Optimal Monetary and Fiscal Policies in Disaggregated Economies

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Macroeconomic Modelling Frontiers for Research and Policy in Central Banks
ECB, November 27-28, 2024

The issue

Last 20 years of research

- Lots of work on the size of the government spending multiplier
- Multiplier quite large, at least sometimes

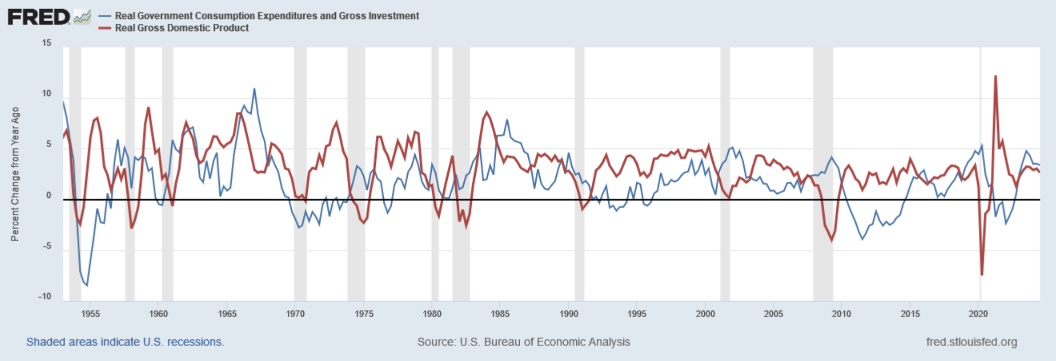
Yet aggregate government spending not countercyclical at all

- Pro-cyclical in developing economies (Gavin Perotti 97)
- A-cyclical in advanced economies (Talvi Vegh 05)

If government spending so powerful, why not used more systematically?

- $Y \Downarrow$ would lead to $G \Uparrow$
- Negative correlation (unless perfect and immediate stabilization)

Growth rate of G and Y in US (correlation 0.13)



A first clue: there is no big G, only many little g's (Cox et al 2024)

US federal purchases: 2001–2021

FACT 2. The variation of federal purchases at business cycle frequency is granular.

1. The top 10 firms (NAICS six sectors) explain 15%–20% (29%–42%) of the variation in federal purchases.
2. Time fixed effects increase the variation explained in the growth rate of federal purchases by 2.2 (0.3) percentage points at the firm (sector) level.

New perspective: sectoral heterogeneity

New Keynesian multi-sector models (w/ IO linkages)

- Limits to monetary policy stabilization: divine coincidence breaks down
- Optimal policy does not target CPI inflation (La'O Tahbaz-Salehi 22, Rubbo 23)

This paper: enter the little g's

- Determine jointly optimal monetary and **sectoral** fiscal policy
- What are the implications for monetary policy?
- What are the cyclical properties of G?

Results—optimal g's matter for aggregate dynamics

Jointly optimal policy

- Sectoral fiscal policy focuses on stabilizing the sector
- Monetary policy focuses on stabilizing aggregate economy: looks almost like inflation targeting

New evidence

- Sectoral government spending looks fairly optimal
- Raised in response to sectoral downturns, lowered in response to sectoral inflation

Aggregate implications

- Volatile cost-push shocks in aggregate Phillips curve
- Correlation of G and Y positive

Related literature

Effect of disaggregated government spending

- Countries in monetary union: Gali Monacelli (2008), Nakamura Steinsson (2014), Farhi Werning (2016), Hettig Müller (2018)
- Sectors: Ramey Shapiro (1998), Proebsting (2021), Flynn et al (2022), Bouakez et al (2021, 2022)

Tax policy when monetary policy constrained

- Non-conventional fiscal policy: Eggertsson (2004), Correia et al (2013), D'Acunto et al (2018, 2022), Bachman et al (2021)
- Tax and transfers within & across countries and sectors: Farhi et al (2014), Woodford (2022), Antonova Müller (2024)

Fiscal rules

- Gali Perotti (2003), Kliem Kriwolutzky (2014), Hatchondo et al. (2022)

2. New Keynesian $K-$sector Model

Hh expected life-time utility

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[(1-\chi) \log(C_t) + \chi \log(G_t) - \sum_{k=1}^{K} \nu_k \frac{N_{kt}^{1+\varphi}}{1+\varphi} \right]$$

$$C_t = \prod_{k=1}^{K} \left(\omega_{ck}^{-1} C_{kt}\right)^{\omega_{ck}}, \quad G_t = \prod_{k=1}^{K} \left(\omega_{gk}^{-1} G_{kt}\right)^{\omega_{ck}}$$

- Hh utility pins down efficient level of public goods provision
- Assuming lump-sum taxes, Hh budget constraint reads as

$$\sum_k P_{kt} C_{kt} + \sum_k P_{kt}^G G_{kt} + Q_{t-1} B_{t-1} = \sum_k W_{kt} N_{kt} + B_t + \Pi_t$$

Sectors $k = 1, ..., K$

Private expenditure allocation across sectors

$$C_{kt} = \omega_{ck}(P_{kt}/P_t)^{-1}C_t$$

Generic sector k

- Continuum of monopolistically competitive firms $j \in [0, 1]$, mass μ_k
- Labor is only input; sectoral productivity A_{kt}
- Standard demand with intra-sectoral elasticity of substitution θ
- Subsidy to undo the steady-state effect of imperfect competition
- Sector-specific Calvo pricing parameter α_k

3. Optimal policy

Benchmark: efficient allocation

- Planner decides on private consumption and public good
- Given time-varying technology in each sector

Decentralized economy: approximate equilibrium dynamics

- Sticky price cause departure from efficient allocation
- Monetary policy generally unable to achieve first best in multi-sector environment
- Determine jointly optimal policy: 1 interest rate and K g's

Efficient allocation: public spending moves with TFP

Planner solution satisfies Samuelson (1954) rule on public good provision

$$\nu_k \frac{N_{kt}^{\varphi}}{A_{kt}} = \frac{(1-\chi)\omega_{ck}}{C_{kt}} = \frac{\chi\omega_{gk}}{G_{kt}}$$

Rearranging yields

$$\begin{aligned} N_{kt}^{FB} &= \mu_k; \quad Y_{kt}^{FB} = \mu_k A_{kt} \\ C_{kt}^{FB} &= \frac{(1-\chi)\omega_{ck}}{\mu_k} Y_{kt}^{FB} \equiv (1-\chi_k)\mu_k A_{kt} \\ G_{kt}^{FB} &= \frac{\chi\omega_{gk}}{\mu_k} Y_{kt}^{FB} \equiv \chi_k \mu_k A_{kt} \end{aligned}$$

with sector size: $\mu_k \equiv (1-\chi)\omega_{ck} + \chi\omega_{gk}$ and $\chi_k^* = \chi_k^* / (1-\chi_k^*)$

Approximate dynamics around efficient steady state

Define sectoral output and fiscal gaps

$$\widetilde{y}_{kt} \equiv y_{kt} - y_{kt}^{FB}; \quad \widetilde{f}_{kt} = \left(g_{kt} - g_{kt}^{FB}\right) - \left(y_{kt} - y_{kt}^{FB}\right)$$

Sectoral Phillips and DIS curves

$$\begin{aligned} \pi_{kt} &= \beta \mathbb{E}_t \pi_{kt+1} + \lambda_k \left[(1+\varphi) \widetilde{y}_{kt} - \chi_k^* \widetilde{f}_{kt} \right] \\ \tilde{y}_{kt} &= \mathbb{E}_t \tilde{y}_{kt+1} - \left(i_t - \mathbb{E}_t \pi_{kt+1} - r_{kt}^{FB} \right) - \chi_k^* \mathbb{E}_t \Delta \tilde{f}_{kt+1} \end{aligned}$$

where

$$r_{kt}^{FB} \equiv (1-\chi_k)^{-1} \left[\mathbb{E}_t \Delta y_{kt+1}^{FB} - \chi_k \mathbb{E}_t \Delta g_{kt+1}^{FB} \right] = \mathbb{E}_t \Delta a_{kt+1}.$$

- K natural rates of interest: one monetary policy rate doesn't fit all

Approximate dynamics around efficient steady state cont'd

Market clearing implies relation b/w sectoral output and fiscal gaps

$$\Delta\widetilde{y}_{kt} - \Delta\widetilde{y}_t = \chi_k^* \Delta\widetilde{f}_{kt} - \chi\Delta\widetilde{f}_t - (\pi_{kt} - \pi_t) - (\Delta a_{kt} - \Delta a_t)$$

with aggregates defined consistently as

$$\pi_t = \sum_{k=1}^{K} \omega_{ck}\pi_{kt}; \quad \widetilde{y}_t = \sum_{k=1}^{K} \mu_k \widetilde{y}_{kt}; \quad a_t = \sum_{k=1}^{K} \mu_k a_{kt}$$

Welfare and key trade-offs

2nd order approximation of per-period welfare

$$W_t = -\frac{1}{2}\sum_{k=1}^{K}\mu_k\left\{\frac{\theta}{\lambda_k}\pi_{kt}^2 + (1+\varphi)\,\widetilde{y}_{kt}^2 + \chi_k^*\widetilde{f}_{kt}^2\right\} + t.i.p.$$

Trade-offs: Assume a positive productivity shock in sector k

- ...inflation and output gap become negative
- Boost sectoral demand, either with monetary policy or by raising govt spending
- MP achieves first best in single-sector ec'my, but it is too blunt here
- Spending can be adjusted but at the expense of a fiscal gap

Optimal discretionary policy

Non-zero fiscal gaps at sectoral level

$$\widetilde{f}_{kt}^{*} = \widetilde{g}_{kt}^{*} - \widetilde{y}_{kt}^{*} = -\frac{(1+\varphi)\,(1+\lambda_k)}{1+(1+\varphi)\,\lambda_k}\widetilde{y}_{kt}^{*} - \frac{\theta(1-\chi_k)\varphi}{1+(1+\varphi)\,\lambda_k}\pi_{kt}^{*}$$

Monetary policy trades off inflation in all sectors and output gaps in all sectors

$$\theta\sum_{k=1}^{K}\frac{(1-\chi_k)\mu_k}{1+(1+\varphi)\,\lambda_k}\pi_{kt}^{*} = -\sum_{k=1}^{K}\frac{\mu_k}{1+(1+\varphi)\,\lambda_k}\widetilde{y}_{kt}^{*}$$

Average fiscal gap remains closed

$$\sum_{k=1}^{K}\mu_k\left(g_{kt} - g_{kt}^{FB}\right) = 0$$

4. Evidence

Estimate sectoral fiscal rules

- Universe of federal procurement contracts from USAspending.gov
- Quarterly data for 2001–2019, sectoral classification based on 4-digit classification
- Underlying data for Producer Price Index
- Output is real sales from Compustat

Write rules in terms of spending (rather than fiscal) gap

$$\tilde{g}_{kt} = -\frac{\varphi}{1 + (1+\varphi)\lambda_k}\tilde{y}_{kt} - \frac{\theta(1-\chi_k^*)}{1+(1+\varphi)\lambda_k}\pi_{kt},$$

Estimation: two issues

1. **Gaps expressed relative to efficient level: not observed**
   - Detrend spending and output with HP Filter
   - Include TFP as control: proxy for efficient level
2. **Sectoral output and inflation endogenous**
   - Aggregate variables/shocks Z_t: fed funds rate surprises, excess bond premium, oil price shocks
   - Industry-level instrument as fitted value in first-stage regression of sector variable on aggregate interacted with industry dummy

$$X_{kt} = \beta_{0k} + (D_k \times Z_t)\beta_{1k} + \epsilon_{kt}, \text{ where } X_{kt} \in (\tilde{y}_{kt}, \pi_{kt})$$

Estimate sectoral fiscal rules: $g_{kt} = \eta_k + \gamma_t + \beta_1 \tilde{y}_{kt} + \beta_2 \pi_{kt} + \nu_{kt}$

	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
	g_{kt}	g_{kt}	f_{kt}	f_{kt}	g_{kt}	f_{kt}
y_{kt}	$-0.113***$	$-0.120***$	$-1.416***$	$-1.425***$	$-0.348***$	$-1.428***$
	(0.032)	(0.032)	(0.043)	(0.044)	(0.093)	(0.122)
π_{kt}	-0.011***	-0.011***	-0.007*	-0.007*	0.002	-0.004
	(0.002)	(0.002)	(0.003)	(0.003)	(0.007)	(0.009)
TFP		0.074*			0.087	
		(0.037)			(0.050)	
Obs.	8954	8953	8954	8953	8389	8389
R^2	0.242	0.243	0.930	0.930	—	—

Sectoral fiscal rules: role of price stickiness

Sticky if below median frequency of price adjustment

	OLS		IV	
	g_{kt}	f_{kt}	g_{kt}	f_{kt}
Flex × y_{kt}	0.232***	-0.887***	-0.232	-1.321***
	(0.058)	(0.078)	(0.135)	(0.179)
Sticky × y_{kt}	-0.255***	-1.606***	-0.585***	-1.683***
	(0.038)	(0.051)	(0.139)	(0.184)
Flex × π_{kt}	-0.011***	-0.020***	0.008	0.005
	(0.003)	(0.004)	(0.007)	(0.010)
Sticky × π_{kt}	-0.017***	0.018**	-0.121***	-0.157***
	(0.004)	(0.006)	(0.026)	(0.034)
Observations	8954	8954	8389	8389
R^2	0.247	0.931	-0.066	0.038

5. Quantitative model analysis

Quantitative model predictions

- Welfare loss w/ jointly optimal policy and w/o
- Inflation dynamics
- Cylical properties of G

Calibration

- Standard parameters: $\beta = .997$, $\theta = 6$, $\chi = 0.15$, $\varphi = 4$ and $\rho = 0.9$
- Heterogeneous pricing friction: $[\alpha_k]$ average frequency of price changes in 121 sectors (Pasten et al 2020, 2024)
- Sectoral size: $[\mu_k]$ GDP share of same sectors, from the BEA (Cox et al 2024)
- Sectoral spending share of public procurement: $[\omega_{gk}]$ (Cox et al 2024)

Welfare loss

	$i^*, \widetilde{f}^*_{kt}$	$i^*, \widetilde{f}_{kt} = 0$	$\pi_t = 0, \widetilde{f}^*_{kt}$	$\pi_t = 0, \widetilde{f}_{kt} = 0$
het α_k, bias	2.9	4.7	3.1	6.3
het α_k, no bias	2.8	4.4	2.9	4.6
hom α_k, bias	2.2	4.3	2.5	4.5
hom α_k, no bias	2.8	3.4	2.8	3.4

Remarks

- First best is never attained: running fiscal gaps is costly
- But fiscal policy makes significant contribution
- Welfare is not so bad with $\pi_t = 0$ and optimal fiscal policy
- Het. in stickiness and sectoral bias makes harder to manage shocks

No divine coincidence under optimal policy

(case with het α_k, bias)

	$i^*, \widetilde{f}^*_{kt}$	$i^*, \widetilde{f}_{kt} = 0$	$\pi_t = 0, \widetilde{f}^*_{kt}$	$\pi_t = 0, \widetilde{f}_{kt} = 0$
$\frac{var(\pi_t)}{var(\widetilde{y}_t)}$	.14% / .35%	.35% / 0	0 / 1.7%	0 / 7.8%
$\frac{var(\pi_{kt})}{var(\widetilde{y}_{kt})}$	14.6% / 53.9%	17.9% / 117%	14.5% / 55.8%	17.7% / 127%

Remarks

- Divine coincidence does not hold
- But optimal mix gets quite close

Sectoral shocks look like aggregate cost-push shock

Aggregate sectoral Phillips curves

$$\pi_{kt} = \beta \mathbb{E}_t \pi_{kt+1} + \lambda_k \left[(1-\varphi)\, \widetilde{y}_{kt} - \chi^* \widetilde{f}_{kt} \right]$$

into

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \bar{\lambda} \left[(1-\varphi)\, \widetilde{y}_t - \chi^* \widetilde{f}_t \right] + u_t$$

whith $u_t \equiv \sum_{k'=1}^{K} \omega_{ck'} \lambda_{k'} \left[(1-\varphi) \tilde{y}_{k't} - \chi^*_{k'} \tilde{f}_{k't} \right] - \bar{\lambda} \left[(1-\varphi) \tilde{y}_t - \chi^* \tilde{f}_t \right]$

- Cost-push shocks reflect sectoral heterogeneity, and policy:

(case with het α_k, bias)

	$i^*, \widetilde{f}^*_{kt}$	$i^*, \widetilde{f}_{kt} = 0$	$\pi_t = 0, \widetilde{f}^*_{kt}$	$\pi_t = 0, \widetilde{f}_{kt} = 0$
$var\,(u_t)$	.35%	.14%	.89%	7.1%

How strongly does G correlate with Y?

First best (flex price)

- W/o sectoral bias ($\omega_{ck} = \omega_{gk}$): perfect co-movement
- Sectoral bias reduces correlation to 0.73 (still much higher than in the data)

Optimal stabilization policy under sticky prices

- Sectoral government spending responds more in sticky sectors
- Correlation further reduced to 0.62

Can be further reduced ...(to do)

- Other shocks, including sectoral spending shocks
- Alternative preference specifications

6. Conclusion

Focus on sectoral heterogeneity: frictions & shocks

- New perspective on optimal stabilization policy

Granular nature of government spending

- Particularly suited to stabilize sectors
- But stabilization incomplete: running fiscal gaps is costly

Some supportive evidence for sectoral fiscal stabilization

- Estimated fiscal rules
- Correlation of G with Y reduced, closer to evidence