

Designing a Simple Loss Function for the Fed: Does the Dual Mandate Make Sense?

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- Advances in academic research – Rogoff (1985) and Persson and Tabellini (1993) – supported a strong focus on price stability
 - As documented in Svensson (2010), many central banks became “inflation targeters” to strengthen credibility and facilitate accountability, setup of ECB one prominent example

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 - Woodford optimal mandate/loss function: $L_t = (\pi_t^a - \pi^*)^2 + \lambda x_t^2$ with $\lambda = 0.048$
 - But Woodford studied a small calibrated model - what goes in an estimated empirically realistic model?

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 - 3 it puts comparison of simple mandate on equal footing to simple interest rate rules (which assumes commitment)

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- Results hold up when allowing for realistic measurement errors in the output gap, and when we introduce interest rate smoothing to capture the observed gradualism in policy behavior
- Given the similarity of parameters and shocks in estimated models of other advanced economies, our results should be relevant for other CBs (e.g. ECB)

Presentation outline

- Our exercise
- Model environment
- Benchmark results
- Robustness of results
- Concluding remarks

Our Exercise

Quadratic approximation of utility and Ramsey policy

- Benigno and Woodford (2006) demonstrated that households utility function could be written as:

$$\sum_{t=0}^{\infty} E_0 [\beta^t U(X_t)] \simeq \text{constant} - \sum_{t=0}^{\infty} E_0 [\beta^t X_t' W^{\text{society}} X_t], \quad (1)$$

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- We adopt unconditional expectations operator for welfare evaluation, so the loss under Ramsey optimal policy is

$$\text{Loss}^{\text{Ramsey}} = E \left[\left(X_t^{\text{Ramsey}} (W^{\text{society}}) \right)' W^{\text{society}} \left(X_t^{\text{Ramsey}} (W^{\text{society}}) \right) \right]$$

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- Measure welfare costs by comparing loss under mandate with Ramsey:

$$CEV = 100 \left(\frac{Loss^{obj} - Loss^{Ramsey}}{\bar{C} \left(\frac{\partial U}{\partial C} \Big|_{s.s.} \right)} \right), \quad (3)$$

where $\bar{C} \left(\frac{\partial U}{\partial C} \right)$ measures how welfare increases when consumption is increased 1%

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where $\bar{C} (\partial U / \partial C)$ measures how welfare increases when consumption is increased 1%

- Hence, CEV is increase in SS C that make households in expectation equally well-off under simple mandate as under Ramsey policy

Model environments

Key features of model structure

- Both EHL and SW models features monopolistic competition in both goods and labour markets
- Nominal price and wage stickiness:
 - Calvo price contracts, indexation of non-optimizers
$$P_t^{NO} = \Pi_{t-1}^{l_p} \Pi_{t-1}^{1-l_p} P_{t-1}^{NO}$$
 - Calvo wage contracts, indexation of non-optimizers
$$W_t^{NO} = \gamma \Pi_{t-1}^{l_w} \Pi_{t-1}^{1-l_w} W_{t-1}^{NO}$$
- SW model also features real rigidities as in CEE (2005):
 - External habit persistence in consumption
 - CEE type of investment adjustment costs
 - Variable capital utilization
 - Kimball (1995) aggregator; lower slope of price and wage schedules for given Calvo parameter

Model environments

Shock structure

- Total factor productivity (ε_t^a) shocks that affect potential output.
- Two “inefficient” shocks (do not affect y_t^{pot}):
 - ε_t^p - “price markup” shock
 - ε_t^w - “wage markup” shock
 - Pay particular attention to what extent the two cost-push shocks drive our results
- SW also includes three additional structural shocks;
Investment-specific (ε_t^i), Risk-shock on financial assets (ε_t^b),
Government-NX (ε_t^g)

Parameterization

Parameters adopted from Smets and Wouters

- We use the posterior mode parameters from SW07 (Tables 1.A-B in their paper)
- Make assumptions on adjustment functions and how we introduce the shocks so that linearized representation of our model coincides exactly with SW07

Analytical results in EHL Model

Simplified version of SW model

- The Erceg, Henderson and Levin (2000) model similar to SW model, but omits physical capital and habit formation in consumer preferences. Key equations:

$$\pi_t^p = \beta E_t \pi_{t+1}^p + \kappa_p y_t^{gap} + \vartheta_p \omega_t^{gap}, \quad (4)$$

$$\pi_t^\omega = \beta E_t \pi_{t+1}^\omega + \kappa_w y_t^{gap} - \vartheta_w \omega_t^{gap}, \quad (5)$$

$$\omega_t^{gap} \equiv \omega_{t-1}^{gap} + \pi_t^\omega - \pi_t^p - \Delta \omega_t^n. \quad (6)$$

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- Not possible to simultaneously stabilize y_t^{gap} , π_t^p and π_t^ω .
- Example, in response to changes in ω_t^n due to ε_t^a , perfect stabilization of the output gap y_t^{gap} requires a change in the real wage ω_t , and thus a change in either prices or nominal wages (or both). But π_t^p and π_t^ω cannot change if both y_t^{gap} and ω_t^{gap} are unchanged.

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- Quadratic approximation of the household utility functional gives the following true loss function:

$$L_t^R = -\frac{1}{2} \left[(\pi_t^p)^2 + \lambda_w^{opt} (\pi_t^w)^2 + \lambda_y^{opt} (y_t^{gap})^2 \right], \quad (7)$$

where $\lambda_w^{opt} \equiv \frac{\epsilon_\omega(1-\alpha)}{\epsilon_p} \frac{\vartheta_p}{\vartheta_w}$ and $\lambda_y^{opt} \equiv \left(\sigma_c + \frac{\sigma_l + \alpha}{1-\alpha} \right) \frac{\vartheta_p}{\epsilon_p}$.

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- But, assume that the CB is assigned the following simple mandate,

$$L_t^{CB} = -\frac{1}{2} \left[(\pi_t^p)^2 + \lambda_y (y_t^{gap})^2 \right], \quad (8)$$

which does not include π_t^w .

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 - Thus, stabilizing y_t^{gap} mitigates the welfare costs of nominal rigidities in both goods and labor markets.

Benchmark results in SW Model

Results for standard inflation-output mandate

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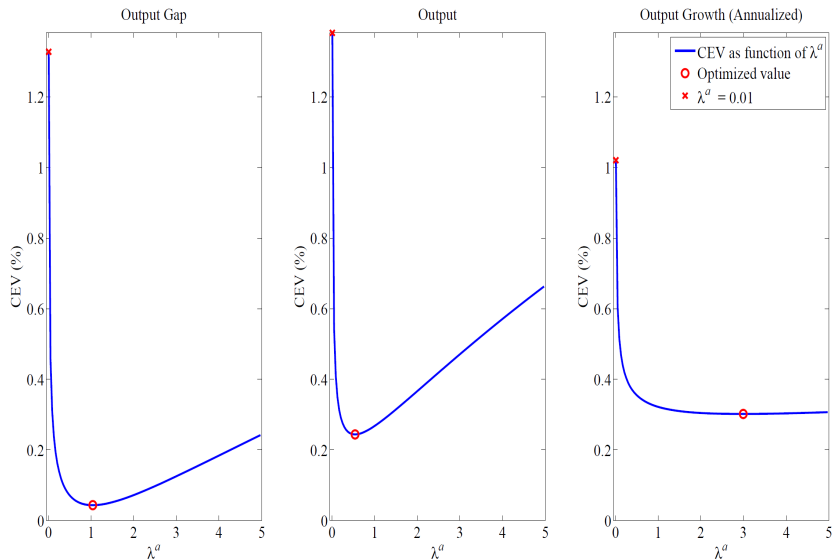
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- CEV as function for λ^a for the alternate x_t measures are reported in Figure 1

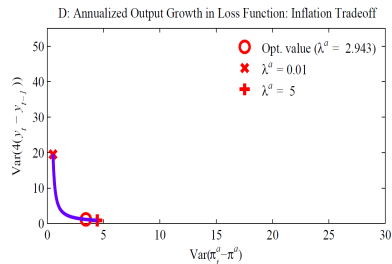
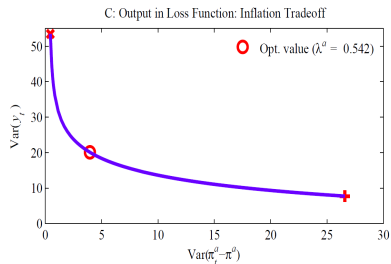
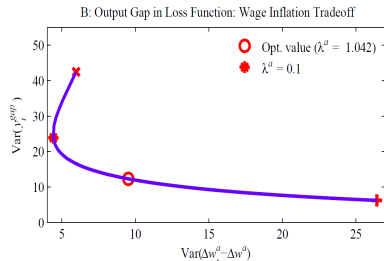
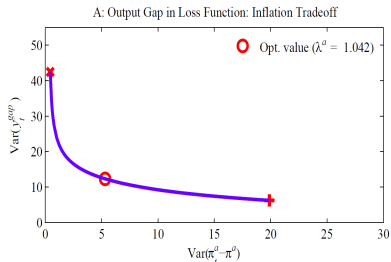
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CEV for simple mandates with alternative utilization measures



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Volatility trade-offs for alternative utilization measures



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- Are the shocks or deep parameters driving our results?

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- To understand the role of the parameters, we compute λ^a using Woodford's (2003) formula

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- Hence, we complement it by studying the influence of dynamic indexation and cost-push shocks

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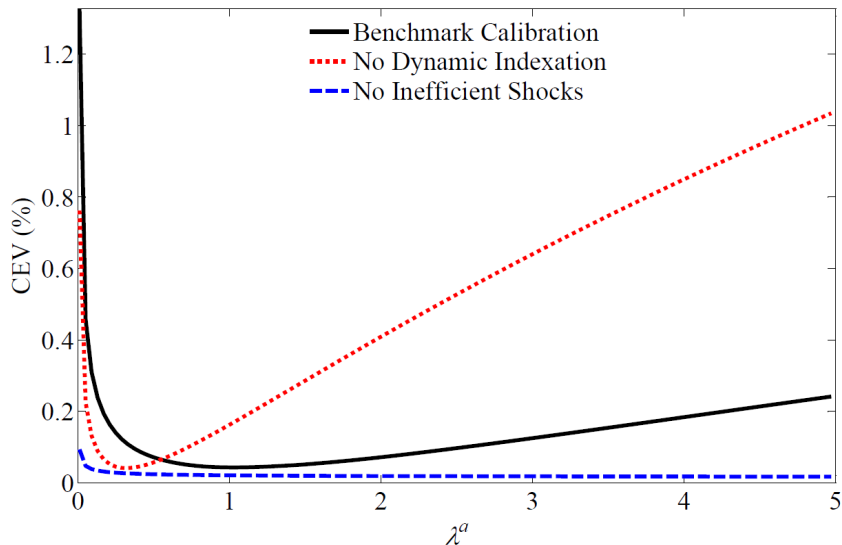
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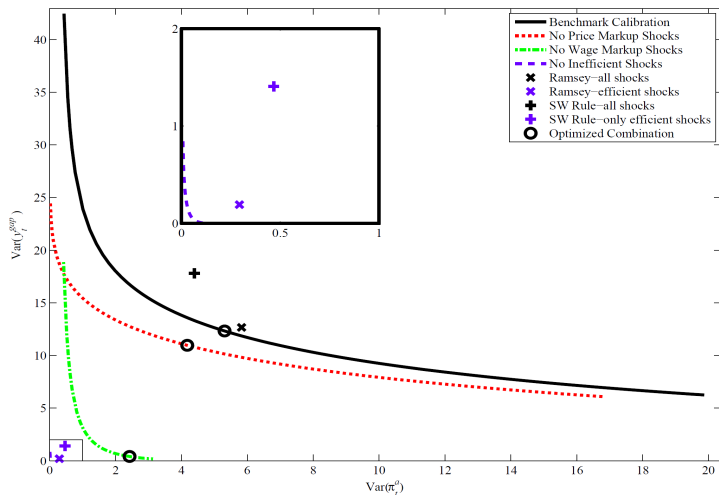
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Sensitivity of results w.r.t. parameters and shocks



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- While we do not necessarily disagree with JPT, their “no trade-off” result is a special case in the sense that it applies only if *BOTH* price and wage markup shocks are irrelevant
 - And since we do not know if this is the case, robustness argument calls for large λ^a in actual policy communication

Robustness of results

- Importantly, we find that our results hold up when we put restrictions on $\text{std}(r_t^a)$:

Results for loss function with interest rate term

Loss Function	$\lambda^a - y_t^{gap}$	λ_r	CEV (%)	$\text{std}(r_t^a)$
Woodford	0.048	—	0.471	8.92
Optimized	1.042	—	0.044	9.00
Optimized*: $r_t^a - r^a$	1.161	0.0770*	0.076	2.24
Optimized*: Δr_t^a	1.110	1.0000*	0.084	2.04

- Obviously, commitment assumption important here
- Results also hold up when we assume output gap measured with errors in real time

- Also study the merits of an alternative mandate with nominal wage inflation and a labor market gap ($l_t - l_t^{pot}$):

$$L_t = (\Delta w_t^a - \Delta w^a)^2 + \lambda^a (l_t - l_t^{pot})^2$$

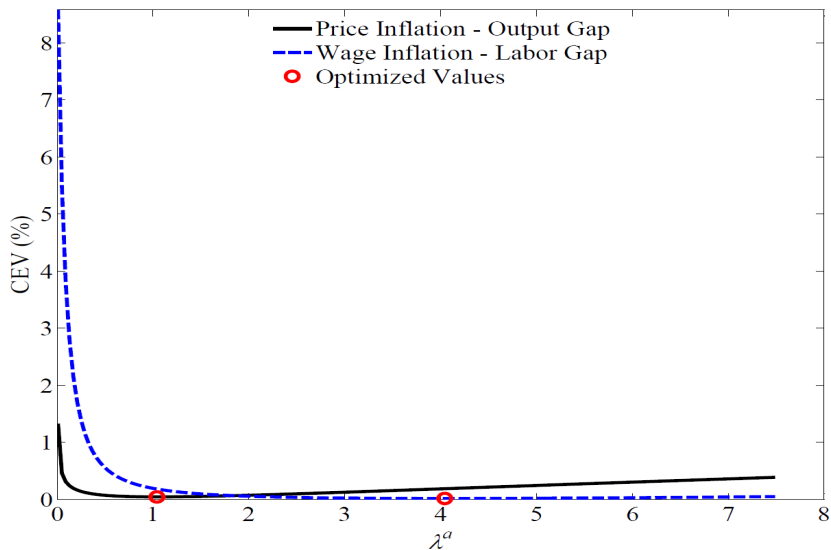
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- Find that labor market variables may warrant further attention; not surprising given that the model features labor market frictions (nominal wage frictions)

Robustness of results

On the importance of labor market variables



Concluding remarks

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 - Find that our basic result of a strong response to economic activity holds up in all cases
- Our results warrant further work to check robustness in models with financial frictions, expectations formation, imperfect information, and plausible transmission lags of monetary policy