Lectures on Trade Policy
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Agenda

- Lecture 1: Reduced-form evidence of trade policy and optimal trade policy
- Lecture 2: General equilibrium frameworks for trade policy analysis
- Lecture 3: Dynamics effects of trade policy

Today

- Reduced-form evidence of trade policy
  - shift-share analysis of trade policy, interpretation and theory
- Optimal trade policy
  - neoclassical environments with product heterogeneity

Shift share analysis of trade policy

Introduction

- Recent focus of the literature on studying the distributional effects of trade policy across space
- Different regions in a given country have different exposure to sectoral changes in import tariffs
- With frictions to the mobility of goods and factors across space, changes in trade policy may have heterogeneous outcomes according to one region's level of exposure relative to another region's.
- The shift-share analysis exploits the fact that trade policy changes are usually heterogeneous across sectors and that sectoral economic activity is unevenly distributed across space

Shift-share analysis

- The basic idea of shift-share analysis is to model the impact of shocks, or "shifters," on given outcomes in regions that have differential exposure, or "shares," to the shock
- Shift-share regressions commonly take the following specification:

$$y_n = \alpha_0 X_n + \alpha_1 \sum_j \omega_{nj} Z_j + e_n$$

  y_n is an outcome of interest, X_n is a set of controls, and e_n is an error term
- The variable Z_j is a set of shocks, or "shifters," that are heterogeneous across sectors j, and ω_{nj} is the employment share of sector j in region n
  - In the context of trade policy, tariffs are used as shifters

Topalova 2010

- Applies the shift-share method to study the effects of trade liberalization on poverty in rural districts in India
- The author exploits both the sectoral composition of economic activity across 450 districts in India and the sectoral variation in trade liberalization
  - the average import tariffs dropped from 80 to 37 percent from 1990 to 1996, while the standard deviation of tariffs fell by 50 percent
- The study runs the following specification:

$$y_{dt} = \alpha_0 + \alpha_1 Tariff_{dt} + Post_t + \delta_d + e_{dt}.$$

y_{dt} is the outcome of interest at the district level d and time t, α_0 is a constant, $Post_t$ controls for aggregate shocks or trends that affect the economy, and δ_d are district fixed effects

Topalova 2010

- This term takes a shift-share form, namely

$$Tariff_{dt} = \sum_j \omega_{dj,1991} \left[\tau_{j,t} - 1\right]$$

- The share is defined as

$$\omega_{dj,1991} = \frac{L_{dj,1991}}{\sum_j L_{dj,1991}}$$

- The author finds $\alpha_1 < 0$, namely rural districts in which the sectors were more exposed to tariff changes experienced a slower decline in poverty and lower consumption growth relative to the other regions.

Kovak (2013)

- Similar shift-share analysis to study the effects of trade liberalization on wages across Brazilian regions. Specification,

$$d\ln w_r = \zeta_0 + \zeta_1 RTC_r + e_r$$

where $d\ln w_r$ is the log wage in region r, RTC_r stands for region-level tariff changes, ζ_0 is a constant, and e_r is an error term orthogonal to tariffs.

- The coefficient of interest is ζ_1, which measures the effects of changes to regional tariffs on earnings across regions.

Kovak (2013)

- As in Topalova (2010), RTC_r takes a shift-share form, in particular

$$RTC_r = \sum_j \omega_{rj} d\ln\tau_j,$$

- The share ω_{rj} is the weight of each industry in each region, given by

$$\omega_{rj} = \frac{\frac{L_{rj}}{L_r}\frac{1}{1-\beta_{rj}}}{\sum_k \frac{L_{rk}}{L_r}\frac{1}{1-\beta_{rk}}},$$

  where β_{rj} is the share of labor payment in gross output in industry j
- Notice that these shares map onto the ones used by Topalova (2010) if $\beta_{rj} = \beta$
- Kovak (2013) finds $\zeta_1 > 0$, regions exposed to the largest tariff declines experienced smaller wage growth relative to regions that experienced smaller tariff cuts

Discussion

- Shift-share analysis poses two main issues for the interpretation of the results from the shift-share regressions
- First, as discussed in Topalova (2010), the coefficient in shift-share regressions, as in any differences-in-differences estimates, captures differential effects; namely, the impact of tariff changes in regions that have greater exposure to changes in trade policy relative to regions that have less exposure
  - Therefore, on their own, shift-share regressions do not provide information about aggregate effects.
- Second, shift-share analysis raises the question of the underlying economic model that justifies the shift-share specification.

Theory behind shift-share analysis

- Kovak (2013) makes a methodological contribution: proposes an economic model that gives rise to a shift-share formulation
- Builds on a specific factors model as in Jones (1975)
- An economy with R regions indexed by n and J sectors indexed by j.
  - Labor is freely mobile across sectors within a region and imperfectly mobile across regions.
  - Firms produce with local factors of production: labor (L) and a fixed factor (H)

Theory behind shift-share analysis

- Optimal labor demand in nj is given by

$$L_{nj} = \frac{\beta_{nj} P_{nj}}{w_n} Y_{nj},$$

  where P_{nj} is the price of output in sector j and region n.

- Labor market clearing condition can be written as

$$L_n = \sum_j \frac{\beta_{nj} P_{nj}}{w_n} Y_{nj} \text{ for all } n.$$

- Totally differentiating the labor market clearing condition, using the first-order condition of the firm's cost-minimization problem, and solving for the change in wages
- Assuming each region is a small open economy, namely $d\ln P_{nj} = d\ln \tau_j$. It follows, then,

Theory behind shift-share analysis

- We obtain
$$d\ln w_n = \sum_j \omega_{nj} d\ln \tau_j + \sum_j \omega_{nj} d\ln A_{nj},$$
- where $\delta_n \equiv \left[\sum_j \frac{L_{nj}}{L_n}\frac{1}{1-\beta_{nj}}\right]^{-1}$ and $\omega_{nj} \equiv \delta_n \frac{L_{nj}}{L_n}\frac{1}{1-\beta_{nj}}$.
  - TFP shifters usually controlled with fixed effects or modeled inside the error term.
- Notice that the theory predicts a regression coefficient $\zeta_1 = 1$ in the regression equation run by Kovak (2013)
- Kovak finds a coefficient $0 < \zeta_1 < 1$. Therefore, the empirical estimate is suggestive of imperfect regional migration as opposed to free mobility or labor immobility.

Theory behind shift-share analysis

- Introduce imperfect labor mobility by assuming that moving to location n entails a multiplicative cost ε_n that is an $i.i.d.$ draw from an extreme-value Frechet distribution with shape parameter ν.

- Using the properties of the Frechet distribution, we see that the labor supply in location n is given by

$$L_n = \frac{[w_n]^{\nu}}{\sum_i [w_i]^{\nu}} L,$$

  where L is the country's total endowment of labor. Totally differentiating this expression, we obtain

$$d\ln L_n = \nu d\ln w_n - d\ln \Phi,$$

  where we denote $\Phi \equiv \sum_i [w_i]^{\nu}$.

Theory behind shift-share analysis

- Substituting and solving for wages once more, we obtain

$$d\ln w_n = \frac{\delta_n}{1+\delta_n \nu} d\ln \Phi + \frac{1}{1+\delta_n \nu} \sum_j \omega_{nj} d\ln P_{nj} + \sum_j \frac{\omega_{nj}}{1+\delta_n \nu} d\ln A_{nj}.$$

- The last important assumption is that each region is a small, open economy. As a result of this assumption, price changes are a function of tariff changes only; namely, $d\ln P_{nj} = d\ln \tau_j$. It follows, then, that

$$d\ln w_n = \frac{\delta_n}{1+\delta_n \nu} d\ln \Phi + \frac{1}{1+\delta_n \nu} \sum_j \omega_{nj} d\ln \tau_j + \sum_j \frac{\omega_{nj}}{1+\delta_n \nu} d\ln A_{nj}.$$

Discussion

- The first takeaway, as mentioned earlier, is that the specification does not estimate level effects
  - The coefficient can only be interpreted as the deviation from aggregate effects; that is, the effect of a change in tariffs in a given market relative to the average effect of the change in tariffs in the economy $\left(\left[\delta_n / \left[1+\delta_n \nu\right]\right] d\ln\Phi\right.$
- Shift-share analysis can shed light on relevant mechanisms or elasticities and in this way can be used to guide structural models.
  - For instance, notice that the specific-factor model in which labor is not mobile across regions but perfectly mobile across sectors predicts a regression coefficient $\zeta_1 = 1$ in the regression before.

Discussion

- Another important lesson from the literature is that the shift-share specification cannot be disconnected from the theory.
- Three examples:
  - Non-tradable goods
  - Non-unit-elastic production function
  - Input-output linkages in production

Non-Tradables

- In the presence of non-tradable sectors, a practical approach has been to set the change in the price of the non-tradable goods equal to zero in the regression (e.g., ADH 2013, Topalova 2010)
- However, the assumption that changes in tariffs have no effects on the price of non-tradable goods might not be innocuous.
- Suppose we add a non-tradable sector in the economy (indexed by NT), then

$$d\ln w_n = -\delta_n d\ln L_n + \sum_{j \neq NT} \omega_{nj} d\ln P_{nj} + \omega_{nNT} d\ln P_{nNT} + \sum_j \omega_{nj} d\ln A_{nj}.$$

- In order to derive the shift-share specification, we need to solve for the endogenous change in the price of non-tradable goods.

Non-Tradables

- Assume Cobb-Douglas preferences of goods produced in each industry, namely
$$U_n = \prod_j C_{nj}^{\alpha_j}, \text{ with income } I_n = \sum_j P_{nj} Y_{nj},$$
consumers are the owners of factors of production
$$\textit{Shift-share}_n = \sum_{j \neq NT} \left[\frac{\omega_{nNT} \vartheta_{nj}}{1 - \vartheta_{nNT}} + \omega_{nj} \right] d\ln\tau_j,$$
where $\vartheta_{nNT} = [1 - \beta_{nNT}] \frac{Y_{nNT} P_{nNT}}{\sum_j P_{nj} Y_{nj}} + \beta_{nNT} \omega_{nNT}$ and
$\vartheta_{nj} = [1 - \beta_{nNT}] \frac{Y_{nj} P_{nj}}{\sum_j P_{nj} Y_{nj}} + \beta_{nNT} \omega_{nj}$
- Accounting for non-tradable goods changes the structural relationship between the shift share and the outcome of interest.
  - The theory suggests that the tariffs affect the price of non-tradable goods and that this indirect effect needs to be taken into account in the shift-share specification
- Kovak (2013) does allow for non-tradable goods in his analysis and finds that the magnitude of the effects are quantitatively different if this margin is taken into account.

IO Linkages

- Assume that firms produce with a constant return-to-scale technology using labor, a fixed factor, and materials (M) from all sectors according to the input-output structure of the economy
- Let $\gamma_{jk,n}$ denote the share of sector k in intermediate consumption in sector j and region n, with $\sum_k \gamma_{jk,n} = 1$.

$$Shift\text{-}share_n = \sum_j \omega_{nj}^{IO} d\ln\tau_j - \sum_j \tilde{\omega}_{nj}^{IO} \sum_{k \neq j} \gamma_{jk,n} d\ln\tau_k,$$

where

$$\omega_{nj}^{IO} = \omega_{nj} \frac{1 - \gamma_{nj}\gamma_{jj,n}}{1 - \gamma_{nj}}.$$

$$\tilde{\omega}_{nj}^{IO} = \omega_{nj} \frac{\gamma_{nj}}{1 - \gamma_{nj}} \sum_{k \neq j} \gamma_{jk,n}.$$

when $\gamma_{jk,n} = 0$ and $\gamma_{jj,n} = 1$, then $\omega_{nj}^{IO} = \omega_{nj}$ and $\tilde{\omega}_{nj}^{IO} = 0$.

CES structure

- Assume a more general production function with an elasticity of substitution between labor and the fixed factor given by ρ_j. Then, it follows that the shift-share equation is

$$Shift\text{-}share_n = \sum_j \omega_{nj}^{CES} d\ln\tau_j,$$

- with the share term given by

$$\omega_{nj}^{CES} = \frac{\frac{L_{nj}}{L_n}\frac{\rho_j}{1-\beta_{nj}}}{\sum_k \frac{L_{nk}}{L_n}\frac{\rho_j}{1-\beta_{nk}}}.$$

- Note that when $\rho_j = 1$, then $\omega_{nj}^{CES} = \omega_{nj}$.

Main messages

- Shift-share regressions estimate differential effects of trade policy (region more exposed relative to less exposed)
- Useful to illustrate mechanisms and guide the differential effects in structural models
- Cannot speak about level or aggregate effects (or welfare effects)

Optimal Trade Policy

Introduction

- Focus on the problem of a government that from a unilateral standpoint, chooses import taxes that maximize home welfare defined as real per-capita income (we abstract, therefore, from political economy considerations in the welfare functions and international transfers)
- Present benchmark results in the literature under different production structures, with and without trade in intermediate goods and make the distinction between a large economy and a small open economy
- Focus on neoclassical environment in which firms have no market power and there are no domestic distortions, like in a Ricardian model of trade.

Introduction

- In neoclassical trade theory, trade protectionism can be justified by terms-of-trade manipulation,
    - refers to the idea that an increase in tariffs can benefit a country by allowing it to extract rents from foreign producers by forcing them to reduce prices in order to continue serving the home economy
- A direct implication of a neoclassical small open economy in which the country cannot affect world prices is that the optimal tariff is zero
- We revisit this and other results in neoclassical models with product heterogeneity.

Two-country, One-sector Economy with a Continuum of Goods

- Consider a one-sector Ricardian trade model, with a gravity as in EK

$$\lambda_{nn} = A_n \left[\frac{w_n}{P_n}\right]^{-\theta} = \frac{A_n \left[w_n\right]^{-\theta}}{A_n \left[w_n\right]^{-\theta} + A_i \left[w_i \tau_{ni} \kappa_{ni}\right]^{-\theta}},$$

- Welfare in country n is given by

$$W_n = \frac{X_n}{L_n P_n}$$

- Using expressions for X_n / L_n and P_n, totally differentiating welfare, and finding the tariff τ_{ni}^* that maximizes welfare

Two-country, One-sector Economy with a Continuum of Goods

- Optimal tariff
$$\tau^*_{ni} - 1 = \frac{1}{\theta \tilde{\lambda}_{ii}}.$$
where $\tilde{\lambda}_{ii} = \frac{\lambda_{ii}\tau_{in}}{\lambda_{ii}\tau_{in}+1-\lambda_{ii}}$,
- The optimal tariff responds to terms of trade considerations, and depends on the trade elasticity θ and on the size of the foreign country captured by $\tilde{\lambda}_{ii}$.
- Small open economy is the limiting economy such that $L_n/L_i \to 0$. Accordingly, in the limiting economy, we have that $\lambda_{ii} = 1$ and $\lambda_{nn} = 0$.
- The optimal import tariff is given by
$$\tau^*_{ni} - 1 = \frac{1}{\theta}.$$

Discussion

- A small economy cannot affect factor prices abroad; still, it would want to manipulate its terms of trade.
- In a Ricardian economy with heterogeneous goods as in EK, any economy, no matter how small, has some goods that it is extremely efficient at producing.
  - This "market power" cannot be exploited by individual sellers
- However, it can be exploited by the government if the government imposes import tariffs to maximize real income.
- For larger values of θ, goods produced across countries are more similar, and therefore there is less room for the government to manipulate its terms-of-trade.

Discussion

- The parameter θ plays a role analogous to the elasticities of substitution in Armington models that assume that goods produced in different countries appear as imperfect substitutes in the utility function.
- In an Armington model

$$\lambda_{nn} = \frac{a_{nn}\left[w_n\right]^{1-\sigma}}{a_{nn}\left[w_n\right]^{1-\sigma} + a_{ni}\left[w_i \tau_{ni} \kappa_{ni}\right]^{1-\sigma}},$$

- where a_{nn} has the interpretation of preference weights on domestic goods, and σ is the elasticity of substitution across goods.
- In this case, we obtain that the optimal tariff for a large economy is given by $\tau^*_{ni} = 1 + 1/\left[[\sigma - 1]\tilde{\lambda}_{ii}\right]$, for the small open economy is given by $\tau^*_{ni} = 1 + 1/[\sigma - 1]$, both increasing in the degree of production

Intermediate goods

- Denote by β the share of value added in output (before we had $\beta = 1$) . The optimal tariff is given by

$$\tau_{ni}^{*} - 1 = \frac{1}{\theta \tilde{\lambda}_{ii}} \left[\frac{1 + \frac{[1-\beta]}{[1+\theta\beta]\tilde{\lambda}_{nn} - [1-\beta]\lambda_{nn}} \left[\frac{1-\lambda_{nn}}{1+\lambda_{nn}[\tau_{ni}^{*}-1]} \right]}{1 + \frac{[1-\beta]}{[1+\theta\beta]\tilde{\lambda}_{nn} - [1-\beta]\lambda_{nn}} \left[\frac{1+\lambda_{nn}}{1+\lambda_{nn}[\tau_{ni}^{*}-1]} \right]} \right].$$

- Conditional on the domestic expenditure shares λ_{nn} and λ_{ii}, the term inside the parentheses is smaller than one; as a result, the optimal import tariff is lower than it would be if there were no intermediates, $(\beta = 1)$
- In the case of a small open economy ($\tilde{\lambda}_{ii} = 1$ and $\tilde{\lambda}_{nn} = 0$), we can see that the optimal tariff formula becomes $\tau_{ni}^{*} - 1 = 1/\theta$, and therefore the optimal tariff in a small open economy is the same as it is in an economy with no intermediate goods.

Multiple sectors

- Costinot, Donaldson, Vogel, and Werning (2015) follow the primal approach as in Dixit (1985) to characterize the structure of optimal trade taxes
- In a nutshell, the primal approach is as follows: first, assume that the government can directly choose output and consumption and solve for the optimal allocation; second, show that the optimal allocation can be implemented using trade taxes. Of course, the first best can be implemented if enough instruments are available.
- **Result:** In a two country Ricardian world, optimal import tariffs are uniform across sectors

Multiple sectors

- Beshkar and Lashkaripour (2020) present similar results and derive the optimal trade tax formulas for a class of general equilibrium trade models with multiple sectors and input-output linkages that have become the workhorse models for quantitative work
- It is important to stress again that the results in these papers apply only to two country frameworks. Intuitively, in a two-country Ricardian world, the relative price of imported goods is not manipulable since they are pinned down by the relative labor requirements in the foreign country
- With more than two countries, the government can manipulate the relative price of its imports by manipulating the relative wage of the foreign countries it sources from.