Trade, specialization and inflation

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[1]The views expressed in this paper are solely the responsibility of the author and should not be interpreted as reflecting the views of the Executive Board of Sveriges Riksbank.

Introduction

- Specialization important trend over time
- Related to market size
- Many aspects of this
  - I focus on monetary policy

This paper

- Studies how optimal inflation, from an optimal taxation perspective, depends on the demand and interacts with the degree of specialization (supply side).
  - Money search framework
- Demand affects inflation directly
- But demand also increases specialization (supply side effects) which in turn affects inflation
  - smaller probability of trade but larger transaction due to lower cost
- Network models: Baqaee, Farhi & Sangani (JPE 2024)
- Preliminary empirical work
- Historical data 1380-1600

The model

- Money search model in the spirit of Lagos & Wright (JPE 2005) - but following Geromichalos & Simonovska (JET 2014)
- Two markets - centralized and decentralized
- The economy consists of n_b buyers, n_s sellers and a government.
- In the decentralized market, a buyer (seller) always stays a buyer (seller)
- Decentralized good heterogenous and buyer only demand subset of all decentralized goods
- Sellers can choose to specialize in production. Then supplies a smaller set of products at lower cost
- CRS meeting technology with meeting probabilities $\alpha_b\left(n_n, n_s\right)$ for buyers and $\alpha_s\left(n_n, n_s\right)$ for sellers

- Buyers (sellers):
  - care about a subset of decentralized goods consumption q (can produce at cost $c(q,y) = qh(y)$), and centralized goods consumption, X (X^*).
  - y is degree of seller specialization
  - buyer need money to buy goods in the decentralized market
  - also works H (H^*) hours
  - Buyer payoff is

$$u(q) + U(X) - H$$

and seller payoff

$$-qh(y) - f(y) + U(X^*) - H^*$$

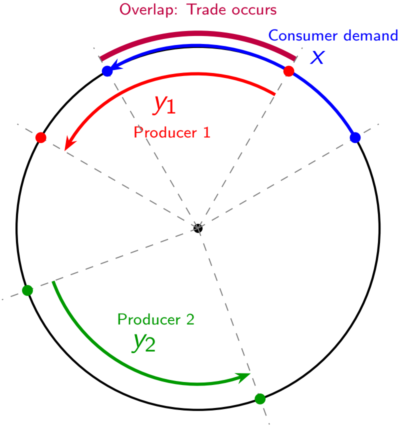
Timing

- At the start of the period gov't chooses the inflation rate and sellers the degree of specialization
- Then decentralized market opens
- Then centralized trade take place
- Buyers buy centralized good and money for labor income to be used in next period's decentralized market
- Sellers buy centralized good for labor income and money earned in this period's decentralized market

Decentralized market

- Buyer preferences and seller supply builds on Camera, Reed & Waller (IER 2003)
- Buyers with preference for good i demands good on arc $[i, i + x]$ of circle
- Sellers of type k produces goods in the interval $[k - y/2, k + y/2]$
- Given a meeting betwen a seller and a buyer, the probability of trade is $p(x, y) = x + y$

Consumer-Producer Preferences on Product Circle



x: Consumer demand
y_1: Producer 1 supply

y_2: Producer 2 supply
Purple: Overlap region

Decentralized quantities

- Kalai Smorodinsky bargaining
- The (relevant part of the) objective for a buyer as

$$J^B\left(m^B\right) = \left[-\psi + \beta\psi'\right] m^B + \beta\alpha_b p \left[u\left(q\left(m^B\right)\right) - \Delta\right].$$

- Optimal quantity is, where θ is the seller share of the surplus, when $\beta \rightarrow 1$

$$u'(q) = \frac{\pi + \alpha_b p}{\alpha_b p - \theta\left(\pi + \alpha_b p\right)} (1-\theta)\, h(y)$$

- Note: q function of y and π

Specialization and Seigniorage choice

- The seller chooses specialization to maximize the *DM* value, treating π as fixed.

$$V^S(0) = \max_y \alpha_s p \left[-qh(y) + W^S\left(m^S\right) - W^S(0) \right] - f(y) + W^S(0).$$

- Seigniorage is

$$n_b \pi \psi m$$

where $\psi m = \theta u(q) + (1-\theta) qh(y)$

- Auxiliary function $g(y, \theta)$:

$$u'(q) = \underbrace{\frac{\pi + \alpha_b p}{\alpha_b p - \theta(\pi + \alpha_b p)}(1-\theta)h(y)}_{g(y,\theta)}$$

Equilibria

- Note: If $u(q) = q^{\alpha}$ and $h(y) = 1 + y$ analysis simplifies.
- **Proposition**: In an interior equilibrium, $\frac{dy}{dn_b} < 0$ and $\frac{d\pi}{dn_b} < 0$.
- **Lemma**: Interior eq. exists for some parameter values
- **Proposition**: The general case: If

$$\frac{3\theta\sigma(q)}{1-\theta} + 1 > -\frac{qu'''(q)}{u''(q)} > \sigma(q)\left(2\theta\frac{u(q)}{qh(y)} + 1 - \theta\right) + \theta g(y,\theta) + 1 - \theta$$

then

$$\frac{d\pi}{dn_b} < 0$$

where $\sigma(q) = -\frac{qu''(q)}{u'(q)}$

Equilibria

- Quadratic prefs $u(q) = aq - \frac{b}{2}q^2$:
- Let $\bar{\theta}$ denote the value of θ where the specialization choice is on the upper bound.
- **Proposition**: There is a $\hat{\theta} < \bar{\theta}$ so that for any $\theta \in (\hat{\theta}, \bar{\theta})$ we have

$$\frac{dy}{dn_b} < 0 \text{ and } \frac{d\pi}{dn_b} > 0$$

if $1 > \eta \left(1 - \frac{f_y(2-x)}{a-(2-x)} b\right)$ where η is the elasticity of the matching function.

Robustness etc

- **Proposition**: Similar if we allow for entry of sellers
- Ramsey policy gives Friedman rule
  - Increase in demand leads to more specialization
- Exogenous changes in specialization:
  - More costly to specialize implies higher inflation (and, trivially, less specialization)

Evidence

- Data from different currency areas in Europe 1380-1600
- Need data for prices (Allen Unger dataset), as well as proxies for specialization and demand
- As a proxy for specialization, we use the number of guilds
- Available for Italy and the low countries
- Have gathered data for several cities in the "Holy Roman Empire"
- Firenze, Milano, Napoli, Antwerpen, Brugge, Leuven, Amsterdam, Leiden, Utrecht, Cologne, Frankfurt am Main, Würzburg, Krakow and Vienna.
- Proxy for demand: population, mainly from the Chandler dataset

- We then estimate the following regression (city i in period t)

$$\log \pi_{it} = \alpha_i + \beta_G \log \hat{G}_{it} + \beta_{pop} \log \hat{x}_{it} + \beta_G \log \hat{G}_{it} * \log \hat{x}_{it} + \beta_S \log \hat{S}_t + \varepsilon_{it}$$

  - $\hat{G}_{it}$ the specialization proxy
  - $\hat{x}_{it}$ the demand proxy
  - $\hat{S}_t$ the London wheat price inflation in terms of silver
  - Also other controls
- Instrument: Guilds endogenous in the model
- Members (apprentices) of a guild in a specific city, as part of their education, travelled to other cities to better learn their craft
- Use distance weighted measure of guilds in neighboring cities as instrument

Table: Results from OLS and IV Regressions

	OLS	IV
Specialization	-10.42	-17.36
	$(3.498)^{***}$	$(4.583)^{***}$
Population	-4.544	-7.223
	$(1.586)^{***}$	$(2.001)^{***}$
Interaction	1.190	1.955
	$(0.400)^{***}$	$(0.520)^{***}$
Silver price	0.200	0.137
	$(0.116)^{*}$	(0.125)
Commune	0.628	0.879
	(0.437)	$(0.513)^{*}$
Dummies:		
City FE	YES	YES
R^2	0.52	0.49

*/**/*** Denotes significance on the 10/5/1 percent level from zero. Standard errors inside par

Effects of changes in demand (population)

- Bootstrap - influenced by Mediation analysis
- Take into account effects of changes in demand/population on specialization through first stage
- Baseline: Effect 0.824 with se 0.189 (without interaction negative)
- Effect of an exogenous change in specialization: -82.56 with se 0.917

Conclusions

- Study money search model that describes the relationship between trade, specialization and seigniorage
- Finds that increases in demand leads to lower/higher inflation and more specialization
- Also looks at data for the period 1380-1600 for several currency areas
- Increase in demand leads to higher inflation
- Increases in specialization leads to lower inflation

Table: Results from OLS and IV Regressions

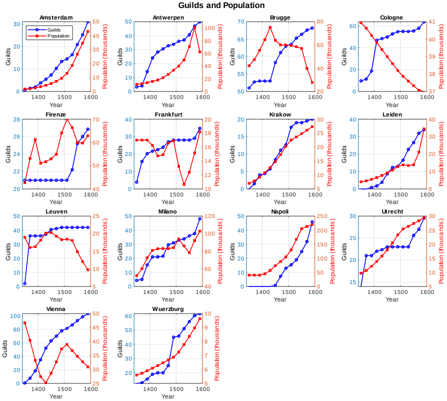
	No specialization	No interaction
Specialization		1.179
		(0.657)*
Population	−0.086	−0.997
	(0.240)	(0.529)*
Silver price	0.312	0.272
	(0.141)**	(0.138)**
Commune	0.205	0.305
	(0.427)	(0.434)
Dummies:		
City FE	YES	YES
R^2	0.45	0.42

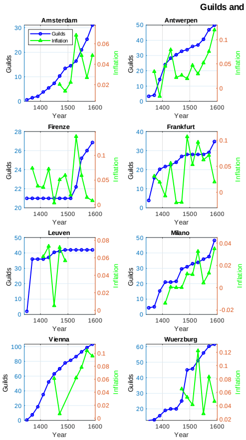
*/**/*** Denotes significance on the 10/5/1 percent level from zero. Standard errors inside par

First stage

Table: Results from OLS and IV Regressions

	Specialization	Interaction
Specialization instr	4.708	37.98
	(1.154)***	(9.693)***
Population	0.875	10.74
	(0.183)***	(1.580)***
Interaction instr	0.402	−3.156
	(0.108)***	(0.914)***
Silver price	0.016	0.212
	(0.021)	(0.206)
Commune	0.059	0.482
	(0.105)	(1.108)
City FE	YES	YES
F-test excluded instr	14.37	15.45


Guilds and Population
Amsterdam
Antwerpen
Brugge
Cologne
Firenze
Frankfurt
Krakow
Leiden
Leuven
Milano
Napoli
Utrecht
Vienna
Wuerzburg
Guilds
Population
Population (thousands)
Year


Guilds and Inflation
Amsterdam
Antwerpen
Brugge
Cologne
Firenze
Frankfurt
Krakow
Leiden
Leuven
Milano
Napoli
Utrecht
Vienna
Wuerzburg
Guilds
Inflation
Year