

Goldrush

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PRESENTATION PLACE

February 11, 2020

Environment

- Aiyagari type, small open economy, where
 - 3 main domestic agents: heterogeneous HHs, nontradable producer, and export producer.
 - 3 intermediate goods (nontradable e , export x , and import m)
 - x is not consumed domestically at all.
- Consumption C and investment I are composite goods of e and m .
- Housing H is a combination of structure S and land, where S is composite of e and m .
- Fixed supply of land.
- C , I , and S has different ratio of e and m .

Environment

- Production sectors faces
 - DRS production technology due to a fixed factor owned locally
 - adjustment costs of capital/worker
 - search frictions when hiring
- HHs
 - can allocate their wealth to liquid and illiquid assets
 - uninsurable idiosyncratic labor productivity shocks
 - shocks to local share of firms
 - unemployment shocks

Model

- Individual state: $(a, s, \epsilon, \theta^e, \theta^x)$
- c is CES aggregation of e and m

$$V(a, s, \epsilon, \theta^e, \theta^x) = \max_{b, h, c} \{u(c, h) + \beta \mathbb{E}[V(a', s', \epsilon', \theta^{e'}, \theta^{x'})]\}$$

$$\text{s.t. } p^e e + m + p^h h + b = a + \mathbb{1}_{s=1}\{w\epsilon\} + \mathbb{1}_{s=0}\{\bar{w}\} + \theta^e \pi^e + \theta^x \pi^x$$

$$b \geq -\lambda p^h h, \quad c = \Psi^c(e, m)$$

$$a' = \underbrace{p^{h'}(1 - \delta_h)h}_{\text{value of indep. H}} + \underbrace{p^{\ell'} \delta_h / H}_{\text{value of land left}} + (1 + r')b$$

Nontradable Sector

- Pay a hiring cost κ per worker.
- Cannot discriminate workers by their skill level, but different separation rates.

$$\Omega^e(k, \{n_\epsilon\}) = \max_{v, k^{e'}, m, e} \left\{ p^e F^e(k', l) - w \sum_{\epsilon} n_{\epsilon} \epsilon - m - p^e e - \kappa v - \phi^n(n', n) + \frac{\Omega^e(k', \{n'_{\epsilon}\})}{1 + r'} \right\}$$

s.t. $k' = (1 - \delta^k)k + i - \phi^{e,k}(k, i), \quad i = \Psi^e(m, e)$

$$n'_{\epsilon} = \underbrace{\sum_{\tilde{\epsilon}} (1 - \delta_{\tilde{\epsilon}}) n_{\tilde{\epsilon}} \Gamma_{\tilde{\epsilon}\epsilon}}_{\text{unseparated worker}} + \underbrace{\sum_{\tilde{\epsilon}} \Gamma_{\tilde{\epsilon}\epsilon} \frac{u_{\tilde{\epsilon}}}{u}}_{\text{measure of hiring } \epsilon \text{ next period}} v$$

How Model Works

Household

- Choose consumption c , amount of housing h , and liquid assets b .
- b is under a collateral constraint: $b \geq -\lambda p^h h$.
- Total wealth at the beginning of each period has three components:
 - remaining housing: $p^h(1 - \delta_h)h$
 - land associated with depreciated part: $p^\ell \delta_h h / H$
 - financial asset: $(1 + r)b$
- Poor households face collateral constraint and cannot own enough h
- As collateral constraint becomes slack, they are leveraged or holds some foreign assets

Labor Market

- Employed HHs supply labor inelastically and are paid $w\epsilon$.
- Unemployed HHs earn \bar{w} units of consumption goods from home production.
- Denote newly created job V and measure of unemployed x_0
- Employment status transition matrix for HHs:

$$\Pi_{s'|s,\epsilon}^w = \begin{cases} 1 - \delta_\epsilon & \text{if } s' = 1, s = 1 \\ \delta_\epsilon & \text{if } s' = 0, s = 1 \\ \frac{V}{u} & \text{if } s' = 1, s = 0 \\ 1 - \frac{V}{u} & \text{if } s' = 0, s = 0 \end{cases}$$

- Note that u and V are equilibrium objects.

Production Sector

- Nontradable goods market is a frictionless, perfect competitive environment.
- Both sector use k and l to produce goods.
- Adjustment costs to adjust capital and employment.
- Search friction: hiring cost of κ per vacancy.
- Wage is exogenous in steady state.
 - but is determined by a function of output deviation from steady state along the transition path
- A part of each firm is owned locally due to a fixed factor owned locally.

Stationary State

Model Moments

Target	Model	Data
GDP (Expenditure Account)	1.00	
GDP (Production Account)	1.00	
Capital to GDP Ratio	2.00	
Housing Value to GDP Ratio	1.80	
Value of Firms to GDP Ratio	2.00	
Int'l Borrowing to GDP Ratio	0.00	
Unemployment Rate	8.00%	
Int'l Interest Rate	3.00%	
Nontradable Output Ratio	0.76	

Expenditure		Production		Distributional	
<i>C</i>	0.6496	$p^e y^e$	0.7148	wL	0.5978
<i>I</i>	0.3486	$p^x y^x$	0.2299	π	0.1200
<i>NX</i>	0.0017	$p^h newH$	0.1440	$p^i \delta_k K$	0.2046
(<i>X</i>)	(0.2298)	$-\kappa V$	0.0223	$p^s s$	0.0950
(<i>M</i>)	(0.2281)	$-m^e - m^x - m^h$	0.0684	rB	0.0000
	0.9999		0.9979		1.0173

I'll check this further

Business Cycle Properties

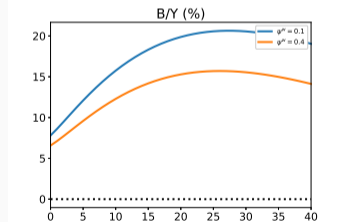
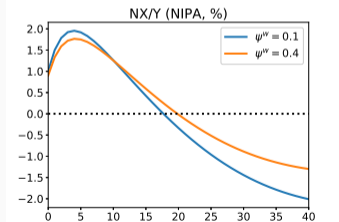
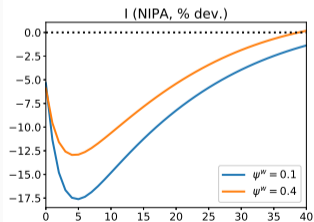
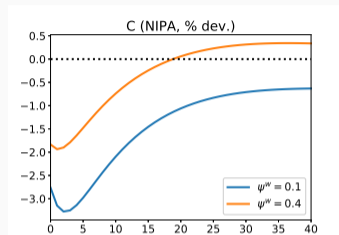
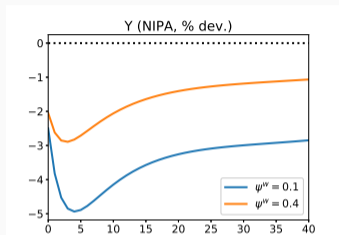
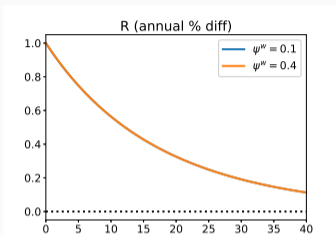
- Implications of business cycle properties through MIT shocks
- Shocks to Int'l interest rate or export price
- Along the transition path, wage is specified by

$$\log w_t - \log w^{ss} = \psi^w (\log Y_t - \log Y^{ss})$$

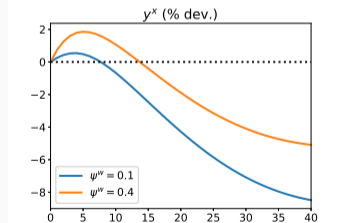
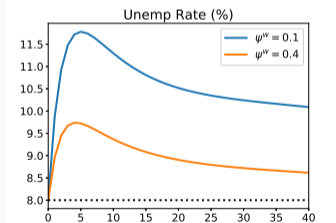
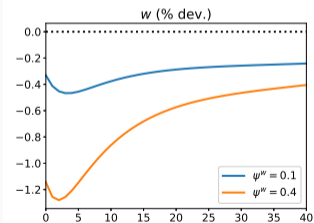
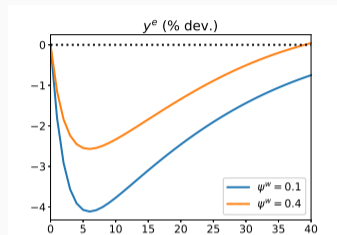
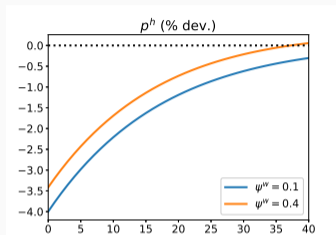
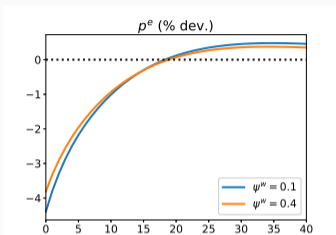
- where ψ^w is the elasticity of wage rate with respect to output and set to 0.1 or 0.4 .
- Shock follows AR(1) process with $\rho = 0.95$
 - r from 3% to 4% in annual term (no income effect in aggregate since $B/Y = 0.0$ at SS).
 - p^x drops 1%

Interest Rate Shock

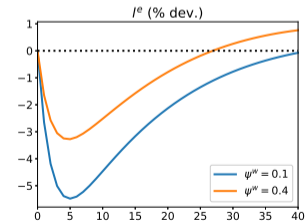
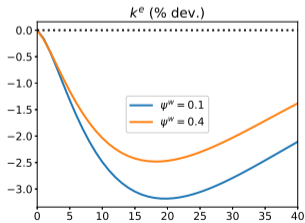
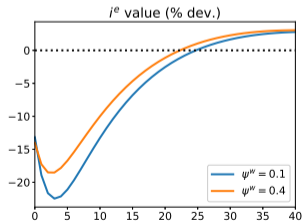
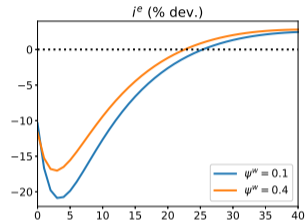
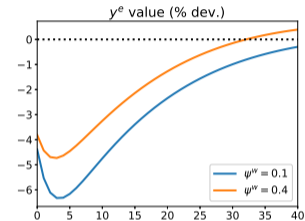
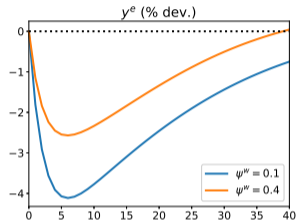
1% Hike in Interest Rate - Aggregates



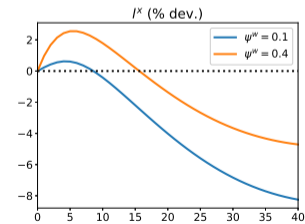
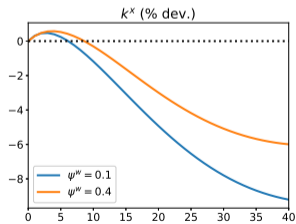
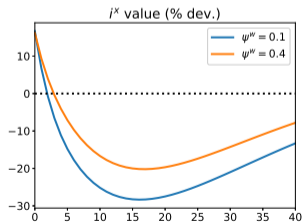
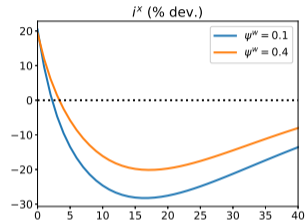
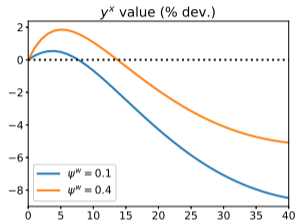
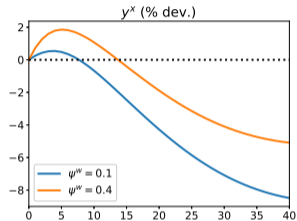
1% Hike in Interest Rate - Prices and Output



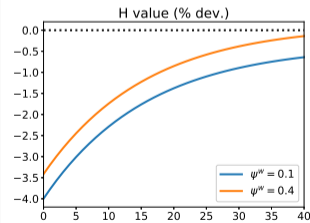
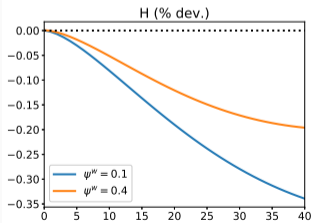
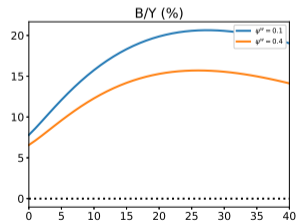
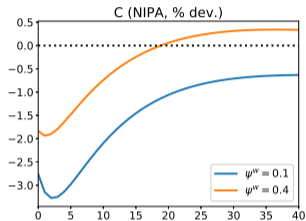
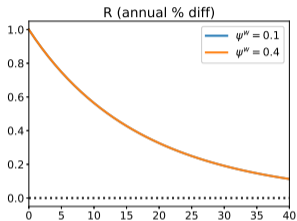
1% Hike in Interest Rate - Nontradable



1% Hike in Interest Rate - Export

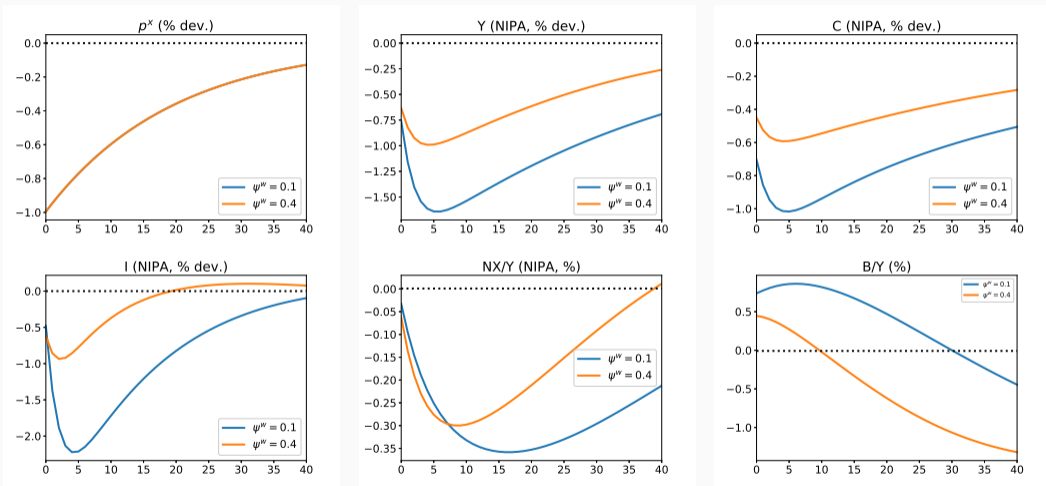


1% Hike in Interest Rate - HH

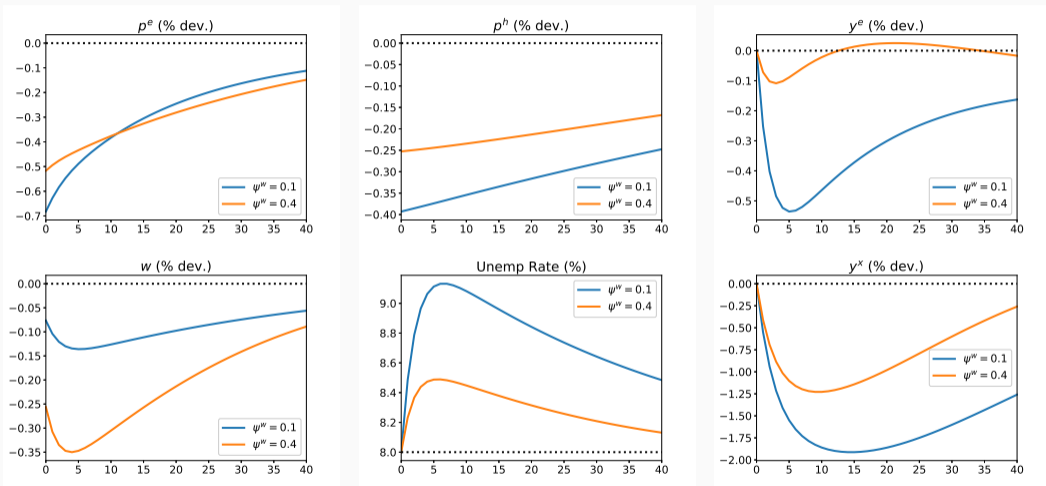


Export Price Shock

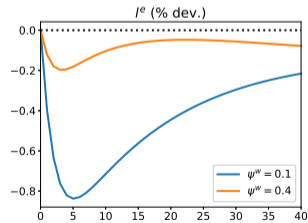
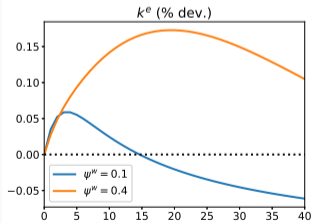
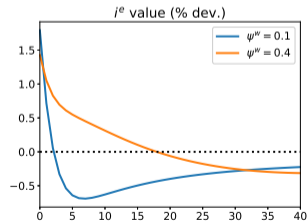
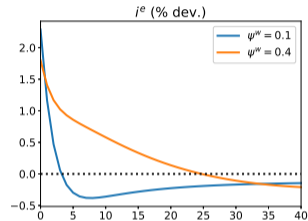
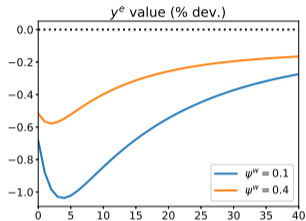
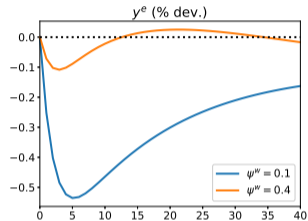
1% Drop in Export Price - Aggregates



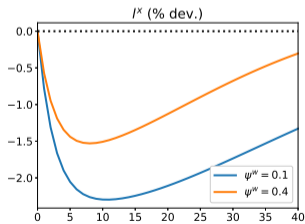
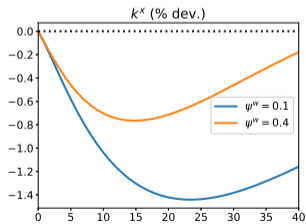
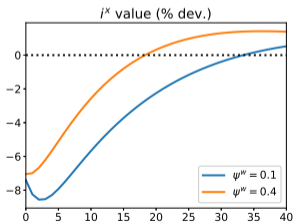
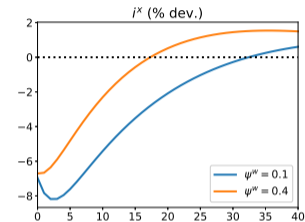
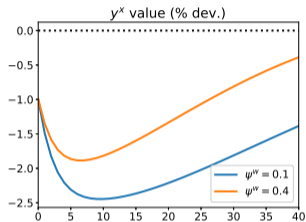
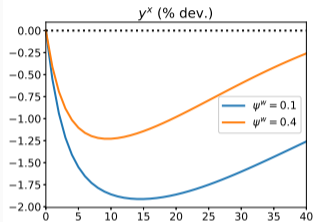
1% Drop in Export Price - Prices and Output



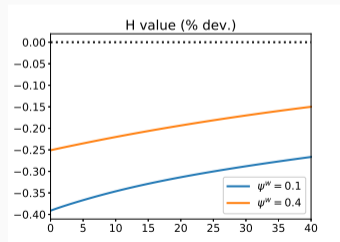
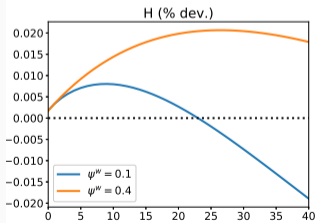
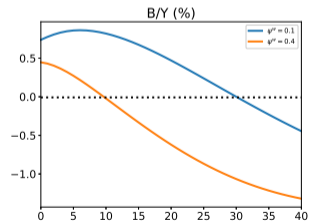
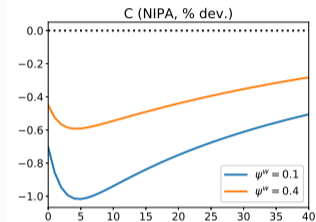
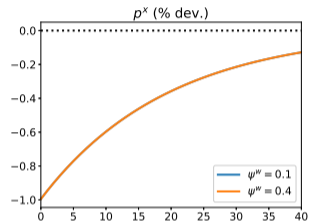
1% Drop in Export Price - Nontradable



1% Drop in Export Price - Export



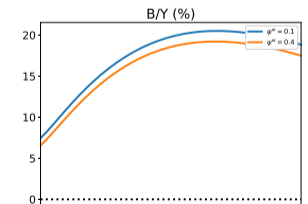
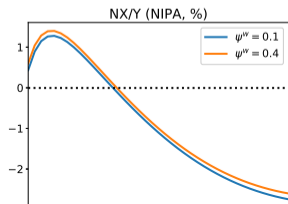
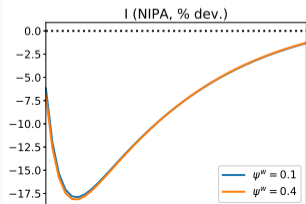
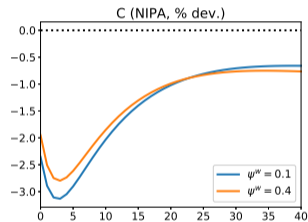
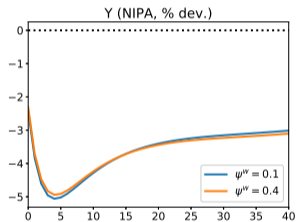
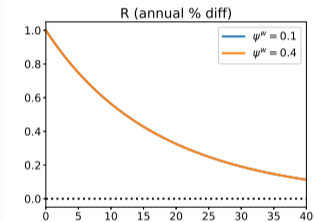
1% Drop in Export Price - HH



Int rate shock when borrowing int rate is
higher

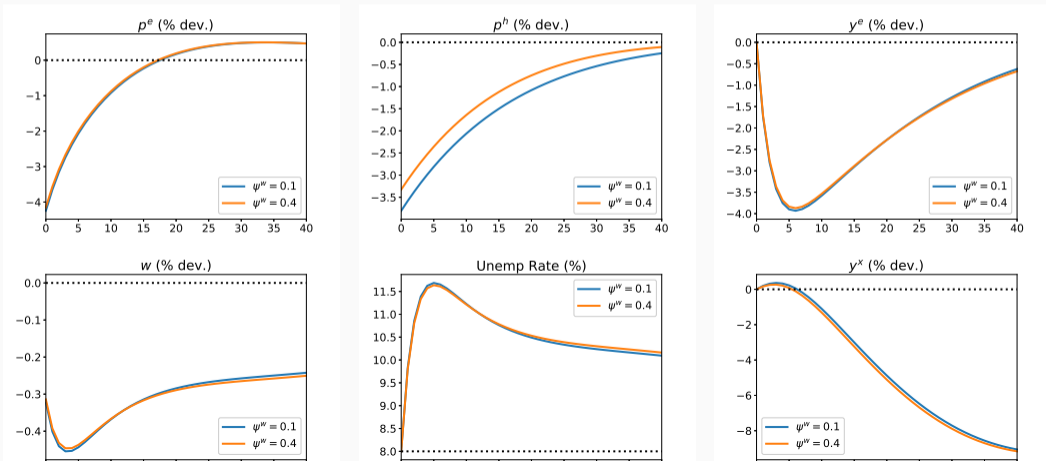
1% Drop in Annual Int Rate - Aggregates

Keep the spread between saving and borrowing rate constant along the path. Labels are wrong: blue is no same int rate, orange is with int spread case Annual rate 3% for saving, 3.65% for borrowing at SS



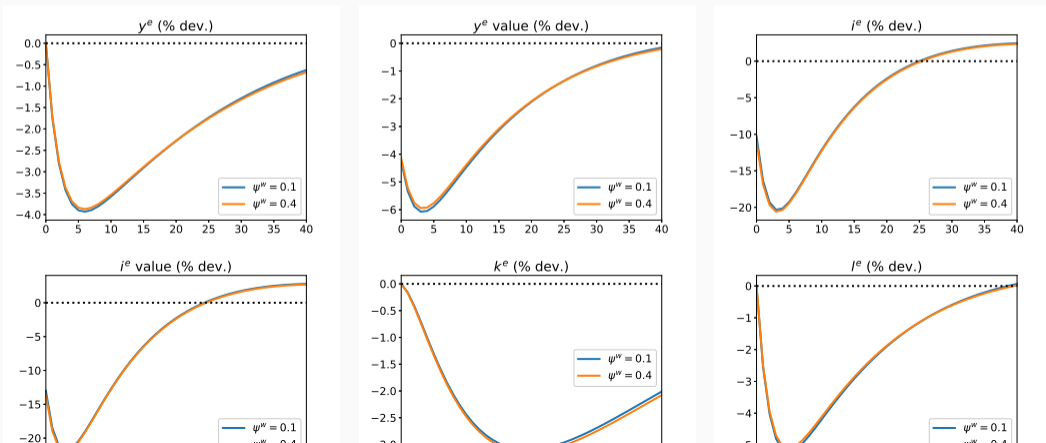
1% Drop in Annual Int Rate- Prices and Output

Keep the spread between saving and borrowing rate constant along the path. Labels are wrong: blue is no same int rate, orange is with int spread case Annual rate 3% for saving, 3.65% for borrowing at SS.



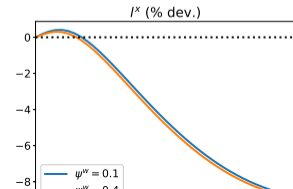
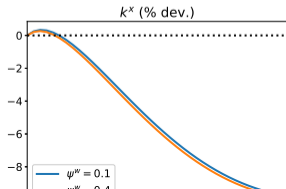
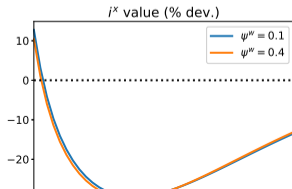
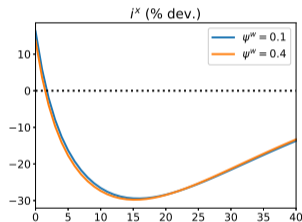
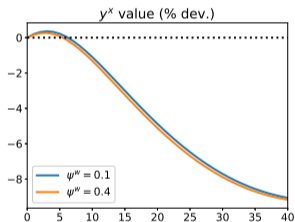
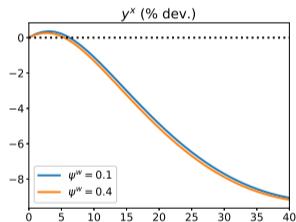
1% Drop in Annual Int Rate - Nontradable

Keep the spread between saving and borrowing rate constant along the path. Labels are wrong: blue is no same int rate, orange is with int spread case Annual rate 3% for saving, 3.65% for borrowing at SS



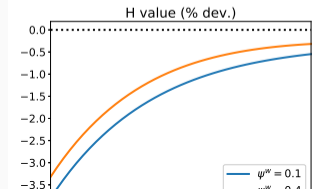
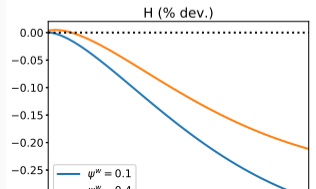
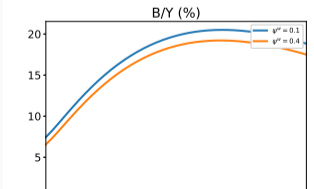
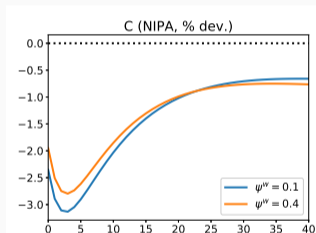
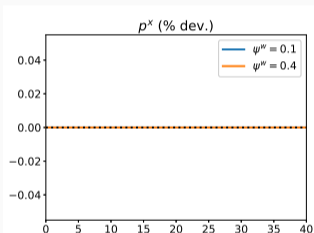
1% Drop in Annual Int Rate - Export

Keep the spread between saving and borrowing rate constant along the path. Labels are wrong: blue is no same int rate, orange is with int spread case Annual rate 3% for saving, 3.65% for borrowing at SS



1% Drop in Annual Int Rate - HH

Keep the spread between saving and borrowing rate constant along the path. Labels are wrong: blue is no same int rate, orange is with int spread case Annual rate 3% for saving, 3.65% for borrowing at SS



NIPA Definition

- Expenditure Account: $GDP = C + I + NX$

$$- C = p^c C^{HH} - \underbrace{\bar{w}x_0}_{\text{home production}} + \underbrace{\alpha \times r p^h H^{HH}}_{\text{imputed rent}}$$

$$- I = p^i (i^e + i^x) + p^h \times newH$$

- Production Account: $GDP = p^e y^e + p^x y^x + p^h newH - \kappa * (v^e + v^x) - m^e - m^x - m^h$

- Distributional Account $GDP = w(I^e + I^x) + \pi^e + \pi^x + p^i \delta_k (k^e + k^x) + \underbrace{p^s s}_{\text{housing dep}}$

TO DO

- Less detail before equations
- shares because fixed factors are owned by local
- $imigrant = 0.001(y - y^{ss})$
- Permanent shock
- spell check
- smaller elasticity (Check literature)
- check NIPA again