Is there a trade-off between inflation and output stabilization?

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HP-detrended GDP in the US
Imperfect competition and inefficient fluctuations

- Modern business cycle models feature imperfect competition

- Market power in goods / labor markets implies
  - Price markups over MC
  - Wage markups over the MRS
Imperfect competition and inefficient fluctuations

- Markups vary over time for 2 reasons:
  ① Sticky prices and wages ➔ endogenous markup variation
  ② Direct shocks to markups ➔ exogenous markup variation
Imperfect competition and inefficient fluctuations

- Markups vary over time for 2 reasons:
  1. Sticky prices and wages ➔ endogenous markup variation
  2. Direct shocks to markups ➔ exogenous markup variation

- Markups variation contributes to fluctuations
  - Inefficient fluctuations
  - Would not be observed in a competitive economy
The questions that we address

① How important are inefficient fluctuations in US postwar business cycles?
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→ Inefficient fluctuations are large
The questions that we address

1. How important are inefficient fluctuations in US postwar business cycles?

   ➤ Inefficient fluctuations are large

2. Should a monetary authority counteract these inefficient fluctuations?
The questions that we address

1. How important are inefficient fluctuations in US postwar business cycles?
   - Inefficient fluctuations are large

2. Should a monetary authority counteract these inefficient fluctuations?
   - Yes, because policy faces a minor trade-off between output gap and inflation stabilization
Outline

1. Motivating questions

2. Model

3. What is the share of inefficient fluctuations?
   - Estimates of counterfactual output under constant markups

4. Is there a trade-off between output and inflation stabilization?
   - Compare optimal allocation to allocation with constant markups

5. Key to the no-trade-off result:
   - Treatment of wages in the estimation
   - Assumption about sources of low frequency labor supply shifts
The model: summary

- Medium-scale DSGE model of the US business cycle
  - Christiano, Eichenbaum and Evans (2005, JPE)
  - Smets and Wouters (2007, AER)

- Stochastic growth model + Shocks + “Frictions”
The model: summary

“Frictions”

1. Preferences
   - Habit in consumption

2. Technology
   - Adjustment costs in investment
   - Variable capital utilization

3. Market structure: Imperfect competition
   - Monopolistic competition in products and labor markets
   - Price and wage stickiness (endogenous markups)
Exogenous disturbances

- Tastes & technology
  - Neutral technology → growth rate is AR(1)
  - Investment specific → AR(1)
  - Inter-temporal preference shock → AR(1)
  - Intra-temporal preference shock → AR(1)

- Shocks to markets competitiveness
  - Markup shock in wages → $i.i.d.$
  - Markup shock in prices → AR(1)

- Policy
  - Government spending → AR(1)
  - MP shocks → $i.i.d.$
  - Inflation target shock → persistent AR(1)
Exogenous disturbances

- Tastes & technology
  - Neutral technology $\rightarrow$ growth rate is AR(1)
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  - Government spending $\rightarrow$ AR(1)
  - MP shocks $\rightarrow$ i.i.d.
  - Inflation target shock $\rightarrow$ persistent AR(1)
Data and estimation

- Observable variables
  1. GDP
  2. Consumption
  3. Investment
  4. Hours
  5. Inflation
  6. Federal funds rate
  7. Wages (compensation, total economy)
  8. Wages (earnings, non-supervisory and production workers)
Two wage inflation measures

Nominal wage inflation

- Blue line: baseline
- Red dashed line: LEPRIVA

Year range: 1960 to 2010

Y-axis: Nominal wage inflation (range -1 to 3.5)
Data and estimation

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- Quarterly data from 1964:I to 2009:IV

- Bayesian inference
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What is the share of inefficient fluctuations?

- Compare actual output to potential output

- Potential output
  - Level of output that would prevail under constant markups
  - Almost same log-linear dynamics of efficient output (i.e. output under perfect competition)
Model economy

- Shocks to preferences and technology
- Shocks to the degree of market competitiveness

- Sticky prices and wages
- Estimated policy rule
- Habit formation, etc...

→

Observed Output

Y
Model economy

Shocks to preferences and technology

Shocks to the degree of market competitiveness

Sticky prices and wages

Estimated policy rule

Habit formation, etc...

Observed Output

$Y$
Model economy under constant markups

Potential output = level of output that would have been observed in the absence of inefficient markup variation
Actual and DSGE-potential output

(a): GDP and Potential GDP

Log GDP Per Capita
Log Potential GDP

5.4 5.5 5.6 5.7 5.8 5.9 6 6.1 6.2 6.3
5.4 5.5 5.6 5.7 5.8 5.9 6 6.1 6.2 6.3

- Log GDP Per Capita
- Log Potential GDP
Actual and DSGE-potential output

(a): GDP and Potential GDP

(b): Output Gap
Actual and DSGE-potential output

(a): GDP and Potential GDP

(b): Output Gap
Decomposing the business cycle

\[ y_t = y_t^* + g_t \]
Decomposing the business cycle

\[ y_t - y_t^{hp} = y_t^* - y_t^{*hp} + g_t - g_t^{hp} \]
Output Gap and Business Cycles
Summary of results about inefficient fluctuations

- Potential output is quite volatile, as in RBC
- The output gap is cyclical and also quite volatile

Inefficient fluctuations are large
Summary of results about inefficient fluctuations

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Inefficient fluctuations are large

- Next question ➔ What should policy do about it?
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The policy tradeoff

Efficient allocation

- \( MRS_t = MPL_t = \frac{W_t}{P_t} \)
- \( Y_{it} = Y_t \quad \forall i \)
- \( L_{jt} = L_t \quad \forall j \)
The policy tradeoff

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- Our economy with sticky prices and wages
  - \( P_t = \mu_t^p MC_t \)
  - \( \frac{W_t}{P_t} = \mu_t^w MRS_t \)
The policy tradeoff

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The policy tradeoff

- The efficient allocation is not achievable by monetary policy in our economy
  - Many independent distortions and one instrument

- Tradeoff between
  - Real stabilization, i.e. closing the output gap
  - Nominal stabilization, i.e. eliminating price and wage dispersion
The policy tradeoff

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- Sources of trade-off
  - Sticky prices and wages
  - Markup shocks
The optimal allocation

- Maximize the utility of the average HH
  - Subject to the (nonlinear) constraints represented by the equilibrium behavior of private agents

- Compute a first order approximation to the dynamics under optimal policy

- Plot the path of variables in a counterfactual economy hit by the same shocks, but with Ramsey policy since the beginning of time
The optimal allocation

(a): Actual and Optimal GDP in deviation from potential

(b): Price Inflation

(c): Wage Inflation
The optimal allocation

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Summary of results about the optimal allocation

- Optimal $\approx$ potential output

- Optimal inflations are quite stable
Summary of results about the optimal allocation

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1. Little trade-off between output and inflation stabilization
Summary of results about the optimal allocation

- Optimal $\approx$ potential output
- Optimal inflations are quite stable

1. Little trade-off between output and inflation stabilization
2. A large fraction of fluctuations should have been avoided
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Importance of measurement of wages
Two wage inflation measures
Importance of measurement of wages

- Re-estimate model using only one series of compensation
  - Standard practice in the DSGE literature (e.g. SW 2007)

- Most parameter estimates are similar to baseline
Importance of measurement of wages

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- Most parameter estimates are similar to baseline

- One exception: Wage markup shocks
  - Six times as volatile \(\rightarrow\) implausibly volatile
  - Resemble noise
  - Explain most high frequency variation in wages
  - Explain negligible shares of BC variance in all real series
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- Compute the optimal allocation in this model
The optimal allocation in a model estimated with one wage series

(a): Actual and Optimal GDP in deviation from potential

(b): Price Inflation

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Importance of measurement of wages

- Model estimated with one wage series:
  - Strong tension between real and nominal stabilization
  - Optimal policy de-stabilizes output to stabilize wages
importance of measurement of wages

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  - Strong tension between real and nominal stabilization
  
  - Optimal policy de-stabilizes output to stabilize wages
  
  - Tension driven by large high frequency variation in desired markups, which seems questionable
The optimal allocation without wage markup shocks

(a): Actual and Optimal GDP in deviation from potential

(b): Price Inflation

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Importance of measurement of wages

Model estimated with one wage series:

- Strong tension between real and nominal stabilization
- Optimal policy de-stabilizes output to stabilize wages
- Tension driven by large high frequency variation in desired markups, which seems questionable
- So much weight on nominal stabilization that optimal output is nearly invariant to the interpretation of labor supply shocks
Potential and optimal output under two interpretations of labor supply shocks
Conclusions

- Inefficient fluctuations are large

- Optimal output \approx potential output
  - A substantial fraction of fluctuations should have been avoided
  - Negligible trade-off between output and inflation stabilization

- Key to the no-trade-off result:
  - Treatment of wages in the estimation
  - Assumption about sources of low frequency labor supply shifts

- Lack of identification of labor supply shocks has only a minor impact on the normative implications of the model (cf. CKM 2010)
The model

- Production technology of final-good producers

\[
Y_t = \left[ \int_0^1 Y_t(i) \frac{1}{1+\lambda_p} \, di \right]^{1+\lambda_p}
\]
The model

- Production technology of final-good producers

\[ Y_t = \left[ \int_0^1 Y_t(i) \frac{1}{1+\lambda_{p,t}} \, di \right]^{1+\lambda_{p,t}} \]

price markup shock
The model

- Production technology of intermediate goods producers

\[ Y_t(i) = A_t^{1-\alpha} K_t(i)^\alpha L_t(i)^{1-\alpha} - A_t F \]

- Monopolistically competitive markets

- Optimizing firms set prices by maximizing PDV of profits

- Calvo type stickiness: a fraction \( \xi_p \) of firms cannot re-optimize
  - index prices to ss and past inflation
The model

- **Households maximization problem**

\[
E_0 \sum_{t=0}^{\infty} \beta^t b_t \left[ \log(C_t - hC_{t-1}) - \varphi_t \frac{L_t(j)^{1+\nu}}{1 + \nu} \right]
\]

subject to

\[
P_tC_t + P_tI_t + T_t + B_t \leq R_{t-1}B_{t-1} + Q_t(j) + \sum_t + W_t(j)L_t(j) + r^kK_t
\]

\[
k_{t+1} = (1 - \delta)K_t + \left(1 - S\left(\frac{I_t}{I_{t-1}}\right)\right)\mu_t I_t
\]
The model

- **Households** maximization problem

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- Monopolistically competitive suppliers of specialized labor

- Calvo-type stickiness: a fraction $\xi_w$ of HH cannot re-optimize
  - index wages to ss and past inflation-productivity
The model

- Employment agencies aggregate differentiated labor into homogeneous labor

\[
L_t = \left[ \int_{0}^{1} L_t(j) \frac{1}{1 + \lambda_{w,t}} \, di \right]^{1 + \lambda_{w,t}}
\]

wage markup shock
The model

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\[ L_t = \left[ \int_0^1 L_t(j) \frac{1}{1+\lambda_{w,t}} \, dj \right]^{1+\lambda_{w,t}} \]

- The wage markup shock and the labor supply shock are observationally equivalent

- …but have different implications for the behavior of the efficient economy (CKM 2009)
The model: log-linear wage Phillips curve

\[ \pi_t^w = \gamma_1 \pi_{t-1}^w + \gamma_2 E_t \pi_{t+1}^w + \kappa \mu_t^w + \kappa \lambda_{w,t} \]
The model

- Monetary policy sets the short-term nominal interest rate following a Taylor-type rule

\[
\frac{R_t}{R} = \left( \frac{R_{t-1}}{R} \right)^{\rho_R} \left[ \frac{\pi_{1,t-3}}{\pi_t^*} \phi_\pi \left( \frac{X_t / X_{t-4}^{1/4}}{e^\gamma} \right)^{\phi_X} \right]^{1-\rho_R} \varepsilon_{R,t}
\]
Wage markup shocks: fact or fiction?

- Wage markup shocks in the log-linear version of the model
  
  - Wage Phillips curve:

  \[ \pi_t^w = \gamma_1 \pi_{t-1}^w + \gamma_2 E_t \pi_{t+1}^w + \kappa \mu_t^w + \kappa \lambda_{w,t} \]

  \[ \text{Std} \approx 30 \text{ basis points} \]

- Shocks to desired markup in the labor market are large
Alternative interpretation of wage markup shocks

- Take seriously the idea that they might just be “noise”

- Estimate models

  - With measurement error for wages (without wage markup shocks)
    - Fits the data better

  - Without wages as observables
    - Markup shocks become very small

  - With two wage inflation measures
    - In the spirit of factor analysis (Boivin and Giannoni, 2006)
    - Helps identifying idiosyncratic errors from wage markup shocks

  \[ \text{Markup shocks are very small} \]
“Going after” (a subset of) the literature

- Output gap estimates differ from standard measures
  - Edge, Kiley and Laforte (2008)
  - Levin, Onatski, Williams and Williams (2005)
Edge, Kiley and Laforte (2008)
Edge, Kiley and Laforte (2008)

“Our” gap without $\pi^*$
"Our" gap with LOWW dataset and policy rule
Andrés, López-Salido and Nelson (2005)
Andrés, López-Salido and Nelson (2005)

“Our” gap without *markup shocks*