Online Appendix to "Protectionism and Inequality"

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A Data description

A.1 Monthly and Quarterly Data

Antidumping Initiatives The data is from the Global Antidumping Database (GAD), which was initiated as the Temporary Trade Barriers Database (Bown (2011)). Following Barattieri et al. (2021), we construct the antidumping initiatives as the total number of HS-6 products affected by new antidumping investigations in a given quarter or month.

Skill Premium, Skilled Wage, Employment Ratio, and Skilled Employment We rely on Dolado et al. (2021) for data of hourly wage and employment, with time series of wage gap and employment ratio being extracted from the NBER extracts of the Current Population Survey (CPS) Merged Outgoing Rotation Groups. The sample includes individuals in working age 25–64, full time, part-time workers, and self-employed, excluding military employees. Employment rate is obtained as the share of employed workers in the labor force. Wages are computed as the ratio of weekly wages and the number of weekly hours worked in each skill category, whereas employment is calculated as number of hours of work per employee per month, multiplied by the number of workers in each skill group. The data is originally obtained in monthly frequency. We transform it to quarterly frequency for our quarterly analysis.

Real Net Exports Data on monthly nominal net exports is from OECD statistics, Monthly International Merchandise Trade (IMTS). We compute real net exports using FRED's monthly CPI index for all urban consumers (seasonally adjusted) with the link here.

Real Exchange Rate Data on montly real exchange rate is the series of Real Narrow Effective Exchange Rate for United States from FRED with the link here.

Industrial Production We use the Industrial Production index (INDPRO) from FRED. The link is here.

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Inflation We use Consumer Price Index for All Urban Consumers (CPIAUCSL) from FRED in unit of Percent Change from One Year Ago. The link is here.

Federal Funds Rate We use the Effective Federal Funds Rate (FEDFUNDS) from the FRED. The link is here.

Firm Entry We use Timely Indicators of Entrepreneurship from OECD as the measurement for firm entry. The data comes in quarterly frequency and is indexed with 2007=100. In their specification, for the United States, new creations refer to establishments. Their data sources are: Bureau of Labor Statistics (BLS) - Business Employment Dynamics (BED), unemployment insurance (UI) records, number of establishments with at least one employee. Link to data is here.

A.2 Panel Data

Tariffs We use the Tariff rate, Applied, Weighted mean, Manufactured products (%) series from the World Bank World Development Indicators for each country and year. We also use HS-2 product-level tariff rates from the WITS when calculating fixed import weights. We detrend tariffs for each country using HP filter.

Skill Premium We obtain annual data on wages and employment for high-skilled and low-skilled workers from the World Input-Output database (WIOD)'s Socio Economic Accounts for all of the countries in our sample from 1995 to 2009. They use the 1997 International Standard Classification of Education (ISCED) classification to define workers with three different skill levels – low, medium and high skilled labor. Following Dix-Carneiro and Traiberman (2023), we convert the low- and medium- skilled labor (people without a tertiary education) to low-skilled labor in our context and keep the high-skilled group as in the data. To obtain high-skilled hourly wage, we divide total high-skilled labor compensation by hours worked by high-skilled persons engaged. In a similar fashion, low-skilled hourly wage is calculated by combining the low-skilled and medium-skilled hourly wage in the data. Finally, we calculate the skill premium as the ratio of high-skilled hourly wage over low-skilled hourly wage. The original dataset can be found here: https://web.archive.org/web/20211102093655/http://www.wiod.org/database/seas13

Employment Ratio Using the same dataset described above, we calculate the employment ratio by dividing the total hours worked by high-skilled persons engaged over the total hours worked by low-skilled persons at the annual frequency. High-skilled employment is measured by total hours worked by persons engaged (millions) multiplied by the share in total hours worked by high-skilled workers. Similarly, low-skilled employment is measured by total hours worked by persons engaged (millions) multiplied by share in total hours worked by both the low-skilled and medium skilled workers.

Real GDP We first obtain nominal GDP and the price level (1995=100) from the World Input-Output Database. We then calculate real GDP by dividing nominal GDP by the price level.

Inflation Inflation data is from World Bank's Inflation, GDP Deflator (Annual %) series.

Country List: Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, India, Indonesia, Ireland, Italy, Japan, South Korea, Republic of Latvia, Lithuania, Luxembourg, Malta, Mexico, Netherlands, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, Spain, Sweden, Turkey, the United States.

B VAR Robustness Checks

China shock, monthly VAR

Our VAR analysis incorporating all countries under the antidumping investigations from the U.S. raises the concern that China plays a substantially larger role by the end of the sample, which might affect our results. Figure A.1 illustrates that there is indeed a moderate increase in the number of antidumping initiatives against China on average in the second half of our sample period, particularly after China's accession into the WTO in 2001. We address the China shock concern by running our VAR on all the countries excluding China in our data. Figure A.2 plots the VAR responses of antidumping duties on countries excluding China together with other variables of interest. The results are very similar to the benchmark ones, suggesting that changes in the focus of the countries against which antidumping investigations are initiated do not interfere with our results.

Panel VAR robustness checks

To provide robustness checks to our panel VAR analysis using tariff data, we re-estimate the panel using applied tariff data with fixed import weights. More specifically, we calculate the import shares of HS 2-digit level products in the initial year, which is 1995, for each country that the U.S. reports imports from. Since there is quite some variation of product codes from year to year for each exporting partner of the U.S., we match the product codes for every year after 1995 with those in 1995 so as to use the import weights in 1995. Then, we are able to generate the applied tariff rates fixing import shares at 1995 level, thus accounting for endogeneity of the import weights. Figure A.3 shows the corresponding VAR results. It is worth noting that with an initial jump on impact, tariff experiences a decline in the second

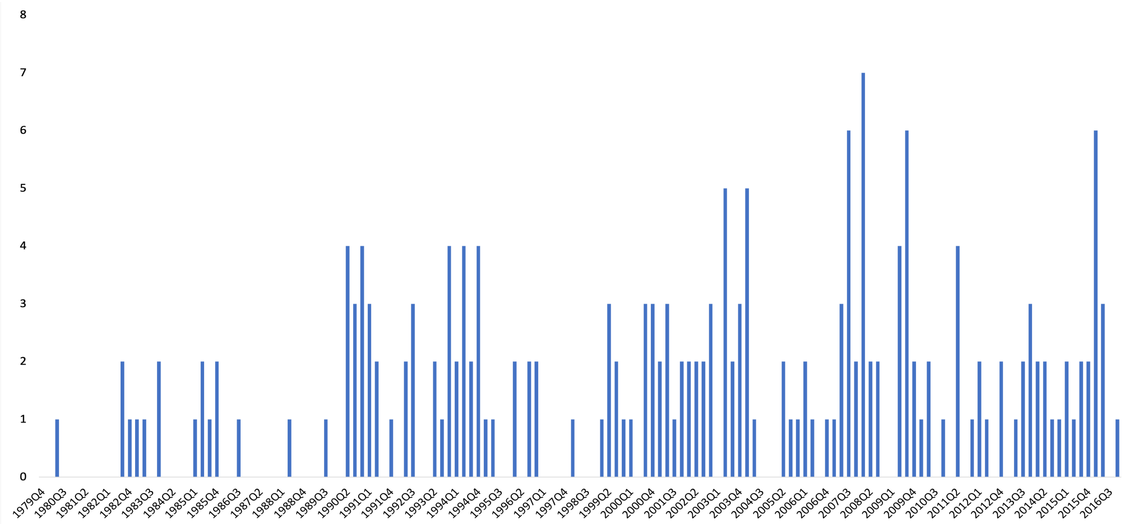

Figure A.1: Antidumping initiatives against China at quarterly frequency

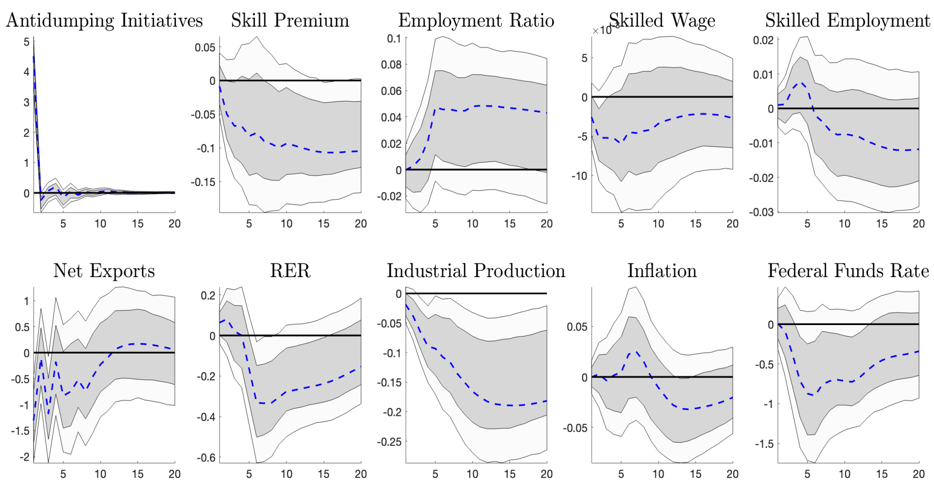

Figure A.2: Monthly VAR. One-standard deviation increase in antidumping initiatives on countries excluding China

period, while skill premium increases and employment ratio decreases. Qualitatively, these are consistent with the panel VAR results without pre-fixed import weights as in Figure 5 in the main text of the paper.

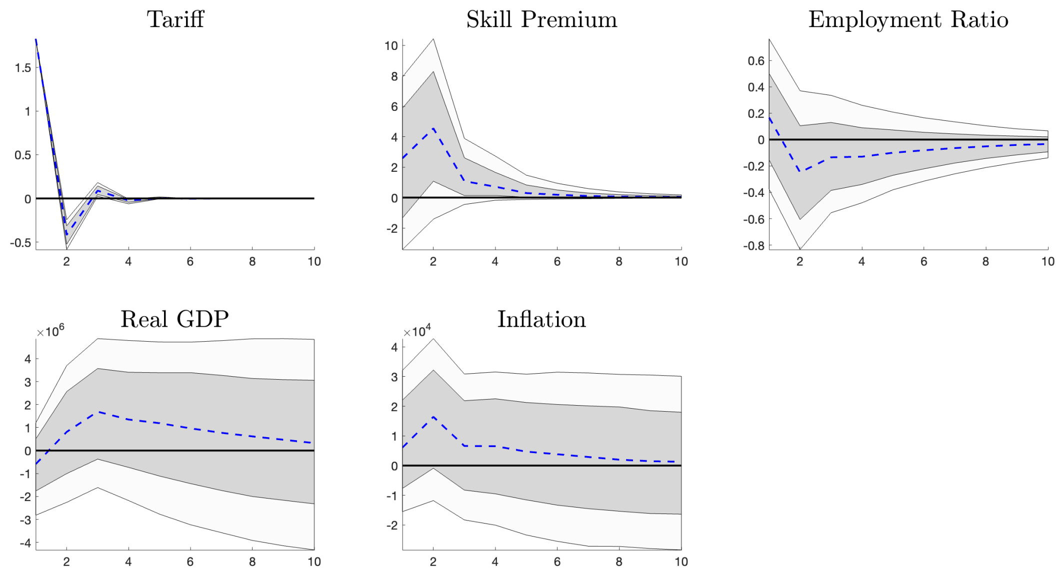

Figure A.3: Panel VAR. One-standard deviation increase in detrendeded applied tariffs with import weights being fixed at the 1995 level.

C Model summary

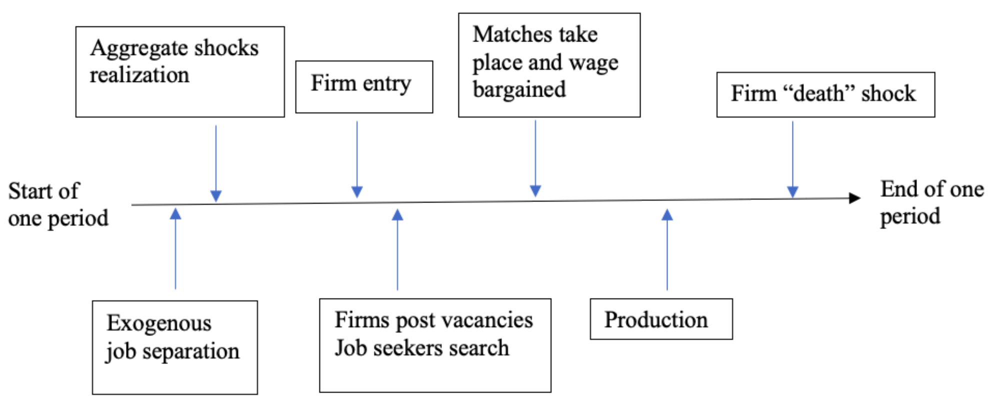

Figure A.4: **Timeline of key events in the model**

Below summarizes the equilibrium conditions of the model.

- average high-skilled employment

$$\tilde{l}_{h,t} = \tilde{l}_{D,h,t} + \frac{N_{X,t}}{N_{D,t}} \tilde{l}_{X,h,t}$$

$$\tilde{l}^*_{h,t} = \tilde{l}^*_{D,h,t} + \frac{N^*_{X,t}}{N^*_{D,t}} \tilde{l}^*_{X,h,t}$$

- average low-skilled employment

$\tilde{l}_{l,t} = \tilde{l}_{D,l,t} + \frac{N_{X,t}}{N_{D,t}} \tilde{l}_{X,l,t}$

$\tilde{l}^*_{l,t} = \tilde{l}^*_{D,l,t} + \frac{N^*_{X,t}}{N^*_{D,t}} \tilde{l}^*_{X,l,t}$

- average capital stock

$\tilde{k}_t = \tilde{k}_{D,t} + \frac{N_{X,t}}{N_{D,t}} \tilde{k}_{X,t}$

$\tilde{k}^*_t = \tilde{k}^*_{D,t} + \frac{N^*_{X,t}}{N^*_{D,t}} \tilde{k}^*_{X,t}$

- flow value of unemployment for high-skilled workers

$b_{h,t} = \chi_h / C_t^{-\eta} + \varkappa_h$

$b^*_{h,t} = \chi_h / C_t^{*-\eta} + \varkappa^*_h$

- flow value of unemployment for low-skilled workers

$b_{l,t} = \chi_l / C_t^{-\eta} + \varkappa_l$

$b^*_{l,t} = \chi_l / C_t^{*-\eta} + \varkappa^*_l$

- symmetry conditions for labor ratios

$\frac{\tilde{l}_{D,h,t}}{\tilde{l}_{D,l,t}} = \frac{\tilde{l}_{X,h,t}}{\tilde{l}_{X,l,t}}$

$\frac{\tilde{l}^*_{D,h,t}}{\tilde{l}^*_{D,l,t}} = \frac{\tilde{l}^*_{X,h,t}}{\tilde{l}^*_{X,l,t}}$

- symmetry conditions for capital-labor ratios

$\frac{\tilde{l}_{D,h,t}}{\tilde{k}_{D,t}} = \frac{\tilde{l}_{X,h,t}}{\tilde{k}_{X,t}}$

$\frac{\tilde{l}^*_{D,h,t}}{\tilde{k}^*_{D,t}} = \frac{\tilde{l}^*_{X,h,t}}{\tilde{k}^*_{X,t}}$

- high-skilled job creation

$\frac{\kappa}{\nu_{h,t}} = (1-\zeta_h)\varphi_t Z_t \frac{\partial \tilde{F}}{\partial \tilde{l}_{h,t}} + (1-\sigma_h)(1-\delta) E_t \left[\beta_{t,t+1} \frac{\kappa}{\nu_{h,t+1}} \right] - \zeta_h E_t[\beta_{t,t+1} \mu_{h,t+1} \frac{\kappa}{\nu_{h,t+1}}] - (1-\zeta_h) b_{h,t}$

$\frac{\kappa}{\nu^*_{h,t}} = (1-\zeta_h)\varphi^*_t Z^*_t \frac{\partial \tilde{F}^*}{\partial \tilde{l}^*_{h,t}} + (1-\sigma_h)(1-\delta) E_t \left[\beta^*_{t,t+1} \frac{\kappa}{\nu^*_{h,t+1}} \right] - \zeta_h E_t[\beta^*_{t,t+1} \mu^*_{h,t+1} \frac{\kappa}{\nu^*_{h,t+1}}] - (1-\zeta_h) b^*_{h,t}$

- low-skilled job creation

$\frac{\kappa}{\nu_{l,t}} = (1-\zeta_l)\varphi_t Z_t \frac{\partial \tilde{F}}{\partial \tilde{l}_{l,t}} + (1-\sigma_l)(1-\delta) E_t \left[\beta_{t,t+1} \frac{\kappa}{\nu_{l,t+1}} \right] - \zeta_l E_t[\beta_{t,t+1} \mu_{l,t+1} \frac{\kappa}{\nu_{l,t+1}}] - (1-\zeta_l) b_{l,t}$

$\frac{\kappa}{\nu^*_{l,t}} = (1-\zeta_l)\varphi^*_t Z^*_t \frac{\partial \tilde{F}^*}{\partial \tilde{l}^*_{l,t}} + (1-\sigma_l)(1-\delta) E_t \left[\beta^*_{t,t+1} \frac{\kappa}{\nu^*_{l,t+1}} \right] - \zeta_l E_t[\beta^*_{t,t+1} \mu^*_{l,t+1} \frac{\kappa}{\nu^*_{l,t+1}}] - (1-\zeta_l) b^*_{l,t}$

- bargained wage for high-skilled workers

$$w_{h,t} = \zeta_h \varphi_t Z_t \frac{\partial \tilde{F}}{\partial \tilde{l}_{h,t}} + (1-\zeta_h)(b_{h,t} + E_t[\beta_{t,t+1}\mu_{h,t+1}\frac{\zeta_h}{1-\zeta_h}\frac{\kappa}{\nu_{h,t+1}}])$$

$$w^*_{h,t} = \zeta_h \varphi^*_t Z^*_t \frac{\partial \tilde{F}^*}{\partial \tilde{l}^*_{h,t}} + (1-\zeta_h)(b^*_{h,t} + E_t[\beta^*_{t,t+1}\mu^*_{h,t+1}\frac{\zeta_h}{1-\zeta_h}\frac{\kappa}{\nu^*_{h,t+1}}])$$

- bargained wage for low-skilled workers

$$w_{l,t} = \zeta_l \varphi_t Z_t \frac{\partial \tilde{F}}{\partial \tilde{l}_{l,t}} + (1-\zeta_l)(b_{l,t} + E_t[\beta_{t,t+1}\mu_{l,t+1}\frac{\zeta_l}{1-\zeta_l}\frac{\kappa}{\nu_{l,t+1}}])$$

$$w^*_{l,t} = \zeta_l \varphi^*_t Z^*_t \frac{\partial \tilde{F}^*}{\partial \tilde{l}^*_{l,t}} + (1-\zeta_l)(b^*_{l,t} + E_t[\beta^*_{t,t+1}\mu^*_{l,t+1}\frac{\zeta_l}{1-\zeta_l}\frac{\kappa}{\nu^*_{l,t+1}}])$$

- demand for capital

$$r_t = \varphi_t Z_t \frac{\partial \tilde{F}}{\partial \tilde{k}_t}$$

$$r^*_t = \varphi^*_t Z^*_t \frac{\partial \tilde{F}^*}{\partial \tilde{k}^*_t}$$

- Euler equations for bond holdings

$$(C_t)^{-\eta} = \beta(1 + r^b_{t+1})E_t[(C_{t+1})^{-\eta}]$$

$$(C^*_t)^{-\eta} = \beta(1 + r^{b*}_{t+1})E_t[(C^*_{t+1})^{-\eta}]$$

- Euler equations for share holdings

$$\tilde{e}_t = E_t\left[\left(\frac{C_{t+1}}{C_t}\right)^{-\eta}(1-\delta)\beta\left(\tilde{e}_{t+1} + \tilde{d}_{t+1}\right)\right]$$

$$\tilde{e}^*_t = E_t\left[\left(\frac{C^*_{t+1}}{C^*_t}\right)^{-\eta}(1-\delta)\beta\left(\tilde{e}^*_{t+1} + \tilde{d}^*_{t+1}\right)\right]$$

- Euler equations for physical capital

$$(C_t)^{-\eta}\left[1 + \omega\left(\frac{K_{t+1}}{K_t} - 1\right)\right] = \beta E_t\left\{(C_{t+1})^{-\eta}\left[r_{t+1} + (1-\delta^k) + \frac{\omega}{2}\left[\left(\frac{K_{t+2}}{K_{t+1}}\right)^2 - 1\right]\right]\right\}$$

$$(C^*_t)^{-\eta}\left[1 + \omega\left(\frac{K^*_{t+1}}{K^*_t} - 1\right)\right] = \beta E_t\left\{(C^*_{t+1})^{-\eta}\left[r^*_{t+1} + (1-\delta^k) + \frac{\omega}{2}\left[\left(\frac{K^*_{t+2}}{K^*_{t+1}}\right)^2 - 1\right]\right]\right\}$$

- law of motion for capital

$$K_{t+1} = I_t + (1-\delta^k)K_t - \frac{\omega}{2}\left(\frac{K_{t+1}}{K_t} - 1\right)^2 K_t$$

$$K^*_{t+1} = I^*_t + (1-\delta^k)K^*_t - \frac{\omega}{2}\left(\frac{K^*_{t+1}}{K^*_t} - 1\right)^2 K^*_t$$

- average real prices

$$\tilde{\rho}_{D,t} = \frac{\psi}{\psi-1}\varphi_t(\left(\frac{\vartheta}{\vartheta-(\psi-1)}\right)^{\frac{1}{\psi-1}} z_{\min})^{-1}$$

$$\tilde{\rho}_{X,t} = Q^{-1}_t \tau_t \frac{\psi}{\psi-1}\varphi_t\left(\tilde{z}_{X,t}\right)^{-1}$$

$\tilde{\rho}^*_{D,t} = \frac{\psi}{\psi-1}\varphi^*_t(\left(\frac{\vartheta}{\vartheta-(\psi-1)}\right)^{\frac{1}{\psi-1}} z_{\min})^{-1}$

$\tilde{\rho}^*_{X,t} = Q_t\tau^*_t\frac{\psi}{\psi-1}\varphi^*_t\left(\tilde{z}^*_{X,t}\right)^{-1}$

- aggregate demand for the composite goods

$Y_t = C_t + I_t + N_{E,t}f_{r,t} + N_{X,t}f_{X,t} + \kappa(V_{h,t} + V_{l,t})$

$Y^*_t = C^*_t + I^*_t + N^*_{E,t}f^*_{r,t} + N^*_{X,t}f^*_{X,t} + \kappa(V^*_{h,t} + V^*_{l,t})$

- profits/dividends

$\tilde{d}_{D,t} = \frac{1}{\psi}\left[\tilde{\rho}_{D,t}\right]^{1-\psi} Y_t$

$\tilde{d}_{X,t} = \frac{Q_t}{\psi}\left[\tilde{\rho}_{X,t}\right]^{1-\psi} Y^*_t - f_{X,t}$

$\tilde{d}^*_{D,t} = \frac{1}{\psi}\left[\tilde{\rho}^*_{D,t}\right]^{1-\psi} Y^*_t$

$\tilde{d}^*_{X,t} = \frac{Q_t^{-1}}{\psi}\left[\tilde{\rho}^*_{X,t}\right]^{1-\psi} Y_t - f^*_{X,t}$

$\tilde{d}_t = \tilde{d}_{D,t} + \frac{N_{X,t}}{N_{D,t}}\tilde{d}_{X,t}$

$\tilde{d}^*_t = \tilde{d}^*_{D,t} + \frac{N^*_{X,t}}{N^*_{D,t}}\tilde{d}^*_{X,t}$

- price indexes

$N_{D,t}\left(\tilde{\rho}_{D,t}\right)^{1-\psi} + N^*_{X,t}\left(\tilde{\rho}^*_{X,t}\right)^{1-\psi} = 1$

$N^*_{D,t}\left(\tilde{\rho}^*_{D,t}\right)^{1-\psi} + N_{X,t}\left(\tilde{\rho}_{X,t}\right)^{1-\psi} = 1$

- free entry

$\tilde{e}_t = f_{r,t} + \kappa\tilde{l}_{h,t}/\nu_{h,t} + \kappa\tilde{l}_{l,t}/\nu_{l,t} + w_{h,t}\tilde{l}_{h,t} + w_{l,t}\tilde{l}_{l,t}$

$\tilde{e}^*_t = f^*_{r,t} + \kappa\tilde{l}^*_{h,t}/\nu^*_{h,t} + \kappa\tilde{l}^*_{l,t}/\nu^*_{l,t} + w^*_{h,t}\tilde{l}^*_{h,t} + w^*_{l,t}\tilde{l}^*_{l,t}$

- zero-profit export cutoffs

$\tilde{d}_{X,t} = f_{X,t}\frac{\psi-1}{\vartheta-(\psi-1)}$

$\tilde{d}^*_{X,t} = f^*_{X,t}\frac{\psi-1}{\vartheta-(\psi-1)}$

- share of exporting firms

$\frac{N_{X,t}}{N_{D,t}} = \left(z_{\min}\right)^{\vartheta}\left(\tilde{z}_{X,t}\right)^{-\vartheta}\left[\frac{\vartheta}{\vartheta-(\psi-1)}\right]^{\vartheta/(\psi-1)}$

$\frac{N^*_{X,t}}{N^*_{D,t}} = \left(z_{\min}\right)^{\vartheta}\left(\tilde{z}^*_{X,t}\right)^{-\vartheta}\left[\frac{\vartheta}{\vartheta-(\psi-1)}\right]^{\vartheta/(\psi-1)}$

- number of firms

$N_{D,t} = (1-\delta)\left(N_{D,t-1} + N_{E,t-1}\right)$

$N^*_{D,t} = (1-\delta)\left(N^*_{D,t-1} + N^*_{E,t-1}\right)$

- aggregate high-skilled job seekers

$$S_{h,t} = \bar{L}_h - (1-\sigma_h)(1-\delta)L_{h,t-1}$$

$$S^*_{h,t} = \bar{L}^*_h - (1-\sigma_h)(1-\delta)L^*_{h,t-1}$$

- aggregate low-skilled job seekers

$$S_{l,t} = \bar{L}_l - (1-\sigma_l)(1-\delta)L_{l,t-1}$$

$$S^*_{l,t} = \bar{L}^*_l - (1-\sigma_l)(1-\delta)L^*_{l,t-1}$$

- transition rate for vacancies for high-skilled workers

$$\nu_{h,t} = \xi_h(S_{h,t}/V_{h,t})^{1-\varepsilon}$$

$$\nu^*_{h,t} = \xi^*_h(S^*_{h,t}/V^*_{h,t})^{1-\varepsilon}$$

- transition rate for vacancies for low-skilled workers

$$\nu_{l,t} = \xi_l(S_{l,t}/V_{l,t})^{1-\varepsilon}$$

$$\nu^*_{l,t} = \xi^*_l(S^*_{l,t}/V^*_{l,t})^{1-\varepsilon}$$

- job-finding rate for high-skilled workers

$$\mu_{h,t} = \xi_h(S_{h,t}/V_{h,t})^{-\varepsilon}$$

$$\mu^*_{h,t} = \xi^*_h(S^*_{h,t}/V^*_{h,t})^{-\varepsilon}$$

- job-finding rate for low-skilled workers

$$\mu_{l,t} = \xi_l(S_{l,t}/V_{l,t})^{-\varepsilon}$$

$$\mu^*_{l,t} = \xi^*_l(S^*_{l,t}/V^*_{l,t})^{-\varepsilon}$$

- goods market clearing for the representative domestic firm

$$[\tilde{\rho}_{D,t}]^{-\psi} Y_t = Z_t \left(\frac{\vartheta}{\vartheta-(\psi-1)}\right)^{\frac{1}{\psi-1}} z_{\min} \left[\phi\left[\lambda\left(\tilde{k}_{D,t}\right)^{\gamma} + (1-\lambda)\left(\tilde{l}_{D,h,t}\right)^{\gamma}\right]^{\frac{\alpha}{\gamma}} + (1-\phi)\left(\tilde{l}_{D,l,t}\right)^{\alpha}\right]^{\frac{1}{\alpha}}$$

$$\left[\tilde{\rho}^*_{D,t}\right]^{-\psi} Y^*_t = Z^*_t \left(\frac{\vartheta}{\vartheta-(\psi-1)}\right)^{\frac{1}{\psi-1}} z_{\min} \left[\phi\left[\lambda\left(\tilde{k}^*_{D,t}\right)^{\gamma} + (1-\lambda)\left(\tilde{l}^*_{D,h,t}\right)^{\gamma}\right]^{\frac{\alpha}{\gamma}} + (1-\phi)\left(\tilde{l}^*_{D,l,t}\right)^{\alpha}\right]^{\frac{1}{\alpha}}$$

- goods market clearing for the representative exporter

$$\tau_t\left[\tilde{\rho}_{X,t}\right]^{-\psi} Y^*_t = Z_t \tilde{z}_{X,t} \left[\phi\left[\lambda\left(\tilde{k}_{X,t}\right)^{\gamma} + (1-\lambda)\left(\tilde{l}_{X,h,t}\right)^{\gamma}\right]^{\frac{\alpha}{\gamma}} + (1-\phi)\left(\tilde{l}_{X,l,t}\right)^{\alpha}\right]^{\frac{1}{\alpha}}$$

$$\tau^*_t\left[\tilde{\rho}^*_{X,t}\right]^{-\psi} Y_t = Z^*_t \tilde{z}^*_{X,t} \left[\phi\left[\lambda\left(\tilde{k}^*_{X,t}\right)^{\gamma} + (1-\lambda)\left(\tilde{l}^*_{X,h,t}\right)^{\gamma}\right]^{\frac{\alpha}{\gamma}} + (1-\phi)\left(\tilde{l}^*_{X,l,t}\right)^{\alpha}\right]^{\frac{1}{\alpha}}$$

- aggregate accounting

  $L_{h,t} = (N_{D,t} + N_{E,t})\tilde{l}_{h,t}$

  $L^*_{h,t} = (N^*_{D,t} + N^*_{E,t})\tilde{l}^*_{h,t}$

  $L_{l,t} = (N_{D,t} + N_{E,t})\tilde{l}_{l,t}$

  $L^*_{l,t} = (N^*_{D,t} + N^*_{E,t})\tilde{l}^*_{l,t}$

  $K_t = N_{D,t}\tilde{k}_t$

  $K^*_t = N_{D,t}\tilde{k}^*_t$

- low of motion for aggregate high-skilled employment

  $L_{h,t} = \nu_{h,t}V_{h,t} + (1-\sigma_h)(1-\delta)L_{h,t-1}$

  $L^*_{h,t} = \nu^*_{h,t}V^*_{h,t} + (1-\sigma_h)(1-\delta)L^*_{h,t-1}$

- low of motion for aggregate low-skilled employment

  $L_{l,t} = \nu_{l,t}V_{l,t} + (1-\sigma_l)(1-\delta)L_{l,t-1}$

  $L^*_{l,t} = \nu^*_{l,t}V^*_{l,t} + (1-\sigma_l)(1-\delta)L^*_{l,t-1}$

- balanced trade

  $Q_tN_{X,t}(\tilde{\rho}_{X,t})^{1-\psi}Y^*_t = N^*_{X,t}(\tilde{\rho}^*_{X,t})^{1-\psi}Y_t$

- The above equations constitute a system of 81 equations in 81 endogenous variables: $\tilde{l}_{D,h,t}$, $\tilde{l}_{D,l,t}$, $\tilde{l}_{X,h,t}$, $\tilde{l}_{X,l,t}$, $\tilde{k}_{D,t}$, $\tilde{k}_{X,t}$, $\tilde{l}_{h,t}$, $\nu_{h,t}$, $\tilde{l}_{l,t}$, $\nu_{l,t}$, φ_t, C_t, $\mu_{h,t}$, $b_{h,t}$, $\mu_{l,t}$, $b_{l,t}$, r_t, $\tilde{k}_t$, r^b_t, $\tilde{e}_t$, $\tilde{d}_t$, K_t, I_t, $\tilde{\rho}_{D,t}$, $\tilde{\rho}_{X,t}$, $\tilde{z}_{X,t}$, Y_t, $N_{E,t}$, $N_{X,t}$, $V_{h,t}$, $V_{l,t}$, $\tilde{d}_{D,t}$, $\tilde{d}_{X,t}$, $N_{D,t}$, $w_{h,t}$, $w_{l,t}$, $L_{h,t}$, $L_{l,t}$, $S_{h,t}$, $S_{l,t}$, their Foreign counterparts and the real exchange rate Q_t.

D Nash wage bargaining

We assume wage is the solution of an individual Nash bargaining between a firm and a worker. The equilibrium sharing rule resulting from the bargaining between a type j worker and a producer with productivity z can be written as $\zeta_j S^F_{j,t}(z) = (1-\zeta_j)S^W_{j,t}(z)$, where $\zeta_j \in (0,1)$ represents the type j worker's bargaining share, $S^F_{j,t}(z)$ is firm surplus, and $S^W_{j,t}(z)$ is worker surplus. The surplus of the match to the firm corresponds to the value of the job to the firm, which is given by the marginal revenue product of the match, plus its expected savings from posting the job next period, net of the wage bill:

$$S^F_{j,t}(z) = \varphi_t(z)zZ_t\frac{\partial F(z)}{\partial l_{j,t}(z)} - w_{j,t}(z) + (1-\sigma_j)(1-\delta)E_t\left[\beta_{t,t+1}\frac{\kappa}{\nu_{j,t+1}}\right] = \frac{\kappa}{\nu_{j,t}} \quad (A.1)$$

Equation (A.1) implies the surplus to the firm is symmetric across z, i.e. $S^F_{j,t}(z) = S^F_{j,t}$. The sharing rule further implies the surplus to the worker is also symmetric across z, i.e. $S^W_{j,t}(z) = \frac{\zeta_j}{1-\zeta_j} S^F_{j,t}(z) = \frac{\zeta_j}{1-\zeta_j}\frac{\kappa}{\nu_{j,t}} = S^W_{j,t}$. Meanwhile, the surplus to the worker can be expressed as the current wage net of the worker's outside option $\bar{\omega}_{j,t}$, plus the expected discounted continuation value of the match for the worker, $S^W_{j,t+1} = \frac{\zeta_j}{1-\zeta_j}\frac{\kappa}{\nu_{j,t+1}}$:

$$S^W_{j,t} = w_{j,t}(z) - \bar{\omega}_{j,t} + (1-\sigma_j)(1-\delta)E_t\left[\beta_{t,t+1}\frac{\zeta_j}{1-\zeta_j}\frac{\kappa}{\nu_{j,t+1}}\right] \tag{A.2}$$

where the worker's outside option is equal to the flow value of unemployment, $b_{j,t} \equiv \chi_j / C_t^{-\eta} + \varkappa_j$, plus the value of searching for other jobs in the next period:

$$\bar{\omega}_{j,t} = b_{j,t} + E_t[\beta_{t,t+1}\mu_{j,t+1}\frac{\zeta_j}{1-\zeta_j}\frac{\kappa}{\nu_{j,t+1}}] \tag{A.3}$$

Equation (A.2) and (A.3) imply worker's wage is symmetric across z, i.e. $w_{j,t}(z) = w_{j,t}$. Plug (A.1) and (A.2) into the sharing rule, we obtain the expression for the bargained wage:

$$w_{j,t} = \zeta_j \varphi_t(z) z Z_t \frac{\partial F(z)}{\partial l_{j,t}(z)} + (1-\zeta_j)\bar{\omega}_{j,t} \tag{A.4}$$

which shows that the bargained wage is a weighted average between the marginal revenue product of the worker and the worker's outside option.

Plugging (A.4) into (A.1), the job creation equation can be expressed as:

$$\frac{\kappa}{\nu_{j,t}} = (1-\zeta_j)\varphi_t(z) z Z_t \frac{\partial F(z)}{\partial l_{j,t}(z)} + (1-\sigma_j)(1-\delta)E_t\left[\beta_{t,t+1}\frac{\kappa}{\nu_{j,t+1}}\right] - \zeta_j E_t[\beta_{t,t+1}\mu_{j,t+1}\frac{\kappa}{\nu_{j,t+1}}] - (1-\zeta_j)b_{j,t} \tag{A.5}$$

E Proof of $\varphi_t(z)z$ symmetric across z

(A.4) implies $\varphi_t(z)zZ_t\frac{\partial F(z)}{\partial l_{h,t}(z)}$ and $\varphi_t(z)zZ_t\frac{\partial F(z)}{\partial l_{l,t}(z)}$ are both symmetric across z. The equilibrium condition that $r_t = \varphi_t(z)zZ_t\frac{\partial F(z)}{\partial k_t(z)}$ implies $\varphi_t(z)zZ_t\frac{\partial F(z)}{\partial k_t(z)}$ is also symmetric across z. The above results further lead to the fact that the ratio of $\varphi_t(z)zZ_t\frac{\partial F(z)}{\partial l_{h,t}(z)}$ to $\varphi_t(z)zZ_t\frac{\partial F(z)}{\partial k_t(z)}$ and the ratio of $\varphi_t(z)zZ_t\frac{\partial F(z)}{\partial k_t(z)}$ to $\varphi_t(z)zZ_t\frac{\partial F(z)}{\partial l_{l,t}(z)}$ are both symmetric across z, which means $\frac{1-\lambda}{\lambda}\left(\frac{l_{h,t}(z)}{k_t(z)}\right)^{(\gamma-1)}$ and $\frac{\phi\lambda}{1-\phi}\left[\lambda + (1-\lambda)\left(\frac{l_{h,t}(z)}{k_t(z)}\right)^{\gamma}\right]^{\frac{\alpha-\gamma}{\gamma}}\left(\frac{l_{l,t}(z)}{k_t(z)}\right)^{1-\alpha}$ are symmetric across z. Therefore, $\frac{l_{h,t}(z)}{k_t(z)}$ and $\frac{l_{l,t}(z)}{k_t(z)}$ are both symmetric across z, which further implies $\frac{l_{h,t}(z)}{l_{l,t}(z)}$ is symmetric across z.

Meanwhile, we have $\frac{\partial F(z)}{\partial l_{l,t}(z)} = (1-\phi)[\frac{F(z)}{l_{l,t}(z)}]^{1-\alpha}$ and

$\frac{F(z)}{l_{l,t}(z)} = \left[\phi\left[\lambda\left(\frac{k_t(z)}{l_{l,t}(z)}\right)^{\gamma} + (1-\lambda)\left(\frac{l_{h,t}(z)}{l_{l,t}(z)}\right)^{\gamma}\right]^{\frac{\alpha}{\gamma}} + (1-\phi)\right]^{\frac{1}{\alpha}}$. Thus, $\frac{\partial F(z)}{\partial l_{l,t}(z)}$ is symmetric across z. Combining this result with the fact that $\varphi_t(z) z Z_t \frac{\partial F(z)}{\partial l_{l,t}(z)}$ is also symmetric across z, it implies $\varphi_t(z) z$ is symmetric across z. This concludes the proof.

F Derivation of firm averages

In Appendix E, we show that $\varphi_t(z) z$ is symmetric across z, which means the real marginal cost $\varphi_t(z)$ is symmetric across producers up to firm-specific productivity differentials, i.e. $\varphi_t(z) = \frac{\varphi_t}{z}$. Thus, the ratio of any two firms' output and revenues depends only on the ratio of their productivity levels. Therefore, as in Melitz (2003), all the information about the distribution of productivity levels $G(z)$ that are relevant for all macroeconomic variables can be summarized by means of "average" productivity levels. Define an average productivity level $\tilde{z}_D$ for all producing firms that serve the domestic market and an average $\tilde{z}_{X,t}$ for all Home exporters:

$$\tilde{z}_D \equiv \left[\int_{z_{\min}}^{\infty} z^{\psi-1} dG(z)\right]^{1/(\psi-1)}, \tilde{z}_{X,t} \equiv \left[\frac{1}{1-G(z_{x,t})}\int_{z_{x,t}}^{\infty} z^{\psi-1} dG(z)\right]^{1/(\psi-1)},$$

where $\tilde{z}_D$ and $\tilde{z}_{X,t}$ are based on weights proportional to relative firm output shares. The model can then be restated in terms of average (representative) firms.

In particular, $\tilde{\rho}_{D,t} \equiv \rho_{D,t}(\tilde{z}_D)$ represents the average real price of Home firms in their domestic market, and $\tilde{\rho}_{X,t} \equiv \rho_{X,t}(\tilde{z}_X)$ represents the average real price of Home exporters in the export market. $\tilde{d}_{D,t} \equiv d_{D,t}(\tilde{z}_D)$ is the average domestic profit, and $\tilde{d}_{X,t} \equiv d_{X,t}(\tilde{z}_X)$ is the average export profit.

The average total profit of Home firms is given by $\tilde{d}_t = \tilde{d}_{D,t} + \frac{N_{X,t}}{N_{D,t}}\tilde{d}_{X,t}$. The average stock of type j workers is $\tilde{l}_{j,t} = \tilde{l}_{D,j,t} + \frac{N_{X,t}}{N_{D,t}}\tilde{l}_{X,j,t}$, where $\tilde{l}_{D,j,t}$ and $\tilde{l}_{X,j,t}$ denote, respectively, the number of type j workers serving domestic and export market for the representative domestic producer and the representative exporter. The average stock of physical capital is $\tilde{k}_t = \tilde{k}_{D,t} + \frac{N_{X,t}}{N_{D,t}}\tilde{k}_{X,t}$, where $\tilde{k}_{D,t}$ and $\tilde{k}_{X,t}$ are defined similarly as the case for labor.

G Sensitivity analysis of asymmetries in market size and skill abundance

We calibrate the benchmark scenario to two symmetric countries based on moments for the US economy. To explore the effects of trade barrier shocks for countries whose trading partner has a different market size and/or skill abundance, we conduct a sensitivity analysis to these two country characteristics in this section.

In particular, we simulate the IRFs of the skill premium and the employment ratio of Home to a temporary increase in Home trade barriers for four different scenarios. First, we hold the Foreign characteristics the same as the benchmark and reduce the population size of both high-skilled labor and low-skilled labor in Home by one-half. This resembles the scenario where a small country establishes trade barrier against a large country of similar skill abundance. Second, we instead hold the Home characteristics the same as the benchmark, but reduce the population size of both high-skilled labor and low-skilled labor in Foreign by one-half to resemble the scenario of a large country engaging protectionist policy against a small one. Third, we reduce the skill abundance of Home by setting its population weights $\bar{L}_h = 0.13$ and $\bar{L}_l = 0.87$, while keeping Foreign unchanged. Fourth, we hold Home characteristics the same as benchmark, but reduce the skill abundance of Foreign by setting its population weights $\bar{L}_h^* = 0.13$ and $\bar{L}_l^* = 0.87$. The results are shown by Figure A.5-A.8, respectively.

As Figure A.5 shows, when the market size of Home is reduced by one-half, the magnitudes of the responses of skill premium and employment ratio are significantly larger than those of the benchmark. In this scenario, both imports and exports relative to GDP for Home increase compared with the benchmark one. This implies a larger share of the varieties of the composite good that is imported. Thus, increases in the price of imports would induce a larger decline in the real income of the household. Moreover, the appreciation of the real exchange rate, which leads to a rise in the price of exports, would cause a greater reduction on the aggregate demand for the domestic goods, as exports make up a larger share of GDP. Both channels tend to amplify the downward aggregate demand pressure caused by the trade barrier shock, thus increasing the magnitude of the responses.

Analogous analysis applies to the opposite scenario in which the market size of Foreign is smaller. In that case, there would be a smaller share of the varieties that is imported and also a smaller share of GDP that is made up of exports for Home. Therefore, the downward aggregate demand pressure tends to be mitigated, reducing the magnitudes of the responses as shown by Figure A.6.

Figure A.7 shows that the responses are larger relative to benchmark if the skill abundance of Home is reduced. In this scenario, high-skilled is valued more by the firms due to its scarcity, thus resulting in higher labor market tightness in steady state, while that for low-skilled is lower. Therefore, drops in the labor market tightness caused by the trade barrier shock tend to hurt more to the high-skilled but less to the low-skilled, which translates into relatively higher labor supply of high-skilled but lower one of low-skilled. This in turn results in a higher employment ratio on impact relative to the benchmark scenario. Larger drop in the low-skilled employment also tends to drive up its marginal product of labor, leading to larger decline in the skill premium.

Changes in the skill abundance of Foreign only affect the steady-state labor market tightness of Home indirectly and the effects are quantitatively small. Therefore, the magnitudes of the responses of skill premium and employment ratio when Foreign is less skill-abundant are similar to those under the benchmark scenario as shown by Figure A.8.

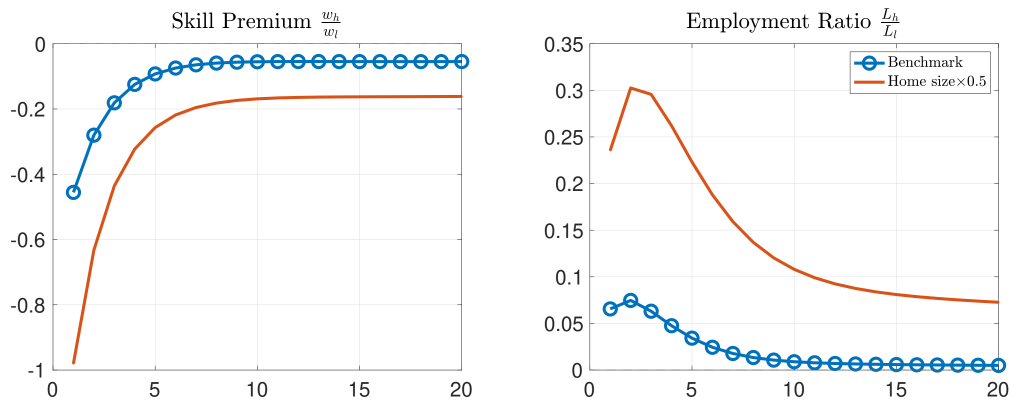

Figure A.5: **Responses to a temporary increase in Home trade barriers, different scenarios. Responses show percentage deviations from the steady state.**

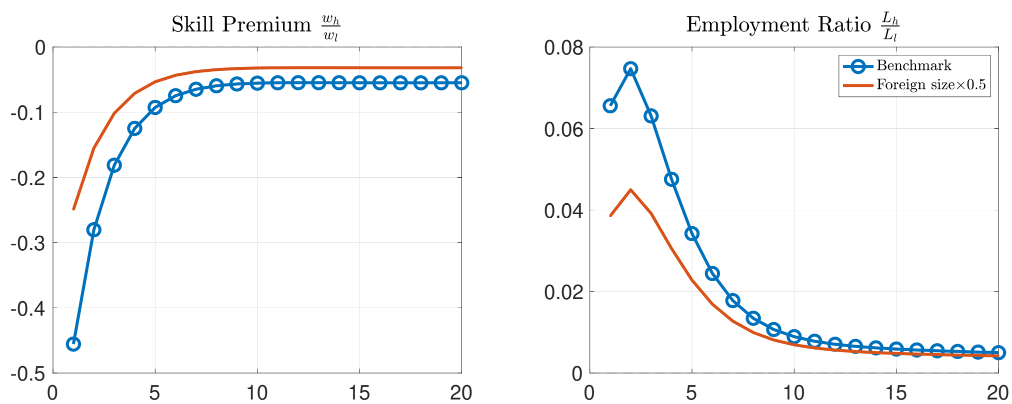

Figure A.6: **Responses to a temporary increase in Home trade barriers, different scenarios. Responses show percentage deviations from the steady state.**

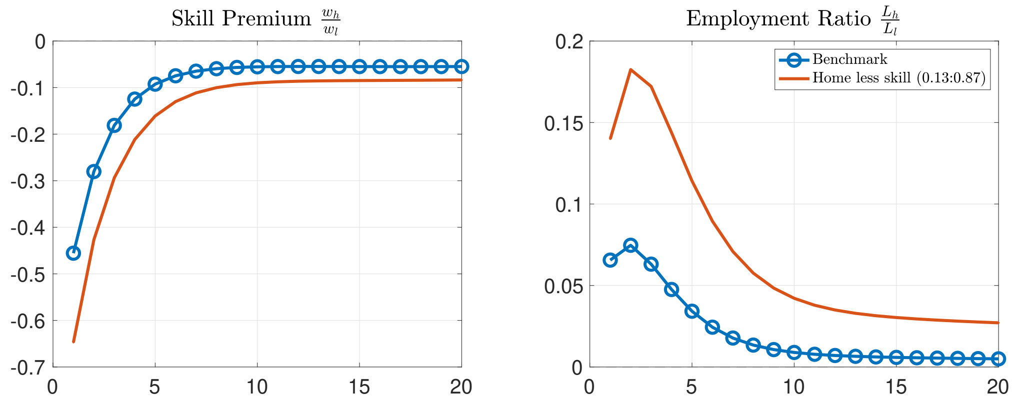

Figure A.7: **Responses to a temporary increase in Home trade barriers, different scenarios. Responses show percentage deviations from the steady state.**

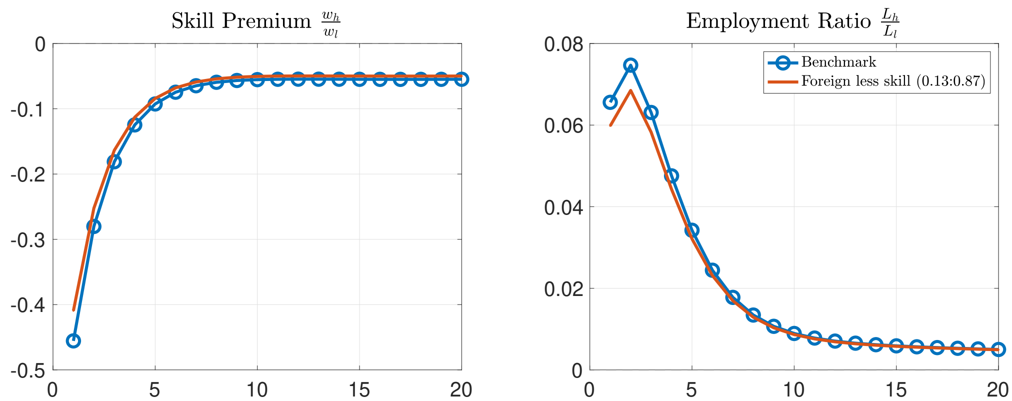

Figure A.8: **Responses to a temporary increase in Home trade barriers, different scenarios. Responses show percentage deviations from the steady state.**

H More log linearization results

The ratio of the marginal product of labor between high-skilled and low-skilled labor is:

$$\text{ratio-Fl}_t \equiv \frac{\frac{\partial \tilde{F}}{\partial \tilde{l}_{h,t}}}{\frac{\partial \tilde{F}}{\partial \tilde{l}_{l,t}}} = \frac{\phi(1-\lambda)}{1-\phi}[\lambda(\frac{k_t}{l_{h,t}})^{\gamma} + (1-\lambda)]^{\frac{\alpha-\gamma}{\gamma}}(\frac{l_{l,t}}{l_{h,t}})^{1-\alpha}$$

Log linearize the above equation, we get:

$$\hat{\text{ratio-Fl}}_t = \frac{(\alpha-\gamma)\lambda(\frac{k}{l_h})^{\gamma}}{\lambda(\frac{k}{l_h})^{\gamma} + (1-\gamma)}\hat{k}_t + (1-\alpha)\hat{l}_{l,t} - \frac{(1-\gamma)\lambda(\frac{k}{l_h})^{\gamma} + (1-\alpha)(1-\lambda)}{\lambda(\frac{k}{l_h})^{\gamma} + (1-\lambda)}\hat{l}_{h,t} \tag{A.6}$$

By linearizing the equation of the definition of the aggregate employment of skill type k, i.e. $L_{k,t} = (N_{D,t} + N_{E,t})\tilde{l}_{k,t}$, we get:

$$\hat{L}_{k,t} = \frac{N_D}{N_D + N_E}\hat{N}_{D,t} + \frac{N_E}{N_D + N_E}\hat{N}_{E,t} + \hat{l}_{k,t} \tag{A.7}$$

I More figures

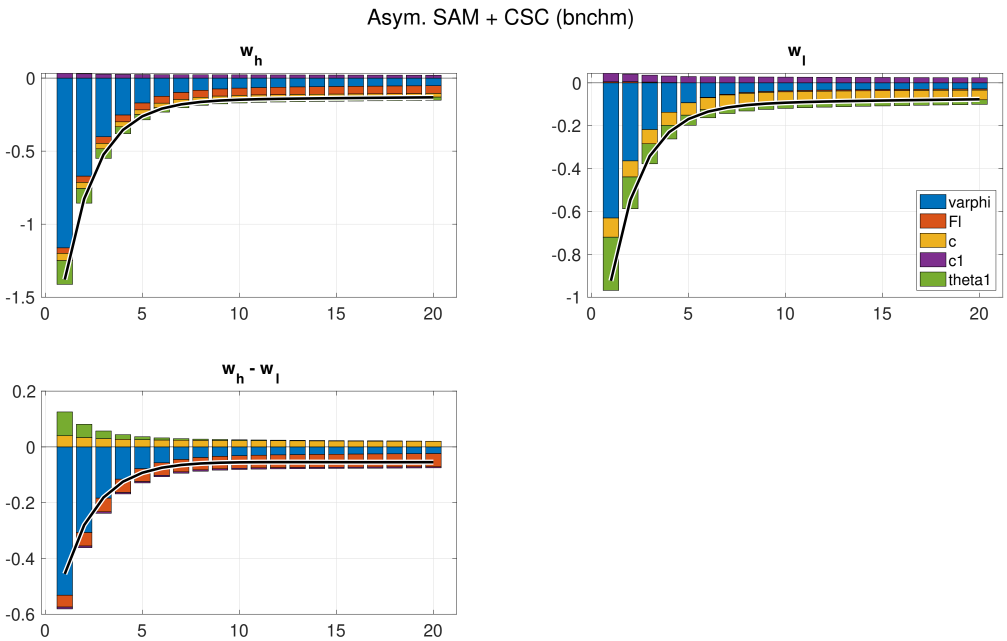

Figure A.9: **Responses to a temporary increase in Home trade barriers, Asym. SAM + CSC scenario (benchamrk). Responses show percentage deviations from the steady state.**

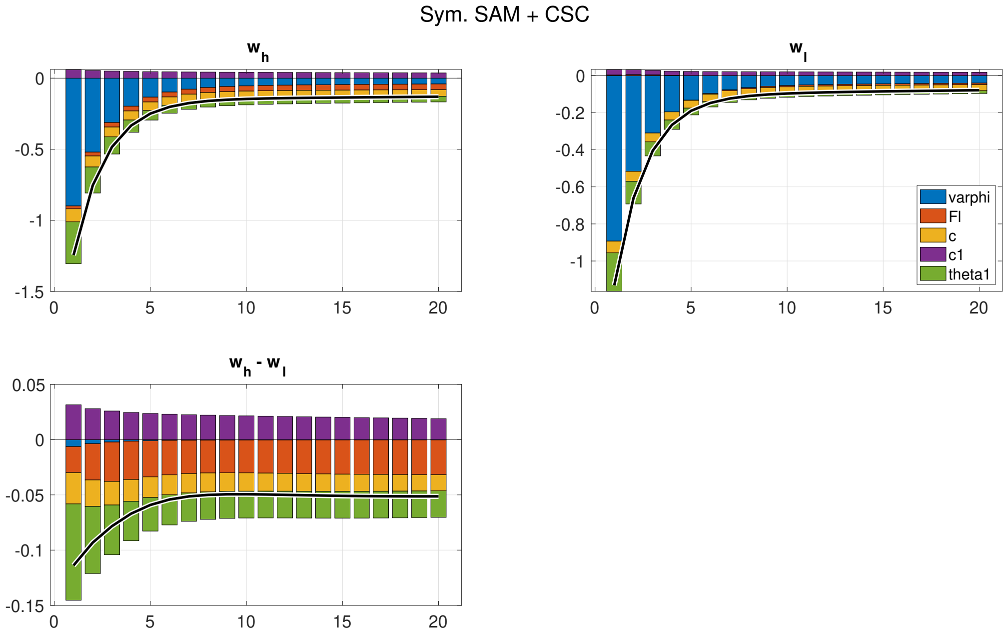

Figure A.10: **Responses to a temporary increase in Home trade barriers, Sym. SAM + CSC scenario. Responses show percentage deviations from the steady state.**

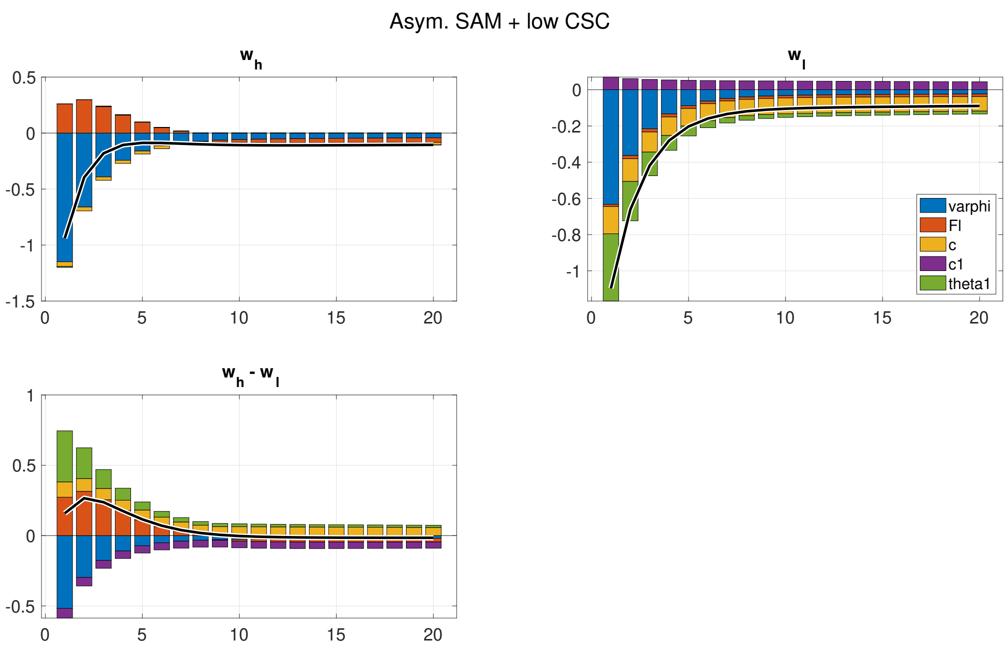

Figure A.11: **Responses to a temporary increase in Home trade barriers, Asym. SAM + low CSC scenario. Responses show percentage deviations from the steady state.**

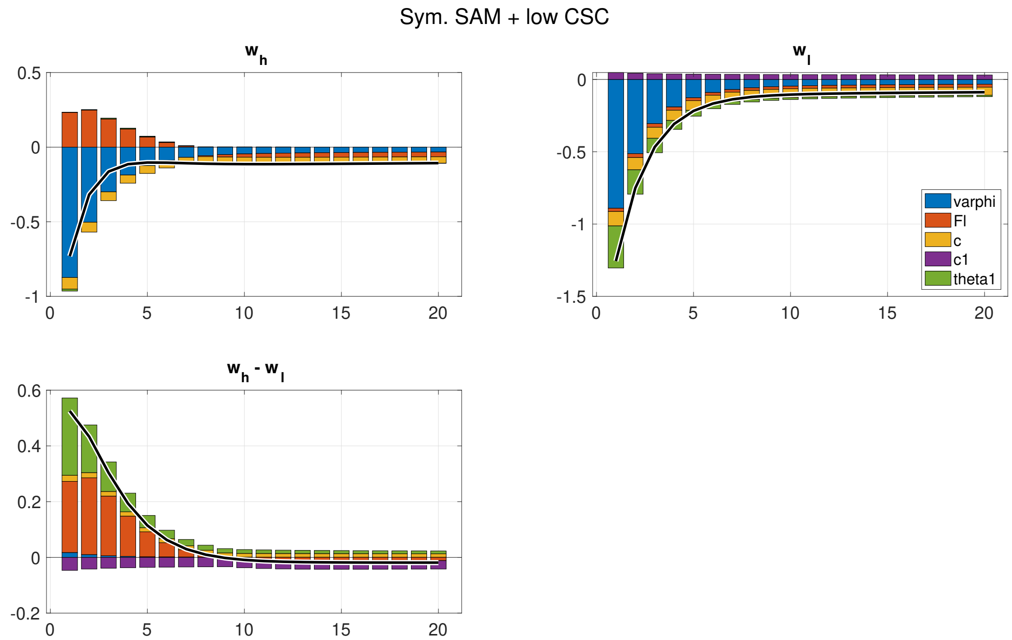

Figure A.12: **Responses to a temporary increase in Home trade barriers, Sym. SAM + low CSC scenario. Responses show percentage deviations from the steady state.**

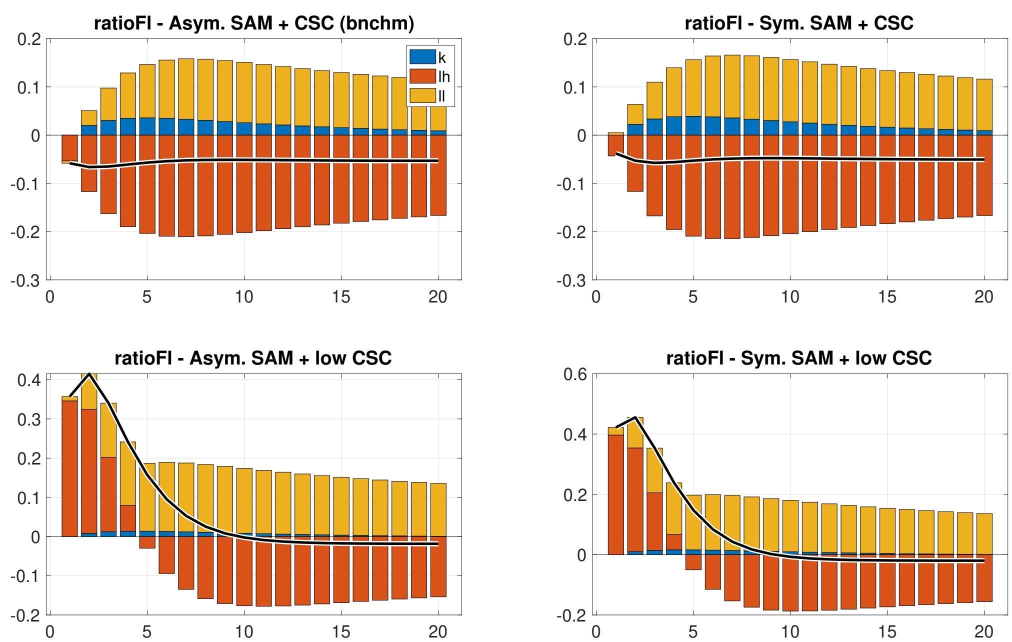

Figure A.13: **Responses to a temporary increase in Home trade barriers, different scenarios. Responses show percentage deviations from the steady state.**

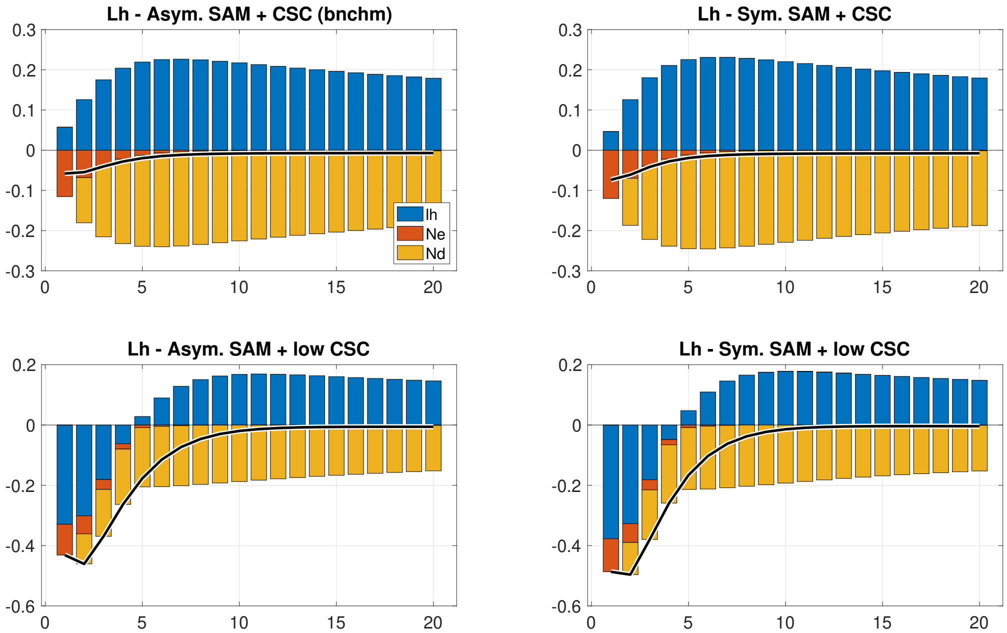

Figure A.14: **Responses to a temporary increase in Home trade barriers, different scenarios. Responses show percentage deviations from the steady state.**

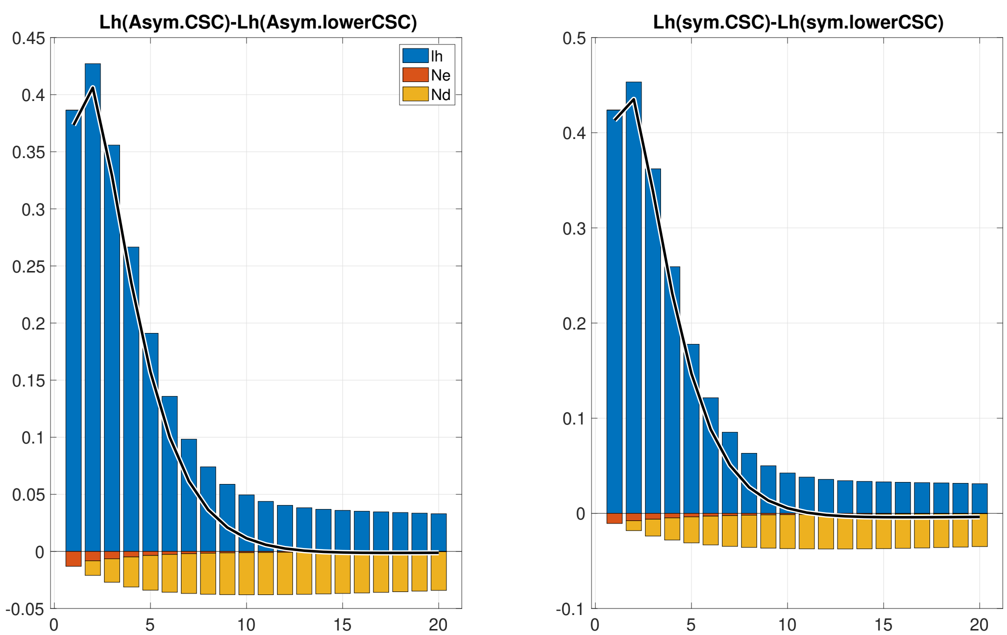

Figure A.15: **Responses to a temporary increase in Home trade barriers, different scenarios. Responses show percentage deviations from the steady state.**

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