment rate (Eurostat lfsa_ugad, age Y20-64)
π^a	Aggregate disaster risk probability	Athens Stock Exchange option prices and Barro and Liao (2021) . See Appendix B.6

Table B.4: Auxiliary Definitions

Variable	Description	Source
H	Tradeables produced by Greece	NACE_r2 A-C,H49,H50,H51,I,N79
N	Non-tradeables	NACE_r2 D-G,H52,H53,J-M,N77,N78,N80_N82,O-S
$P_N g_N^c$	Nominal government non-tradeable consumption purchases	Total government final consumption expenditure (gov_10a_main, sector S13, item P3) less intermediate consumption expenditure (gov_10a_main, sector S13, item P2) scaled by share of intermediate inputs from H sector in NACE_r2 O-Q in 2010-2012 input-output table naio_10_cp16
$P_T g_T^x + P_N g_N^x$	Nominal government investment purchases	Eurostat gov_10a_main, sector S13, item P51G
$P_T x_T + P_N x_N$	Nominal private investment purchases	Eurostat nama_10_gdp,item P51G less $(P_T g_T^x + P_N g_N^x)$
$P_N g_N^x$	Nominal government non-tradeable investment purchases	Total government construction investment $((P_T g_T^x + P_N g_N^x) \times \text{construction share from nama_10_nfa_fl, sectors O-Q, asset N11KG/N11G})$ scaled by the value-added share of gross output in the construction sector (Eurostat nama_10_a64, NACE_r2 F, item B1G divided by item P1)
$P_N x_N$	Nominal private investment purchases from non-tradeable sector	Total construction investment (Eurostat nama_10_nfa_fl, asset N11KG) scaled by the value-added share of gross output in the construction sector (Eurostat nama_10_a64, NACE_r2 F, item B1G divided by item P1) less $P_N g_N^x$
$P_T y_T, P_N y_N$	Sectoral nominal value-added	Eurostat nama_10_a64 item B1G
$\tilde{P}_{x,j}$	Price of investment of type j	Eurostat nama_10_nfa_st, assets $j \in \{N11KN, N11MN, N115N, N117N\}$
$(1 + \tau^C) P_c c$	Nominal consumption expenditure	Eurostat nama_10_gdp, item P31.S14.S15 (household and NPISH final consumption expenditure)
$\tilde{k}_{H,j}, \tilde{k}_{N,j}$	Sectoral replacement cost capital stock of type j	$\tilde{k}_{i,j,t} / \tilde{P}_{x,j,t} = (1 - \delta_j) \tilde{k}_{i,j,t-1} / \tilde{P}_{x,j,t-1} + x_{i,j,t}, i \in \{H, N\}$
\tilde{k}_H, \tilde{K}_N	Sectoral replacement cost capital stock	$\sum_j \tilde{k}_{i,j}, i \in \{H, N\}$
KS_H, KS_N	Capital services	$\sum_j (r + \delta_j) \tilde{K}_{i,j}, i \in \{H, N\}$
P_T	Price index of tradeable absorption	$(\gamma P_H^{1-\eta} + (1 - \gamma) P_F^{1-\eta})^{\frac{1}{1-\eta}}$
EX	Value-added exports	$P_H y_H - \gamma (P_H / P_T)^{1-\eta} \times (P_c c - P_N c_N + P_T x_T + P_T g_T^x)$
B^g	Total government debt	Bank of Greece financial accounts, General Government, Liabilities, short-term debt securities + long-term debt securities + short-term loans + long-term loans + other accounts payable less Assets, Currency and deposits + short-term debt securities + long-term debt securities + short-term loans + long-term loans
$B^g - \bar{B}^g$	Government debt held by Greek banks	Bank of Greece financial accounts, Monetary Financial Institutions Excluding Bank of Greece, Assets, sector S13, short-term debt + long-term debt + short-term loans + long-term loans

we estimate the model allowing for serially correlated measurement error on observables. Tables C.5 and C.6 report the sources of the boom and bust under the new parameters with serially correlated measurement error on observables. For these results, we treat the persistence of the measurement errors as additional parameters, and estimate these parameters jointly with other parameters of the model.

- Table C.7 reports parameter estimates when we estimate the model allowing for contemporaneously correlated measurement error on observables. Figure C.6 reports time series of outcomes when we estimate the model allowing for contemporaneously correlated measurement error on observables. Tables C.8 and C.9 report the sources of the boom and bust under the new parameters with contemporaneously correlated measurement error on observables. For these results, we treat the contemporaneous correlations of the measurement errors as fixed parameters, because estimating all correlations proves too computationally demanding. The assigned values of these correlations equal the correlations of the measurement errors that we calculate ex-post in the baseline estimation, which assumed uncorrelated measurement errors.
- Table C.10 presents the correlation between data and model variables and R-squared coefficients from a regression of data on model variables.
- Figure C.7 presents labor, investment, and utilization time series by sector in the model and the data.
- Figure C.8 shows the time series of outcomes when we estimate the model under the restriction that the parameter on nominal wage rigidity $\psi_W = \infty$ between 2008 and 2010. We treat the changes in 2008 and 2011 in ψ_W as unanticipated. Wages are not exactly constant because we specify the rigidity in terms of after-tax wages and taxes are time varying. Table C.11 reports the sources of the bust when we restrict $\psi_W = \infty$ between 2008 and 2010.
- Tables C.12 and C.13 presents the sources of the boom and the bust under the alternative assumption that government spending adjusts to balance the budget. For this exercise, we fix lump-sum transfers to the optimizing household T^o to a constant and adjust the five

spending variables, $g_T^c, g_N^c, g_T^x, g_N^x, T^r$ proportionally to their size in steady state to balance the budget in every period. Thus, only relative government spending matters for the sources of the boom and the bust.

- Table C.14 presents the sources of macroeconomic dynamics in the first part of the bust (2007-2012).
- Table C.15 presents the sources of the boom and the bust under alternative parameters.
- Figure C.9 presents the differences in variables between the counterfactual fiscal adjustment and the baseline in Figure 5 along with their 90 percent confidence intervals.
- Table C.16 reports 90 percent confidence intervals for the fiscal and revenue multipliers at horizon $h = 7$.
- Table C.17 reports the fiscal and revenue multipliers for various horizons.
- Table C.18 reports multipliers under various financing systems and horizons.
- Table C.19 reports fiscal multipliers financed with lump sum transfers T^o at horizon $h = 1$ for various alternative parameter values.
- Table C.20 reports fiscal multipliers financed with lump sum transfers T^o at horizon $h = 7$ for various alternative parameter values.
- Table C.21 reports fiscal multipliers financed initially with deficit \bar{B}^g and then with lump sum transfers T^r and T^o at horizon $h = 1$ for various alternative parameter values.
- Table C.22 reports fiscal multipliers financed initially with deficit \bar{B}^g and then with lump sum transfers T^r and T^o at horizon $h = 7$ for various alternative parameter values.
- Figure C.10 presents the differences in variables between the counterfactual path of fiscal policy and the baseline in Figure 6 along with their 90 percent confidence intervals.
- Figure C.11 presents the differences in variables between the counterfactual path without external bailout of the Greek government and the baseline in Figure 7 along with their 90 percent confidence intervals.

- Figure C.12 presents the differences in variables between the counterfactual path without bailout of domestic banks and the baseline in Figure 8 along with their 90 percent confidence intervals.

Table C.1: Persistence and Volatility of Exogenous Processes

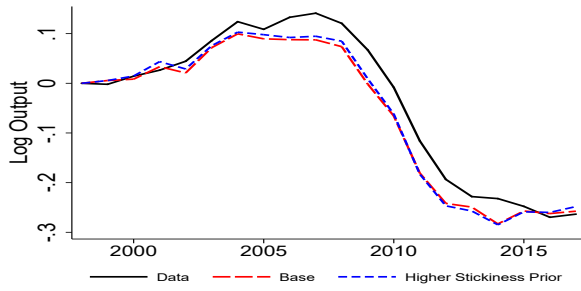
Exogenous process	Persistence	Standard Deviation
$\log z_H$ productivity, traded	0.71	0.02
$\log z_N$ productivity, non-traded	0.56	0.04
$\log \bar{a}_T$ external demand	0.81	0.07
$\log P_F$ price of foreign traded goods	0.54	0.01
T^g capital transfer	0.92	0.01
\bar{T}^l transfer anticipation, persistent	1.00	0.01
\hat{T}^l transfer anticipation, transitory	0.00	0.11
$\log \bar{B}^g$ government debt	0.73	0.13
$\log \bar{B}^r$ rule-of-thumb debt	0.85	0.10
\bar{r} government interest rate	0.87	0.01
\bar{i} private interest rate	0.64	0.01
T_W^b rest of the world asset valuation	-0.05	0.02
T_{Gd}^b sovereign debt valuation	-0.08	0.04
T_{Ge}^b bank equity injection	-0.08	0.04
$\log g_T^c$ government consumption, traded	0.89	0.12
$\log g_T^x$ government investment, traded	0.82	0.23
$\log g_N^c$ government consumption, non-traded	1.00	0.03
$\log g_N^x$ government investment, non-traded	0.76	0.28
$\log T^r$ transfers to rule-of-thumb	0.85	0.06
τ^c tax rate on consumption	0.91	0.01
τ^x tax rate on investment	1.00	0.01
τ^ℓ tax rate on labor	0.86	0.02
τ_H^k tax rate on capital, traded	0.84	0.03
τ_N^k tax rate on capital, non-traded	1.00	0.03
κ_τ prepayment fraction	0.96	0.08
π^θ probability of idiosyncratic disaster	1.00	0.02
π^a probability of aggregate disaster	0.76	0.12

Table C.2: Parameter Estimates

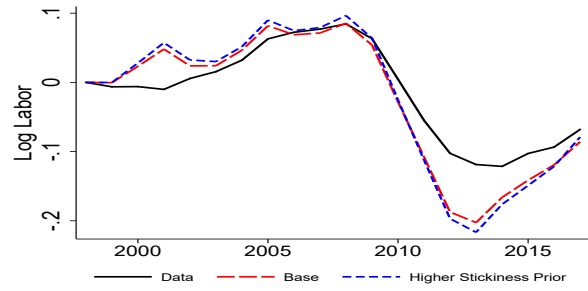
Parameter	Priors				Posteriors		
	Distribution	Support	Mean	St. Deviation	Mean	Median	90 Percent Interval
ρ	Beta	[0, 2]	0.50	0.40	0.97	0.97	[0.81,1.14]
ϕ	Gamma	(0, ∞)	0.44	0.40	3.17	3.14	[2.21,4.16]
ϵ	Gamma	(0, ∞)	1.50	0.75	1.16	1.06	[0.44,1.88]
κ_x	Beta	[0, 1]	0.50	0.20	0.59	0.60	[0.39,0.80]
κ_ℓ	Beta	[0, 1]	0.50	0.20	0.06	0.06	[0.01,0.10]
ζ	Beta	[0, 1]	0.23	0.13	0.34	0.35	[0.21,0.47]
φ^θ	Beta	[0, 1]	0.20	0.04	0.16	0.16	[0.14,0.17]
ξ_H	Gamma	(0, ∞)	7.00	1.00	3.12	3.11	[2.89,3.34]
ξ_N	Gamma	(0, ∞)	7.00	1.00	3.75	3.72	[3.30,4.16]
δ_b	Beta	(0, ∞)	0.50	0.20	0.70	0.71	[0.53,0.90]
ψ_π	Gamma	(0, ∞)	0.50	0.25	0.60	0.55	[0.14,1.04]
ψ_x	Gamma	(0, ∞)	7.00	2.00	6.28	6.12	[3.71,8.74]
ψ_ℓ	Gamma	(0, ∞)	1.00	0.25	1.52	1.50	[1.00,2.02]
$\psi_{H,p}$	Gamma	(0, ∞)	40.0	25.0	79.3	76.0	[39.5,119.0]
$\psi_{N,p}$	Gamma	(0, ∞)	40.0	25.0	36.5	35.3	[18.3,53.7]
ψ_w	Gamma	(0, ∞)	40.0	25.0	78.4	74.8	[43.1,112.5]

Table C.3: Parameter Estimates with Higher Prior Means for Price and Wage Adjustment Costs

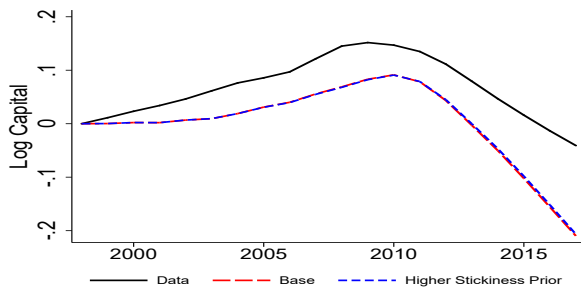
Parameter	Priors				Posteriors		
	Distribution	Support	Mean	St. Deviation	Mean	Median	90 Percent Interval
ρ	Beta	[0, 2]	0.50	0.40	0.97	0.97	[0.81,1.13]
ϕ	Gamma	(0, ∞)	0.44	0.40	3.64	3.59	[2.57,4.67]
ϵ	Gamma	(0, ∞)	1.50	0.75	0.89	0.83	[0.43,1.38]
κ_x	Beta	[0, 1]	0.50	0.20	0.56	0.58	[0.29,0.79]
κ_ℓ	Beta	[0, 1]	0.50	0.20	0.06	0.05	[0.01,0.10]
ζ	Beta	[0, 1]	0.23	0.13	0.31	0.31	[0.18,0.44]
φ^θ	Beta	[0, 1]	0.20	0.04	0.16	0.16	[0.14,0.17]
ξ_H	Gamma	(0, ∞)	7.00	1.00	3.21	3.19	[2.96,3.48]
ξ_N	Gamma	(0, ∞)	7.00	1.00	3.93	3.88	[3.40,4.44]
δ_b	Beta	(0, ∞)	0.50	0.20	0.66	0.68	[0.39,0.89]
ψ_π	Gamma	(0, ∞)	0.50	0.25	0.62	0.57	[0.14,1.09]
ψ_x	Gamma	(0, ∞)	7.00	2.00	6.63	6.42	[3.76,9.29]
ψ_ℓ	Gamma	(0, ∞)	1.00	0.25	1.54	1.52	[1.03,2.06]
$\psi_{H,p}$	Gamma	(0, ∞)	100.0	25.0	110.8	108.7	[72.5,148.1]
$\psi_{N,p}$	Gamma	(0, ∞)	100.0	25.0	66.6	65.1	[42.4,90.4]
ψ_w	Gamma	(0, ∞)	100.0	25.0	101.9	99.6	[67.5,136.2]



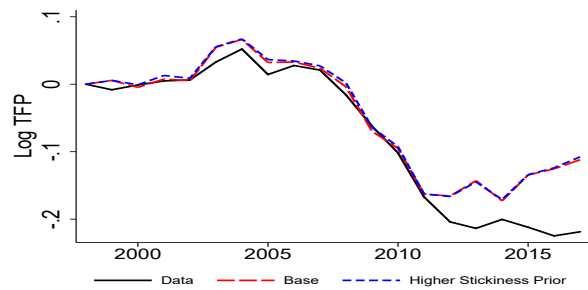
(a) Time Series of y



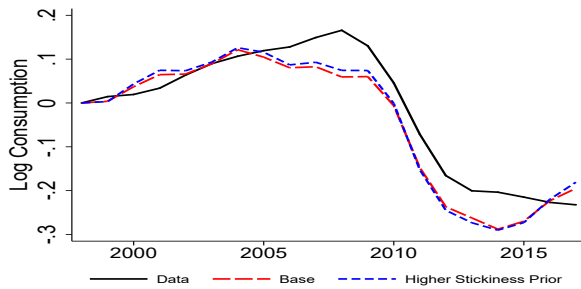
(b) Time Series of ℓ



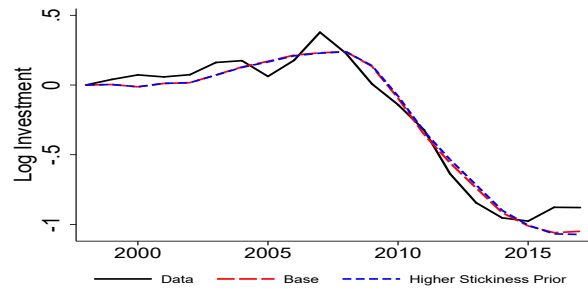
(c) Time Series of \tilde{k}



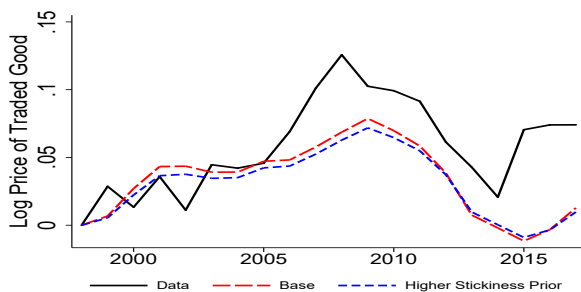
(d) Time Series of TFP



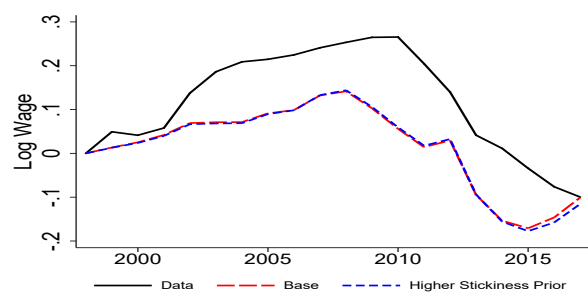
(e) Time Series of c



(f) Time Series of x

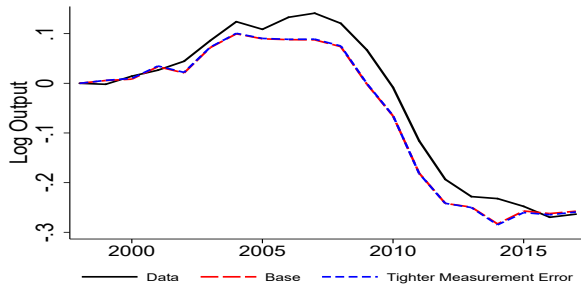


(g) Time Series of P_H

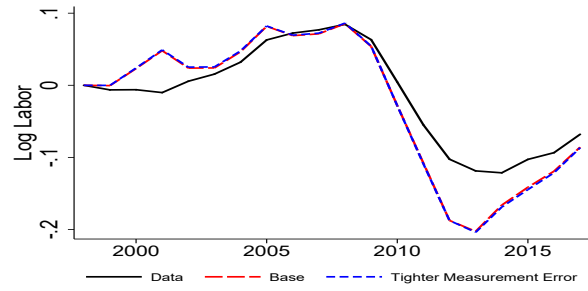


(h) Time Series of W

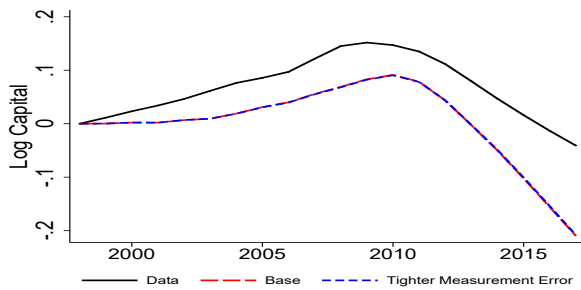
Figure C.1: Path of Variables with Higher Priors Means for Price and Wage Adjustment Costs



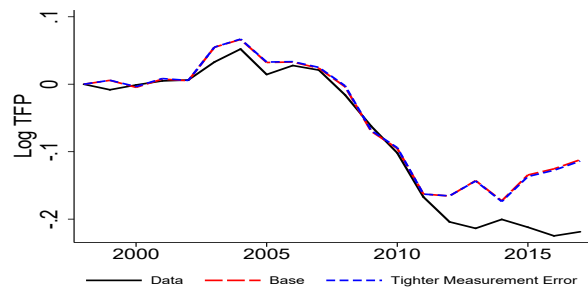
(a) Time Series of y



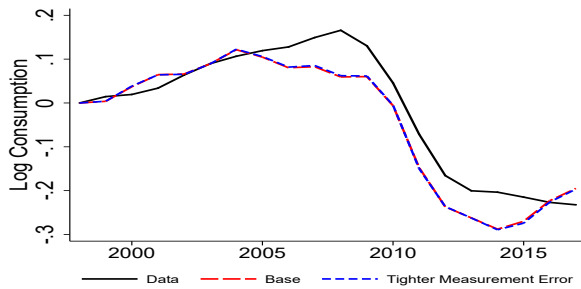
(b) Time Series of ℓ



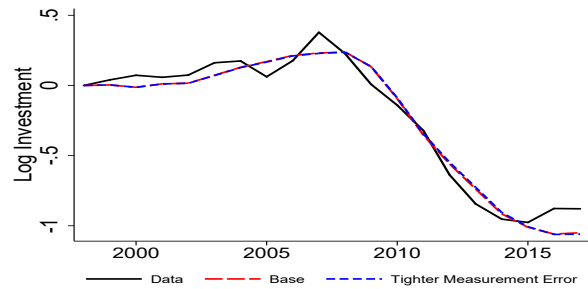
(c) Time Series of \tilde{k}



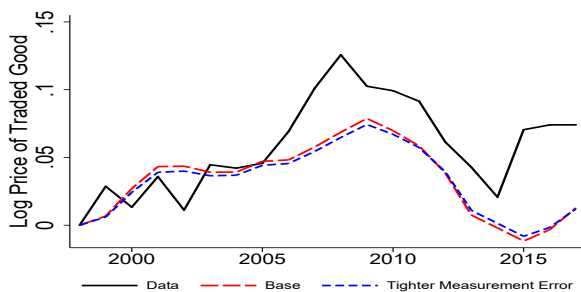
(d) Time Series of TFP



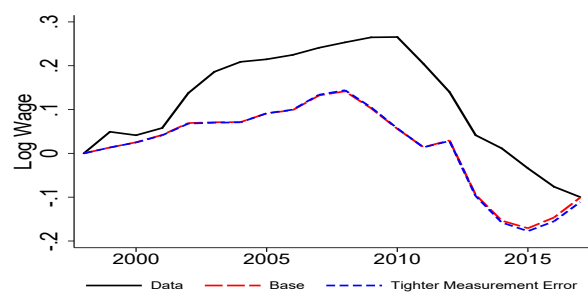
(e) Time Series of c



(f) Time Series of x

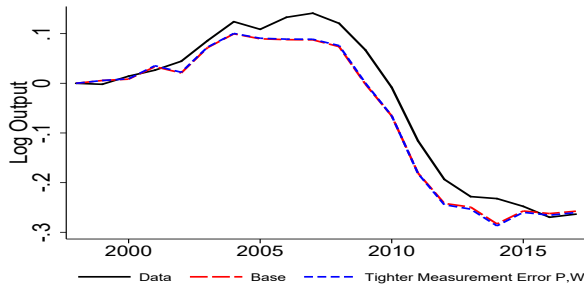


(g) Time Series of P_H

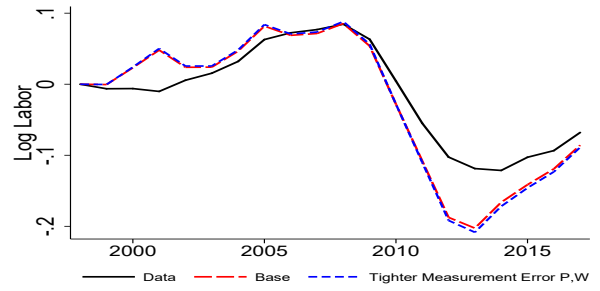


(h) Time Series of W

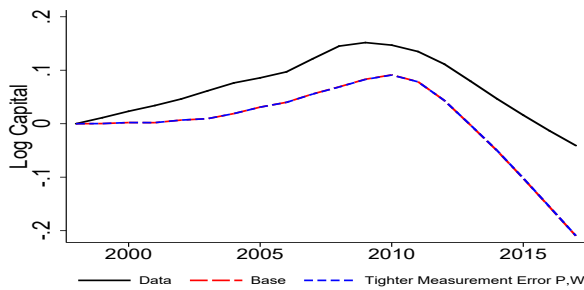
Figure C.2: Path of Variables with Tighter Measurement Error on All Variables



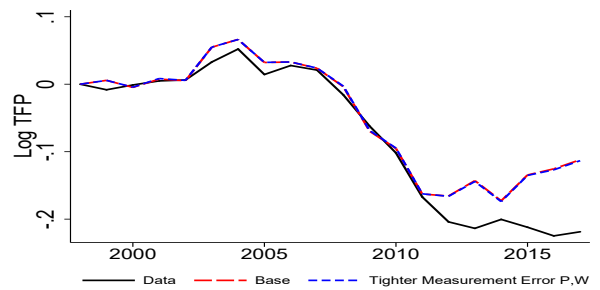
(a) Time Series of y



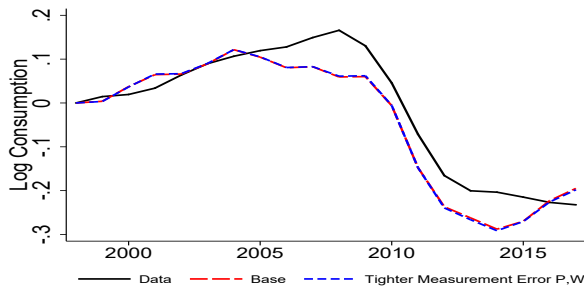
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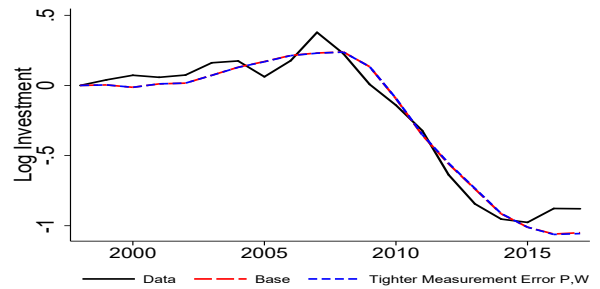
(c) Time Series of \tilde{k}



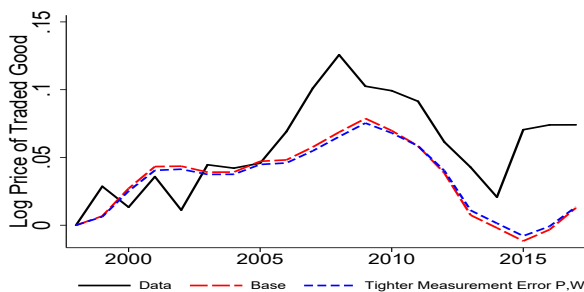
(d) Time Series of TFP



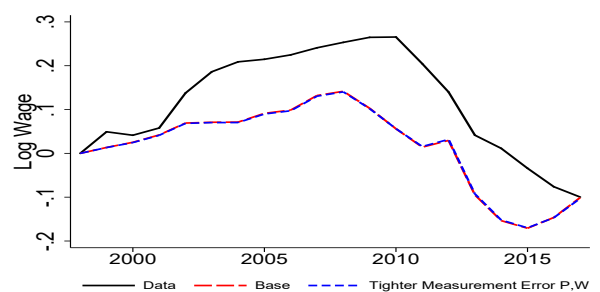
(e) Time Series of c



(f) Time Series of x

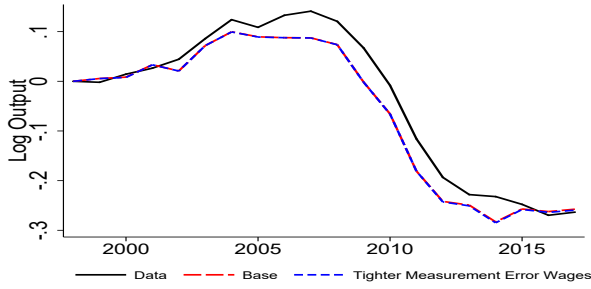


(g) Time Series of P_H

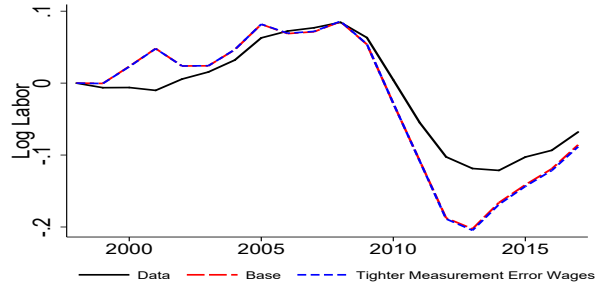


(h) Time Series of W

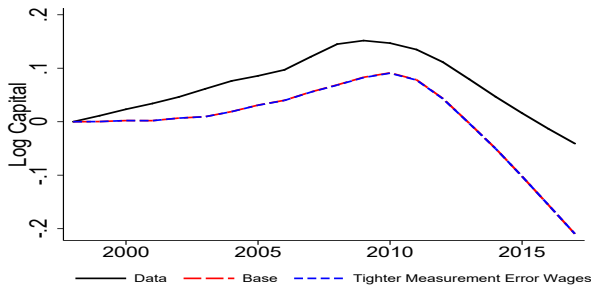
Figure C.3: Path of Variables with Tighter Measurement Error on Prices and Wages



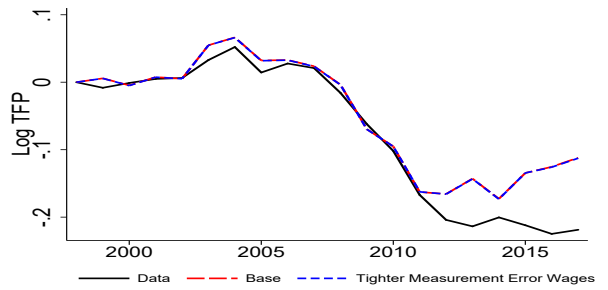
(a) Time Series of y



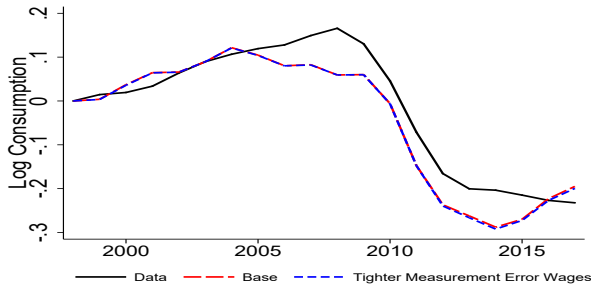
(b) Time Series of ℓ



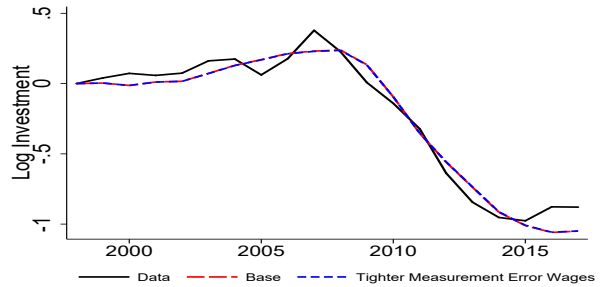
(c) Time Series of \tilde{k}



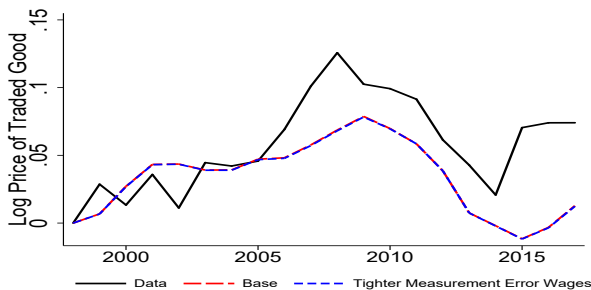
(d) Time Series of TFP



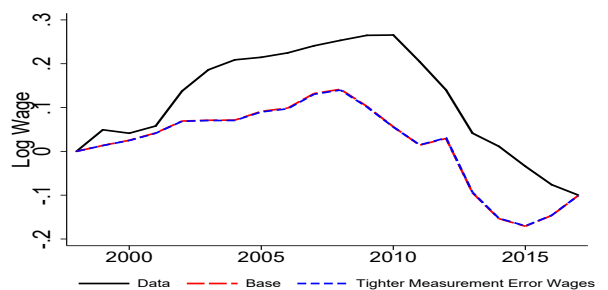
(e) Time Series of c



(f) Time Series of x



(g) Time Series of P_H

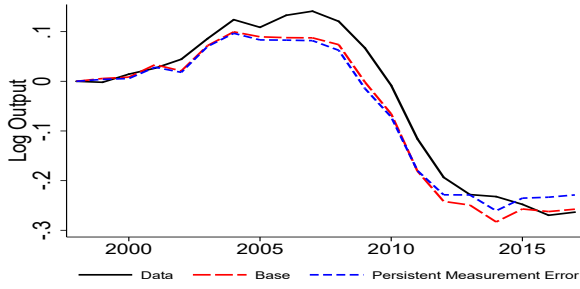


(h) Time Series of W

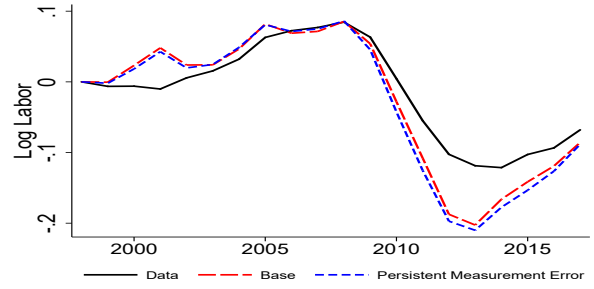
Figure C.4: Path of Variables with Tighter Measurement Error on Wages

Table C.4: Parameter Estimates with Serially Correlated Measurement Errors

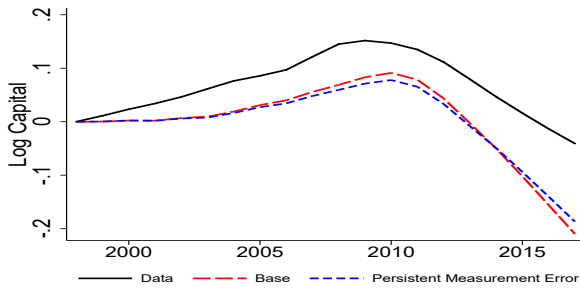
	Measurement Error	Posterior Mean	
		Baseline (i.i.d.)	Serially Correlated
ρ	intertemporal elasticity of substitution	0.97	0.90
ϕ	traded-nontraded elasticity	3.17	4.93
ϵ	frisch elasticity	1.16	1.46
κ_x	working capital, investment	0.59	0.70
κ_ℓ	working capital, labor	0.06	0.11
ζ	fraction rule-of-thumb	0.34	0.49
φ^θ	size of idiosyncratic disaster	0.16	0.16
ξ_H	utilization elasticity, traded	3.12	3.65
ξ_N	utilization elasticity, non-traded	3.75	4.15
δ_b	exit rate, bankers	0.70	0.58
ψ_π	adjustment cost, profits	0.60	0.54
ψ_x	adjustment cost, investment	6.28	6.49
ψ_ℓ	adjustment cost, labor	1.52	1.74
$\psi_{H,p}$	adjustment cost, prices traded	79.3	71.7
$\psi_{N,p}$	adjustment cost, prices non-traded	36.5	43.8
ψ_w	adjustment cost, wages	78.4	77.8



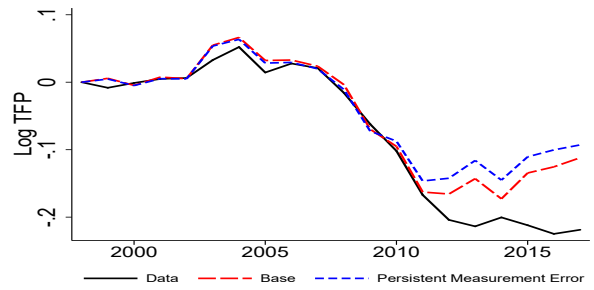
(a) Time Series of y



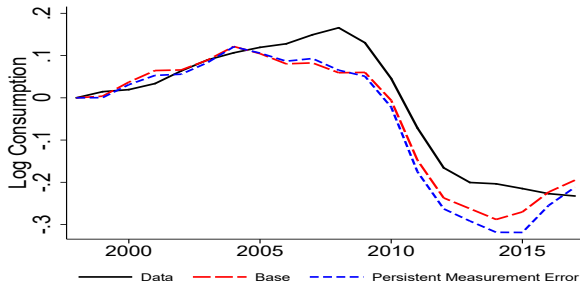
(b) Time Series of ℓ



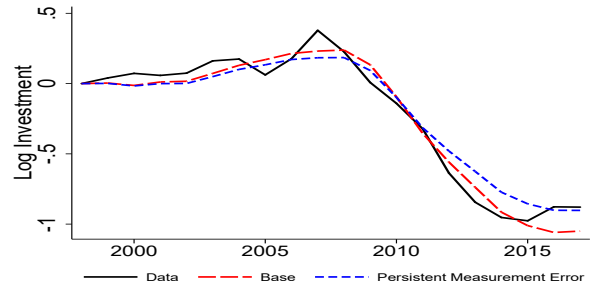
(c) Time Series of \tilde{k}



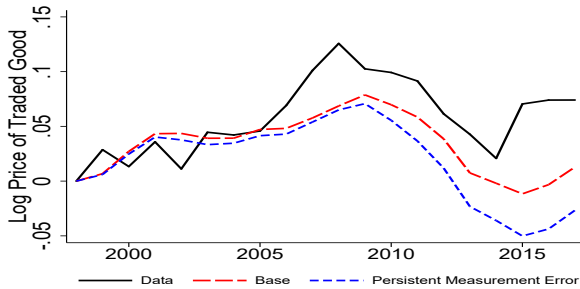
(d) Time Series of TFP



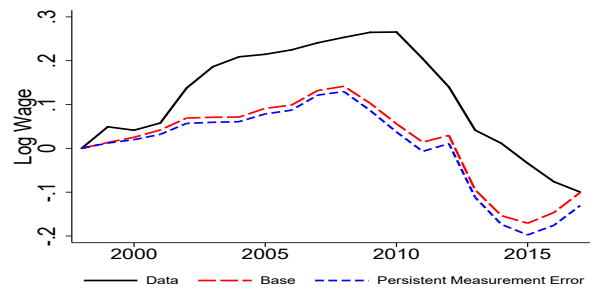
(e) Time Series of c



(f) Time Series of x



(g) Time Series of P_H



(h) Time Series of W

Figure C.5: Path of Variables with Serially Correlated Measurement Errors

Table C.5: Robustness of Sources of Macroeconomic Dynamics: Boom Period 1998-2007

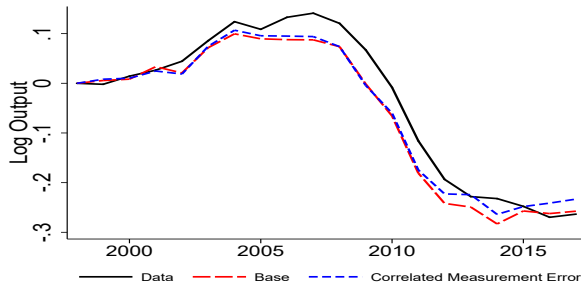
	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	0.14	0.08	0.12	0.02	0.15	0.10	0.18	0.24	-0.03
Model	0.08	0.07	0.05	0.02	0.09	0.05	0.08	0.12	-0.04
Productivity	0.00	0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00
$\log z_H$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log z_N$	0.00	0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00
External	0.04	0.03	0.02	0.01	0.04	0.04	0.05	0.07	0.00
$\log \bar{a}_T$	0.04	0.04	0.01	0.01	0.02	0.02	0.03	0.04	0.02
$\log P_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T^g	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.01	-0.01
T^l	-0.01	-0.01	0.00	0.00	0.01	0.01	0.01	0.02	-0.01
Financial	0.00	-0.01	0.01	0.00	0.01	0.01	0.01	0.02	-0.01
$\log \bar{B}^g$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log \bar{B}^r$	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.01	0.01
\bar{r}	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00
\bar{i}	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	-0.01
T_W^b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T_{Gd}^b	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
T_{Ge}^b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gov Spending	0.04	0.04	0.03	0.01	0.01	0.00	0.00	0.01	-0.03
$\log g_T^c$	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	-0.01
$\log g_N^c$	0.02	0.02	0.00	0.00	-0.03	0.00	0.00	-0.01	0.00
$\log g_T^x$	0.01	0.01	0.02	0.00	0.00	-0.01	-0.01	0.00	-0.01
$\log g_N^x$	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
$\log T^r$	0.01	0.00	0.00	0.01	0.03	0.01	0.01	0.02	-0.01
Tax Policy	0.00	0.00	-0.01	0.00	0.00	-0.01	0.01	0.01	0.00
τ^c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ^x	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ^ℓ	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ_H^k	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ_N^k	-0.01	0.00	-0.01	0.00	-0.01	0.00	0.01	0.00	0.00
κ_τ	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Disaster Risk	0.01	0.00	0.00	0.00	0.03	0.01	0.01	0.02	-0.01
π^θ	0.00	0.00	0.00	0.00	0.03	0.01	0.01	0.02	-0.01
π^a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table C.6: Robustness of Sources of Macroeconomic Dynamics: Bust Period 2007-2017

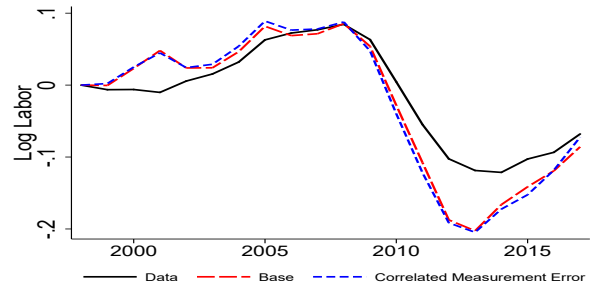
	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	-0.40	-0.14	-0.16	-0.24	-0.38	-0.03	-0.11	-0.34	0.11
Model	-0.31	-0.16	-0.23	-0.11	-0.30	-0.08	-0.04	-0.25	0.13
Productivity	-0.02	0.00	0.00	-0.02	-0.03	-0.01	0.03	-0.01	-0.01
$\log z_H$	0.01	0.00	0.00	0.01	0.00	-0.01	0.00	0.00	0.00
$\log z_N$	-0.03	0.01	0.00	-0.03	-0.03	0.00	0.03	-0.01	-0.01
External	-0.05	-0.04	-0.01	-0.02	-0.05	-0.05	-0.06	-0.09	0.00
$\log \bar{a}_T$	-0.05	-0.06	0.00	-0.02	-0.02	-0.03	-0.04	-0.05	-0.03
$\log P_F$	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T^g	-0.01	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00
T^l	0.01	0.02	-0.01	0.00	-0.02	-0.02	-0.03	-0.04	0.02
Financial	-0.01	0.02	-0.04	0.00	0.03	0.02	0.02	0.01	-0.01
$\log \bar{B}^g$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log \bar{B}^r$	0.01	0.01	-0.01	0.01	0.00	0.00	0.00	0.01	-0.01
\bar{r}	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	-0.01
\bar{i}	0.02	0.03	0.01	0.00	0.05	0.00	0.01	0.01	-0.01
T_W^b	-0.02	-0.01	-0.02	0.00	-0.02	0.00	0.00	-0.02	0.01
T_{Gd}^b	-0.04	-0.02	-0.05	0.00	-0.02	0.01	0.01	-0.02	0.01
T_{Ge}^b	0.02	0.01	0.03	0.00	0.01	-0.01	-0.01	0.01	-0.01
Gov Spending	-0.08	-0.08	-0.05	-0.02	0.01	0.00	-0.01	-0.02	0.05
$\log g_T^c$	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
$\log g_N^c$	-0.04	-0.05	0.00	-0.01	0.06	-0.01	-0.01	0.01	0.01
$\log g_T^x$	-0.02	-0.01	-0.03	0.00	-0.01	0.01	0.01	0.00	0.01
$\log g_N^x$	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00
$\log T^r$	-0.01	-0.01	0.01	-0.01	-0.05	-0.01	-0.01	-0.02	0.01
Tax Policy	-0.17	-0.12	-0.11	-0.05	-0.13	0.06	0.09	0.03	0.02
τ^c	-0.01	-0.01	0.00	0.00	-0.02	0.00	0.00	0.00	0.00
τ^x	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
τ^ℓ	-0.03	-0.06	0.00	0.00	-0.04	0.01	0.02	0.07	0.00
τ_H^k	-0.01	0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.00
τ_N^k	-0.04	-0.01	-0.04	-0.02	-0.03	0.00	0.04	-0.01	0.00
κ_τ	-0.06	-0.04	-0.06	-0.02	-0.03	0.03	0.03	-0.03	0.02
Disaster Risk	0.01	0.06	-0.03	0.00	-0.13	-0.09	-0.10	-0.18	0.08
π^θ	0.01	0.06	-0.02	-0.01	-0.14	-0.09	-0.10	-0.18	0.08
π^a	0.00	0.00	0.00	0.00	0.01	0.00	0.00	-0.01	0.00

Table C.7: Parameter Estimates with Contemporaneously Correlated Measurement Error

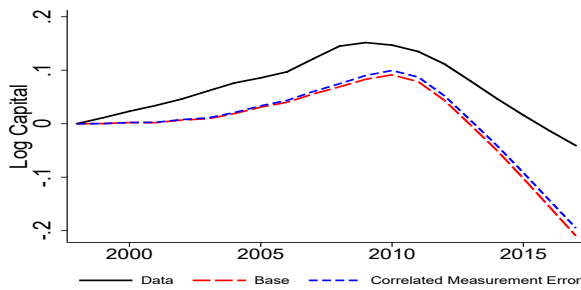
		Posterior Mean	
		Baseline	Contemporaneous Correlation
Parameters			
ρ	intertemporal elasticity of substitution	0.97	0.84
ϕ	traded-nontraded elasticity	3.17	2.02
ϵ	frisch elasticity	1.16	0.35
κ_x	working capital, investment	0.59	0.69
κ_ℓ	working capital, labor	0.06	0.09
ζ	fraction rule-of-thumb	0.34	0.46
φ^θ	size of idiosyncratic disaster	0.16	0.15
ξ_H	utilization elasticity, traded	3.12	3.33
ξ_N	utilization elasticity, non-traded	3.75	4.06
δ_b	exit rate, bankers	0.70	0.81
ψ_π	adjustment cost, profits	0.60	0.26
ψ_x	adjustment cost, investment	6.28	7.25
ψ_ℓ	adjustment cost, labor	1.52	1.74
$\psi_{H,p}$	adjustment cost, prices traded	79.3	41.7
$\psi_{N,p}$	adjustment cost, prices non-traded	36.5	22.4
ψ_w	adjustment cost, wages	78.4	210.4



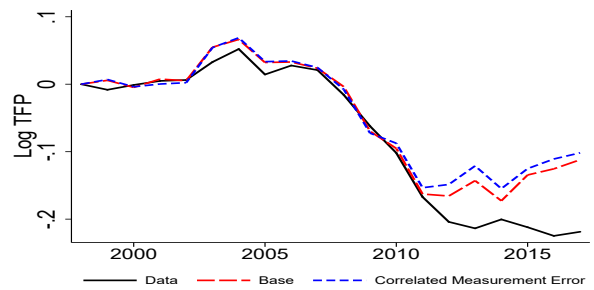
(a) Time Series of y



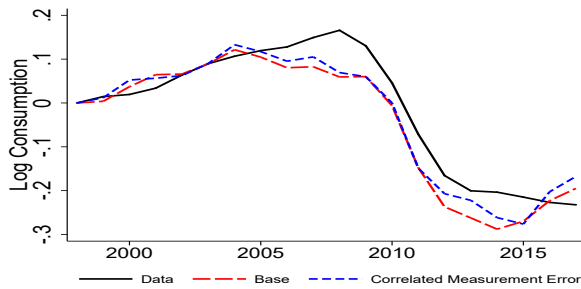
(b) Time Series of ℓ



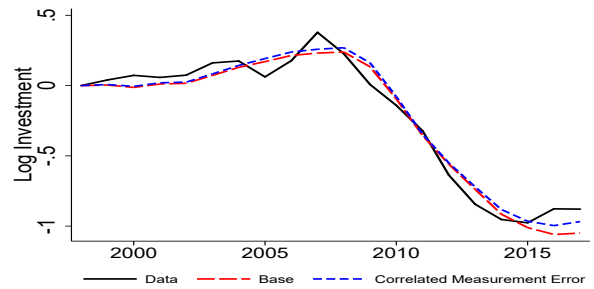
(c) Time Series of \tilde{k}



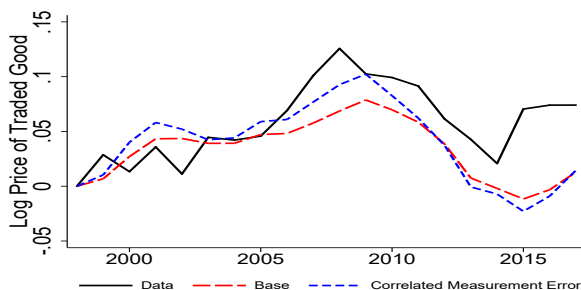
(d) Time Series of TFP



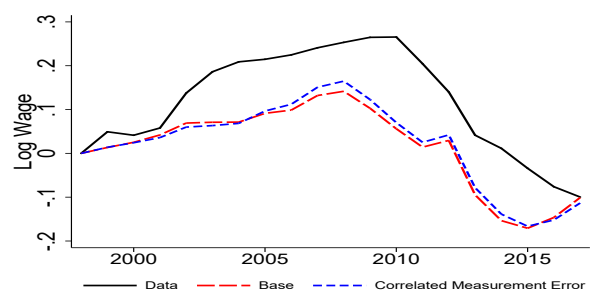
(e) Time Series of c



(f) Time Series of x



(g) Time Series of P_H



(h) Time Series of W

Figure C.6: Path of Variables with Contemporaneously Correlated Measurement Error

Table C.8: Robustness of Sources of Macroeconomic Dynamics: Boom Period 1998-2007

	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	0.14	0.08	0.12	0.02	0.15	0.10	0.18	0.24	-0.03
Model	0.09	0.08	0.06	0.02	0.11	0.08	0.11	0.15	-0.04
Productivity	0.00	0.01	0.00	-0.01	0.00	0.00	0.01	0.00	0.00
$\log z_H$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log z_N$	0.00	0.01	0.00	-0.01	0.00	0.00	0.01	0.00	0.00
External	0.05	0.03	0.03	0.02	0.06	0.06	0.07	0.09	0.00
$\log \bar{a}_T$	0.04	0.04	0.02	0.02	0.02	0.03	0.04	0.06	0.02
$\log P_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T^g	0.01	0.01	0.00	0.00	0.02	0.01	0.01	0.01	-0.01
T^l	0.00	-0.01	0.01	0.00	0.02	0.02	0.02	0.02	-0.01
Financial	0.01	0.00	0.01	0.00	0.02	0.01	0.01	0.01	-0.01
$\log \bar{B}^g$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log \bar{B}^r$	-0.01	-0.01	-0.02	0.00	0.00	0.00	0.01	-0.02	0.01
\bar{r}	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00
\bar{i}	0.01	0.00	0.02	0.00	0.01	0.00	0.00	0.02	-0.01
T_W^b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T_{Gd}^b	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
T_{Ge}^b	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00
Gov Spending	0.04	0.03	0.03	0.01	0.00	0.00	0.00	0.02	-0.03
$\log g_T^c$	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	-0.01
$\log g_N^c$	0.01	0.01	0.00	0.00	-0.04	0.01	0.01	0.00	0.00
$\log g_T^x$	0.01	0.00	0.02	0.00	0.00	-0.01	-0.01	0.00	-0.01
$\log g_N^x$	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
$\log T^r$	0.01	0.01	0.00	0.01	0.04	0.01	0.01	0.02	-0.01
Tax Policy	0.00	0.00	-0.01	0.00	0.00	0.00	0.01	0.01	0.00
τ^c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ^x	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ^ℓ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
τ_H^k	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ_N^k	-0.01	0.00	-0.01	0.00	-0.01	0.00	0.01	0.00	0.00
κ_τ	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Disaster Risk	0.01	0.00	0.00	0.00	0.02	0.01	0.01	0.01	-0.01
π^θ	0.01	0.00	0.00	0.00	0.02	0.01	0.01	0.01	-0.01
π^a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table C.9: Robustness of Sources of Macroeconomic Dynamics: Bust Period 2007-2017

	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	-0.40	-0.14	-0.16	-0.24	-0.38	-0.03	-0.11	-0.34	0.11
Model	-0.33	-0.15	-0.26	-0.13	-0.27	-0.06	-0.01	-0.26	0.13
Productivity	-0.02	0.01	0.00	-0.02	-0.03	-0.01	0.04	0.00	0.00
$\log z_H$	0.01	0.00	0.00	0.01	0.00	-0.01	0.00	0.00	0.00
$\log z_N$	-0.02	0.01	0.00	-0.03	-0.03	0.01	0.04	0.00	0.00
External	-0.06	-0.05	-0.01	-0.03	-0.07	-0.08	-0.09	-0.13	0.00
$\log \bar{a}_T$	-0.06	-0.06	0.00	-0.03	-0.02	-0.05	-0.06	-0.09	-0.02
$\log P_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T^g	-0.01	-0.01	0.01	0.00	-0.01	0.00	0.00	0.00	0.00
T^l	0.00	0.01	-0.02	0.00	-0.04	-0.03	-0.03	-0.04	0.02
Financial	-0.01	0.02	-0.05	0.00	0.02	0.02	0.03	0.00	-0.01
$\log \bar{B}^g$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log \bar{B}^r$	0.01	0.02	-0.02	0.01	0.00	0.00	0.00	0.02	-0.02
\bar{r}	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.01	-0.01
\bar{i}	0.01	0.02	0.01	0.00	0.03	0.00	0.01	0.00	-0.01
T_W^b	-0.02	-0.01	-0.03	0.00	-0.02	0.00	0.00	-0.02	0.01
T_{Gd}^b	-0.04	-0.02	-0.06	0.00	-0.02	0.02	0.01	-0.03	0.02
T_{Ge}^b	0.02	0.01	0.03	0.00	0.01	-0.01	-0.01	0.02	-0.01
Gov Spending	-0.07	-0.06	-0.04	-0.02	0.02	-0.01	-0.02	-0.04	0.05
$\log g_T^c$	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
$\log g_N^c$	-0.02	-0.03	0.00	-0.01	0.08	-0.01	-0.02	-0.01	0.01
$\log g_T^x$	-0.02	-0.01	-0.04	0.00	0.00	0.01	0.01	0.00	0.01
$\log g_N^x$	-0.01	0.00	-0.02	0.00	0.00	0.00	0.00	-0.01	0.00
$\log T^r$	-0.02	-0.02	0.01	-0.02	-0.06	-0.01	-0.02	-0.02	0.01
Tax Policy	-0.15	-0.08	-0.11	-0.05	-0.09	0.08	0.11	0.03	0.03
τ^c	-0.01	-0.01	0.00	0.00	-0.02	0.00	0.00	0.00	0.00
τ^x	-0.01	0.00	-0.01	0.00	0.00	0.01	0.01	0.00	0.00
τ^ℓ	-0.03	-0.04	0.00	0.00	-0.04	0.01	0.01	0.05	0.00
τ_H^k	-0.01	0.00	-0.01	-0.01	0.00	0.02	0.00	0.00	0.00
τ_N^k	-0.04	0.00	-0.03	-0.02	-0.02	0.02	0.06	0.01	0.00
κ_τ	-0.06	-0.02	-0.06	-0.01	-0.02	0.04	0.03	-0.03	0.02
Disaster Risk	-0.02	0.01	-0.04	-0.01	-0.12	-0.07	-0.08	-0.13	0.06
π^θ	-0.02	0.01	-0.03	-0.01	-0.13	-0.07	-0.07	-0.13	0.05
π^a	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00

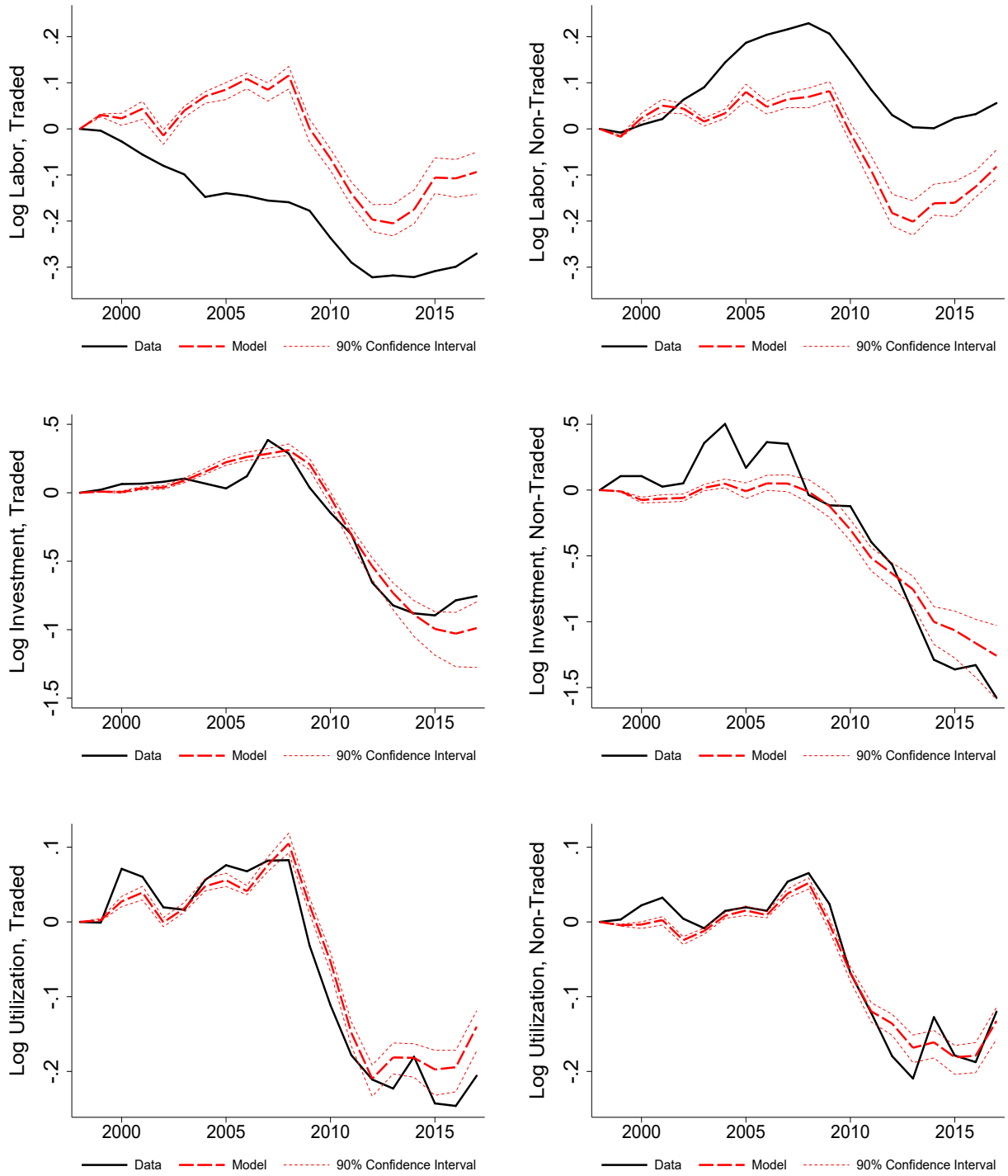
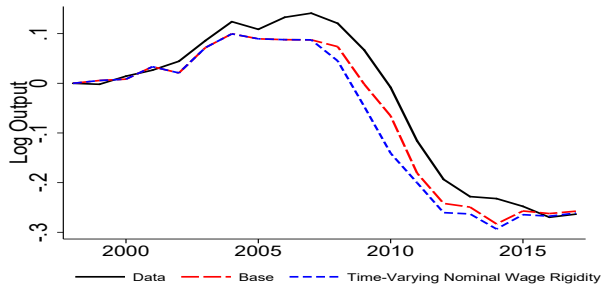
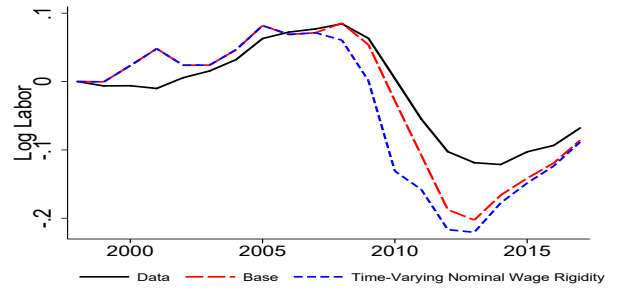


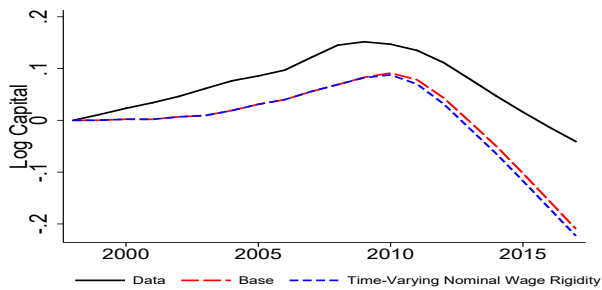
Figure C.7: Additional Sectoral Outcomes



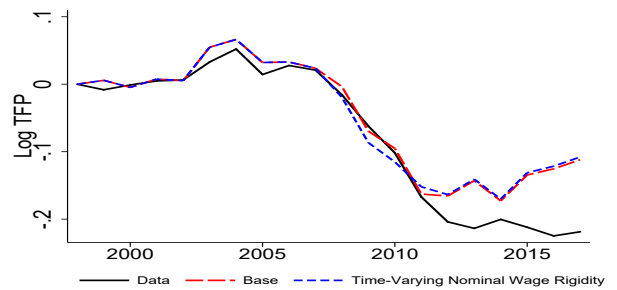
(a) Time Series of y



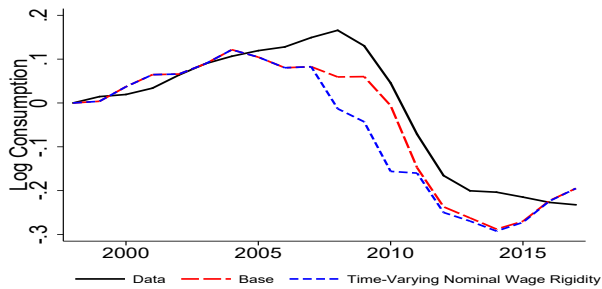
(b) Time Series of ℓ



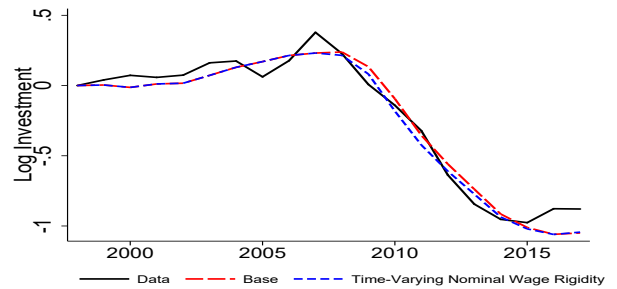
(c) Time Series of \tilde{k}



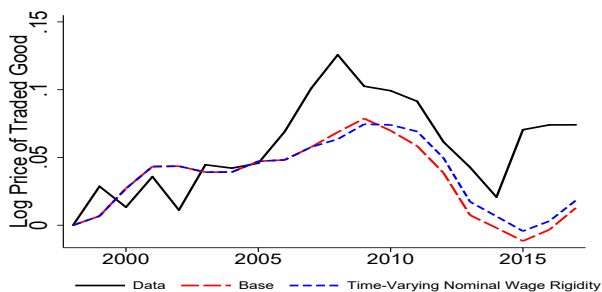
(d) Time Series of TFP



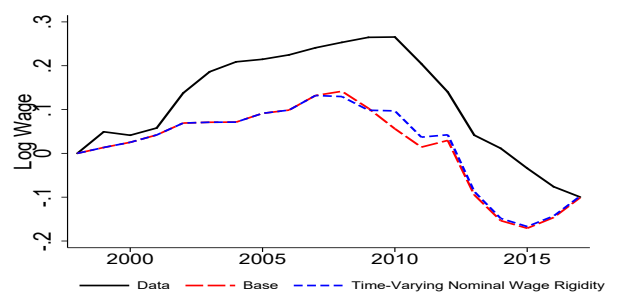
(e) Time Series of c



(f) Time Series of x



(g) Time Series of P_H



(h) Time Series of W

Figure C.8: Path of Variables with Time-Varying Nominal Wage Rigidity

Table C.10: Covariations with Variables in the Data

Data Variable	Model Variable		Residual	
	Correlation	Variance Fraction	Correlation	Variance Fraction
Output	0.98	0.97	0.22	0.05
Capital	0.86	0.73	-0.22	0.05
TFP	0.96	0.92	0.75	0.57
Consumption	0.96	0.92	0.02	0.00
Investment	0.98	0.96	-0.02	0.00
Net Exports / GDP	0.93	0.87	-0.50	0.25
Output, Traded	0.96	0.92	0.43	0.18
Output, Non-Traded	0.98	0.96	-0.04	0.00
Labor	0.96	0.92	-0.65	0.43
Prices, Traded	0.56	0.32	0.66	0.43
Prices, Non-Traded	0.59	0.34	0.87	0.76
Wages	0.86	0.73	0.60	0.36

Table C.11: Robustness of Sources of Macroeconomic Dynamics: Bust Period 2007-2017

	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	-0.40	-0.14	-0.16	-0.24	-0.38	-0.03	-0.11	-0.34	0.11
Model	-0.35	-0.16	-0.28	-0.13	-0.28	-0.04	0.01	-0.23	0.12
Productivity	-0.02	0.01	0.00	-0.02	-0.03	-0.01	0.03	0.00	0.00
$\log z_H$	0.01	0.00	0.00	0.01	0.00	-0.01	0.00	0.00	0.00
$\log z_N$	-0.02	0.01	0.00	-0.03	-0.03	0.00	0.03	0.00	-0.01
External	-0.06	-0.05	-0.01	-0.03	-0.05	-0.05	-0.07	-0.10	-0.01
$\log \bar{a}_T$	-0.06	-0.06	0.00	-0.03	-0.01	-0.03	-0.04	-0.06	-0.03
$\log P_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T^g	-0.01	-0.01	0.01	0.00	-0.01	0.00	0.00	0.00	0.00
T^l	0.00	0.02	-0.02	0.00	-0.03	-0.03	-0.03	-0.04	0.02
Financial	-0.01	0.02	-0.06	0.01	0.03	0.02	0.03	0.01	-0.01
$\log \bar{B}^g$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log \bar{B}^r$	0.01	0.01	-0.02	0.01	-0.01	0.00	0.00	0.01	-0.01
\bar{r}	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	-0.01
\bar{i}	0.02	0.03	0.01	0.00	0.05	0.00	0.01	0.01	-0.01
T_W^b	-0.02	-0.01	-0.03	0.00	-0.02	0.00	0.00	-0.01	0.01
T_{Gd}^b	-0.04	-0.02	-0.06	0.00	-0.02	0.02	0.02	-0.02	0.02
T_{Ge}^b	0.02	0.01	0.03	0.00	0.01	-0.01	-0.01	0.01	-0.01
Gov Spending	-0.08	-0.07	-0.05	-0.02	0.02	0.00	0.00	-0.01	0.04
$\log g_T^c$	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01
$\log g_N^c$	-0.04	-0.05	0.00	-0.01	0.06	-0.01	-0.01	0.01	0.01
$\log g_T^x$	-0.02	-0.01	-0.03	0.00	0.00	0.01	0.01	0.00	0.01
$\log g_N^x$	-0.01	-0.01	-0.02	0.00	0.00	0.00	0.00	-0.01	0.00
$\log T^r$	-0.01	-0.01	0.01	-0.01	-0.04	-0.01	-0.01	-0.02	0.01
Tax Policy	-0.18	-0.11	-0.12	-0.06	-0.12	0.09	0.12	0.06	0.02
τ^c	-0.01	-0.01	0.00	0.00	-0.02	0.00	0.00	0.00	0.00
τ^x	-0.01	0.00	-0.01	0.00	0.00	0.01	0.01	0.00	0.00
τ^ℓ	-0.03	-0.05	0.00	0.00	-0.03	0.01	0.02	0.07	0.00
τ_H^k	-0.01	0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.00
τ_N^k	-0.05	-0.01	-0.04	-0.02	-0.03	0.01	0.06	0.00	0.00
κ_τ	-0.07	-0.04	-0.07	-0.02	-0.02	0.04	0.04	-0.02	0.02
Disaster Risk	0.00	0.05	-0.04	-0.01	-0.14	-0.09	-0.10	-0.18	0.07
π^θ	-0.01	0.05	-0.03	-0.01	-0.14	-0.09	-0.10	-0.18	0.07
π^a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table C.12: Robustness of Sources of Macroeconomic Dynamics: Boom Period 1998-2007

	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	0.14	0.08	0.12	0.02	0.15	0.10	0.18	0.24	-0.03
Model	0.13	0.09	0.07	0.05	0.11	0.06	0.10	0.14	-0.06
Productivity	0.00	0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00
$\log z_H$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log z_N$	0.00	0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00
External	0.08	0.06	0.03	0.03	0.04	0.05	0.06	0.09	-0.01
$\log \bar{a}_T$	0.06	0.05	0.02	0.02	0.01	0.03	0.04	0.05	0.01
$\log P_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T^g	0.02	0.02	0.00	0.01	0.02	0.01	0.01	0.02	-0.01
T^l	0.00	-0.01	0.01	0.00	0.01	0.01	0.01	0.02	-0.01
Financial	0.06	0.02	0.03	0.03	0.03	0.01	0.02	0.02	-0.03
$\log \bar{B}^g$	0.03	0.02	0.01	0.02	0.01	0.00	0.00	0.00	-0.01
$\log \bar{B}^r$	-0.02	-0.01	-0.02	0.00	0.00	0.00	0.00	-0.01	0.01
\bar{r}	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	-0.01
\bar{i}	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.02	-0.01
T_W^b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T_{Gd}^b	0.02	0.01	0.00	0.01	0.01	0.00	0.00	0.00	-0.01
T_{Ge}^b	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gov Spending	-0.01	-0.01	0.01	-0.01	0.02	-0.01	-0.01	0.00	0.00
$\log g_T^c$	-0.01	0.00	-0.01	0.00	-0.01	0.00	-0.01	-0.01	0.00
$\log g_N^c$	0.00	0.01	0.00	0.00	-0.01	0.01	0.01	0.00	0.00
$\log g_T^x$	0.00	0.00	0.01	0.00	0.00	-0.01	-0.01	-0.01	0.00
$\log g_N^x$	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
$\log T^r$	-0.01	-0.01	0.00	0.00	0.03	0.00	0.00	0.01	0.00
Tax Policy	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.01	0.00	0.00
τ^c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ^x	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ^ℓ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ_H^k	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ_N^k	-0.01	0.00	-0.01	0.00	-0.01	0.00	0.01	0.00	0.00
κ_τ	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Disaster Risk	0.01	0.00	0.00	0.01	0.03	0.01	0.01	0.02	-0.01
π^θ	0.01	0.00	0.00	0.01	0.03	0.01	0.01	0.02	-0.01
π^a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table C.13: Robustness of Sources of Macroeconomic Dynamics: Bust Period 2007-2017

	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	-0.40	-0.14	-0.16	-0.24	-0.38	-0.03	-0.11	-0.34	0.11
Model	-0.32	-0.12	-0.25	-0.14	-0.32	-0.06	-0.02	-0.25	0.12
Productivity	-0.02	0.00	-0.01	-0.02	-0.03	-0.01	0.03	-0.01	0.00
$\log z_H$	0.01	0.00	0.00	0.01	0.00	-0.01	0.00	0.00	0.00
$\log z_N$	-0.03	0.01	-0.01	-0.03	-0.03	0.00	0.03	0.00	0.00
External	-0.09	-0.08	0.00	-0.05	-0.05	-0.07	-0.09	-0.12	0.02
$\log \bar{a}_T$	-0.08	-0.08	0.00	-0.04	-0.01	-0.04	-0.05	-0.07	-0.01
$\log P_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T^g	-0.02	-0.02	0.02	-0.02	-0.01	0.00	-0.01	0.00	0.01
T^l	0.00	0.01	-0.02	0.00	-0.03	-0.03	-0.03	-0.04	0.02
Financial	-0.02	0.02	-0.03	-0.01	0.03	0.00	0.01	0.00	0.00
$\log \bar{B}^g$	-0.01	-0.01	0.02	-0.01	0.00	-0.01	-0.01	-0.01	0.01
$\log \bar{B}^r$	0.01	0.02	-0.03	0.02	-0.01	0.01	0.01	0.02	-0.02
\bar{r}	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.02	-0.01
\bar{i}	0.03	0.03	0.02	0.00	0.05	0.00	0.00	0.01	-0.01
T_W^b	-0.03	-0.02	-0.03	0.00	-0.01	0.00	0.00	-0.02	0.02
T_{Gd}^b	-0.06	-0.03	-0.05	-0.02	-0.02	0.01	0.01	-0.02	0.03
T_{Ge}^b	0.03	0.01	0.03	0.00	0.01	-0.01	-0.01	0.01	-0.01
Gov Spending	0.00	0.00	-0.05	0.02	-0.01	0.01	0.02	0.01	0.00
$\log g_T^c$	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00
$\log g_N^c$	-0.01	-0.02	0.00	0.00	0.02	-0.02	-0.02	-0.01	0.00
$\log g_T^x$	0.00	0.01	-0.02	0.01	0.00	0.02	0.02	0.02	0.00
$\log g_N^x$	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
$\log T^r$	0.00	0.01	-0.01	0.01	-0.04	0.00	0.00	-0.01	0.00
Tax Policy	-0.15	-0.09	-0.11	-0.05	-0.12	0.09	0.13	0.07	0.01
τ^c	0.00	0.00	0.00	0.00	-0.02	0.00	0.00	0.00	0.00
τ^x	0.00	0.00	-0.01	0.00	0.00	0.01	0.01	0.00	0.00
τ^ℓ	-0.01	-0.03	0.01	0.01	-0.03	0.02	0.03	0.08	-0.02
τ_H^k	-0.01	0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.00
τ_N^k	-0.04	0.00	-0.03	-0.02	-0.04	0.01	0.05	0.00	0.00
κ_τ	-0.09	-0.05	-0.08	-0.03	-0.02	0.04	0.04	-0.02	0.03
Disaster Risk	-0.03	0.03	-0.06	-0.02	-0.14	-0.09	-0.11	-0.20	0.09
π^θ	-0.03	0.03	-0.06	-0.02	-0.14	-0.09	-0.11	-0.20	0.09
π^a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table C.14: Sources of Macroeconomic Dynamics: Bust Period 2007-2012

Process	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	-0.33	-0.18	-0.01	-0.22	-0.31	-0.04	0.03	-0.10	0.08
Model	-0.33	-0.26	-0.01	-0.19	-0.32	-0.02	-0.05	-0.10	0.09
Productivity	-0.01	-0.02	0.00	0.00	-0.01	0.01	0.00	0.00	0.00
$\log z_H$	-0.01	0.00	0.00	-0.01	0.00	0.01	0.00	0.00	0.00
$\log z_N$	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00
External	-0.09	-0.08	0.02	-0.05	-0.06	-0.04	-0.06	-0.07	-0.04
$\log \bar{a}_T$	-0.07	-0.08	0.02	-0.04	-0.01	-0.02	-0.03	-0.03	-0.05
$\log P_F$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T^g	-0.01	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00
T^l	0.00	0.00	0.00	0.00	-0.04	-0.02	-0.02	-0.04	0.02
Financial	-0.04	-0.03	-0.01	-0.02	-0.06	0.00	-0.01	-0.04	0.03
$\log \bar{B}^g$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log \bar{B}^r$	0.00	0.00	-0.02	0.01	0.00	0.00	0.00	0.00	0.00
\bar{r}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
\bar{i}	0.00	0.00	0.01	0.00	-0.01	-0.01	-0.02	-0.02	0.01
T_W^b	-0.01	-0.01	0.00	-0.01	-0.01	0.00	0.00	-0.01	0.01
T_{Gd}^b	-0.04	-0.03	0.00	-0.02	-0.03	0.01	0.01	-0.02	0.02
T_{Ge}^b	0.01	0.01	0.00	0.01	0.00	0.00	-0.01	0.01	-0.01
Gov Spending	-0.05	-0.05	0.01	-0.03	0.04	0.00	0.00	0.01	0.05
$\log g_T^c$	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
$\log g_N^c$	-0.02	-0.02	0.00	-0.01	0.04	0.00	-0.01	0.00	0.00
$\log g_T^x$	-0.01	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.03
$\log g_N^x$	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$\log T^r$	-0.01	-0.01	0.01	-0.01	-0.01	0.00	0.00	0.00	0.00
Tax Policy	-0.08	-0.05	-0.02	-0.04	-0.04	0.04	0.06	0.09	0.00
τ^c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ^x	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
τ^ℓ	-0.01	-0.04	0.00	0.01	-0.02	0.01	0.01	0.09	0.00
τ_H^k	-0.01	0.00	0.00	-0.01	0.00	0.01	0.01	0.00	0.00
τ_N^k	-0.02	0.00	-0.01	-0.02	-0.01	0.01	0.03	0.00	0.00
κ_τ	-0.03	-0.02	-0.01	-0.02	-0.01	0.02	0.02	-0.01	0.01
Disaster Risk	-0.06	-0.04	0.00	-0.05	-0.20	-0.03	-0.05	-0.09	0.05
π^θ	-0.06	-0.04	0.00	-0.04	-0.19	-0.03	-0.05	-0.08	0.04
π^a	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00

Table C.15: Role of Structural Elements

Boom: 1998-2007	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	0.14	0.08	0.12	0.02	0.15	0.10	0.18	0.24	-0.03
Baseline Model	0.09	0.07	0.06	0.02	0.08	0.06	0.09	0.13	-0.04
$\epsilon = 2$	0.09	0.08	0.06	0.02	0.08	0.05	0.08	0.12	-0.04
$\rho = 0.5$	0.10	0.08	0.05	0.03	0.12	0.06	0.09	0.14	-0.04
$\zeta = 0$	0.10	0.08	0.08	0.02	0.04	0.04	0.06	0.12	-0.04
$\eta = 0.9$	0.10	0.08	0.07	0.03	0.09	0.07	0.11	0.16	-0.04
$\eta = 2.4$	0.08	0.06	0.05	0.02	0.08	0.05	0.08	0.12	-0.04
$\psi_p = 0$	0.05	0.04	0.05	0.00	0.05	0.09	0.12	0.12	-0.05
$\psi_p = 1000$	0.15	0.13	0.07	0.05	0.14	0.03	0.04	0.17	-0.03
$\psi_w = 0$	0.08	0.04	0.06	0.03	0.07	0.07	0.10	0.19	-0.04
$\psi_w = 1000$	0.12	0.14	0.06	0.02	0.12	0.03	0.06	0.05	-0.03
$\psi_\ell = 0$	0.10	0.10	0.06	0.02	0.10	0.05	0.08	0.14	-0.04
$\psi_x = 0$	0.02	0.03	0.06	-0.03	0.07	0.06	0.09	0.11	0.03
$\phi = 0.44$	0.10	0.08	0.07	0.03	0.09	0.08	0.11	0.16	-0.03
$\kappa_x = 1$	0.08	0.07	0.05	0.02	0.08	0.06	0.09	0.13	-0.04
$\kappa_\ell = 1$	0.07	0.08	0.04	0.02	0.09	0.07	0.09	0.15	-0.03
Bust: 2007-2017	$\log y$	$\log \ell$	$\log \tilde{k}$	$\log \text{TFP}$	$\log c$	$\log P_H$	$\log P_N$	$\log W$	NX/GDP
Data	-0.40	-0.14	-0.16	-0.24	-0.38	-0.03	-0.11	-0.34	0.11
Baseline Model	-0.34	-0.16	-0.27	-0.14	-0.28	-0.04	0.00	-0.23	0.13
$\epsilon = 2$	-0.36	-0.18	-0.27	-0.13	-0.28	-0.04	0.02	-0.20	0.12
$\rho = 0.5$	-0.36	-0.17	-0.28	-0.13	-0.31	-0.05	-0.01	-0.26	0.14
$\zeta = 0$	-0.38	-0.18	-0.32	-0.13	-0.21	-0.01	0.05	-0.23	0.15
$\eta = 0.9$	-0.35	-0.17	-0.25	-0.14	-0.25	-0.03	0.02	-0.21	0.11
$\eta = 2.4$	-0.33	-0.14	-0.27	-0.13	-0.29	-0.05	0.00	-0.24	0.14
$\psi_p = 0$	-0.36	-0.17	-0.27	-0.15	-0.31	-0.06	0.04	-0.22	0.12
$\psi_p = 1000$	-0.39	-0.20	-0.26	-0.16	-0.30	0.00	0.02	-0.27	0.12
$\psi_w = 0$	-0.32	-0.12	-0.26	-0.13	-0.25	-0.07	-0.02	-0.23	0.13
$\psi_w = 1000$	-0.45	-0.35	-0.27	-0.14	-0.37	0.03	0.09	-0.03	0.10
$\psi_\ell = 0$	-0.35	-0.15	-0.27	-0.14	-0.28	-0.04	0.00	-0.24	0.13
$\psi_x = 0$	-0.20	-0.07	-0.24	-0.05	-0.24	-0.06	0.00	-0.17	-0.02
$\phi = 0.44$	-0.34	-0.16	-0.25	-0.14	-0.24	-0.01	0.04	-0.19	0.11
$\kappa_x = 1$	-0.27	-0.11	-0.21	-0.11	-0.25	-0.09	-0.04	-0.21	0.10
$\kappa_\ell = 1$	-0.26	-0.16	-0.13	-0.11	-0.29	-0.09	-0.04	-0.28	0.07

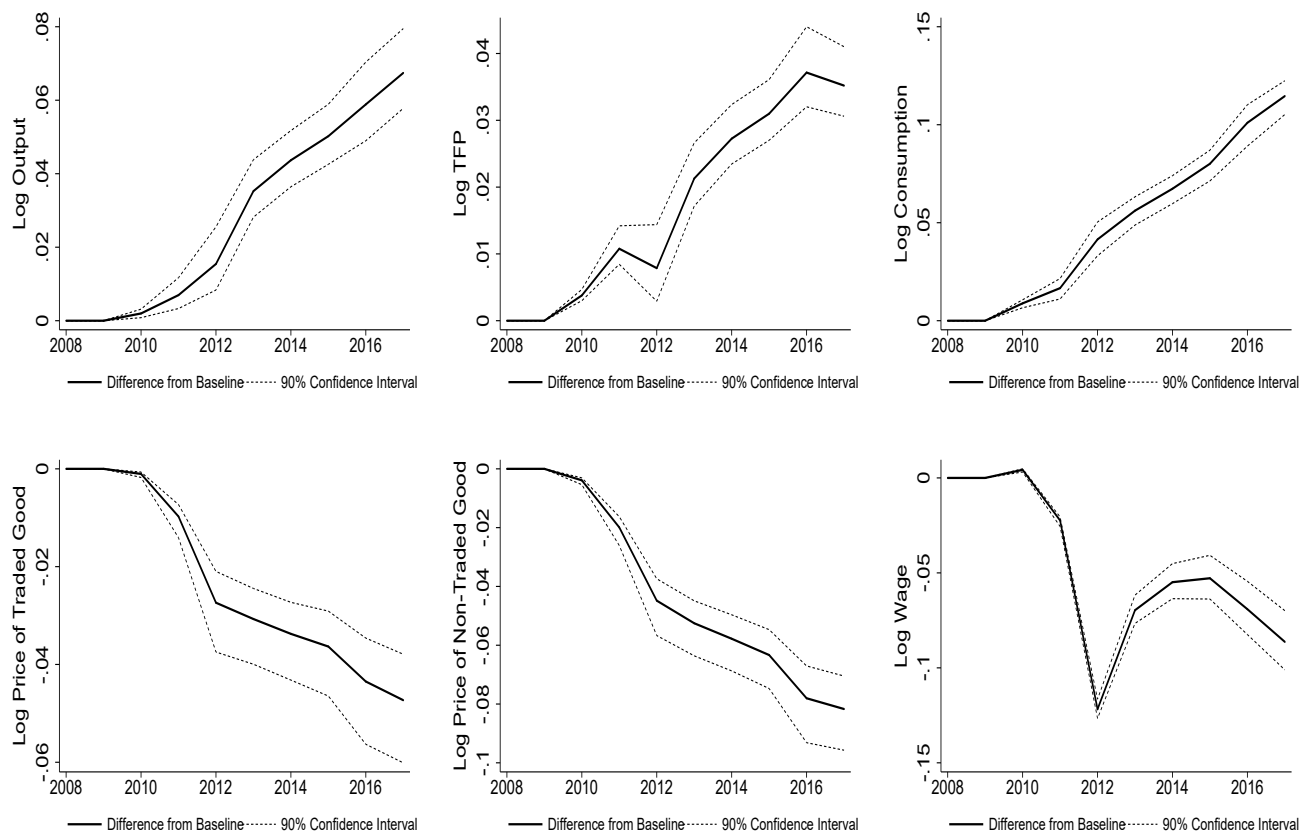


Figure C.9: Tilting Fiscal Adjustment to Spending Cuts

Table C.16: Confidence Intervals of Output and Revenue Effects of Fiscal Instruments

	Point Estimate			Lower Bound (5 percentile)			Upper Bound (95 percentile)		
	Output	Cost	Ratio	Output	Cost	Ratio	Output	Cost	Ratio
g_N^c	0.56	0.89	0.62	0.43	0.94	0.46	0.65	0.85	0.76
g_T^c	0.14	1.04	0.14	0.09	1.06	0.09	0.18	1.02	0.18
g_N^x	1.24	0.54	2.29	1.14	0.59	1.93	1.31	0.50	2.62
g_T^x	0.62	0.85	0.73	0.56	0.88	0.64	0.66	0.83	0.80
ζT^r	0.21	0.81	0.26	0.13	0.86	0.16	0.29	0.75	0.39
τ^c	-0.27	-0.38	0.72	-0.30	-0.37	0.57	-0.23	-0.40	0.81
τ^x	-0.15	-0.12	1.25	-0.17	-0.10	0.83	-0.11	-0.13	1.68
τ^ℓ	-0.38	-0.42	0.90	-0.44	-0.40	0.70	-0.31	-0.45	1.08
τ_H^k	-0.14	-0.03	4.46	-0.17	-0.02	3.38	-0.13	-0.04	6.62
τ_N^k	-0.26	-0.10	2.71	-0.31	-0.07	1.98	-0.22	-0.11	4.25

Table C.17: Output and Revenue Effects of Fiscal Instruments

	horizon $h = 1$			horizon $h = 7$			horizon $h = \infty$		
	Output	Cost	Ratio	Output	Cost	Ratio	Output	Cost	Ratio
g_N^c	0.49	0.94	0.52	0.56	0.89	0.62	0.62	0.90	0.69
g_T^c	0.05	1.04	0.05	0.14	1.04	0.14	0.30	1.11	0.27
g_N^x	0.93	0.68	1.38	1.24	0.54	2.29	2.33	0.32	7.23
g_T^x	0.27	0.91	0.30	0.62	0.85	0.73	1.68	0.71	2.36
ζT^r	0.32	0.80	0.40	0.21	0.81	0.26	0.22	0.86	0.25
τ^c	-0.26	-0.40	0.67	-0.27	-0.38	0.72	-0.31	-0.40	0.77
τ^x	-0.04	-0.16	0.23	-0.15	-0.12	1.25	-0.27	-0.10	2.73
τ^ℓ	-0.18	-0.50	0.35	-0.38	-0.42	0.90	-0.41	-0.40	1.04
τ_H^k	-0.07	-0.06	1.14	-0.14	-0.03	4.46	-0.18	-0.02	8.57
τ_N^k	-0.12	-0.16	0.75	-0.26	-0.10	2.71	-0.33	-0.07	4.57

Table C.18: Fiscal Multipliers

Financing and Horizon		g_N^c	g_T^c	g_N^x	g_T^x	ζT^r	τ^c	τ^x	τ^ℓ	τ_H^k	τ_N^k
T^o financed	$h = 1$	0.49	0.05	0.93	0.27	0.32	-0.26	-0.04	-0.18	-0.07	-0.12
T^o financed	$h = 7$	0.56	0.14	1.24	0.62	0.21	-0.27	-0.15	-0.38	-0.14	-0.26
T^o financed	$h = \infty$	0.62	0.30	2.33	1.68	0.22	-0.31	-0.27	-0.41	-0.18	-0.33
T^r, T^o financed	$h = 1$	0.48	-0.06	0.83	0.15	0.23	-0.22	-0.03	-0.11	-0.06	-0.10
T^r, T^o financed	$h = 7$	0.55	0.07	1.18	0.54	0.15	-0.25	-0.14	-0.34	-0.14	-0.26
T^r, T^o financed	$h = \infty$	0.62	0.24	2.25	1.59	0.15	-0.29	-0.27	-0.38	-0.18	-0.33
\bar{B}^g, T^r, T^o financed	$h = 1$	0.63	0.11	0.94	0.30	0.36	-0.29	-0.05	-0.19	-0.07	-0.13
\bar{B}^g, T^r, T^o financed	$h = 7$	0.57	0.09	1.20	0.56	0.17	-0.26	-0.14	-0.35	-0.14	-0.26
\bar{B}^g, T^r, T^o financed	$h = \infty$	0.63	0.26	2.27	1.62	0.17	-0.29	-0.27	-0.39	-0.18	-0.33

Table C.19: Fiscal Multipliers: T^o financed, horizon $h = 1$

Parameters	g_N^c	g_T^c	g_N^x	g_T^x	ζT^r	τ^c	τ^x	τ^ℓ	τ_H^k	τ_N^k
Baseline Model	0.49	0.05	0.93	0.27	0.32	-0.26	-0.04	-0.18	-0.07	-0.12
$\rho_f = 0.30$	0.84	0.18	0.89	0.23	0.41	-0.31	-0.02	-0.08	-0.04	-0.07
$\rho_f = 0.75$	0.80	0.13	0.93	0.26	0.36	-0.30	-0.03	-0.15	-0.06	-0.10
$\xi_H = \xi_N = \infty$	0.36	0.05	0.59	0.17	0.19	-0.18	0.01	-0.22	-0.01	0.02
$\xi_H = \xi_N = 2.5$	0.53	0.06	0.98	0.27	0.36	-0.29	-0.07	-0.16	-0.07	-0.28
$\epsilon = 2$	0.54	0.06	0.94	0.28	0.27	-0.27	-0.04	-0.19	-0.07	-0.12
$\rho = 0.5$	0.51	0.08	1.01	0.30	0.41	-0.21	-0.05	-0.20	-0.06	-0.13
$\zeta = 0$	0.51	0.04	0.92	0.27	.	-0.26	-0.05	-0.16	-0.08	-0.14
$\zeta = 0.7$	0.48	0.07	0.97	0.28	0.42	-0.28	-0.03	-0.20	-0.06	-0.11
$\eta = 0.9$	0.51	-0.01	0.93	0.20	0.34	-0.27	0.02	-0.16	-0.05	-0.09
$\eta = 2.4$	0.47	0.08	0.92	0.30	0.31	-0.26	-0.06	-0.19	-0.09	-0.13
$\psi_p = 0$	0.25	0.10	0.55	0.31	0.13	-0.14	-0.12	-0.26	-0.19	-0.27
$\psi_p = 1000$	0.62	-0.02	1.09	0.18	0.46	-0.33	0.03	-0.07	0.00	0.01
$\psi_w = 0$	0.50	0.06	0.91	0.27	0.30	-0.26	-0.04	-0.15	-0.07	-0.12
$\psi_w = 1000$	0.48	0.01	0.97	0.27	0.37	-0.27	-0.03	-0.22	-0.07	-0.11
$\psi_\ell = 0$	0.60	0.05	1.11	0.29	0.39	-0.32	-0.02	-0.30	-0.05	-0.09
$\psi_x = 0$	0.54	0.03	1.04	0.26	0.40	-0.30	-0.05	-0.18	-0.05	-0.09
$\phi = 0.44$	0.52	0.00	0.96	0.21	0.35	-0.28	0.01	-0.15	-0.06	-0.01
$\varphi^\theta = 0$	0.49	0.05	0.93	0.27	0.32	-0.26	-0.04	-0.18	-0.07	-0.12
$\varphi^\theta = 0.3$	0.49	0.05	0.93	0.27	0.32	-0.26	-0.04	-0.18	-0.07	-0.12
$\kappa_\ell = 1$	0.54	0.07	0.98	0.29	0.32	-0.28	-0.07	-0.34	-0.09	-0.14
$\kappa_x = 1$	0.49	0.05	0.92	0.26	0.32	-0.26	-0.05	-0.18	-0.06	-0.10
$\delta_b = 0.3$	0.47	0.05	0.90	0.27	0.31	-0.26	-0.03	-0.18	-0.06	-0.10
$\delta_b = 0.9$	0.50	0.05	0.95	0.27	0.33	-0.27	-0.04	-0.18	-0.07	-0.12
No Working Capital	0.48	0.04	0.84	0.21	0.30	-0.25	-0.06	-0.19	-0.06	-0.09

Table C.20: Fiscal Multipliers: T^o financed, horizon $h = 7$

Parameters	g_N^c	g_T^c	g_N^x	g_T^x	ζT^r	τ^c	τ^x	τ^ℓ	τ_H^k	τ_N^k
Baseline Model	0.56	0.14	1.24	0.62	0.21	-0.27	-0.15	-0.38	-0.14	-0.26
$\rho_f = 0.30$	0.89	0.19	1.33	0.64	0.36	-0.33	-0.17	-0.24	-0.12	-0.25
$\rho_f = 0.75$	0.81	0.17	1.24	0.61	0.26	-0.30	-0.13	-0.35	-0.14	-0.24
$\xi_H = \xi_N = \infty$	0.47	0.13	1.06	0.60	0.10	-0.20	-0.07	-0.40	-0.05	-0.06
$\xi_H = \xi_N = 2.5$	0.61	0.16	1.26	0.57	0.27	-0.31	-0.20	-0.37	-0.15	-0.52
$\epsilon = 2$	0.63	0.17	1.28	0.64	0.17	-0.29	-0.15	-0.43	-0.15	-0.27
$\rho = 0.5$	0.61	0.17	1.34	0.65	0.28	-0.26	-0.15	-0.42	-0.14	-0.26
$\zeta = 0$	0.57	0.14	1.26	0.62	.	-0.27	-0.17	-0.35	-0.16	-0.29
$\zeta = 0.7$	0.56	0.15	1.29	0.63	0.29	-0.29	-0.14	-0.41	-0.14	-0.26
$\eta = 0.9$	0.58	0.08	1.23	0.51	0.25	-0.28	-0.11	-0.34	-0.11	-0.24
$\eta = 2.4$	0.54	0.17	1.24	0.67	0.18	-0.26	-0.16	-0.41	-0.17	-0.27
$\psi_p = 0$	0.49	0.19	1.11	0.70	0.11	-0.23	-0.18	-0.47	-0.21	-0.31
$\psi_p = 1000$	0.67	-0.02	1.34	0.32	0.44	-0.35	-0.07	-0.16	-0.04	-0.10
$\psi_w = 0$	0.57	0.18	1.18	0.62	0.14	-0.26	-0.15	-0.32	-0.14	-0.26
$\psi_w = 1000$	0.53	0.04	1.38	0.61	0.34	-0.29	-0.13	-0.52	-0.15	-0.25
$\psi_\ell = 0$	0.62	0.15	1.38	0.64	0.24	-0.31	-0.14	-0.47	-0.14	-0.25
$\psi_x = 0$	0.53	0.15	1.15	0.61	0.17	-0.25	-0.13	-0.37	-0.14	-0.25
$\phi = 0.44$	0.58	0.09	1.28	0.52	0.26	-0.29	-0.12	-0.33	-0.14	-0.17
$\varphi^\theta = 0$	0.56	0.14	1.24	0.62	0.21	-0.27	-0.15	-0.38	-0.14	-0.26
$\varphi^\theta = 0.3$	0.56	0.14	1.24	0.62	0.21	-0.27	-0.15	-0.38	-0.14	-0.26
$\kappa_\ell = 1$	0.60	0.17	1.13	0.53	0.14	-0.27	-0.23	-0.63	-0.17	-0.27
$\kappa_x = 1$	0.54	0.15	1.19	0.60	0.20	-0.26	-0.16	-0.39	-0.12	-0.19
$\delta_b = 0.3$	0.51	0.14	1.12	0.60	0.17	-0.24	-0.12	-0.38	-0.12	-0.22
$\delta_b = 0.9$	0.59	0.14	1.33	0.63	0.24	-0.29	-0.16	-0.38	-0.16	-0.28
No Working Capital	0.54	0.12	0.83	0.33	0.12	-0.22	-0.23	-0.40	-0.11	-0.19

Table C.21: Fiscal Multipliers: \bar{B}^g, T^r, T^o financed, horizon $h = 1$

Parameters	g_N^c	g_T^c	g_N^x	g_T^x	ζT^r	τ^c	τ^x	τ^ℓ	τ_H^k	τ_N^k
Baseline Model	0.63	0.11	0.94	0.30	0.36	-0.29	-0.05	-0.19	-0.07	-0.13
$\rho_f = 0.30$	0.85	0.19	0.89	0.24	0.42	-0.32	-0.02	-0.09	-0.04	-0.07
$\rho_f = 0.75$	0.83	0.16	0.94	0.28	0.38	-0.31	-0.03	-0.16	-0.06	-0.10
$\xi_H = \xi_N = \infty$	0.45	0.09	0.61	0.19	0.22	-0.20	0.00	-0.24	-0.01	0.00
$\xi_H = \xi_N = 2.5$	0.67	0.11	0.99	0.30	0.39	-0.31	-0.08	-0.18	-0.07	-0.28
$\epsilon = 2$	0.65	0.11	0.95	0.30	0.30	-0.29	-0.05	-0.20	-0.07	-0.13
$\rho = 0.5$	0.67	0.15	1.02	0.33	0.45	-0.24	-0.07	-0.22	-0.06	-0.14
$\zeta = 0$	0.51	0.04	0.92	0.27	.	-0.26	-0.05	-0.16	-0.08	-0.14
$\zeta = 0.7$	0.82	0.22	1.00	0.35	0.51	-0.34	-0.07	-0.24	-0.07	-0.14
$\eta = 0.9$	0.65	0.05	0.94	0.24	0.37	-0.29	0.00	-0.17	-0.05	-0.11
$\eta = 2.4$	0.61	0.13	0.93	0.33	0.35	-0.28	-0.07	-0.21	-0.09	-0.14
$\psi_p = 0$	0.29	0.10	0.55	0.31	0.13	-0.15	-0.12	-0.26	-0.19	-0.28
$\psi_p = 1000$	0.78	0.03	1.09	0.19	0.48	-0.35	0.01	-0.08	0.00	0.00
$\psi_w = 0$	0.64	0.15	0.94	0.32	0.35	-0.29	-0.06	-0.18	-0.07	-0.14
$\psi_w = 1000$	0.61	0.05	0.97	0.28	0.39	-0.29	-0.04	-0.23	-0.07	-0.12
$\psi_\ell = 0$	0.76	0.12	1.12	0.33	0.43	-0.35	-0.04	-0.32	-0.05	-0.10
$\psi_x = 0$	0.69	0.07	1.05	0.28	0.43	-0.32	-0.07	-0.20	-0.05	-0.10
$\phi = 0.44$	0.66	0.06	0.97	0.24	0.39	-0.30	-0.01	-0.17	-0.06	-0.03
$\varphi^\theta = 0$	0.63	0.11	0.94	0.30	0.36	-0.29	-0.05	-0.19	-0.07	-0.13
$\varphi^\theta = 0.3$	0.63	0.11	0.94	0.30	0.36	-0.29	-0.05	-0.19	-0.07	-0.13
$\kappa_\ell = 1$	0.68	0.14	1.00	0.33	0.37	-0.31	-0.08	-0.35	-0.09	-0.15
$\kappa_x = 1$	0.62	0.11	0.94	0.30	0.36	-0.29	-0.06	-0.20	-0.07	-0.11
$\delta_b = 0.3$	0.61	0.11	0.92	0.30	0.35	-0.28	-0.04	-0.20	-0.06	-0.11
$\delta_b = 0.9$	0.64	0.11	0.96	0.30	0.37	-0.29	-0.06	-0.19	-0.07	-0.14
No Working Capital	0.61	0.11	0.87	0.26	0.34	-0.27	-0.07	-0.21	-0.06	-0.11

Table C.22: Fiscal Multipliers: \bar{B}^g, T^r, T^o financed, horizon $h = 7$

Parameters	g_N^c	g_T^c	g_N^x	g_T^x	ζT^r	τ^c	τ^x	τ^ℓ	τ_H^k	τ_N^k
Baseline Model	0.57	0.09	1.20	0.56	0.17	-0.26	-0.14	-0.35	-0.14	-0.26
$\rho_f = 0.30$	0.84	0.12	1.28	0.57	0.31	-0.31	-0.16	-0.20	-0.12	-0.24
$\rho_f = 0.75$	0.76	0.10	1.20	0.54	0.21	-0.28	-0.12	-0.32	-0.13	-0.23
$\xi_H = \xi_N = \infty$	0.48	0.12	1.03	0.58	0.09	-0.20	-0.07	-0.39	-0.05	-0.06
$\xi_H = \xi_N = 2.5$	0.62	0.09	1.21	0.49	0.21	-0.29	-0.20	-0.33	-0.15	-0.52
$\epsilon = 2$	0.64	0.13	1.25	0.59	0.14	-0.28	-0.15	-0.40	-0.14	-0.26
$\rho = 0.5$	0.62	0.11	1.28	0.57	0.22	-0.23	-0.15	-0.39	-0.14	-0.26
$\zeta = 0$	0.57	0.14	1.26	0.62	.	-0.27	-0.17	-0.35	-0.16	-0.29
$\zeta = 0.7$	0.58	-0.01	1.15	0.44	0.16	-0.24	-0.14	-0.34	-0.13	-0.25
$\eta = 0.9$	0.59	0.01	1.17	0.44	0.19	-0.26	-0.10	-0.30	-0.10	-0.24
$\eta = 2.4$	0.55	0.14	1.20	0.63	0.15	-0.25	-0.16	-0.39	-0.17	-0.27
$\psi_p = 0$	0.50	0.16	1.09	0.67	0.08	-0.22	-0.17	-0.46	-0.21	-0.31
$\psi_p = 1000$	0.68	-0.16	1.24	0.16	0.33	-0.30	-0.06	-0.08	-0.03	-0.09
$\psi_w = 0$	0.58	0.16	1.15	0.59	0.12	-0.26	-0.15	-0.31	-0.14	-0.26
$\psi_w = 1000$	0.53	-0.06	1.30	0.50	0.26	-0.25	-0.13	-0.47	-0.14	-0.25
$\psi_\ell = 0$	0.63	0.10	1.33	0.58	0.20	-0.29	-0.14	-0.45	-0.13	-0.25
$\psi_x = 0$	0.53	0.11	1.11	0.57	0.14	-0.24	-0.13	-0.35	-0.14	-0.25
$\phi = 0.44$	0.59	0.02	1.23	0.44	0.20	-0.26	-0.11	-0.30	-0.14	-0.17
$\varphi^\theta = 0$	0.57	0.09	1.20	0.56	0.17	-0.26	-0.14	-0.35	-0.14	-0.26
$\varphi^\theta = 0.3$	0.57	0.09	1.20	0.56	0.17	-0.26	-0.14	-0.35	-0.14	-0.26
$\kappa_\ell = 1$	0.62	0.15	1.11	0.51	0.12	-0.26	-0.23	-0.62	-0.17	-0.27
$\kappa_x = 1$	0.55	0.10	1.14	0.54	0.16	-0.25	-0.16	-0.36	-0.12	-0.19
$\delta_b = 0.3$	0.52	0.11	1.08	0.55	0.13	-0.23	-0.12	-0.36	-0.12	-0.21
$\delta_b = 0.9$	0.60	0.09	1.27	0.56	0.19	-0.27	-0.16	-0.35	-0.15	-0.27
No Working Capital	0.55	0.10	0.81	0.30	0.10	-0.22	-0.23	-0.39	-0.11	-0.19

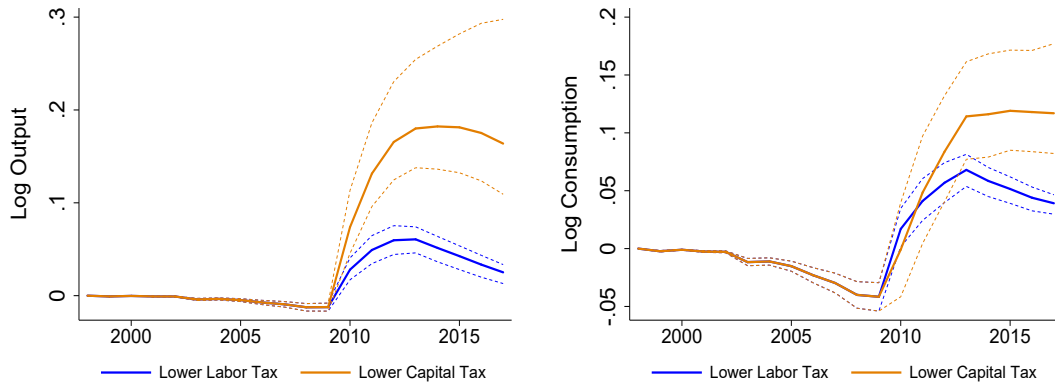


Figure C.10: Reducing Transfers in the Boom and Taxes in the Bust

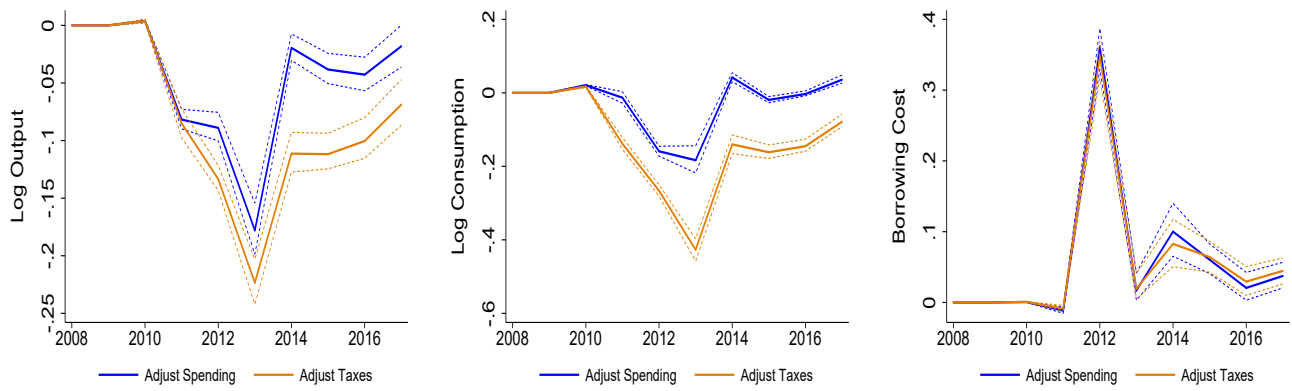


Figure C.11: External Bailout of Greek Government

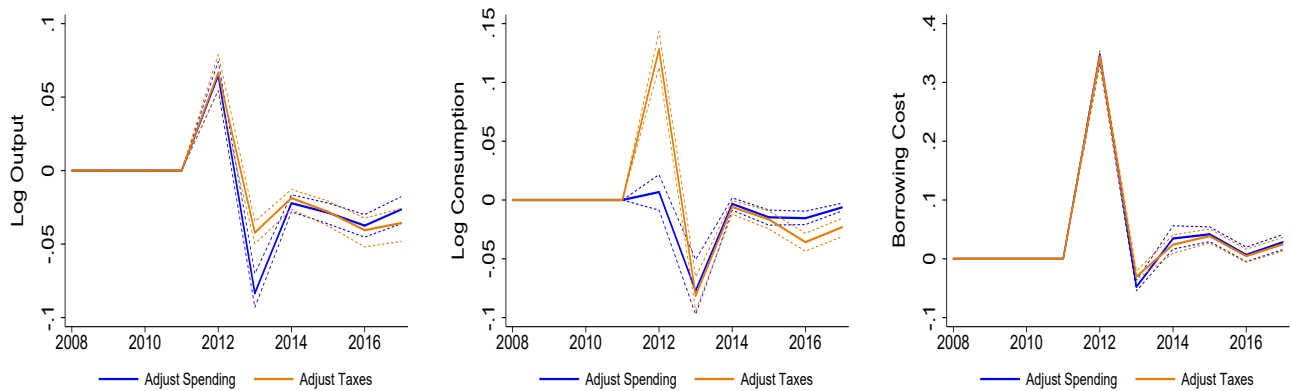


Figure C.12: Bailout of Domestic Banks