

Adjusting to capital account liberalisation

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May 6, 2008

Objective and summary

- ▶ Objective: theoretically study how adjustment to capital account liberalisation depends on degree of domestic credit frictions.
- ▶ Model: A small open economy model with:
 - ▶ heterogeneous productivity among agents (high & low)
 - ▶ domestic and international borrowing constraints
- ▶ Adjustment to capital account liberalisation:
When domestic borrowing constraint is:
 1. very tight: capital inflow, TFP becomes lower
 2. intermediate: capital outflow, TFP becomes higher
 3. high: capital inflow

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Literature

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- ▶ Prasad, Rogoff, Wei and Kose (2003):
 - ▶ No robust relationship between liberalisation and growth
 - ▶ Benefits with strong institution, and costs outweigh with weak institution

Model

- ▶ A small open economy with homogeneous goods and labour
 - ▶ Many entrepreneurs, workers and foreigners
- Preference

$$\text{entrepreneur} : E_0 \left[\sum_{t=0}^{\infty} \beta^t \log c_t \right]$$

$$\text{worker} : E_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_t - v(l_t)) \right]$$

$$\text{foreign interest rate} : 1 < r^* \leq \frac{1}{\beta}$$

- ▶ Production function:

$$y_{t+1} = a_t l_t,$$

- ▶ Production takes one period \rightarrow entrepreneur may borrow to pay wage bill.
- ▶ Productivity:

$$a_t = \begin{cases} \alpha, & \text{if the agent is productive} \\ \gamma < \alpha, & \text{if the agent is unproductive} \end{cases}$$

- ▶ Idiosyncratic transition of productivity of the individual agent:

$$\text{Prob}(a_{t+1} = \gamma \mid a_t = \alpha) = \delta,$$

$$\text{Prob}(a_{t+1} = \alpha \mid a_t = \gamma) = n\delta$$

- ▶ Each entrepreneur takes prices (w_t, r_t, r^*) and initial net worth as given, and chooses quantities $(c_t, l_t, y_{t+1}, b_{t+1}, b_{t+1}^*)$, subject to the flow-of-funds constraint:

$$c_t + w_t l_t = y_t - b_t - b_t^* + \frac{b_{t+1}}{r_t} + \frac{b_{t+1}^*}{r^*}$$

and the international and domestic borrowing constraints:

$$\begin{aligned} b_{t+1}^* &\leq \phi \theta y_{t+1} \\ b_{t+1} + b_{t+1}^* &\leq \theta y_{t+1} \end{aligned}$$

- ▶ θ : parameter of domestic credit frictions
- ▶ ϕ : parameter of relative tightness of international borrowing, $0 < \phi < 1$.
- ▶ Workers supply labour and consume. (skip in this presentation)

Autarky each entrepreneur

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- ▶ BC and borrowing constraint imply

$$c_t + \underbrace{(w_t - \alpha\theta/r_t)l_t}_{\text{downpayment}} \leq z_t,$$

$z_t \equiv y_t - b_t$: net worth

- ▶ In equilibrium, high-productivity agents become borrower, and low-productive agents become lender.

Production decision

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- ▶ Productive:

$$l_t \leq \frac{\beta z_t}{w_t - \alpha \theta / r_t}, \quad \text{equality holds if } \frac{\alpha}{w_t} > r_t.$$

- ▶ Unproductive:

- ▶ Specialise in lending ($l'_t = 0$) if $r_t > \frac{\gamma}{w_t}$
- ▶ If $l'_t > 0$, then $r_t = \frac{\gamma}{w_t}$

Equilibrium

$(w_t, r_t, L_t, L'_t, x_t, Z_{t+1}, s_{t+1})$ as a function of (Z_t, s_t) ,
which satisfy

1. $L_t + L'_t = L^S(w_t)$: labor market
2. $r_t \geq \frac{\gamma}{w_t}$: unproductive, = holds if $L'_t > 0$
3. $L_t \leq \frac{\beta s_t Z_t}{w_t - (\alpha \theta / r_t)}$: productive, = holds if $\frac{\alpha}{w_t} > r_t$
4. $w_t L^S(w_t) = \beta Z_t$: goods market
5. $x_t = \left[\frac{\alpha(1-\theta)}{w_t - (\alpha \theta / r_t)} - r_t \right] / r_t$: excess rate of return of productive
6. $Z_{t+1} = r_t x_t s_t \beta Z_t + r_t (1 - s_t) \beta Z_t$: wealth accumulation
7. $s_{t+1} = \frac{(1-\delta)(1+x_t)s_t + n\delta(1-s_t)}{1+s_t x_t} \equiv f(s_t, x_t)$: share of net worth of productive

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Autarky steady state

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Autarky

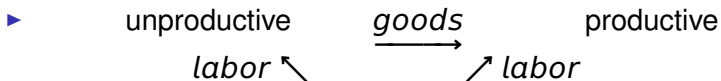
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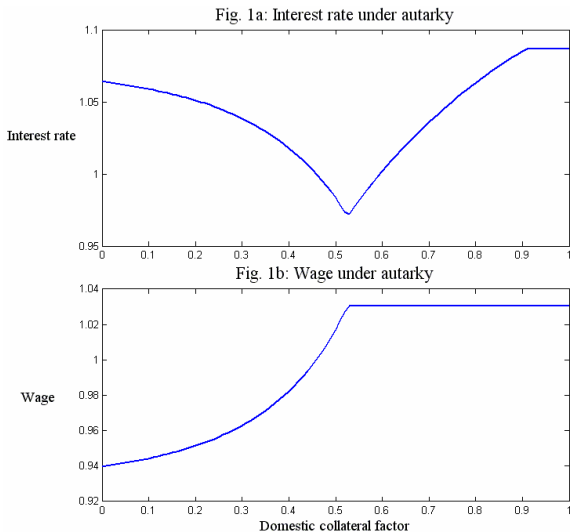
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- ▶ If domestic borrowing constraint is tight
 $\theta < \bar{\theta} \equiv \frac{\delta}{(1+n)\delta + [(\alpha-\gamma)/\gamma]}$, then the unproductive entrepreneurs do not lend all of their net worth, and produce themselves.



- ▶ If $\theta > \bar{\theta}$, then the unproductive stops producing

Autarky steady state



- ▶ Interest rate is not monotone in θ

Capital account liberalisation: $\phi > 0$

individual entrepreneur

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- ▶ BC and borrowing constraint imply

$$c_t + \underbrace{[w_t - \alpha(\phi\theta/r^* + (1 - \phi)\theta/r_t)]l_t}_{\text{downpayment}} \leq z_t,$$

$z_t \equiv y_t - b_t$: net worth

- ▶ In equilibrium, high-productivity agents become borrower, and low-productive agents become lender in the domestic market.
- ▶ Low-productive agents may borrow from abroad

Capital account liberalisation: Equilibrium

$(w_t, r_t, L_t, L'_t, x_t, Z_{t+1}, s_{t+1})$ as a function of (Z_t, s_t) ,
which satisfy

1. $L_t + L'_t = L^S(w_t)$: labor market
2. $r_t \geq \frac{\gamma(1-\phi\theta)}{w_t - (\gamma\phi\theta/r^*)}$: unproductive
3. $L_t \leq \frac{\beta s_t Z_t}{w_t - (\alpha\phi\theta/r^*) - [\alpha(1-\phi)\theta/r_t]}$: productive
4. $w_t L(w_t) \leq \beta Z_t + (\phi\theta/r^*) (\alpha L_t + \gamma L'_t)$: international capital mkt.
5. $x_t = \left\{ \frac{\alpha(1-\theta)}{w_t - (\alpha\phi\theta/r^*) - [\alpha(1-\phi)\theta/r_t]} - r_t \right\} / r_t$
6. $Z_{t+1} = r_t x_t s_t \beta Z_t + r_t (1 - s_t) \beta Z_t$: wealth accumulation
7. $s_{t+1} = \frac{(1-\delta)(1+x_t)s_t + n\delta(1-s_t)}{1+s_t x_t} \equiv f(s_t, x_t)$: share of net worth of productive

Capital account liberalisation

Fig. 2a: Interest rate under autarky and liberalization

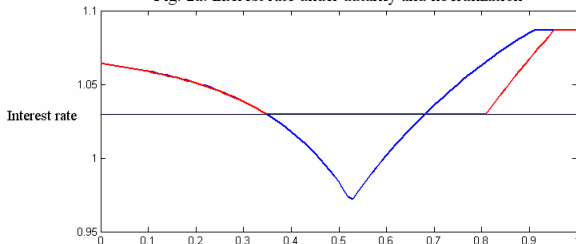
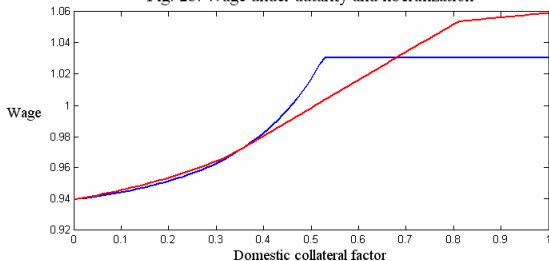


Fig. 2b: Wage under autarky and liberalization

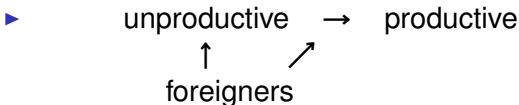


- ▶ Direction of capital flow depends on θ

Region 1

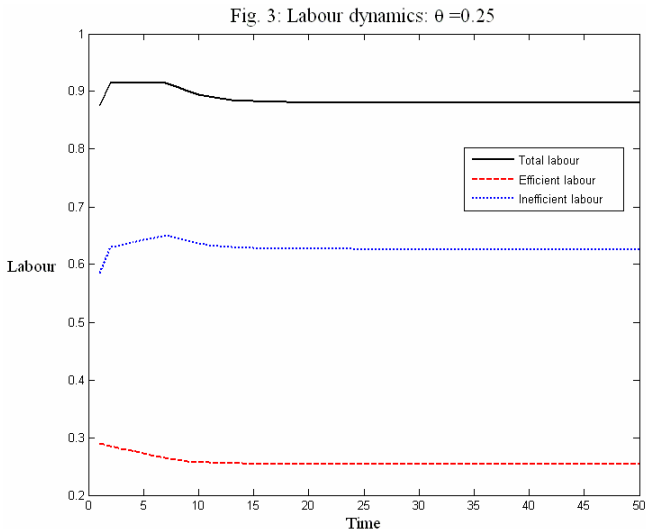
wage suppression

- ▶ Before liberalization, wage was low
- ▶ rate of return of unproductive = domestic interest rate $>$ foreign interest rate
- ▶ Liberalization leads to minor capital inflow



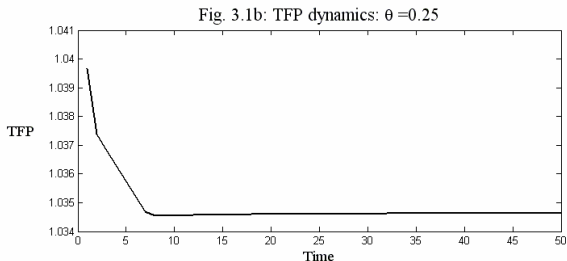
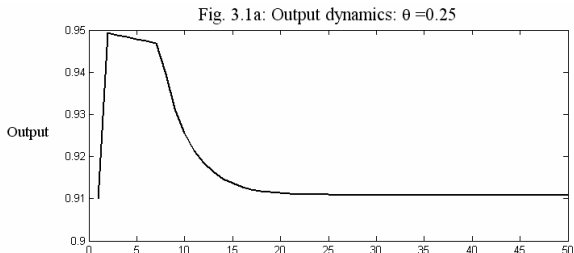
- ▶ unproductive becomes financial intermediary
- ▶ long-run benefit is questionable

Region 1



- ▶ Efficient production crowded out by inefficient production

Region 1



- ▶ Temporary boom followed by stagnation
- ▶ TFP decreases as inefficient production expands

Region 1

Fig 3.2a: Wage dynamics: $\theta = 0.25$

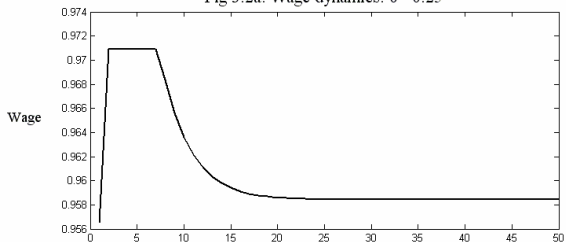
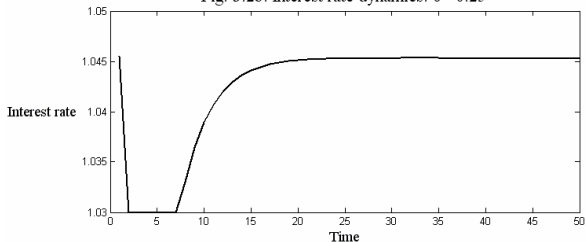


Fig. 3.2b: Interest rate dynamics: $\theta = 0.25$



- ▶ International borrowing constraint becomes binding

Region 2

Interest-rate suppression

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- ▶ Before liberalization, $r^A < r^*$
- ▶ liberalization causes capital outflow

unproductive → productive
 ↓
 foreigners

- ▶ workers suffer in the short-run
- ▶ international capital market act as "catalyst"

Region 2

Model

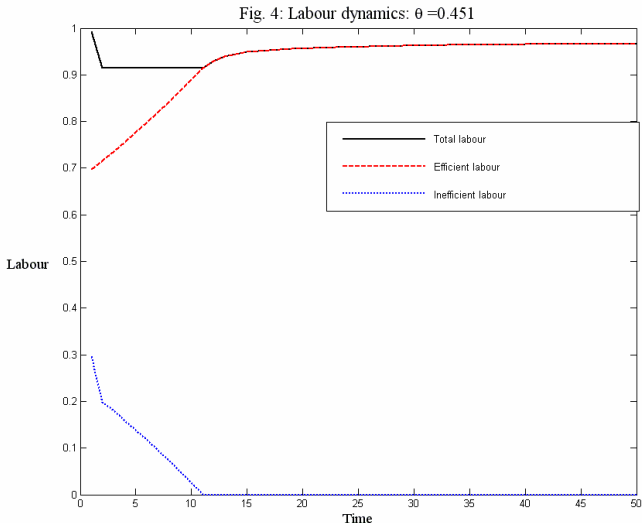
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- ▶ Inefficient production decreases followed by capital outflow

Region 2

Fig. 4.1a: Output dynamics: $\theta = 0.451$

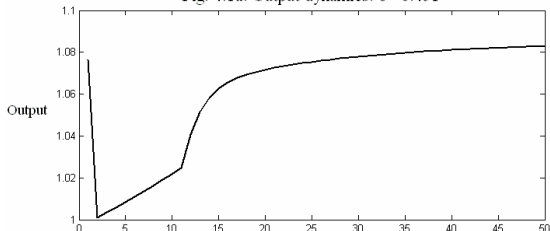
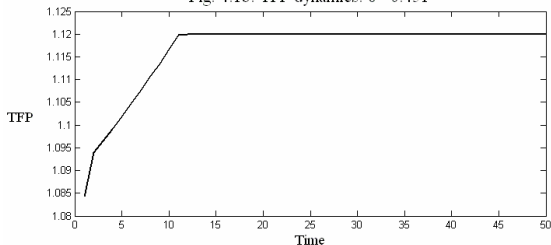


Fig. 4.1b: TFP dynamics: $\theta = 0.451$



- ▶ Temporary contraction
- ▶ TFP increases as inefficient production decreases

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Fig 4.2a: Wage dynamics: $\theta = 0.451$

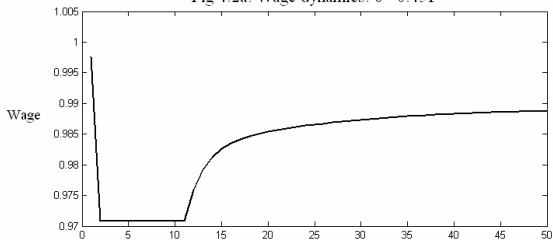
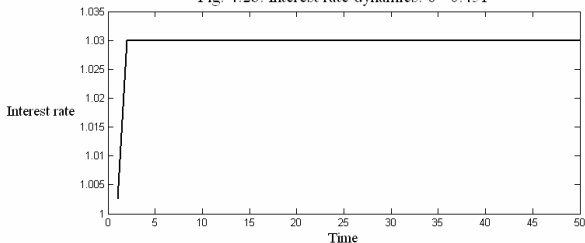


Fig. 4.2b: Interest rate dynamics: $\theta = 0.451$



- ▶ wage decreases following capital outflow

Region 3

More advanced finance

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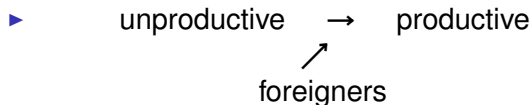
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- ▶ Before liberalization, production is efficient: $r^A > r^*$
- ▶ liberalization causes capital inflow



- ▶ Capital inflow to developed country

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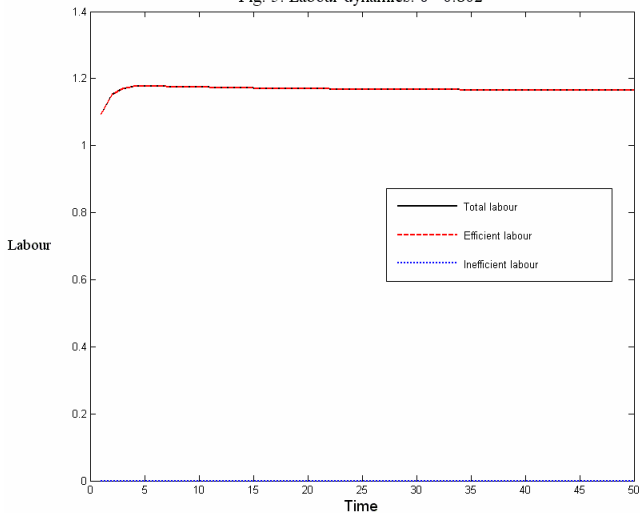
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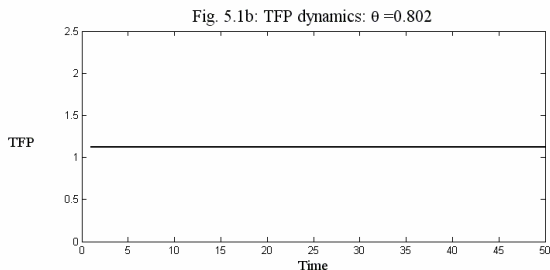
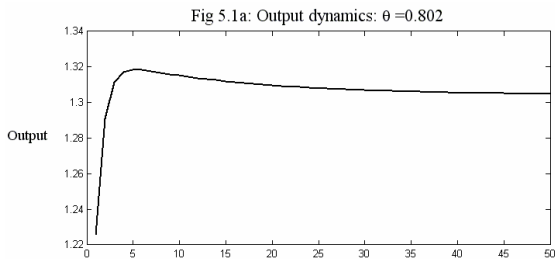
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Fig. 5: Labour dynamics: $\theta = 0.802$



► Employment increases following capital inflow

Region 3



- ▶ Output also increases

Government policy in region 2

In region 2, workers suffer following capital outflow. Can government mitigate loss of workers?

- ▶ Policy: subsidize unproductive with taxing productive entrepreneurs: $\sigma_t \gamma L'_t = \tau_t \alpha L_t$
- ▶ Borrowing limit affected by policy:

$$\tau_t y_{t+1} \leq \phi \theta y_{t+1}$$

$$\tau_t y_{t+1} + b_{t+1}^* \leq \phi \theta y_{t+1}$$

$$\tau_t y_{t+1} + b_{t+1}^* + b_{t+1} \leq \theta y_{t+1}$$

- ▶ Equilibrium now satisfies

$$r_t \geq \frac{\gamma(1+\sigma_t-\phi\theta)}{w_t - (\gamma\phi\theta/r^*)} : \text{unproductive}$$

$$L_t \leq \frac{\beta s_t Z_t}{w_t - [\alpha(\phi\theta - \tau_t)/r^*] - [\alpha(1-\phi)\theta/r_t]} : \text{productive}$$

Government policy in region 2 subsidy to prevent wage-drop

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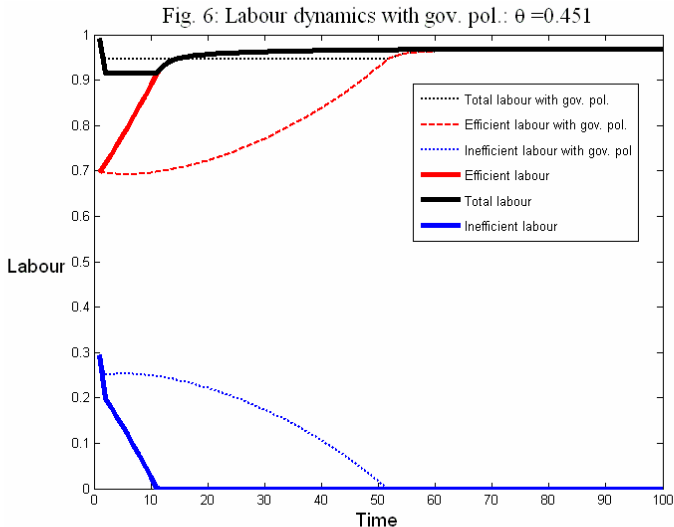
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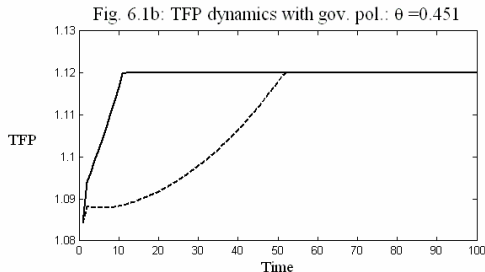
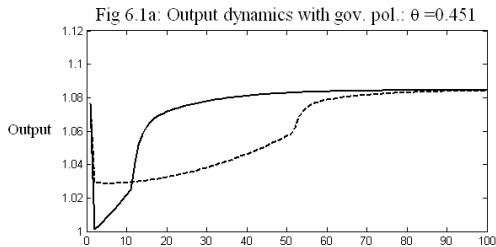
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► Loss of employment mitigated only temporarily

Government policy in region 2



- ▶ Drop in output mitigated only temporarily
- ▶ Improvement in TFP becomes slower

Government policy in region 2

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Fig. 6.2a: Wage dynamics with gov. pol.: $\theta = 0.451$

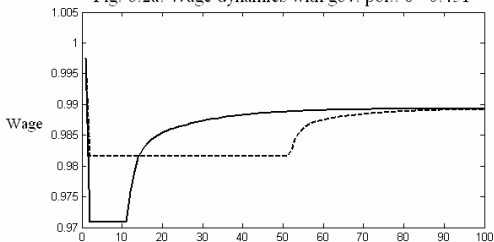
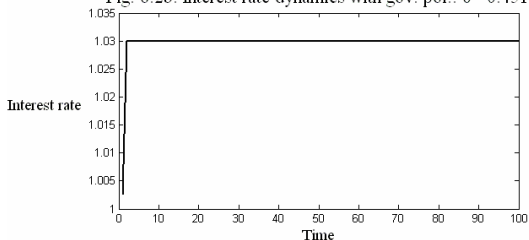


Fig. 6.2b: Interest rate dynamics with gov. pol.: $\theta = 0.451$



- ▶ Drop in wage mitigated only temporarily

Summary

- ▶ Under autarky with limited collateral, unproductive agents with dominated technology produce
 - ▶ low average productivity
 - ▶ interest rate for savers is suppressed
 - ▶ wage is suppressed
- ▶ Capital account liberalization:

(i) Interest rate suppression leads to capital outflow

unproductive → productive



foreigners

(ii) Wage suppression causes capital inflow

unproductive → productive



foreigners

Allocation depends upon both absolute and relative levels
of financial development

Summary

Effect on output

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θ	short run	long run
low	expansionary	mixed
medium	contractionary	expansionary
high	expansionary	expansionary

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end

Production technology

- ▶ At date t
 - ▶ Entrepreneur A hires l_t to start production
 - ▶ Agent B lends and monitors
 - ▶ Agent C lends and does not monitor
- ▶ At date $t + 1$ output of intermediate goods:
 - ▶ $y_{t+1} = a_t l_t$ if A finishes
 - ▶ $y_{t+1} = \theta a_t l_t$ if B finishes
 - ▶ $y_{t+1} = \phi \theta a_t l_t$ if C finishes
- ▶ Only single home agent can be the monitor of each segment of project at home.

$$0 < \phi \theta < \theta < 1, \quad 0 < \phi^* \theta^* < \theta^* < 1 \quad (\text{Assumption})$$

Workers

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- ▶ Each worker chooses $(c_t, l_t, b_{t+1}, b_{t+1}^*)$ subject to their constraints:

$$c_t = w_t l_t - b_t - b_t^* + \frac{b_{t+1}}{r_t} + \frac{b_{t+1}^*}{r^*}$$

$$b_{t+1} \leq 0, \quad b_{t+1}^* \leq 0$$

- ▶ The markets clear for goods, labor, and domestic and international credits

Parameter values

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efficient productivity	α	1.1
inefficient productivity	γ	1.0
labour elacity	η	3
transition prob.	n	0.1
transition prob.	δ	0.15
discount rate	β	0.92
world gross int. rate	r^*	1.03

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Fig.3.3a: Wealth dynamics: $\theta = 0.25$

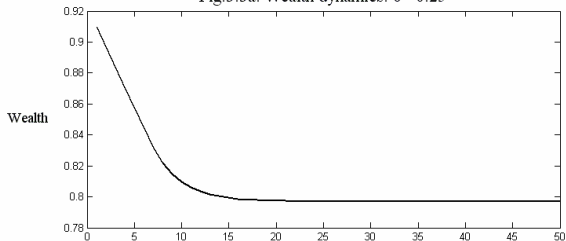
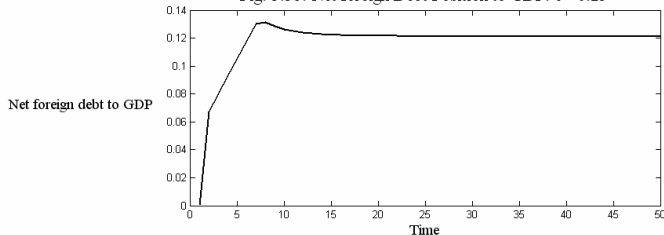


Fig. 3.3b: Net foreign Debt Position to GDP: $\theta = 0.25$



- ▶ Wealth decreases as foreign debt accumulates

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Fig. 4.3a: Wealth dynamics: $\theta = 0.451$

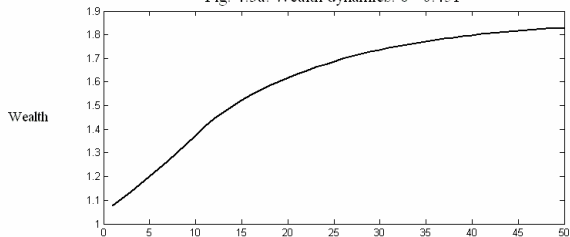
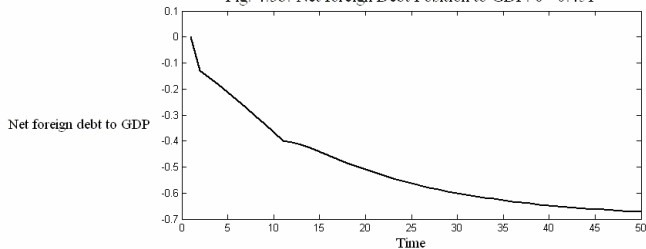


Fig. 4.3b: Net foreign Debt Position to GDP: $\theta = 0.451$



► Wealth accumulates

Region 3

Fig. 5.2a: Wage dynamics: $\theta = 0.802$

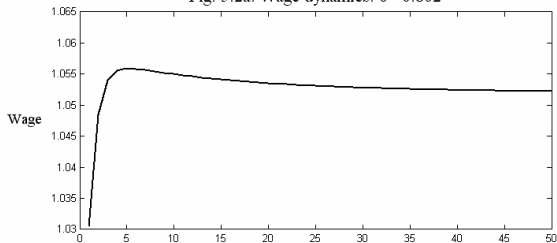
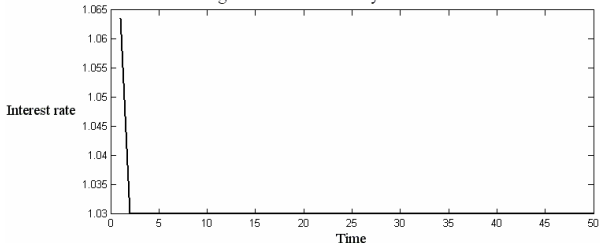


Fig. 5.2b: Interest rate dynamics: $\theta = 0.802$



► Wage increases

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Fig. 5.3a: Wealth dynamics: $\theta = 0.802$

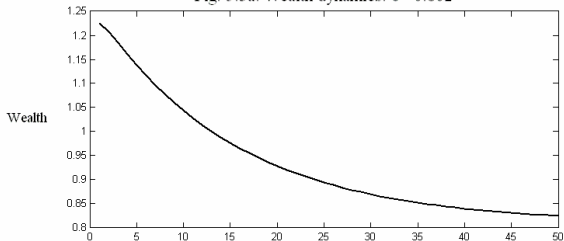
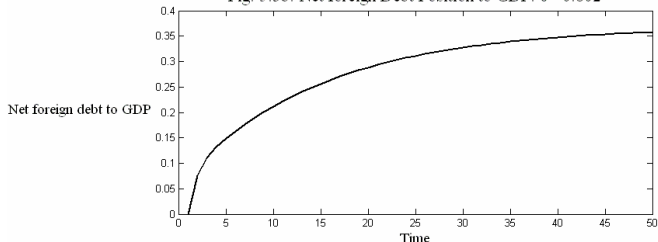


Fig. 5.3b: Net foreign Debt Position to GDP: $\theta = 0.802$



- ▶ Wealth decreases as foreign debt accumulates

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efficient productivity	α	1.1
inefficient productivity	γ	1.0
labour elacity	η	3
transition prob.	n	0.1
transition prob.	δ	0.15
discount rate	β	0.92
world gross int. rate	r^*	1.03
government policy	ψ	0.4

- ▶ wage rate is determined as $(1 - \psi)\tilde{w} + \psi w^a$
 \tilde{w} : wage rate without government policy

Government policy in region 2

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Fig. 6.3a: Wealth dynamics with gov. pol.: $\theta = 0.451$

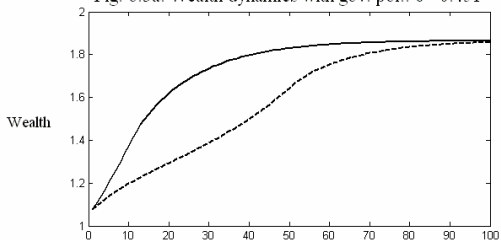
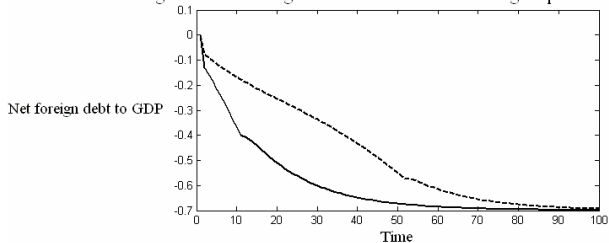


Fig. 6.3b: Net foreign Debt Position to GDP with gov. pol.: $\theta = 0.451$



- ▶ Wealth accumulation becomes slower

Government policy in region 2

Fig. 6.4a: Subsidy dynamics: $\theta = 0.451$

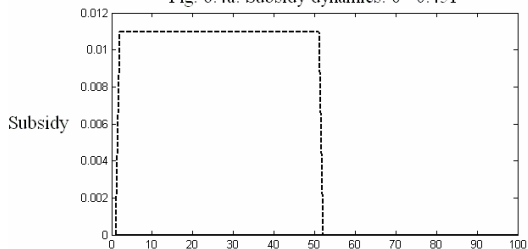
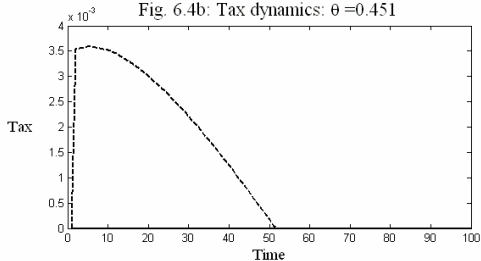


Fig. 6.4b: Tax dynamics: $\theta = 0.451$



► Dynamics of taxes

Government policy in general case

- ▶ Government BC

$$G_t + \sigma_{t-1} Y'_t + B_t^G = \tau_{t-1} Y_t + \frac{B_{t+1}^G}{r^*}$$

- ▶ Limited commitment of government

$$B_{t+1}^G \leq \tau_t Y_{t+1}$$

- ▶ International capital mkt.

$$w_t L^S(w_t) \leq \beta Z_t + \frac{1}{r^*} [(\phi\theta - \tau_t)\alpha L_t + \phi\theta\gamma L'_t]$$

- ▶ Extra rate of returns

$$x_t = \left\{ \frac{\alpha(1-\theta)}{w_t - [\alpha(\phi\theta - \tau_t)/r^*] - [\alpha(1-\phi)\theta/r_t]} - r_t \right\} / r_t$$