

Trade Liberalization and Labor Market Dynamics with Heterogeneous Firms

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Motivation

- ① Does globalization create turbulence in the labor market?
 - wage income loss?
 - job loss and unemployment?
- ② Are the labor market effects mostly at the level of:
 - sectors, skill groups and/or occupations?
 - regions?
 - firms?
- ③ In the aftermath of a trade shock, do labor market frictions:
 - slow down the adjustment to trade?
 - lead to a dissipation of gains from trade?
 - create winners and losers (good jobs and bad jobs)?

Motivation

- Recent trade models emphasize **labor reallocation** within sectors, from less to more productive firms
 - trade shocks result in simultaneous job destruction and job creation within sector-occupations
 - an aggregate shock with heterogenous effects across firms
- Most existing work with heterogenous firms focuses on:
 - static models or steady states
 - or flexible labor markets
- This paper studies transition dynamics after a trade shock in a version of a Melitz model with DMP labor market frictions
 - DMP in a model of large firms with aggregate shocks
 - challenging task due to the size of the state space, $\mathcal{G}_t(h, \theta)$
 - focus on a special case with full analytical characterization

Environment

- Two symmetric countries
- Homogenous workers as the only factor of production
- Two sectors:
 - ① homogenous non-traded good
 - numeraire outside good
 - ② differentiated traded good
 - large monopolistically competitive firms
 - fully persistent productivity types
- Symmetric DMP labor market frictions in both sectors:
 - random search and CRS matching (no firing costs)
 - Stole-Zweibel (Nash) wage bargaining without commitment (no wage “stickiness”)
- Free entry in both sectors (no DRS in entry)
- Perfect mobility of unemployed across sectors (no OJS)
- One-time unanticipated bilateral trade liberalization.
Discrete time with short time intervals, $\Delta \approx 0$

Main findings

- ① Dynamic adjustment to a trade shock features:
 - (a) slow transitions in the labor market resulting in misallocation and reduced productivity
 - (b) new productive entrants crowded out by slowly shrinking old unproductive incumbents
 - (c) depressed trade flows

Main findings

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- ② This notwithstanding, **gains in consumer surplus**
 - are instantaneous (cf., Atkeson and Burstein, 2010)
 - do not depend on LM frictions
 - constitute the only source of long-run gains from trade

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 - (c) depressed trade flows
- ② This notwithstanding, **gains in consumer surplus**
 - are instantaneous (cf., Atkeson and Burstein, 2010)
 - do not depend on LM frictions
 - constitute the only source of long-run gains from trade
- ③ But LM frictions lead to profit loss, endogenous job destruction and depressed wages in some incumbent firms:
 - temporary and permanent ‘bad jobs’
 - income losses are increasing in LM frictions, but small
 - LM frictions shield workers from unemployment, and more surprisingly also from wage income loss

Related Literature

- A dynamic version of Helpman and Itskhoki (2010) with focus on transition dynamics
- Trade and labor market dynamics:
 - ① No firm heterogeneity with focus on intersectoral reallocation:
 - Davidson, Martin and Matusz (1999), Kambourov (2009), Coşar (2010), Artuç et al. (2010), Dix-Carneiro (2014), Traiberman (2015)
 - ② Firm heterogeneity with focus on steady state comparisons:
 - Coşar, Guner and Tybout (2011), Felbermayr, Impullitti and Prat (2014), Cacciatore (2013)
- Labor-macro:
 - Acemoglu and Hawkins (2014), Elsby and Michaels (2013)
 - Schaal (2012), Kaas and Kircher (2013)

Demand

- Representative family with flow utility $\mathcal{U}(q_{0t}, Q_t)$ and discount rate r
- CES aggregator of differentiated goods:

$$Q = \left(\int_{\omega \in \Omega} q(\omega)^\beta d\omega \right)^{1/\beta}, \quad 0 < \beta < 1$$

- **Assumption 1:** *The utility function is quasi-linear:*

$$\mathcal{U}(q_0, Q) = q_0 + \frac{1}{\zeta} Q^\zeta, \quad 0 < \zeta < \beta, \quad q_0 \in \mathbb{R}, Q \in \mathbb{R}_+.$$

- Period utility is then: $\mathcal{U}_t = I_t + \frac{1-\zeta}{\zeta} Q_t^\zeta$ with expenditure I_t

Families and Labor Supply

- Unit-continuum of families with L units of labor:
 - N workers are assigned to differentiated sector
 - $N_0 = L - N$ workers are assigned to outside sector
- Workers can be employed H or unemployed (searching) U
 - s is exogenous job separation rate
 - x is job finding rate (\sim labor market tightness)
- **Assumption 2:** *Unemployed are mobile across sectors.*
- Families pool consumption risk and consume their income (labor income plus distributed profits)

Outside sector

- Free entry and hiring cost (Cobb-Douglas matching function):

$$b_0 = \frac{\text{Vacancy cost}}{\text{Job filling rate}} = a_0 x_0^\alpha$$

- Hired workers produce one unit of outside good per unit of time and job is destroyed at rate s_0
- Wages are Nash bargained without commitment

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- Wages are Nash bargained without commitment
- **Assumption 3:** *L is large enough that along the equilibrium path $U_{0t} > 0$ for all t.*
- **Lemma 1:** (i) (x_0, b_0) are constant and satisfy:

$$[2(r + s_0) + x_0] b_0 = 1 - b_u.$$

- (ii) *The value of unemployed is constant and given by:*

$$rJ_0^U = b_u + x_0 b_0.$$

Differentiated sector

Setup

- 1 Fixed cost $f_e \Rightarrow$ productivity $\theta \sim G(\theta) = 1 - \theta^{-k}$, $k > \frac{\beta}{1-\beta}$
- 2 Production $y = \theta h$ at fixed cost f_d with revenue:

$$R = \left[1 + \iota \tau^{-\frac{\beta}{1-\beta}} \left(\frac{Q^*}{Q} \right)^{-\frac{\beta-\zeta}{1-\beta}} \right]^{1-\beta} Q^{-(\beta-\zeta)} y^\beta \equiv \Theta(\iota; \theta)^{1-\beta} h^\beta$$

- 3 Export decision $\iota \in \{0, 1\}$ at fixed cost f_x and iceberg cost τ
- 4 Cost of hiring: bh , where $b = ax^\alpha$
- 5 Stole-Zweibel wage bargaining $\Rightarrow w(h)$
- 6 Firms die at rate δ and matches are destroyed at rate σ
 \Rightarrow exogenous separation rate $s \equiv \delta + \sigma$

Differentiated sector

Problem of a firm

- Bellman equation for firm θ with export status ι :

$$J^F(h) = \max_{h'} \left\{ \varphi(h)\Delta - b[h' - (1 - \sigma\Delta)h]^+ + \frac{1 - \delta\Delta}{1 + r\Delta} J_+^F(h') \right\},$$

where $\varphi(h) = R(h) - w(h)h - f_d - \iota f_x$

▶ Show FOC and ET

- Optimal hiring policy (when $\Delta \approx 0$):

$$J_h^F(h') = b \quad \Rightarrow \quad \varphi'(h) = (r + s)b$$

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▶ Show FOC and ET

- Optimal hiring policy (when $\Delta \approx 0$):

$$J^F_h(h') = b \quad \Rightarrow \quad \varphi'(h) = (r + s)b$$

- Stole-Zweibel bargaining: $J^E(h) - J^U = J^F_h(h)$
- Value to unemployed: $rJ^U - \dot{J}^U = b_u + xb$ and $J^U = J^U_0$

Differentiated sector

Characterization

- **Lemma 2:** *Bargaining wage schedule is:*

$$w(h) = \frac{\beta}{1 + \beta} \frac{R(h)}{h} + \frac{1}{2} r J_0^U.$$

Differentiated sector

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- **Lemma 3:** (a) (x, b) are constant and satisfy $xb = x_0 b_0$.
(b) *Equilibrium employment conditional on hiring:*

$$h = \Phi^{1/\beta} \Theta(\iota; \theta), \quad \text{where} \quad \Phi \equiv \left[\frac{\beta}{1 + \beta} \frac{2}{b_u + [2(r + s) + x]b} \right]^{\frac{\beta}{1 - \beta}}.$$

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- **Lemma 4:** *Value of an entrant with productivity θ and zero employees, if it hires in every future period satisfies:* ▶ proof

$$(r+\delta)J^V(\theta) - j^V(\theta) = \max_{\iota \in \{0,1\}} \left\{ \frac{1-\beta}{1+\beta} \Phi \Theta(\iota; \theta) - f_d - \iota f_x, 0 \right\}.$$

Steady-state Comparisons

- **Proposition 1:** *In a symmetric Pareto world economy steady state, a reduction in τ leads to:*

- (i) *an increase in Q , H , M , with H/M constant, and changes in these variables do not depend on labor market frictions:*

$$\left(\frac{Q'}{Q}\right)^\zeta = \frac{H'}{H} = \frac{M'}{M} = \left(\frac{\theta'_d}{\theta_d}\right)^{\frac{\beta\zeta}{\beta-\zeta}}$$

$$\text{and } \theta_d = \left[\frac{f_d}{f_e} \cdot \frac{1+(f_d/f_x)^{k/(\varepsilon-1)-1}\tau^{-k}}{[k/(\varepsilon-1)-1](r+\delta)} \right]^{1/k}.$$

- (ii) *Assume $s = s_0$ and $x = x_0$. Then aggregate unemployment and income do not change with τ , and steady state welfare gains from trade do not depend on labor market frictions.*

- Measure of welfare: $GT' = \frac{(I'-I) + \frac{1-\zeta}{\zeta}(Q')^\zeta}{\frac{1-\zeta}{\zeta}Q^\zeta} = \left(\frac{Q'}{Q}\right)^\zeta$

Dynamic Gains

- Consider a one-time unanticipated and permanent reduction in trade cost, $\tau' < \tau$
- **Proposition 2:** *Along the transition path, $Q_t \geq Q'$. If there is entry in every period, then $Q_t \equiv Q'$.*
- **Proof:** $\tau_t = \tau'$ and $b_t = b$. Two cases: (i) Continuous entry. Then free entry implies $\int J^V(\theta) dG_\theta = (r+\delta)f_e \Rightarrow Q_t = Q'$. (ii) No entry for $t \in [0, T_e)$. Then $\dot{Q}_t < 0$ and $Q_{T_e} = Q'$. ■
- Intuition: entry acts as a buffer

Dynamic Gains

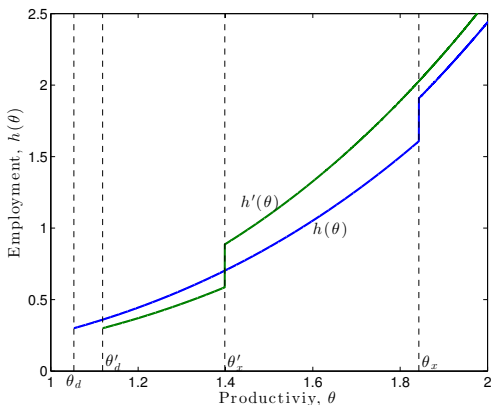
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- **Corollary:** Dynamic gains in consumer surplus are instantaneous and do not depend on labor market frictions!

Dynamic Gains

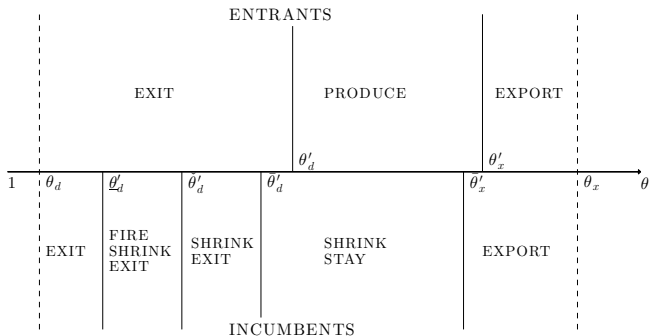
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- Intuition: entry acts as a buffer
- **Corollary:** Dynamic gains in consumer surplus are instantaneous and do not depend on labor market frictions!
- Income / changes in general:
 - ① decrease in the aggregate value of firms
 - ② decrease in the value of employed at shrinking firms
 - ③ endogenous separation into unemployment (firing)

Dynamic Adjustment

- With entry, gains in CS do not depend on $\mathcal{G}_t(h, \theta)$
- Yet, productivity, trade and income all depend on it



Cutoffs: Incumbents vs Entrants

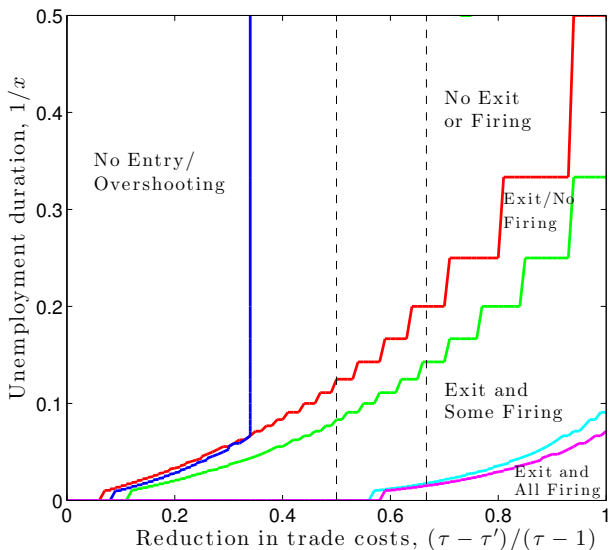


Parameter Values

Moment	Parameter	Value	Comment
Discount rate	r	0.05	
Exogenous separation rate	s	0.2	$s_0 = s$
— Labor force attrition rate	σ	0.175	
— Firm death rate	δ	0.025	
Job finding rate	x	2	$a_0 = a = 0.12$
Relative elasticity of matching	α	1	
Unemployment benefit	b_u	0.4	
Pareto shape parameter	k	4	
CES within sector	ε	4	$\beta = 3/4$
Semi-elasticity across sectors		2	$\zeta = 1/2$
Employment share in the traded sector		14%	$L = 10, f_d = 0.05$
Fraction of exitors		25%	$(r + \delta)f_e/f_d = 2.7$
Fraction of exporters		11%	$f_x/f_d = 1$
Fraction of output exported		16%	$\tau = 1.75$
Trade liberalization			$\tau' = 1.375$
— Fraction of exporters		28%	
— Fraction of output exported		28%	

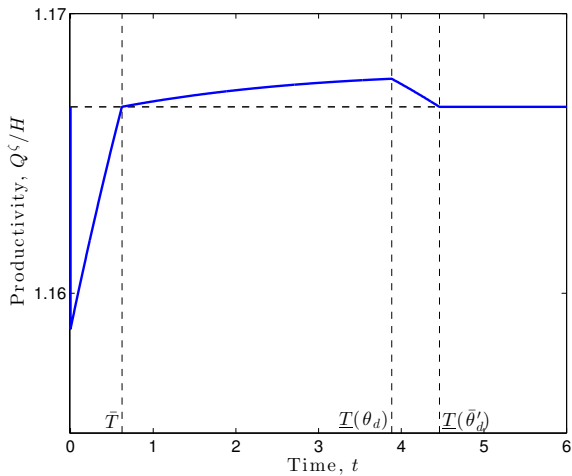
Adjustment Patterns

Regions in the parameter space



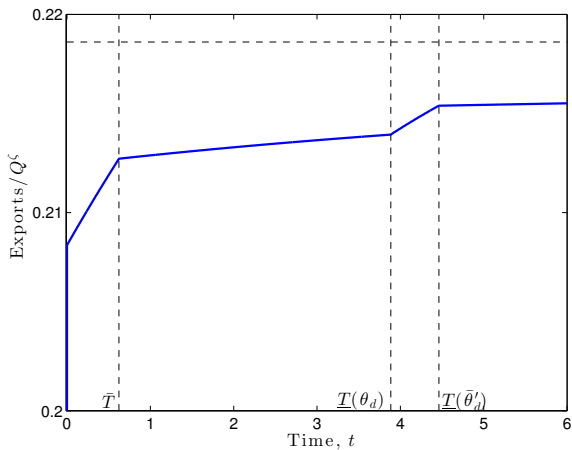
Aggregate dynamics

Productivity



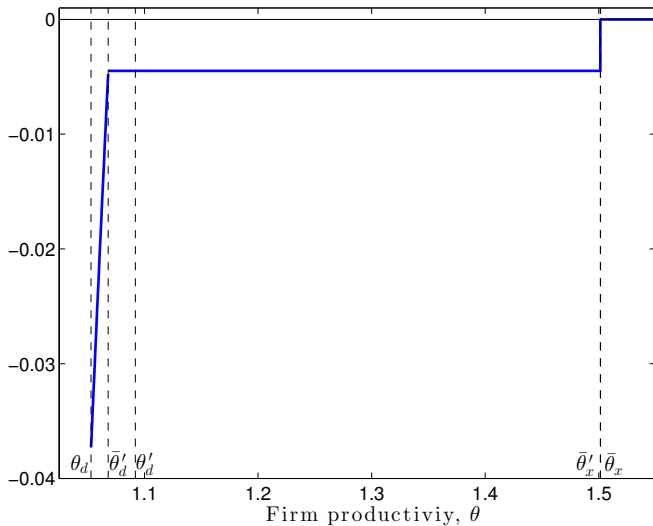
Aggregate dynamics

Trade



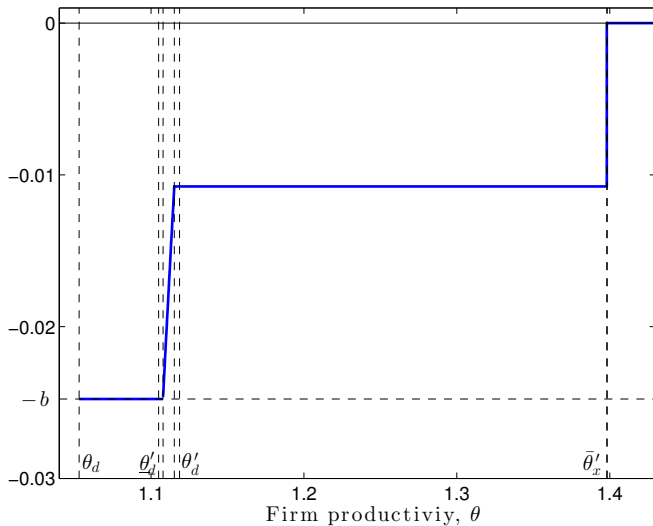
Good and Bad Jobs

Changes in the value of employment values (6 months)

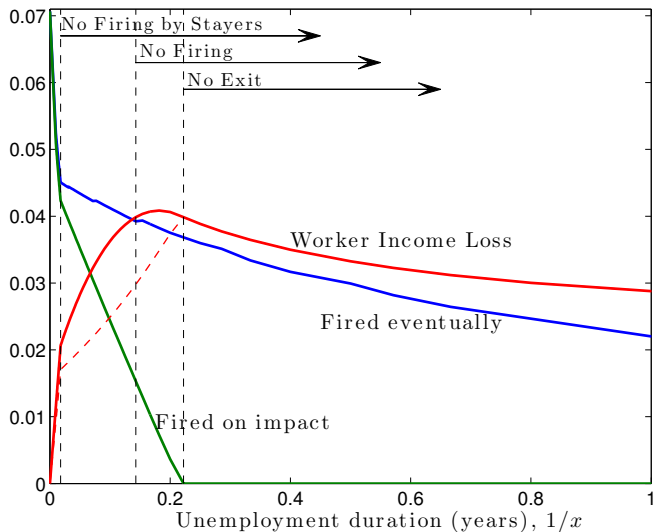


Good and Bad Jobs

Changes in the value of employment values (1/2 months)



Job destruction vs wage cuts



Income Loss and Gains from Trade

- Gains from trade are measured as:

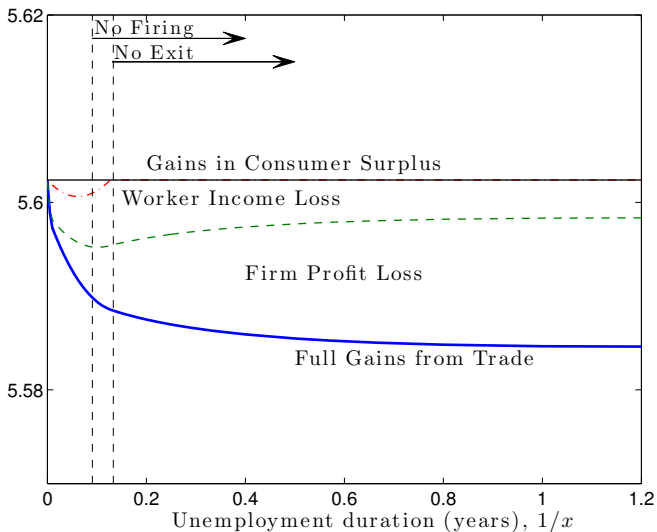
$$GT = \frac{-r(L^F + L^W) + \frac{1-\zeta}{\zeta}(Q')^\zeta}{\frac{1-\zeta}{\zeta}Q^\zeta}, \quad L^W = L^E + L^U$$

- Decomposition of Gains from Trade:

Trade shock, τ' (% change)	1.375 (50%)		1.25 (66.7%)	
	2	24	2	24
(1) Gains in consumer surplus	5.60	5.60	9.50	9.50
(2) Capital-income loss (L^F)	0.24	0.06	0.51	0.10
(3) Wage-income loss (L^W)	0.09	0.12	0.27	0.23
(3*) — due to unemployment (L^U)	—	0.03	—	0.06
(4) Full gains (= (1) - r[(2) + (3)])	5.585	5.595	9.46	9.48

Gains from Trade

Decomposition



Conclusion

- Trade liberalization with a frictional labor market results in lengthy transitions with:
 - misallocation of labor and reduced productivity
 - depressed value of trade
 - bad jobs and good jobs
 - but instantaneous gains from trade and gains in consumer surplus independent from the extent of LM frictions
- Quantitatively modest disruptions in the labor market

Conclusion

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- Strong assumptions to relax next:
 - ① Linear hiring costs
 - ② Frictionless free entry
 - ③ Perfect mobility across sectors
 - ④ Symmetric countries/single traded sector
 - ⑤ Flexible wages

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 - but instantaneous gains from trade and gains in consumer surplus independent from the extent of LM frictions
- Quantitatively modest disruptions in the labor market
- Strong assumptions to relax next → **quantitative model:**
 - ① Linear hiring costs
 - ② Frictionless free entry → **slow entry and job creation**
 - ③ Perfect mobility across sectors
 - ④ Symmetric countries/single traded sector → **sectoral CA**
 - ⑤ Flexible wages → **rigid wages and inefficient separations**

Outside sector

Characterization (Proof of Lemma 1)

- ① $U_0 > 0$ ensures entry of firms (i.e., vacancy posting)

$$\Rightarrow J_0^V \equiv 0 \quad \text{and} \quad J_0^F = b_0$$

- ② Then Nash bargaining results in:

$$J_0^E - J_0^U = J_0^F = b_0$$

- ③ Surplus from employment satisfies:

$$\begin{aligned}(r + s_0)J_0^F &= (1 - w_0) + j_0^F, \\ (r + s_0 + x_0)(J_0^E - J_0^U) &= (w_0 - b_u) + (j_0^E - j_0^U)\end{aligned}$$

Has unique stationary solution (x_0, b_0) with $\dot{b}_0 = 0$

- ④ Finally, the value of unemployed and equilibrium wage are:

$$\begin{aligned}rJ_0^U &= b_u + x_0 b_0, \\ w_0 &= b_u + (r + s_0 + x_0)b_0.\end{aligned}$$

Firm's problem

FOC and ET

- First order condition (*sS rule*):

$$\frac{1 - \delta\Delta}{1 + r\Delta} J_{h,+}^F(h') = \begin{cases} b, & \text{when } h' > (1 - \sigma\Delta)h, \\ \in [0, b], & \text{when } h' = (1 - \sigma\Delta)h, \\ 0, & \text{when } h' < (1 - \sigma\Delta)h, \end{cases}$$

- Envelope theorem:

$$J_h^F(h) = \varphi'(h)\Delta + \frac{1 - s\Delta}{1 + r\Delta} J_{h,+}^F(h')$$

- Combining the two, conditional on hiring, and with $b = \text{const}$:

$$\varphi'(h) = \frac{(r + s)b}{1 - \delta\Delta}$$

Proof of Lemma 3

Value of an Entrant

- 1 The value of a hiring entrant ($h' > (1 - \sigma\Delta)h$)

$$J^F(h) = \varphi(h)\Delta + (1 - \sigma\Delta)h - bh' + \frac{1 - \delta\Delta}{1 + r\Delta} J_+^F(h')$$

- 2 Optimal hiring is given by:

$$\frac{1 + r\Delta}{1 - \delta\Delta} b_{-1} = \varphi'(h)\Delta + (1 - \sigma\Delta)b$$

- 3 Combining (1) and (2):

$$\underbrace{\left(J^F(h) - \frac{1 + r\Delta}{1 - \delta\Delta} b_{-1} h \right)}_{\frac{1 - \delta\Delta}{1 + r\Delta} J_{-1}^F(0)} = \underbrace{\left(\varphi(h) - \varphi'(h)h \right)}_{\frac{1 - \beta}{1 + \beta} \Theta^{1 - \beta} h^\beta - f_d - \iota f_x} \Delta + \underbrace{\left(\frac{1 - \delta\Delta}{1 + r\Delta} J_+^F(h') - bh' \right)}_{J^F(0)}$$

Additional Equilibrium Conditions

Steady State

- With two symmetric countries:

$$Q^\zeta = M\Phi \int_{\theta_d}^{\infty} \Theta(\iota(\theta); \theta) dG(\theta),$$
$$H = \Phi^{\frac{1-\beta}{\beta}} Q^\zeta$$

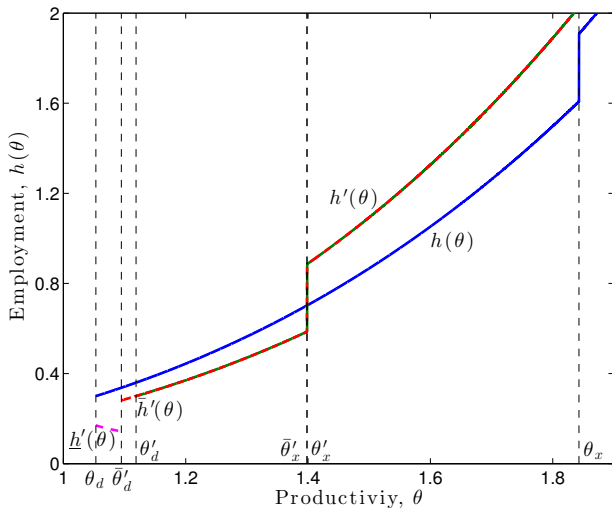
- Additionally, under Pareto productivity distribution:

$$\frac{H}{M} = \frac{2k(r + \delta)f_e}{b_u + [2(r + s) + x]b}$$

- $N = \frac{x+s}{x}H$ and $N_0 = L - N$

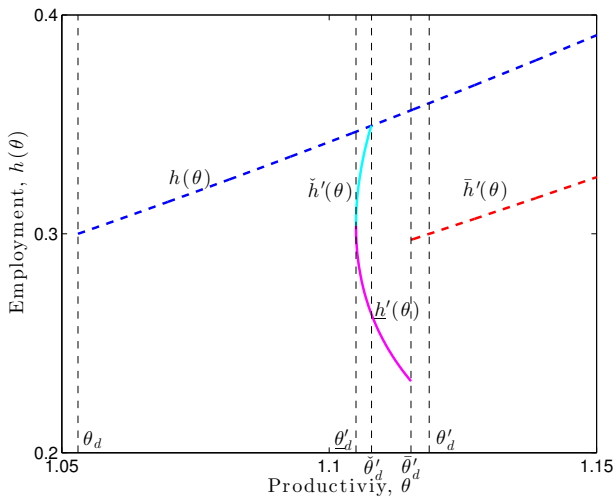
Firm Employment: Before and After

Frictional labor market (6 months duration)



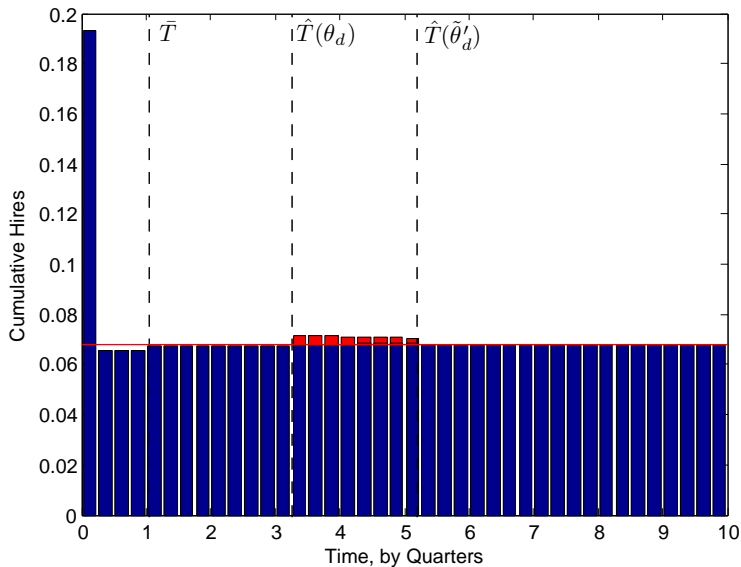
Firm Employment: Before and After

Flexible labor market (1/2 months duration)



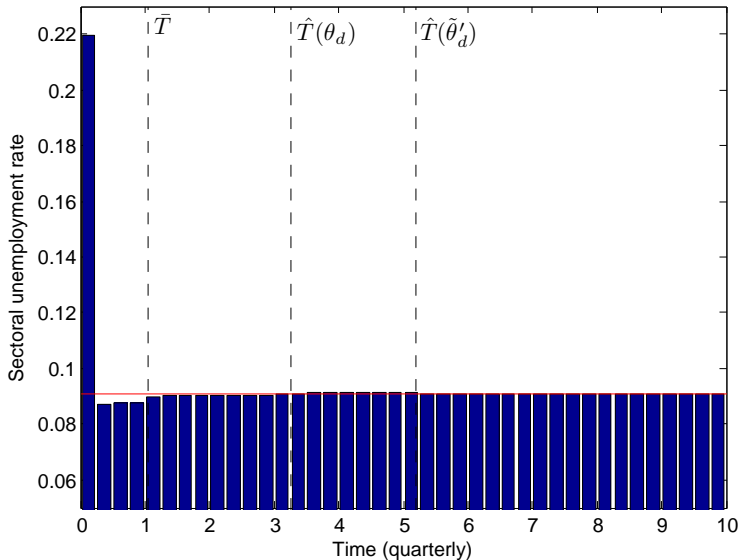
Job Creation and Unemployment

Differentiated-sector hires (quarterly)



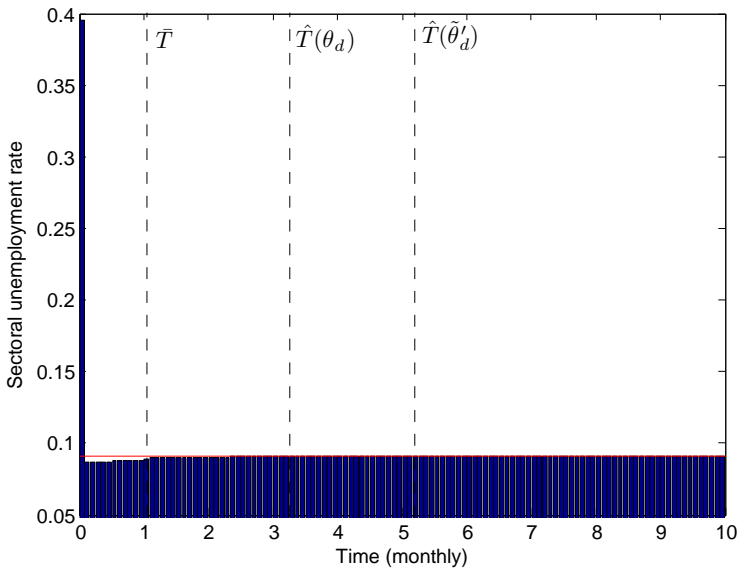
Job Creation and Unemployment

Differentiated-sector unemployment (quarterly)



Job Creation and Unemployment

Differentiated-sector unemployment (monthly)



Job Creation and Unemployment

Increase in sectoral unemployment on impact

