

Optimal policy with incomplete markets:  
Correcting Demand Imbalances and  
Exchange-Rate Misalignments

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## Exchange Rate misalignments and demand/trade imbalances

- ▶ Concerns about cross-country demand imbalances are recurrent in the policy debate
- ▶ Motivation for monetary policy to correct Exchange Rate (ER) swings
- ▶ Can misalignments in asset prices, like the exchange rate, create trade-offs with other policy objectives?
- ▶ NOEM literature has focused on the impact of nominal price rigidities in goods markets:
  - ▶ Emphasize effects of ER misalignments on relative price of goods
- ▶ What about misalignments arising from the ER dual role as good and asset price in incomplete markets economies?

# Exchange Rate misalignments and demand/trade imbalances

- ▶ With incomplete markets, misalignments lead to inefficiencies (relative to first best) even with flexible prices
  - ▶ Real Exchange Rate (RER) misalignments give rise to cross-country (relative) demand imbalances, reflecting suboptimal wealth effects across countries
  - ▶ Exchange rate is a “shock absorber” responding to fundamentals only, yet triggers inefficient adjustment
- ▶ Allowing for alternative pricing mechanisms (PCP vs LCP), what is the optimal policy trade-offs?

## CDL 2010

- ▶ High trade elasticity economy: Strict inflation targeting pretty close to optimal cooperative policy
  - ▶ Similar to complete-market economies, but quite different reason: Near divine coincidence only, inefficiencies are small and thus neglected
- ▶ Low trade elasticity: Sizable inefficiencies, reflected in currency misalignments and large demand imbalances. Optimal monetary policy:
  - ▶ significantly improves over the flex-price incomplete-markets allocation
  - ▶ gets close to the first-best allocation under LCP
- ▶ Policy leans against misalignments, reducing domestic and trade imbalances

## What are the lessons?

- ▶ Asset-price misalignments pose relevant trade-offs for monetary policy when they lead to wealth and demand imbalances even for reasons independent of nominal frictions
- ▶ Optimal policy should generally use monetary stance to redress misalignments in these cases
- ▶ The success of optimal monetary policy in doing so depends on the structure of the economy, including the form of nominal rigidities – PCP vs. LCP in our case

## Recap: welfare-relevant gaps in open economy

- ▶ International-price gaps provide welfare-based concept of *misalignments*

$$RER^{gap} = \hat{Q}_t - \tilde{Q}_t^{fb};$$

$$TOT^{gap} = \hat{T}_t - \tilde{T}_t^{fb};$$

Deviations from the law of one price  $\hat{\Delta}_t = \frac{\mathcal{E}_t P_{H,t}^*}{P_{H,t}} - 1$

- ▶ Deviations from efficiency condition under complete markets:

$$\ln Q_t = \ln \frac{\mathcal{E}_t P_t^*}{P_t} = \ln \left( \frac{C_t}{C_t^*} \right)^\sigma$$

are *cross-country demand imbalances*:

$$\hat{D}_t^{gap} = \sigma(\hat{C}_t - \hat{C}_t^*) - \hat{Q}_t$$

## Gaps enter the Open-Economy Phillips curves...

NKPC is a function of output gaps, markups, misalignment, and imbalances ...:

$$\pi_{H,t} = \beta E_t \pi_{H,t+1} + \kappa \left\{ \begin{array}{l} (\eta + \sigma) \left( \hat{Y}_{H,t}^{gap} \right) + \hat{\mu}_t + \\ - (1 - a_H) \left[ (\sigma\phi - 1) \left( \hat{T}_t^{gap} + \hat{Q}_t^{gap} \right) - \hat{\Delta}_{H,t} - \hat{D}_t^{gap} \right] \end{array} \right.$$

- ▶  $\hat{\Delta}_{H,t} = 0$  under PCP, but not under LPC
- ▶  $\hat{D}_t^{gap} = 0$  under complete markets, but not under IM

## ... and characterize loss function

Under cooperation and PCP the following encompass Financial Autarky and Complete Markets

$$\begin{aligned} &\propto -\frac{1}{2}\{(\sigma + \eta) \left(\widehat{Y}_{H,t}^{gap}\right)^2 + (\sigma + \eta) \left(\widehat{Y}_{F,t}^{gap}\right)^2 \\ &+ \frac{\theta\alpha(1 + \theta\eta)}{(1 - \alpha\beta)(1 - \alpha)} \pi_{H,t}^2 + \frac{\theta\alpha^*(1 + \theta\eta)}{(1 - \alpha^*\beta)(1 - \alpha^*)} \pi_{F,t}^{*2} \\ &- 2a_H(1 - a_H) \frac{\sigma\phi - 1}{\sigma} (4(1 - a_H)a_H\sigma\phi + (2a_H - 1)^2) \Psi \left(\widehat{TOT}_t^{gap}\right)^2 \\ &+ \frac{2a_H(1 - a_H)(\phi - 1)}{\sigma(2a_H\phi - 1) - (2a_H - 1)} \left(\widehat{\mathcal{D}}_t^{gap}\right)^2 \} \end{aligned}$$

▶ under CM:

$$\Psi = 1 \text{ and } \widehat{\mathcal{D}}_t^{gap} = 0$$

▶ under FA:

$$\Psi = \frac{\sigma(1 + 2a_H(\phi - 1))}{4(1 - a_H)a_H\sigma\phi + (2a_H - 1)^2}$$

## Devereux and Engel: are there misalignment with CM+PCP?

Recall the optimal policy: global sum targeting

$$0 = \left[ \left( \widehat{Y}_{H,t}^{gap} - \widehat{Y}_{H,t-1}^{gap} \right) + \left( \widehat{Y}_{F,t}^{gap} - \widehat{Y}_{F,t-1}^{gap} \right) \right] + \theta \left( \pi_{H,t} + \pi_{F,t}^* \right)$$

and relative (difference)

$$0 = \left[ \left( \widehat{Y}_{H,t}^{gap} - \widehat{Y}_{H,t-1}^{gap} \right) - \left( \widehat{Y}_{F,t}^{gap} - \widehat{Y}_{F,t-1}^{gap} \right) \right] + \theta \left( \pi_{H,t} - \pi_{F,t}^* \right)$$

- ▶ International variables matter only if they influence output gap and inflation
- ▶ Same as in closed economy: strict inflation targeting is optimal against all *efficient shocks* (preferences technology) – does not matter whether *current or anticipated future*.
  - ▶ correcting output gaps coincides with closing misalignments (as in DE)

## But divine coincidence breaks with incomplete market

With financial autarky and PCP, global targeting rule is the same as with CM, but relative rule is

$$\begin{aligned} 0 = & (\sigma + \eta) \left[ \left( \widehat{Y}_{H,t}^{gap} - \widehat{Y}_{H,t-1}^{gap} \right) - \left( \widehat{Y}_{F,t}^{gap} - \widehat{Y}_{F,t-1}^{gap} \right) \right] \\ & + \theta \left[ (\sigma + \eta) + 2 \frac{(1 - a_H)(1 - \sigma)}{1 - 2a_H(1 - \phi)} \right] (\pi_{H,t} - \pi_{F,t}^*) \\ & + 4a_H(1 - a_H)(\sigma\phi - 1) \left( \widehat{TOT}_t^{gap} - \widehat{TOT}_{t-1}^{gap} \right) \\ & + \frac{4a_H(1 - a_H)(\phi - 1)}{1 - 2a_H(1 - \phi)} \left( \widehat{D}_t^{gap} - \widehat{D}_{t-1}^{gap} \right) \end{aligned}$$

- ▶ Trade-off between stabilizing relative  $Y^{gap}$  and  $\pi$ , and correcting  $\widehat{TOT}_t^{gap}$  and  $\widehat{D}_t^{gap}$ .

# Trade-offs and effectiveness of optimal policy (1)

- ▶ *Relevance* of misalignment/imbances in trade-offs depends on size of incomplete market distortions, hence on structure of the economy
- ▶ *Effectiveness* of optimal policy also depends on type of nominal distortions, i.e.
  - ▶ With PCP, terms of trade (RER) and relative output are proportional to each other
  - ▶ With LCP, no longer true because of  $\hat{\Delta}_t$ :

$$\frac{4(1 - a_H) a_H \phi \sigma + (2a_H - 1)^2}{\sigma} \hat{T}_t^{gap} =$$
$$\hat{Y}_{H,t}^{gap} - \hat{Y}_{F,t}^{gap} - \frac{2a_H - 1}{\sigma} \hat{D}_t^{gap} - 2a_H \phi \hat{\Delta}_t$$

## Trade-offs and effectiveness of optimal policy (2)

- ▶ With LCP, ER depreciation causes positive deviations from the law of one price  $\widehat{\Delta}_t$ .

$$\begin{aligned}\widehat{T}_t &= \left(\widehat{Y}_{H,t} - \widehat{Y}_{F,t}\right) \frac{1}{1 - 2a_H(1 - \phi)} \\ &\quad - \widehat{\Delta}_t \frac{2a_H\phi}{1 - 2a_H(1 - \phi)} \\ \widehat{D}_t &= \left(\widehat{Y}_{H,t} - \widehat{Y}_{F,t}\right) \frac{\sigma(2a_H\phi - 1) - (2a_H - 1)}{1 - 2a_H(1 - \phi)} \\ &\quad + \widehat{\Delta}_t a_H \left[ \frac{2a_H - 1 + \phi(2\sigma(1 - a_H) - 1)}{1 - 2a_H(1 - \phi)} \right] - \dots\end{aligned}$$

Acting on  $\widehat{\Delta}_t$ , redress incomplete-market inefficiencies, as to offset impact of movements in relative output on  $\widehat{T}_t$ ,  $\widehat{D}_t$

## Digression: special cases

- ▶ Under flexible prices, FA and CM market allocations coincide if parameters are such that  $\widehat{D}_t = 0$ , that is

$$\frac{\sigma(2a_H\phi - 1) - (2a_H - 1)}{1 - 2a_H(1 - \phi)} (\widetilde{Y}_{H,t} - \widetilde{Y}_{F,t}) - (\widehat{\zeta}_{C,t} - \widehat{\zeta}_{C,t}^*) = 0.$$

this condition cannot hold for productivity and preference shocks in general.

- ▶ For productivity shocks the above holds when

$$\sigma\phi = 1 + \frac{1 - \phi}{2a_H\phi - 1}$$

so, when  $\phi = 1$ , utility must be logarithmic.

- ▶ But easy to verify that a necessary condition the FA and CM allocations to coincide with preference shocks is

$$\sigma\phi \neq 1 + \frac{1 - \phi}{2a_H\phi - 1}!$$

## Experiments: focus on news shocks

Linear technology with standard ( $\zeta$ ) shocks and news ( $\zeta^v$ ) shocks:

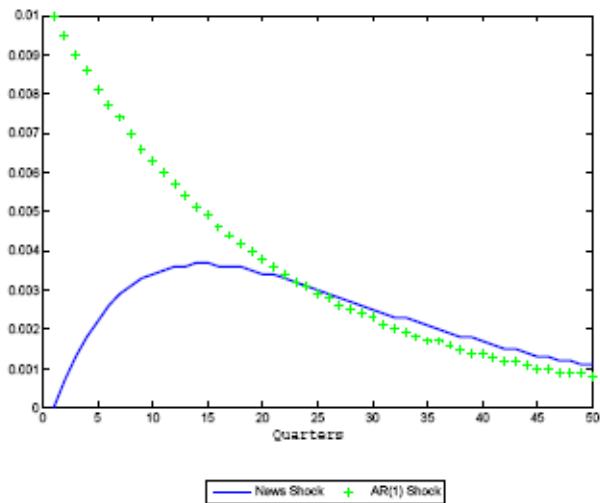
$$Y_t(h) = Z_t L_t(h), \quad Z_t = U_t - V_t$$

$$U_t = 0.95U_{t-1} + \zeta_t + \zeta_t^v$$

$$V_t = 0.9V_{t-1} + \zeta_t^v$$

- ▶ Why news shocks?
  - ▶ forward looking nature of exchange rate
  - ▶ persistent shocks amplify the difference complete/incomplete markets: news shocks have 'persistent'
- ▶ Focus on a positive shock in the Home country

## Technology: News shocks vs Autoregressive AR

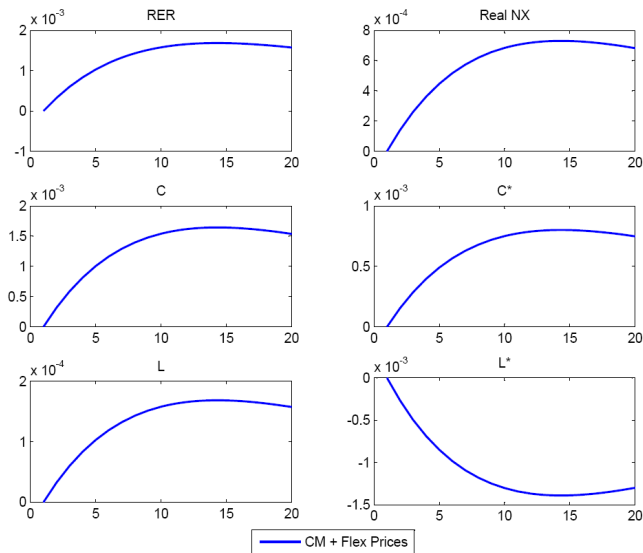


## Values of key parameters

- ▶  $\theta = 0.75$
- ▶  $\beta [C_t, L_t] = 1 / (1 + \psi [C_t + \kappa(1 - L_t)])$
- ▶  $\theta = 6$  : implying a 20% markup
- ▶  $a_H$  set to generate a 10% import share
- ▶  $\kappa$  set so that households spend 1/3 of their time working
- ▶  $\phi = \{0.45, 6\}$

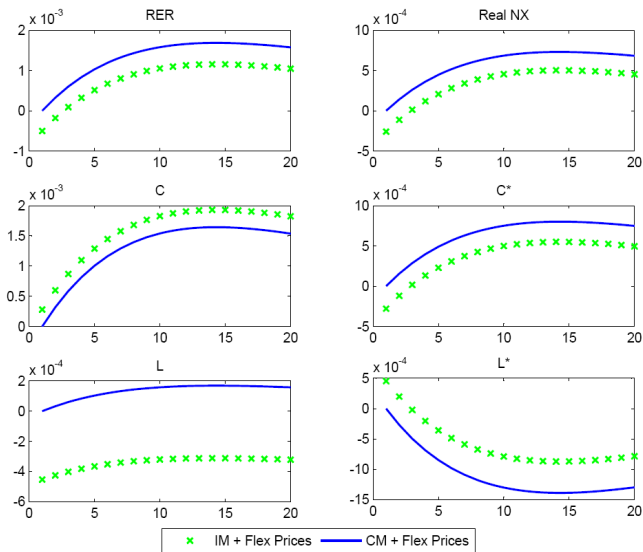
# Understanding misalignment and demand imbalances: flex-price allocation and CM

Anticipated Home productivity increase with High trade elasticity / good substitutability



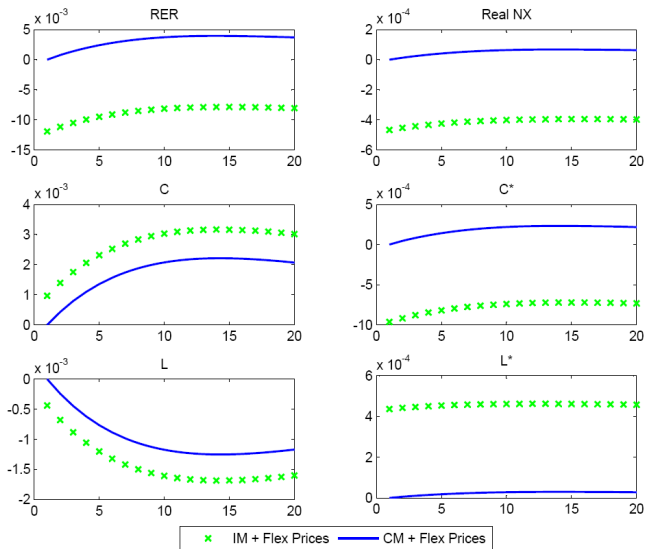
# Understanding misalignment and demand imbalances: flex-price allocation, gaps between CM and IM

Anticipated Home productivity increase with High trade Prices elasticity / good substitutability



# Understanding misalignment and demand imbalances: larger gaps with low elasticity

Anticipated Home productivity increase with low trade elasticity / good complementarity



## Large imbalances: recall role of low trade elasticity

- ▶ Following an increase in Home tradable output, with a low trade elasticity, income effects are large
- ▶ If TOT worsen (as in the efficient case):
  - ▶ Home demand falls (large negative income effect)
  - ▶ With enough home bias: world demand for Home goods falls
- ▶ TOT must improve to bring the goods market in equilibrium (and RER appreciates)
- ▶ These movements amplify cross-country (relative) demand imbalances

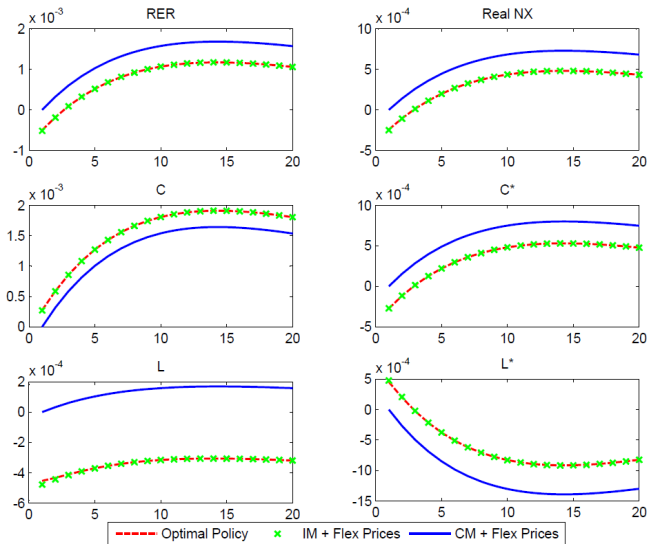
# Optimal policy

Increasing size of trade-offs with misalignments/imbbalances

- ▶ High elasticity: near divine coincidence, PCP versus LCP
- ▶ Low elasticity: optimal policy corrects misalignment and imbalances
  - ▶ moderate success (short run) with PCP
  - ▶ higher degree of success with LCP

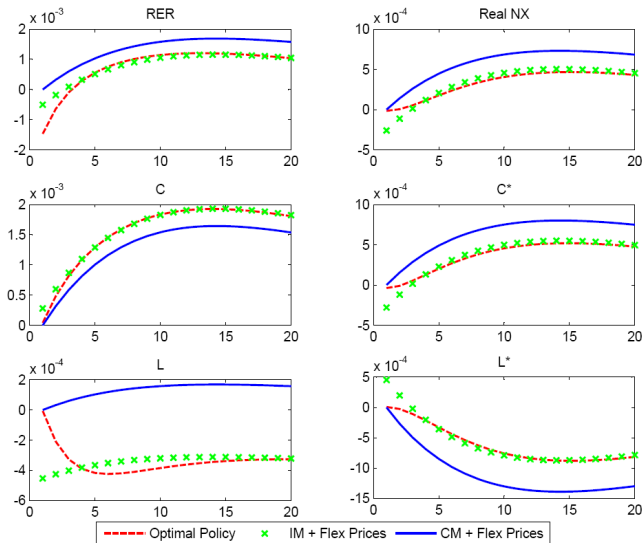
# 'Near divine coincidence' with high elasticity and PCP

Optimal policy arbitrarily close to strict inflation targeting  
(flex-price)



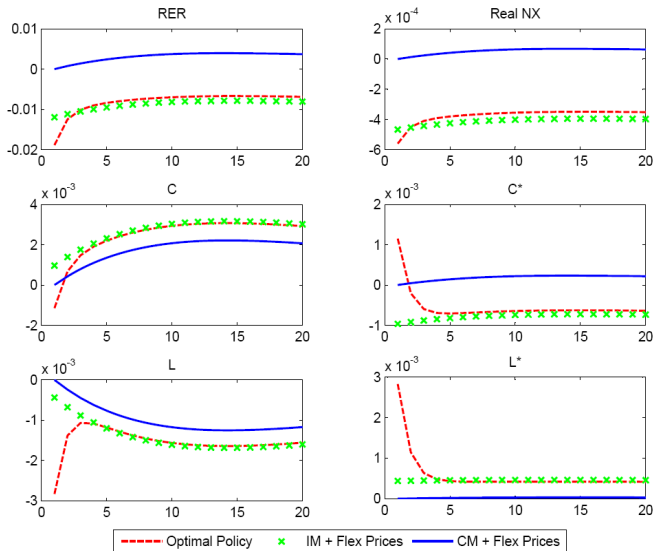
# 'Near divine coincidence' with high elasticity and LCP

Some correction, but inefficient gaps remain open



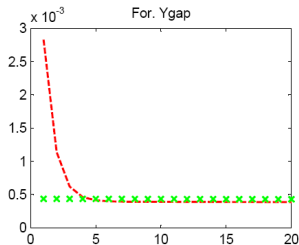
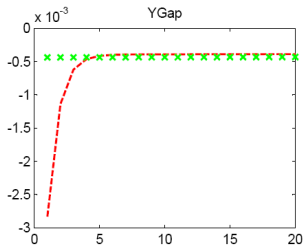
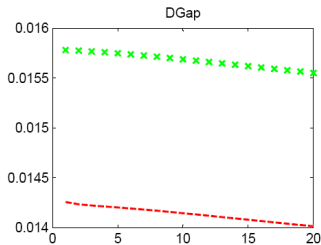
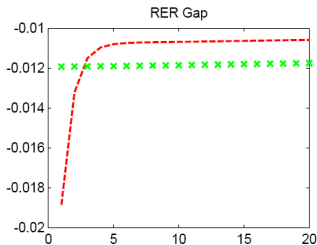
# Low trade elasticity and PCP

Correcting  $D^{gap}$  via consumption: effective in the short-run



# Low trade elasticity and PCP

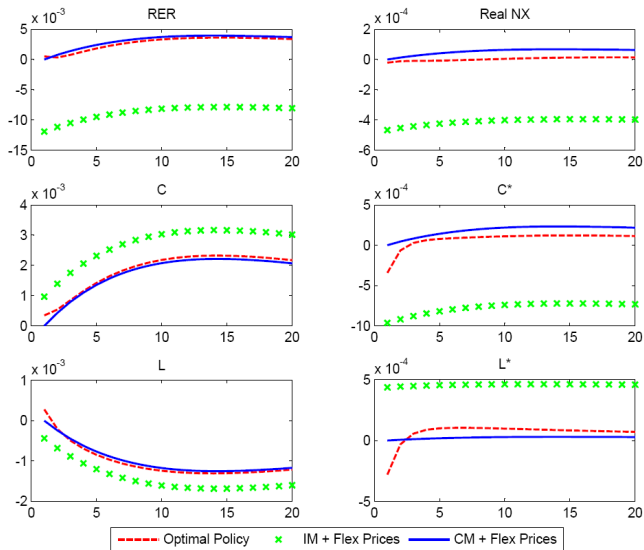
Correcting  $D^{gap}$  via consumption: effective in the short-run



--- Optimal Policy    x IM + Flex Prices

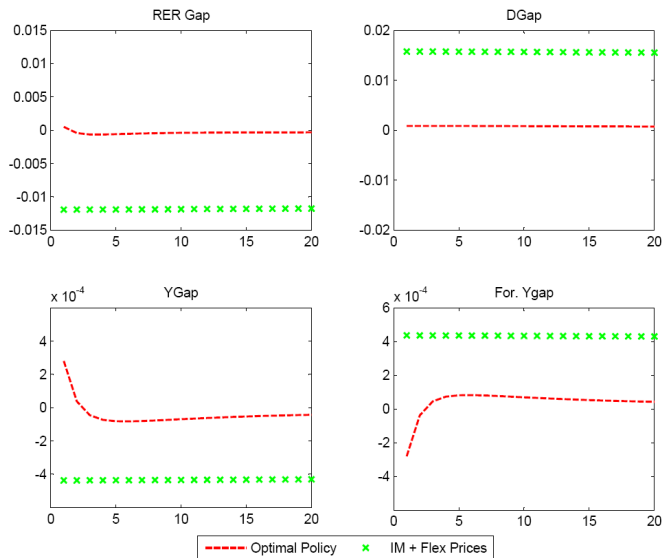
# Low trade elasticity and LCP

Leaning against misalignment has persistent effects on imbalances



# Optimal policy with low trade elasticity and LCP

Considerable improvement over flex-price allocation: 0,36% of steady state consumption



## To recap

- ▶ High trade elasticity:
  - ▶ size of welfare trade-offs from misalignment are small
  - ▶ quasi- strict inflation targeting
  - ▶ suboptimal cross-country wealth effects on consumption and labor
- ▶ Low trade elasticity
  - ▶ misalignment are sizeable
  - ▶ optimal policy attempts to correct them
  - ▶ higher degree of success with LCP: more distortions help getting close to first best allocation
  - ▶ policy leans against misalignment reducing demand and trade imbalances

## Some important points

- ▶ Results not specific to news shock
  - ▶ Analysis is similar for Autoregressive shocks
  - ▶ Even stronger welfare results
- ▶ Leaning against misalignment is not the same as limiting exchange rate flexibility
  - ▶ Imposing a fixed exchange rate in the model significantly reduces welfare gains from optimal policy
- ▶ Same as regards external borrowing and global imbalances
  - ▶ Policy act on imbalances generated by inefficient wealth effects only

## Why and how should monetary policy be concerned with market frictions?

- ▶ In the literature, there are contributions stressing that monetary policy can 'complete the markets', essentially by manipulating the ex-post value of nominal assets, making it contingent on shocks
  - ▶ variable inflation
  - ▶ variable exchange rates
  - ▶ FTPL, Lucas, Svensson, Devereux Sutherland
- ▶ Here, monetary policy is not concerned directly with 'completing the markets,' but with redressing welfare-reducing wealth effects stemming from incomplete market distortions. Trade-offs are relevant also with financial autarky
- ▶ Optimal monetary policy is not a substitute for other kind of (structural) policies. But it cannot ignore welfare relevant distortions

# Conclusions

- ▶ Misalignments and wealth/demand imbalances — inefficiencies that generally arise independently of monetary and nominal distortions — raise relevant policy trade-offs
- ▶ Examples of economies where inward-looking strict inflation targeting, rather than correcting, results in significant misalignments
  - ▶ Even when the latter only reflects fundamental-based valuations
  - ▶ Generate suboptimal demand and current account imbalances
- ▶ Monetary policy should address misalignments in the foreign exchange market
- ▶ Degree of success of optimal monetary policy depends on the structure of the economy, including the form of nominal rigidities – PCP vs. LCP in our case

# Conclusions

Further exercises/directions:

- ▶ Implementation
- ▶ Domestically and international incomplete markets
- ▶ Cooperative vs Nash