(In)Efficient Separations, Firing Costs and Temporary Contracts

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The views and opinions expressed herein are those of the authors and do not necessarily reflect the position of the Bank of Italy.

Motivation

- **Labour market rigidities** are often blamed for the relatively poor performance of the European labor market compared to US
- During the '90s and the '00s many European countries have implemented labor market reforms **mixed success**:
    - Spain and Italy: reforms and counter-reforms to liberalize the use of fixed-term contracts and lower dismissal costs
    - Success of **broad reform packages**: Hartz reforms in Germany (2004-2007), Portugal's Memorandum (2011-2014)

This paper

- We investigate how **employment protection** affects social efficiency and unemployment.
  - Employment Protection on Regular contracts (EPR)
  - Introduction of fixed-term, Temporary contracts (Dual mkt)
- Crucially, the answer depends on the **interaction** with other labor market institutions (LMIs), such as generosity of unemployment benefits and wage setting protocol.
- What is the *constrained optimal* level of employment protection?
  - Analytical results
  - Quantitative application on Italy
- We adopt a **general equilibrium** approach to take into account externalities.

Related literature

- ***Macro effects of labor market institutions***
  - *Empirics:* Nickell and Layard (1999), Blanchard and Wolfers (2000), Bassanini and Duval (2009), Gnocchi, Lagerborg, and Pappa (2015), Boeri and Jimeno (2016)
  - *Theory:* Mortensen and Pissarides (1999), Blanchard and Giavazzi (2003), Garibaldi and Violante (2005), Zanetti (2011), Cacciatore and Fiori (2016), Murtin and Robin (2018)
- ***Effects of employment protection***
  - *EPR*: Blanchard and Tirole (2008), Karabay and McLaren (2011), Boeri, Garibaldi, and Moen (2017), Lalé (2019)
  - *Dual mkt*: Bentolila and Saint-Paul (1992), Blanchard and Landier (2002), Sala, Silva, and Toledo (2012), Berton and Garibaldi (2012), Cahuc, Charlot, and Malherbet (2016), Veracierto (2007), Alonso-Borrego et al. (2005)

Preview of the results

- The **optimal level of EPR** can be positive and it increases with the degree of rigidity introduced by **other LMIs**.
  - In Italy the optimal level of firing costs during the period 1985-1995 was estimated at 2.5 monthly wages
- **EPR is welfare improving** as long as it reduces job destruction but there is an upper bound to this effect. However, too high firing costs generate sizable welfare losses.
  - In Italy too high firing costs during the period 1985-1995 (3.5 monthly wages) generated a consumption loss of 1.7% compared to the second best allocation
- **The introduction of temporary contracts is welfare improving** when EPR is *too high*, but generates high labor turnover, with potential side effects.
  - The flexibility introduced in Italy during the 2000s closed around 1/4 of the gap between the inefficient pre-reform allocation and the single-contract second best allocation

Outline

1. Introduction

2. Single contract
   - The setup
   - LMIs and social efficiency
   - Constrained optimal level of EPR

3. Dual market
   - Introduce temporary contracts
   - Quantitative analysis

4. Conclusions

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Overview of the model

- The **representative household** consumes and invests in bonds. Labor supply is fixed Households
- The **government** gets fiscal revenues from layoff taxes and from a lump-sum component, which adjusts to finance unemployment benefits (balanced budget) Gov't
- The labor market is characterized by **labor market frictions**: unemployed workers (u_{t-1}) search for jobs and firms post vacancies (v_t). Hires are determined by an aggregate matching function $m(v_t, u_{t-1})$ Laws of motion
- Each firm-worker match **produces** using linear technology s.t. aggregate & idiosyncratic productivity shocks: $y_{it} = A_t + z_{it}$ Resource const.

Labor market institutions

We consider these labor market institutions (LMIs):

1. γ: level of firing costs (EPR: Employment Protection on Regular contracts) paid by the firm upon layoff
2. b: unemployment benefits paid to unemployed individuals and financed by the government through lump-sum taxes
3. Θ_w: trade union density, which affects wage rigidity (the higher Θ_w, the less firms can adjust wages to idiosyncratic shocks)

We study the **interaction** among them, and whether there exist an **optimal level** of γ, given the levels of b and Θ_w

Firm's decisions

- **Value of a productive match**:

$$J(z_{it}) = y(\cdot) - w(\cdot) + \mathbb{E}_t \left\{ \beta \frac{\lambda_{t+1}}{\lambda_t} \left[(1-\phi) \max \left\{ J_{t+1}, V_{t+1} - \gamma \right\} + \phi V_{t+1} \right] \right\}$$

For a new match: $z_{it} = \bar{z}$ (max of the idiosyncratic prod). Workers

- **Job creation**: free-entry by firms until $V_t = 0$ or:

$$\frac{c}{q_t} = J_{0t}(\bar{z})$$

where $q(\theta_t)$ is the job filling probability.

- **Job destruction**: exogenous (at rate ϕ) + endogenous $\rightarrow$ in any period a new z_{it} is drawn and the firm decides to continue iff $z_{it} \geq \tilde{z}_t$. Otherwise the worker is laid off and the firm pay the firing cost γ

$$S_t^F(\tilde{z}_t) = J_t(\tilde{z}_t) - V_t + \gamma = 0$$

Wage setting schemes

1. **Flexible wages**: wages are renegotiated whenever a shock occurs and set through Nash bargaining. Nash

2. **Rigid wages**: The wage is a weighted average of the efficient Nash-bargained wage – $w^n(z_{it})$ – and a wage norm – w_t^*.

$$w(z_{it}) = (1 - \Theta)w^n(z_{it}) + \Theta w_t^*$$

where Θ is a proxy for trade union density.

When $\Theta > 0$ wages cannot perfectly adjust to idiosyncratic productivity shocks → there exist **privately inefficient** separations when wage is too high and firms cease a match with negative *firm* surplus, but positive *total* one.

Effects of LMIs on social efficiency

Question: How do LMIs affect allocative efficiency?

Compare:

(i) The decentralized competitive allocation Details

(ii) Social planner allocation (*first best*): efficient allocation that would be selected by a social planner who maximizes welfare subject *only* to technological constraints and search and matching frictions, abstracting from LMIs Details

Steps:

1. Study the role of unemployment benefits (b) and trade union density (Θ) by setting firing costs to 0 ($\gamma = 0$)
2. Re-introduce firing costs as a way to compensate inefficiencies generated by other institutions (taken as given)

Effects of LMIs on social efficiency: results

Proposition 1

1. *Positive* ***unemployment benefits*** *determine a sub-optimal low level of job creation and a sub-optimal high level of job destruction*
2. ***Wage rigidities*** *determine a sub-optimal high level of both job creation and job destruction*

Sub-optimal high level of job destruction ⇒ market allocation generates *socially inefficient* separations:

- unemployment subsidies: they are distortive while taxes to finance them are lump-sum. So hh's fail to recognize that subsidies cancel out with taxes
- wage rigidity: here separations are also *privately inefficient* because they could be neutralized by appropriate side payments between the firm and the worker

Can firing costs restore efficiency?

Question: Can EPR be used to compensate the inefficiencies generated by the other LMIs?

- The effects of EPR is *a priori* ambiguous because it may help reducing excessive job destruction but may also hinder job creation.
- We need to find the optimal level of EPR conditional on the other LMIs (*second best*):
  1. We derive analytically the constrained optimal level of firing costs by solving a suitable Ramsey problem Details
  2. Application to the Italian economy

Can firing costs restore efficiency? (1) Analytical results

Proposition 2

The optimal level of firing costs which implements the second-best allocation is:

1. *equal to zero in absence of unemployment benefits and trade union density* ($b = \Theta_w = 0$)
2. *monotonically increasing in the amount of unemployment benefits* b $\left(\frac{\partial \gamma^*}{\partial b} > 0\right)$
3. *monotonically increasing in trade union density* Θ_w $\left(\frac{\partial \gamma^*}{\partial \Theta_w} > 0\right)$

Can firing costs restore efficiency? (2) The case of Italy

Calibrate the model to the Italian economy in 1985-1995 (high firing costs); afterwards, several reforms liberalized the labor market by introducing temporary contracts

	Parameter	Value	Source
Targeted moments			
Interest rate	-	11.9%	avg. ann. int. rate (1985-1995)
Unemployment rate	u	9.4%	avg. unemp. rate (1985-1995)
Job finding rate	$f(\theta)$	0.4	D'Amuri et al. (2021)
Quits out of total separations	$\bar{s} = \phi/\delta$	60%	Comunicazioni Obbligatorie
Hiring costs as % of GDP	$\bar{h} = cn_0/Y$	1%	Blanchard and Galí (2010)
Institutional parameters			
Benefits over labor income	$\frac{bu}{w(1-u)}$	0.04	Luksic (2020)
Trade union density	Θ_w	40%	OECD
Firing cost as fraction of avg. perm wage	γ/w	**1.2**	Garibaldi and Violante (2005)

Constrained optimal level of EPR

Figure 1: Long-run effects of firing costs

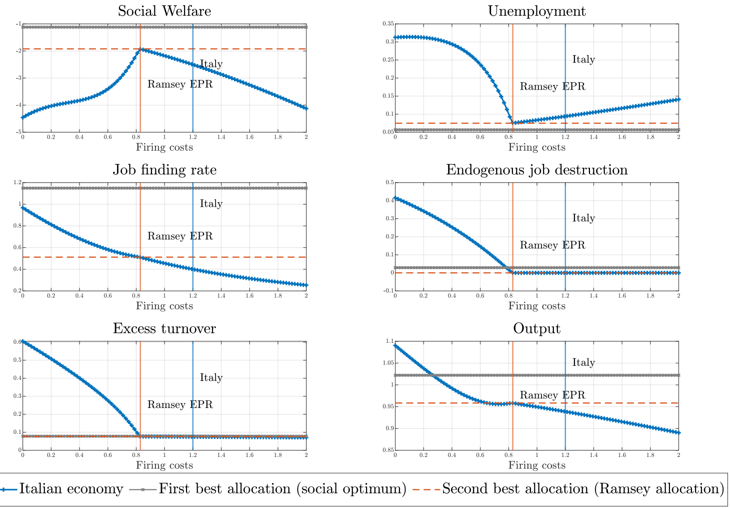
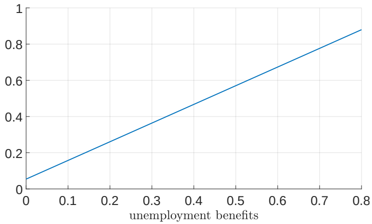
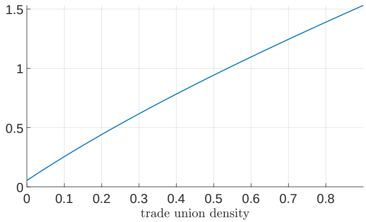


Figure 2: Optimal firing costs γ^*

(a) γ^* *wrt Unemployment benefits*



(b) γ^* *wrt Trade union density*



In panel a) the wage rigidity parameter is set at its benchmark value ($\Theta_w = 0.4$); in panel b) unemployment benefits are at their benchmark level ($b = 0.37$).

LMIs and efficiency in Italy: summary of results

- The downward wage rigidity determined by unemployment benefits and trade union density generate inefficient job separations
- In this context, a moderate amount of firing costs is welfare-improving: the Ramsey planner would choose a level of firing costs roughly equal to 2.5 monthly wages (0.83 at quarterly frequency)
- Beyond optimal EPR, the negative impact on job creation prevails
- The stricter firing restrictions faced by Italy (3.5 monthly wages) generated a sizeable consumption loss (1.7%) compared to Ramsey
- Practical solution: **flexibility at the margin** (introduction of temporary contracts). Welfare improving?

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Research questions

- Can temporary contracts restore efficiency when EPR is too high?
- Can temporary contracts substitute for excessive job security in regular contracts?
- What is the constrained optimal level of duality?

Introduce temporary contracts (1)

- Temporary contracts (TCs) are characterized by:
  - No firing costs ($\gamma^T = 0$)
  - No wage rigidity ($\Theta_w^T = 0$)
  - Expiration rate ι: if expired, can be converted to permanent; if not, can be renewed a limited number of times
  - Cost of posting a vacancy c^T
- In this setup c^T can serve as proxy for legal impediments to the introduction of TCs
- By setting c^T to a very high number, we are indeed able to replicate the single-contract economy

Introduce temporary contracts (2)

The introduction of TCs implies a modification of the single contract model by:

- **new budget constraint** Budget constraint
- **new laws of motions** Law of motions
- **new firms' value functions for TCs** Firms' value functions for TCs
- **new workers' value functions for TCs** Workers' value functions for TCs
- **new Nash and effective wages for TCs** Wages for TCs
- **new JC and JD**: see next slides

Job creation

- **One-sided directed search**:
  - Firms can post vacancies in either the temporary or permanent submarket
  - In both submarkets they face the same pool of (unemployed) workers
- **Firms trade off** the *ex-ante* benefits of a quick search with the *ex-post* costs of EPR
- **Spillovers** from the market of regular jobs to the one of TCs:

$$(job\ finding\ rate)^T = f_t^T (1 - f_t^P)$$
$$(job\ filling\ rate)^T = q_t^T (1 - f_t^P)$$

- **Free-entry** in both markets
- **Co-existence** of temporary and permanent contracts in the flow of new matches

The reduced TCs' model

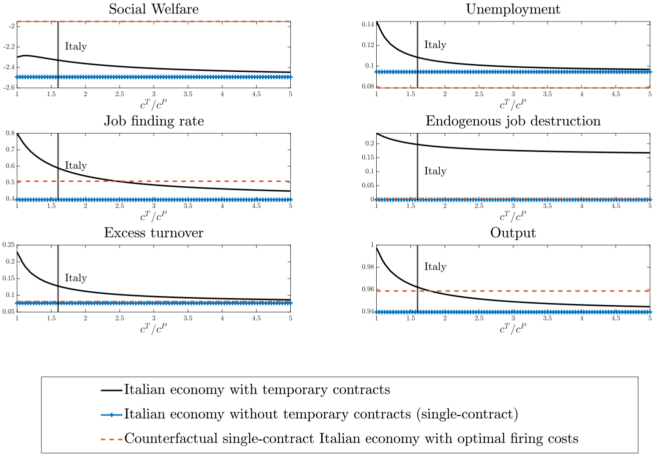
By following (and doubling) the same steps as in the single-contract economy we derive the reduced equilibrium form of the dual market model as:

$$S_t^F(\tilde{z}_t^C) = J_{0t}^P(z_{it}) - V_t = 0$$
$$S_t^F(\tilde{z}_t^T) = J_t^T(z_{it}) - V_t + \gamma^T = 0$$
$$\tilde{z}_t^C = \tilde{z}_t^P + \frac{\gamma^P}{[1 - \eta(1 - \Theta_w^P)]}$$
$$\frac{c^T}{\xi_t^T} = \left[1 - \eta\left(1 - \Theta_w^T\right)\right](\bar{z} - \tilde{z}_t^T) - \gamma^T$$

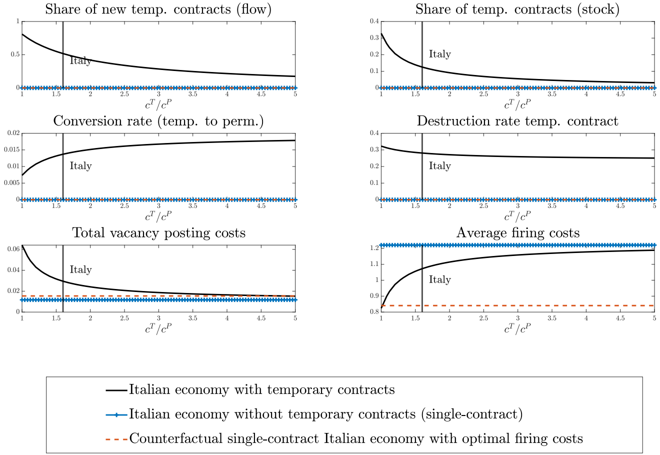
The experiments

- We calibrate c^T and ι to match Italian data in the period 2003-2012:
  - average share of TCs must equal 12.6% ($\rightarrow c^T$ is 60% higher than c^P)
  - transition rate from a temporary job to unemployment equal to 0.29 ($\rightarrow \iota = 0.083$ corresponding to a maximum duration of 12 quarters)
- We then perform several experiments:
  - lowering c^T to simulate the gradual liberalization of TCs
  - lowering ι to simulate extending their duration
  - increasing γ^T to simulate increasing employment protection
  - increasing Θ_w^T to simulate increasing wage stickiness

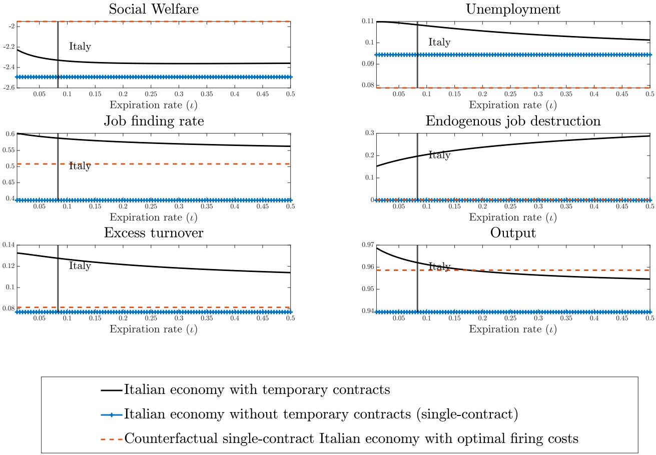
LR effects of cost of creating a TC (1)



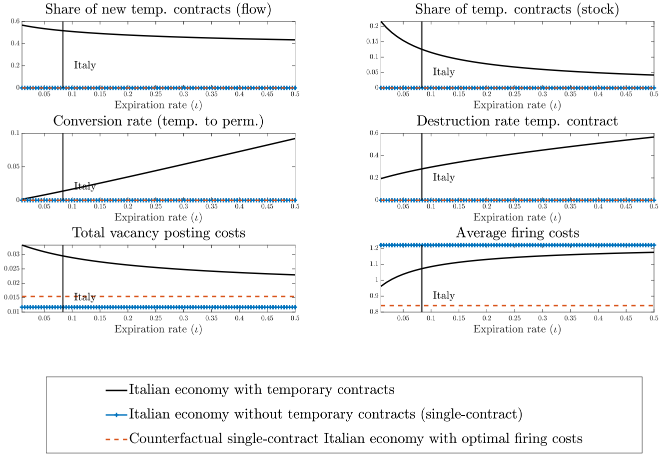
LR effects of cost of creating a TC (2)



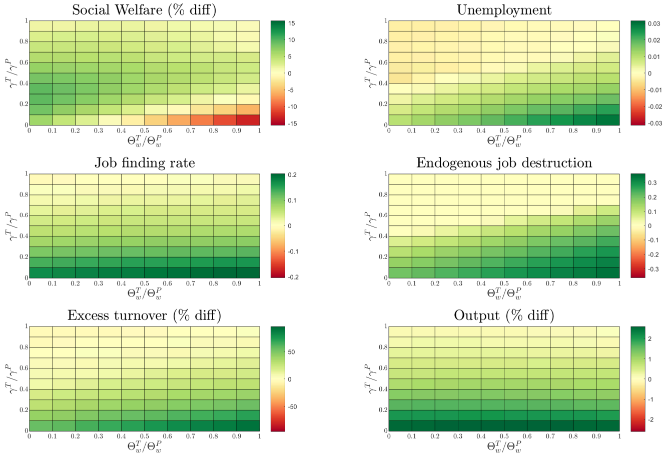
LR effects of TC's expiration rate (1)



LR effects of TC's expiration rate (2)



LR effects of TC's employment protection and wage stickiness (w.r.t. the single-contract economy



Answers to the research questions

- The introduction of TCs increases social welfare and closes around **one fourth of the gap** between the decentralized single-contract economy (blue line) and the optimal EPR policy (orange line)
- **Social welfare is maximized when TCs are almost fully liberalized**, hence when there are no limits to their duration and when the cost of posting a vacancy for a temporary job is only slightly higher than the cost of creating a regular job
- Overall, starting from the single-contract scenario, the most dangerous policy is introducing temporary contracts with no firing costs but still rather inflexible wages: ideally, **one would have TCs with fully flexible wages and a moderate degree of firing restrictions**

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Wrap up

- Employment protection on regular contracts has non-linear effects
- The *optimal* level of employment protection increases with downward real wage rigidities generated by other LMIs
- Flexible contracts can mitigate the effects of excessive firing costs but exacerbate turnover
- Policy implication: need of unified design of labor market policies

Thanks for your attention

Households ◂ Back

The **representative household** consumes and invests in bonds. Labor supply is fixed and equal to 1.

$$W_t^H = \max_{C_t, B_t} \left[\log C_t + \mathbb{E}_t \beta W_{t+1}^H \right]$$

$$\text{s.t. } C_t + B_t = R_{t-1} B_{t-1} + w_{0t} n_{0t} + w_t n_t + b u_t + \Pi_t^F - \bar{T}_t$$

$$\Pi_t^F = Y_t - w_{0t} n_{0t} - w_t n_t - c v_t - (1-\phi) G(\tilde{z}_t) (n_{0t} + n_t) \gamma$$

$$\bar{T}_t = T_t + (1-\phi) G(\tilde{z}_t) (n_{0t} + n_t) \gamma$$

where

- We distinguish between **newly hired** (n_{0t}) and **incumbent workers** (n_t) because they earn a different wage (w_{0t} and w_t)
- Π_t^F: **firm's profits** $\Rightarrow$ production (Y) - labor income - vacancy costs (cv_t) - firing costs ($(1-\phi) G(\tilde{z}_t) (n_{0t} + n_t) \gamma$)
- $\bar{T}_t$: lump-sum **taxes**

The government ◂ Back

$$\bar{T}_t = T_t + (1-\phi)\,G(\tilde{z}_t)\,(n_{0t} + n_t)\,\gamma$$
$$bu_t = T_t$$

Notice that:

- Total taxes $\bar{T}_t$ are made of two components: T_t, collected lump-sum but adjusted each period to finance unemployment benefits, plus layoff taxes, collected via dismissals [Albertini and Fairise (2013)]
- **Unemployment subsidy** (b) does not have any proper insurance motive (pooled consumption within the household): however, it affects both labor supply and demand, interacting with other LMIs
- **Firing costs** (γ) do not represent a pure waste because they finance the government and reduce the need to levy additional taxes

Laws of motion

$$1 = n_{0t} + n_t + u_t$$

$$n_{0t} = f_t u_{t-1}$$

$$n_t = (1 - \delta_t)(n_{0t-1} + n_{t-1})$$

where

- f_t is the job finding rate
- δ_t is the overall separation rate (exogenous + endogenous separations)

back

Aggregate resource constraint

- Total production

$$Y_t = n_{0t}\left(A_t + \bar{z}\right) + n_t \left(A_t + \int_{\tilde{z}_t}^{\bar{z}} z' dG(z')\right)$$

- Aggregate resource constraint

$$Y_t = C_t + cv_t$$

back

Worker's value functions

- Value of unemployment:

$$U_t = b + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} \left[f_{t+1} W_{0t+1}(\bar{z}) + (1 - f_{t+1}) U_{t+1} \right]$$

where f_t is the job finding rate.

- Value function for a worker:

$$W_t(z_{it}) = w_t(z_{it}) + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} (1 - \phi) \left[\int_{\tilde{z}_{t+1}}^{\bar{z}} W_{t+1}(z') dG(z') + G(\tilde{z}_{t+1}) U_{t+1} \right] + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} \phi U_{t+1}$$

back

Nash bargaining

Wage setting:

$$(1-\eta)\left(W_t(z_{it})-U_t\right)=\eta\left(J_t(z_{it})-V_t+\gamma\right)$$
$$(1-\eta)\left(W_{0t}(\bar{z})-U_t\right)=\eta\left(J_{0t}(\bar{z})-V_t+\gamma\right)$$

After some algebra we obtain:

$$w_t^n(z_{it})=(1-\eta)b+\eta\left\{y_t(A_t,z_{it})+\mathbb{E}_t\beta\frac{\lambda_{t+1}}{\lambda_t}c\theta_{t+1}+\gamma\left[1-\mathbb{E}_t\beta\frac{\lambda_{t+1}}{\lambda_t}(1-\phi-f_{t+1})\right]\right\}$$
$$w_{0t}^n(\bar{z})=w_t^n(\bar{z})$$

back

Decentralized allocation

We collapse the main equations of the model to obtain two conditions for the labor market tightness (θ_t) and the job destruction threshold $(\tilde{z}_t)$ which characterize the decentralized allocation and evaluate them in steady state:

$$\frac{c}{q(\theta^{dec})} = [1-\eta(1-\Theta_w)](A+\bar{z}) + [1-\eta(1-\Theta_w)]\beta(1-\delta)\left[H(\tilde{z}^{dec}) - \tilde{z}^{dec}\right]$$
$$-\eta(1-\Theta_w)\beta c\theta^{dec} - (1-\Theta_w)(1-\eta)b - \Theta_w w^*$$
$$-\eta(1-\Theta_w)[1-\beta(1-\phi)]\gamma - \beta(1-\phi)\gamma - \eta(1-\Theta_w)\beta f(\theta^{dec})\gamma$$
$$\frac{c}{q(\theta^{dec})} = [1-\eta(1-\Theta_w)](\bar{z} - \tilde{z}^{dec}) - \gamma$$

back

Social planner allocation (first best)

The social planner chooses labor market tightness, unemployment and the job destruction threshold to solve the following problem:

$$\max_{\{\theta_t, u_t, \tilde{z}_t\}_{t=0}^{\infty}} \quad \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t)$$

$$\text{s.t.} \quad C_t = n_{0t}\left(A_t + \bar{z}\right) + n_t\left[A_t + \frac{1}{1 - G(\tilde{z}_t)} \int_{\tilde{z}_t}^{\bar{z}} x g(x) dx\right] - c\theta_t u_{t-1}$$

$$n_{0t} = f(\theta_t) u_{t-1}$$

$$n_t = (1 - \phi)\left[1 - G(\tilde{z}_t)\right]\left(n_{0t-1} + n_{t-1}\right)$$

$$1 = u_t + n_{0t} + n_t$$

$$f(\theta_t) = \Phi \theta_t^{\varepsilon}$$

back

Social planner allocation: solution

By computing the planner's FOCs and simplifying we obtain two conditions characterizing labor market tightness and the job destruction threshold for the optimal allocation in steady state:

$$\frac{c}{q(\theta^{opt})} = \varepsilon\left(A + \bar{z}\right) + \varepsilon\beta(1-\delta)\left[H(\tilde{z}^{opt}) - \tilde{z}^{opt}\right] - (1-\varepsilon)\beta c\theta^{opt}$$

$$\frac{c}{q(\theta^{opt})} = \varepsilon(\bar{z} - \tilde{z}^{opt})$$

back

Ramsey allocation (second best) ◂ back

We solve the Ramsey problem of a social planner who takes into account the constraints due to agents' choices in the decentralized economy, which are affected by LMIs. The planner takes as given b and Θ_w and choose the best possible allocation that can be attained by changing γ.

$$\max_{\{\theta_t, u_t, \tilde{z}_t, \gamma\}_{t=0}^{\infty}} \quad \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t)$$

$$\text{s.t.} \quad C_t = n_{0t}\left(A_t + \bar{z}\right) + n_t \left[A_t + \frac{1}{1 - G(\tilde{z}_t)} \int_{\tilde{z}_t}^{\bar{z}} x g(x) dx\right] - c\theta_t u_{t-1}$$

$$n_{0t} = f(\theta_t) u_{t-1}$$

$$n_t = (1 - \phi)\left[1 - G(\tilde{z}_t)\right]\left(n_{0t-1} + n_{t-1}\right)$$

$$1 = u_t + n_{0t} + n_t$$

$$f(\theta_t) = \Phi \theta_t^{\varepsilon}$$

$$\frac{c}{q(\theta_t)} = \left[1 - \eta(1 - \Theta_w)\right]\left(\bar{z} - \tilde{z}_t\right) - \gamma$$

$$J_t(\tilde{z}_t) - V_t + \gamma = 0$$

The dual labor market

HHs' budget constraint in the dual labor market model:

$$C_t + B_t = R_{t-1}B_{t-1} + w_{0t}^P n_{0t}^P + w_t^P n_t^P + w_{0t}^T n_{0t}^T + w_t^T n_t^T + bu_t + \Pi_t^F - \bar{T}_t$$

Law of motions in the dual labor market model:

$$1 = n_{0t}^T + n_t^T + n_{0t}^P + n_t^P + u_t$$

$$n_{0t}^T = \chi_t^T u_{t-1}$$

$$n_{0t}^P = f_t^P u_{t-1} + \zeta_t \left(n_{0t-1}^T + n_{t-1}^T \right)$$

$$n_t^T = (1 - \delta_t^T - \zeta_t)(n_{0t-1}^T + n_{t-1}^T)$$

$$n_t^P = (1 - \delta_t^P)(n_{0t-1}^P + n_{t-1}^P)$$

back

The dual labor market

Firms' value functions for TCs in the dual labor market

$$J_t^T(z_{it}) = y_t(A_t, z_{it}) - w_t^T(A_t, z_{it}) + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} \Bigg\{ (1-\phi) \Bigg[\iota \int_{\tilde{z}^C_{t+1}}^{\bar{z}} J^P_{t+1}(z') dG(z') + (1-\iota) \Big[\int_{\tilde{z}^T_{t+1}}^{\bar{z}} J^T_{t+1}(z') dG(z') - G(\tilde{z}^T_{t+1}) \gamma^T$$

$$J_{0t}^T(\bar{z}) = y_{0t}(A_t, \bar{z}) - w_{0t}^T(A_t, \bar{z}) + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} \Bigg\{ (1-\phi) \Bigg[\iota \int_{\tilde{z}^C_{t+1}}^{\bar{z}} J^P_{t+1}(z') dG(z') + (1-\iota) \Big[\int_{\tilde{z}^T_{t+1}}^{\bar{z}} J^T_{t+1}(z') dG(z') - G(\tilde{z}^T_{t+1}) \gamma^T \Big] \Bigg]$$

$$V_t^T = -c^T + \xi_t^T J_{0t}^T(\bar{z}) + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} \left(1 - \xi_t^T\right) V_{t+1}^T$$

$$S_t^{FT}(z_{it}) = J_t^T(z_{it}) - V_t^T + \gamma^T$$

back

The dual labor market

HHs' value functions for TCs in the dual labor market

$$W_t^T(z_{it}) = w_t^T(A_t, z_{it}) + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} \left\{ (1-\phi) \begin{bmatrix} \iota \int_{\tilde{z}_{t+1}^C}^{\bar{z}} W_{t+1}^P(z')dG(z') \\ + (1-\iota) \left[\int_{\tilde{z}_{t+1}^T}^{\bar{z}} W_{t+1}^T(z')dG(z') \right] \\ + \left[\iota G(\tilde{z}_{t+1}^C) + (1-\iota) G(\tilde{z}_{t+1}^T) \right] U_{t+1} \end{bmatrix} + \phi U_{t+1} \right\}$$

$$W_{0t}^T(\bar{z}) = w_{0t}^T(A_t, \bar{z}) + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} \left\{ (1-\phi) \begin{bmatrix} \iota \int_{\tilde{z}_{t+1}^C}^{\bar{z}} W_{t+1}^P(z')dG(z') \\ + (1-\iota) \left[\int_{\tilde{z}_{t+1}^T}^{\bar{z}} W_{t+1}^T(z')dG(z') \right] \\ + \left[\iota G(\tilde{z}_{t+1}^C) + (1-\iota) G(\tilde{z}_{t+1}^T) \right] U_{t+1} \end{bmatrix} + \phi U_{t+1} \right\}$$

$$U_t = b + \mathbb{E}_t \beta \frac{\lambda_{t+1}}{\lambda_t} \left[\chi_t^T W_{0t+1}^T(\bar{z}) + f_{t+1}^P W_{0t+1}^P(\bar{z}) + \left(1 - \chi_t^T - f_{t+1}^P\right) U_{t+1} \right]$$

$$S_t^{WT}(z_{it}) = W_t^T(z_{it}) - U_t$$

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The dual labor market

Nash and effective wages in the dual labor market

$$(1-\eta)\left(W_t^T(z_{it}) - U_t\right) = \eta\left(J_t^T(z_{it}) - V_t^T + \gamma^T\right)$$
$$(1-\eta)\left(W_{0t}^T(\bar{z}) - U_t\right) = \eta\left(J_{0t}^T(\bar{z}) - V_t^T + \gamma^T\right)$$
$$w_t^T(z_{it}) = (1-\Theta_w^T)w_t^{nT}(z_{it}) + \Theta_w^T w_t^{T*}$$
$$w_{0t}^T(\bar{z}) = (1-\Theta_w^T)w_{0t}^{nT}(\bar{z}) + \Theta_w^T w_t^{T*}$$

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