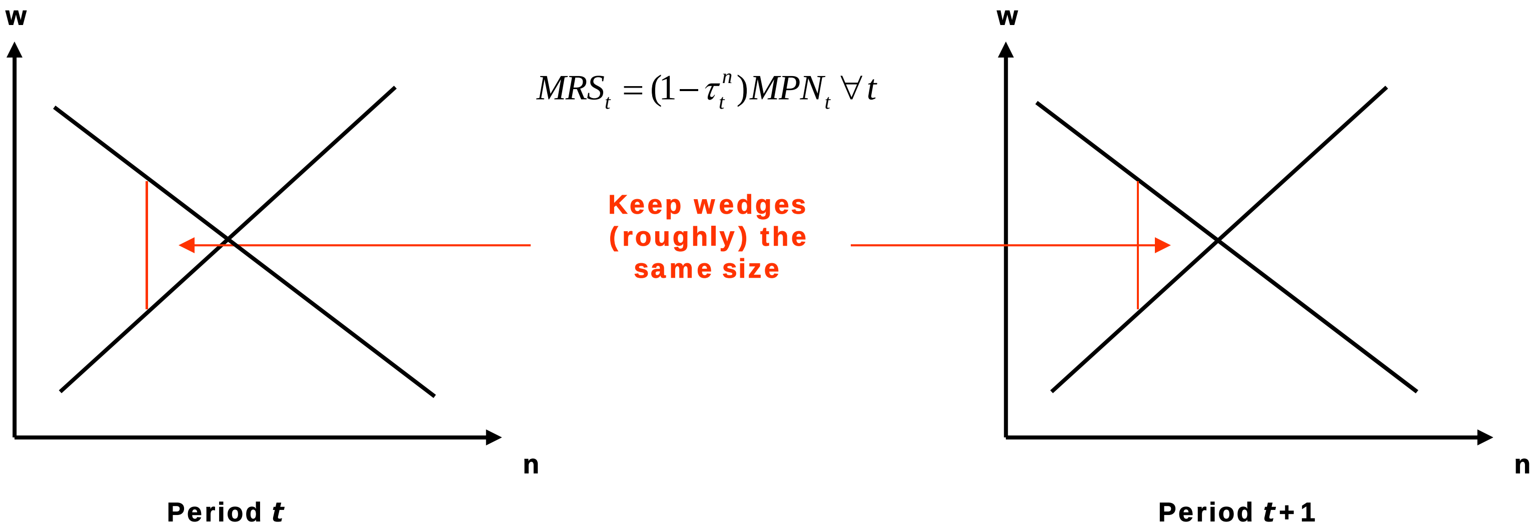
TAX SMOOTHING IN FRICTIONAL LABOR MARKETS

APRIL 13, 2017

TAX SMOOTHING



$$MRS_t = (1-\tau_t^n)MPN_t \; \forall t$$

- Ramsey wants to keep these wedges constant
- Result and intuition depend on neoclassical view of labor markets
  - Labor tax is the only wedge → tax-smoothing is wedge-smoothing

- Question: Is tax smoothing optimal in search and matching labor markets?

OVERVIEW OF MODEL

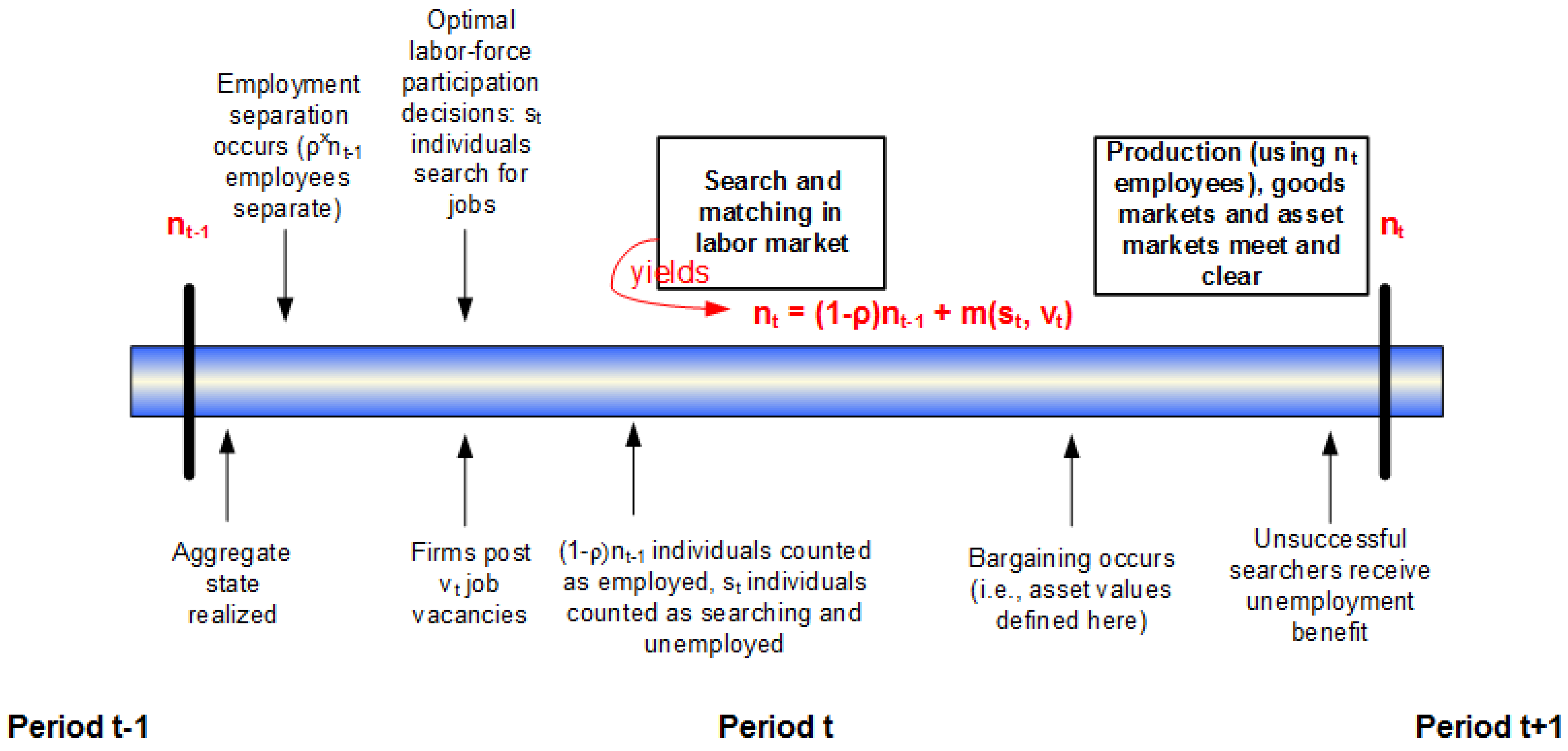
- **Infinitely-lived representative household, measure one of members**
    - **Employed members**
    - **Unemployed members**
    - **Members outside the labor force (“leisure”)**

Full consumption insurance – standard in DSGE labor search models

Incompleteness of government debt markets NOT driving our results (Aiyagari et al (2002 *JPE*))

- **Exogenous stochastic government spending**
    - **Financed via labor income taxation and one-period real state-contingent debt**
    - **Government provides unemployment benefits**
    - **Government provides vacancy subsidies**
        - **For completeness of tax instruments (Ramsey issue)**
- **Labor market with matching frictions and wage-setting frictions**
- **Only an extensive labor margin, no intensive labor margin**
- **Timing: “instantaneous production”**

OVERVIEW OF MODEL



n_{t-1}

Employment separation occurs ($\rho^x n_{t-1}$ employees separate)

Optimal labor-force participation decisions: s_t individuals search for jobs

Search and matching in labor market

yields $n_t = (1-\rho)n_{t-1} + m(s_t, v_t)$

Production (using n_t employees), goods markets and asset markets meet and clear

n_t

Aggregate state realized

Firms post v_t job vacancies

$(1-\rho)n_{t-1}$ individuals counted as employed, s_t individuals counted as searching and unemployed

Bargaining occurs (i.e., asset values defined here)

Unsuccessful searchers receive unemployment benefit

Period t-1

Period t

Period t+1

- **Unemployed are the unsuccessful searchers: $ue_t = (1-p_t)s_t$**
  - **p_t = probability an individual finds a job and begins working immediately**

HOUSEHOLD OPTIMIZATION

- ☐ **Maximize expected lifetime utility**

$$\max_{\{c,n_t,s_t,b_t\}} E_0 \sum_{t=0}^{\infty} \beta^t \left[u(c_t) - h\underbrace{\left((1-p_t)s_t + n_t\right)}_{\text{disutility of employment + unsuccessful search}} \right]$$

s.t.

$$c_t + b_t = \underbrace{n_t(1-\tau_t^n)w_t}_{\text{measure } n \text{ earn after-tax wage income}} + \underbrace{(1-p_t)s_t\chi}_{\text{measure } ue = (1-p)s \text{ receive ue benefit } \chi \text{ (government financed)}} + R_t b_{t-1} + \underbrace{(1-\tau^d)d_t}_{\text{Baseline analysis: set } \tau^d = 1 \rightarrow \text{ no } \textit{profit}\text{-taxation issues driving results}}$$

Flow budget constraint

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Flow budget constraint

$$n_t = \underbrace{(1-\rho)n_{t-1}}_{\text{(exogenous) measure of pre-existing employment relationships terminate}} + \underbrace{s_t p_t}_{\text{flow of new employment relationships = measure of searchers } s_t \text{ x probability a searcher successfully lands a job}}$$

Perceived LOM for employment ("instantaneous production")

↓

FOCs with respect c_t, n_t, s_t, b_t

HOUSEHOLDS

- ❑ **Household LFP condition (the labor supply condition!)**

$$\frac{h'(lfp_t)}{u'(c_t)} = p_t\left[(1-\tau_t^n)w_t + (1-\rho)E_t\left\{\Xi_{t+1|t}\left(\frac{1-p_{t+1}}{p_{t+1}}\right)\left(\frac{h'(lfp_{t+1})}{u'(c_{t+1})}-\chi\right)\right\}\right] + (1-p_t)\chi$$

  - ❑ **MRS between *lfp_t* and *c_t* = expected payoff of searching**
    - ❑ **Unemployment benefit (with probability 1 – *p_t*)**
    - ❑ **After-tax wage + continuation value (with probability *p_t*)**

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  - **MRS between lfp_t and c_t = expected payoff of searching**
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To recover standard labor supply function (e.g., RBC)

1. $\rho = 1$ (all employment relationships terminate at end of every period)

2. $p = 1$ (probability a searcher finds a job)

3. $\chi = 0$ (no ue benefit because no notion of "ue")

$$\frac{h'(lfp_t)}{u'(c_t)} = (1-\tau_t^n)w_t$$

FIRMS

- **Production**
    - **Requires a matched job-worker pair: posting cost γ per vacancy**
    - **Individual job *i* produces $y_{it} = z_t$**
    - **Aggregate output $y_t = n_t z_t$ (symmetry across jobs)**

- **Dynamic profit-maximization problem**

Ensures completeness of tax instruments

$$\max_{\{n_t, v_t\}} \sum_{t=0}^{\infty} \Xi_{t|0} \left[z_t n_t - w_t n_t - (1 - \tau_t^s) \gamma v_t \right]$$

$$n_t = \underbrace{(1-\rho) n_{t-1}}_{} + \underbrace{v_t q_t}_{}$$

Firm's perceived LOM for total employment ("instantaneous hiring")

(exogenous) measure of pre-existing employment relationships terminate

flow of new employment relationships = # job-openings x probability an opening attracts a searching individual

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Firm's perceived LOM for total employment ("instantaneous hiring")

- **Vacancy-creation condition**

$$\underbrace{\frac{\gamma(1-\tau_t^s)}{q_t}}_{\text{cost of posting vacancy (inclusive of subsidy or tax)}} = \underbrace{z_t - w_t + (1-\rho)E_t\left[\Xi_{t+1|t} \frac{\gamma(1-\tau_{t+1}^s)}{q_{t+1}} \right]}_{\text{benefit of posting vacancy}}$$

LABOR MARKET

- **Labor-market tightness $\theta_t = v_t / u_t$**
  - **Important aggregate variable in matching-based models**
  - **Matching probabilities p and q depend only on θ given CRTS matching**
  - **Key statistic for matching efficiency**

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  - **Key statistic for matching efficiency**

- **Matching function** $m(s_t, v_t) = \psi s_t^{\xi} v_t^{1-\xi}$
- **LOM for aggregate employment** $n_t = (1-\rho)n_{t-1} + m(s_t, v_t)$

- **Nash bargaining over wage payment solves**

$$\max_{w_t} \underbrace{\left(\mathbf{W}_t - \mathbf{U}_t\right)^{\eta}}_{\text{Gain to household of successfully forming another employment relationship}} \underbrace{\mathbf{J}_t^{1-\eta}}_{\text{Value to firm of hiring another worker}} \longrightarrow \frac{\mathbf{W}_t - \mathbf{U}_t}{1-\tau_t^n} = \frac{\eta}{1-\eta}\mathbf{J}_t$$

$$\longrightarrow w_t = \eta z_t + (1-\eta)\frac{\chi}{1-\tau_t^n} + \eta(1-\rho)E_t\left\{\Xi_{t+1|t}\left[1-(1-p_{t+1})\frac{1-\tau_{t+1}^n}{1-\tau_t^n}\right]\frac{\gamma(1-\tau_{t+1}^s)}{q_{t+1}}\right\}$$

GOVERNMENT AND RESOURCE FRONTIER

- **Exogenous government spending financed via**
  - **Labor income tax**
  - **One-period state contingent real debt**

$$\tau_t^n w_t n_t + b_t + \tau^d d_t = g_t + R_t b_{t-1} + (1 - p_t) s_t \chi + \tau_t^s \gamma v_t$$

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- Resource constraint

$$c_t + g_t + \gamma v_t = z_t n_t$$

- = govt budget constraint + hh budget constraint
- Assuming χ is govt-financed allows it to drop out of resource constraint
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    - **Makes model more comparable to existing Ramsey models**

- **Precise nature of χ (ue benefit? home production? value of leisure?) not typically specified in DSGE matching models**
  - **Our model articulates both ue benefit and value of leisure**

PRIVATE-SECTOR EQUILIBRIUM

- **Stochastic processes** $\left\{c_t, n_t, s_t, w_t, \theta_t, R_t, b_t\right\}_{t=0}^{\infty}$ **that satisfy**
  - **Household's bond Euler equation**
  - **Vacancy-creation condition**
  - **Labor force participation condition**
  - **Nash wage outcome**
  - **Law of motion for employment** $n_t = (1-\rho)n_{t-1} + m(s_t, v_t)$
  - **Government budget constraint (key condition in Ramsey models)**
  - **Resource constraint** $c_t + g_t + \gamma v_t = z_t n_t$
  - **Given processes** $\left\{g_t, z_t, \tau_t^n, \tau_t^s\right\}_{t=0}^{\infty}$

Standard conditions in basic Ramsey models

CALIBRATION

- **Baseline calibration**
  - **So that exogenous policy (non-Ramsey) equilibrium broadly matches U.S. labor market fluctuations**
  - **Preferences and key parameters**

$$u(c_t) - h(lfp_t) = \ln c_t - \frac{\kappa}{1+1/\iota} lfp_t^{1+1/\iota}$$

  - **Participation (labor supply) elasticity (ι = 0.18)**
  - **Low worker bargaining power (η = 0.05)**
  - **High unemployment benefit (98% of real wage)**

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The two key parameters of HM calibration

- **Rest of parameters, matching-related and otherwise, standard**
  - **$\beta = 0.99$**
  - **$\rho = 0.10$**
  - **$\xi = 0.40$**
  - **AR(1) parameters for LOMs for TFP and government spending**
  - **Etc.**

DYNAMICS

		Ramsey		Exogenous Policy Benchmark		Data
		Calibration		**Calibration**		
		HM	**0% and Hosios**	**HM**		
Labor Tax Rate	**Mean**					**22%**
	Rel SD					**1.4**
Market tightness (θ)	**Rel SD**					**11.3**
Vacancies	**Rel SD**					**6.3**
Unemployment	**Rel SD**					**5.2**
LFP	**Rel SD**					**0.20**
Real wage	**Rel SD**					**0.52**
Static wedge	**SD (%)**					
Intertemporal wedge	**SD (%)**					

Gertler and Trigari (2009 *JPE*)

DYNAMICS

Ramsey

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		Calibration		Calibration		
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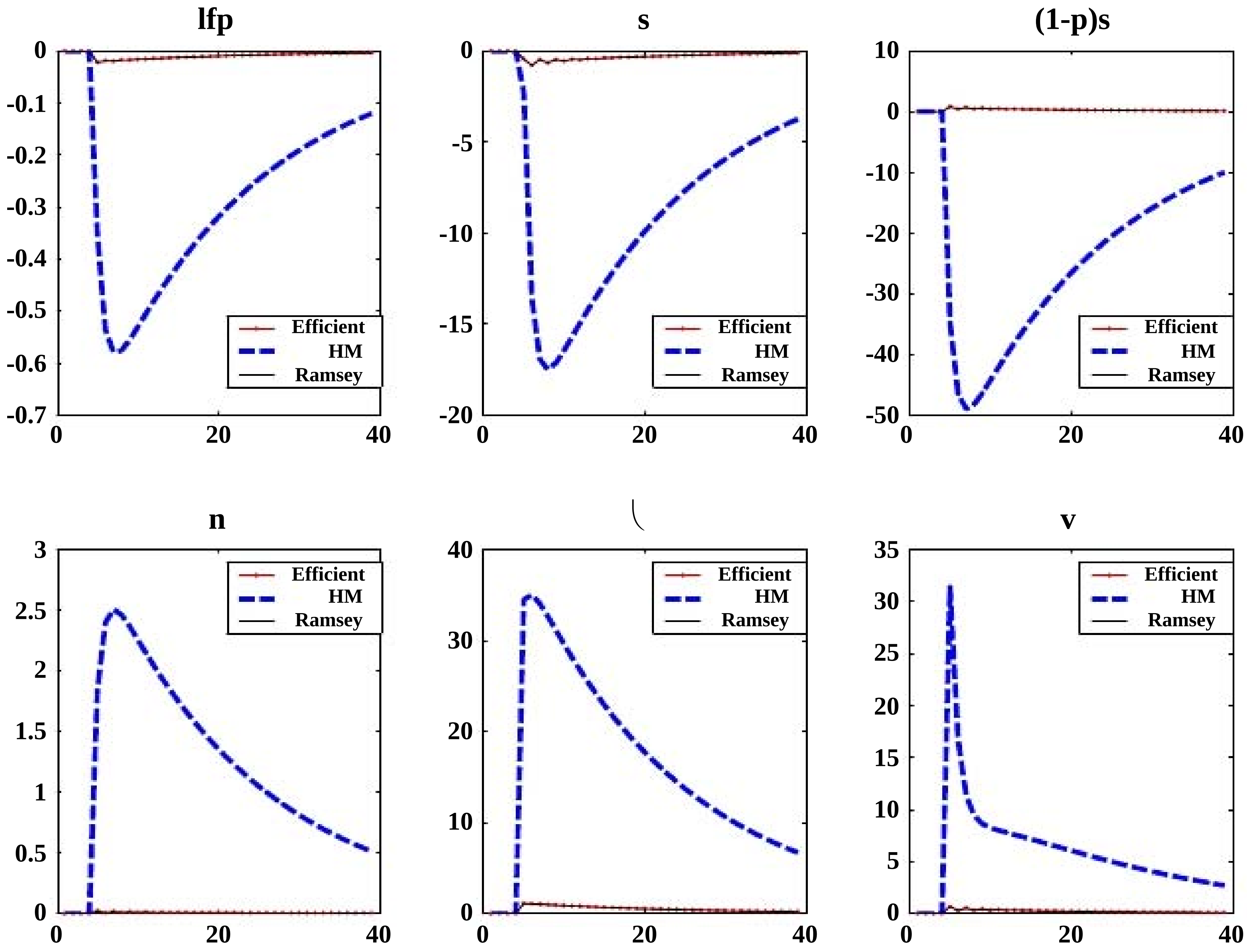
Labor Tax Rate	**Mean**	**11%**		**22%**		**22%**
	Rel SD	**5.6**		**1.4**		**1.4**
Market tightness (θ)	**Rel SD**	**1.1**		**10.9**		**11.3**
Vacancies	**Rel SD**	**1.3**		**6.9**		**6.3**
Unemployment	**Rel SD**	**1.4**		**5.4**		**5.2**
LFP	**Rel SD**	**0.13**		**0.20**		**0.20**
Real wage	**Rel SD**	**0.50**		**0.28**		**0.52**
Static wedge	**SD (%)**					
Intertemporal wedge	**SD (%)**					

DYNAMICS

- **Ramsey fluctuations IDENTICAL to efficient fluctuations for ANY (η, χ) pair**
  - In terms of fluctuations around a given steady state
  - Steady-state levels of (τ^n, τ^s) depend on (η, χ) pair


lfp
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
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20
40
Efficient
HM
Ramsey
s
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-15
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  - **By appropriately adjusting (τ^n, τ^s) over the business cycle**

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- **Wedge dynamics**
  - **Ramsey smooths both static wedge….**
  - **…and intertemporal wedge**

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LFP	Rel SD	0.13	0.13	0.20		0.20
Real wage	Rel SD	0.50	1.1	0.28		0.52
Static wedge	**SD (%)**	0.08	0	22.9	0.66	
Intertemporal wedge	**SD (%)**	0	0	12.3	0.63	

Gertler and Trigari (2009 *JPE*)

STATIC AND INTERTEMPORAL CONDITIONS

- **Efficiency characterized by**

$$\frac{h'(lfp_t)}{u'(c_t)} = \frac{\gamma m_s(s_t,v_t)}{m_v(s_t,v_t)} = \gamma\theta_t \frac{\xi}{1-\xi}$$

$$\frac{u'(c_t)}{\beta u'(c_{t+1})} = \frac{(1-\rho)\left(\frac{\gamma}{m_v(s_{t+1},v_{t+1})}\right)(1-m_s(s_{t+1},v_{t+1}))}{\frac{\gamma}{m_v(s_t,v_t)} - z_t}$$

- **Decentralized equilibrium conditions characterized by**

$$\frac{h'(lfp_t)}{u'(c_t)} = \underbrace{\left[\frac{\chi(1-\xi)}{\gamma\cdot\xi\cdot\theta_t} + (1-\tau_t^n)(1-\tau_t^s)\frac{\eta(1-\xi)}{\xi(1-\eta)}\right]}_{\text{= wedge between static MRS}_t\text{ and static MRT}_t}\gamma\theta_t\frac{\xi}{1-\xi}$$

To obtain zero static wedge in every period, need $\tau^n = \tau^s = 0$ in every period, $\eta = \xi$, $\chi = 0$

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(See eqn. (29) for intertemporal wedge)

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To obtain zero intertemporal wedge in every period, need $\tau^n = \tau^s = 0$ in every period, $\eta = \xi$, $\chi = 0$

CONCLUSIONS

- **Labor tax smoothing not optimal in DSGE search and matching model**
  - **Calibrated to match key labor market dynamics under exogenous tax policy**
  - **Rigid real wage (delivered through Nash-Hosios bargaining as benchmark) the important feature of the model**

- **But wedge smoothing IS optimal**
  - **Basic Ramsey theory**

- **Ramsey fluctuations in allocations efficient regardless of calibration**

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- ☐ **But wedge smoothing IS optimal**
  - ☐ **Basic Ramsey theory**

- ☐ **Ramsey fluctuations in allocations efficient regardless of calibration**

- ☐ **Welfare-relevant notions of wedges**
  - ☐ **Developing matching-model concepts of efficiency and MRTs for use in virtually any matching application**

- ☐ **Could think of “labor wedge” as featuring both static and intertemporal dimensions**
  - ☐ **Use as framework to empirically measure labor wedges (in progress)**