Commodity Price Fluctuations and Monetary Policy in Small Open Economies

Roberto Chang

Rutgers Univ. and NBER

October 2014

Motivation

- Increased volatility in world prices of commodities

Motivation

- Increased volatility in world prices of commodities
- Some are basic imports, such as oil and food

Motivation

- Increased volatility in world prices of commodities
- Some are basic imports, such as oil and food
- Immediate questions for small open economies: How should monetary policy adjust? Should it try to stabilize the CPI, or rather an index of producer prices? Should it react to the exchange rate?

Motivation

- Increased volatility in world prices of commodities
- Some are basic imports, such as oil and food
- Immediate questions for small open economies: How should monetary policy adjust? Should it try to stabilize the CPI, or rather an index of producer prices? Should it react to the exchange rate?
- The answers are quite important in practice (Chile is an excellent example)

Lessons of Recent Literature

The New Keynesian model balances two considerations:

Lessons of Recent Literature

The New Keynesian model balances two considerations:

Nominal Rigidities

- Policy should address domestic distortions and price setting behavior
- Favors stabilizing the PPI

Lessons of Recent Literature

The New Keynesian model balances two considerations:

Nominal Rigidities

- Policy should address domestic distortions and price setting behavior
- Favors stabilizing the PPI

International relative prices (terms of trade externality)

- Policy can stabilize the real exchange rate or the terms of trade
- Suggests stabilizing the CPI

Recent Related Studies

1. Gali and Monacelli (2005): small open economy, finds PPI stabilization optimal for a special case

Recent Related Studies

1. Gali and Monacelli (2005): small open economy, finds PPI stabilization optimal for a special case
2. De Paoli (2009): confirms GM, derives welfare function and targeting rules in terms of output, domestic inflation, and the real exchange rate

Recent Related Studies

1. Gali and Monacelli (2005): small open economy, finds PPI stabilization optimal for a special case
2. De Paoli (2009): confirms GM, derives welfare function and targeting rules in terms of output, domestic inflation, and the real exchange rate
3. Catão-Chang (2013,14, henceforth CC): focus on international relative price shocks, extends analysis in several directions, CPI stabilization beats PPI stabilization under realistic assumptions

"But what price index should inflation targeting ideally refer to? Recent work...has emphasized that, from a welfare point of view, monetary policy should stabilize sticky prices rather than flexible prices...These results can be interpreted as favoring a core CPI or domestic inflation targeting...

"But what price index should inflation targeting ideally refer to? Recent work...has emphasized that, from a welfare point of view, monetary policy should stabilize sticky prices rather than flexible prices...These results can be interpreted as favoring a core CPI or domestic inflation targeting...

How should the central bank respond to oil price changes (or any terms of trade changes)?...Good Monetary Policy is flexible inflation targeting, which can be narrowly be specified as aiming at both stabilizing inflation around an inflation target and stabilizing the output gap around zero...

"But what price index should inflation targeting ideally refer to? Recent work...has emphasized that, from a welfare point of view, monetary policy should stabilize sticky prices rather than flexible prices…These results can be interpreted as favoring a core CPI or domestic inflation targeting...

How should the central bank respond to oil price changes (or any terms of trade changes)?...Good Monetary Policy is flexible inflation targeting, which can be narrowly be specified as aiming at both stabilizing inflation around an inflation target and stabilizing the output gap around zero...

Importantly, under inflation targeting, the exchange rate is not a target variable... "

"But what price index should inflation targeting ideally refer to? Recent work...has emphasized that, from a welfare point of view, monetary policy should stabilize sticky prices rather than flexible prices...These results can be interpreted as favoring a core CPI or domestic inflation targeting...

How should the central bank respond to oil price changes (or any terms of trade changes)?...Good Monetary Policy is flexible inflation targeting, which can be narrowly be specified as aiming at both stabilizing inflation around an inflation target and stabilizing the output gap around zero...

Importantly, under inflation targeting, the exchange rate is not a target variable... "

Svensson (2008), Comments on Frankel (2008)

Objective of This Paper

A simple version of CC with two objectives:

1. Review main lessons of CC, especially conditions under which PPI stabilization is optimal
2. Reexamine the question of what objectives or targets are appropriate to assign to the central bank

Main Takeaways

- PPI stabilization will be optimal only under very special assumptions

Main Takeaways

- PPI stabilization will be optimal only under very special assumptions
- Elasticities of demand matter, but also other aspects of the economy, such as the degree of international risk sharing

Main Takeaways

- PPI stabilization will be optimal only under very special assumptions
- Elasticities of demand matter, but also other aspects of the economy, such as the degree of international risk sharing
- The appropriate welfare criterion and target rules to assign to the central bank can be chosen in many alternative ways

Main Takeaways

- PPI stabilization will be optimal only under very special assumptions
- Elasticities of demand matter, but also other aspects of the economy, such as the degree of international risk sharing
- The appropriate welfare criterion and target rules to assign to the central bank can be chosen in many alternative ways
- To say, for example, that the central bank "should react to the exchange rate" can be as correct, or incorrect, as saying that the central bank should "stabilize domestic inflation".

The Analytical Framework

- Siimple version of CC (prices fixed one period in advance)

The Analytical Framework

- Siimple version of CC (prices fixed one period in advance)
- A small open economy with a sticky price sector (manufacturing)

The Analytical Framework

- Siimple version of CC (prices fixed one period in advance)
- A small open economy with a sticky price sector (manufacturing)
- An imported consumption good

The Analytical Framework

- Siimple version of CC (prices fixed one period in advance)
- A small open economy with a sticky price sector (manufacturing)
- An imported consumption good
- Relative world prices of imports are exogenous.

The Analytical Framework

- Siimple version of CC (prices fixed one period in advance)
- A small open economy with a sticky price sector (manufacturing)
- An imported consumption good
- Relative world prices of imports are exogenous.
- Perfect International Risk Sharing, but also Portfolio Autarky

Households

- Representative agent that maximizes the expected discounted value of

$$\mathcal{W} = \frac{C^{1-\sigma}}{(1-\sigma)} - \frac{\varsigma N^{1+\varphi}}{1+\varphi}$$

Households

- Representative agent that maximizes the expected discounted value of

$$\mathcal{W} = \frac{C^{1-\sigma}}{(1-\sigma)} - \frac{\varsigma N^{1+\varphi}}{1+\varphi}$$

- Consumption is a C.E.S. aggregate of a home good C_h and imports C_m

Households

- Representative agent that maximizes the expected discounted value of

$$\mathcal{W} = \frac{C^{1-\sigma}}{(1-\sigma)} - \frac{\varsigma N^{1+\varphi}}{1+\varphi}$$

- Consumption is a C.E.S. aggregate of a home good C_h and imports C_m
- The home good is a C.E.S aggregate of a continuum of varieties.

Relative Prices

- Our specification implies that

$$1 = (1-\alpha)\left(\frac{P_h}{P}\right)^{1-\eta} + \alpha X^{1-\eta} Z^{*1-\eta}$$

where P is the CPI, P_h the price of the home good, X the *real exchange rate* and Z^* the *world relative price of the imported good.*

Relative Prices

- Our specification implies that

$$1 = (1-\alpha)\left(\frac{P_h}{P}\right)^{1-\eta} + \alpha X^{1-\eta} Z^{*1-\eta}$$

  where P is the CPI, P_h the price of the home good, X the *real exchange rate* and Z^* the *world relative price of the imported good.*
- Z^* is exogenous

- This implies that (in a log linear approximation):

$$x = (1 - \alpha)\tau - z^*$$

where τ denotes the *terms of trade*.

- This implies that (in a log linear approximation):

$$x = (1 - \alpha)\tau - z^*$$

where τ denotes the *terms of trade*.

- Hence the terms of trade and the real exchange rate can move in opposite directions (in contrast with most of the literature).

Optimal Labor Supply

The household's optimal choice of labor effort is given by

$$\frac{v'(N)}{u'(C)} = \varsigma N^{\varphi} C^{\sigma} = \frac{W}{P}$$

where W is the nominal wage.

International Risk Sharing

I allow for either *perfect international risk sharing*:

$$C = C^* X^{1/\sigma}$$

or *portfolio autarky*:

$$PC = P_h Y$$

Domestic Production

- Variety j is produced with labor

$$Y(j) = AL(j)$$

Domestic Production

- Variety j is produced with labor

$$Y(j) = AL(j)$$

- Nominal marginal cost is then

$$\Psi = \frac{(1-\upsilon)W}{A}$$

Domestic Production

- Variety j is produced with labor

$$Y(j) = AL(j)$$

- Nominal marginal cost is then

$$\Psi = \frac{(1-\upsilon)W}{A}$$

- If all prices were flexible, each variety producer would price as a fixed markup over marginal cost:

$$P_h = \frac{\varepsilon}{\varepsilon - 1}\Psi$$

Domestic Production

- Variety j is produced with labor

$$Y(j) = AL(j)$$

- Nominal marginal cost is then

$$\Psi = \frac{(1-\upsilon)W}{A}$$

- If all prices were flexible, each variety producer would price as a fixed markup over marginal cost:

$$P_h = \frac{\varepsilon}{\varepsilon - 1}\Psi$$

- To introduce nominal rigidities, assume instead that prices are set one period in advance, so:

$$\mathcal{E}\left[C^{-\sigma}\frac{Y}{P}\left(P_h - \frac{\varepsilon}{\varepsilon - 1}\Psi\right)\right] = 0$$

Equilibrium

- Market Clearing for the home good requires

$$Y_h = (1-\alpha)Q^{-\eta}C + \alpha\left(\frac{X}{Q}\right)^{\gamma}C^*$$

where the real price of home output is

$$Q = \frac{P_h}{P}$$

Equilibrium

- Market Clearing for the home good requires

$$Y_h = (1-\alpha)Q^{-\eta}C + \alpha\left(\frac{X}{Q}\right)^{\gamma}C^*$$

  where the real price of home output is

$$Q = \frac{P_h}{P}$$

- To close the model, I assume that monetary policy controls nominal demand:

$$M = PC$$

Optimal Monetary Policy

Valuable insight is obtained by characterizing the *Ramsey planning outcome* and the *flexible price (natural) outcome.*

Key observation: PPI stabilization will generally replicate the natural outcome, so it is optimal if the Ramsey and natural outcomes coincide.

Ramsey Outcome Under Perfect Risk Sharing

1. Market Clearing for Home Goods:

$$
\begin{aligned}
Y &= AN = (1-\alpha)Q^{-\eta}C + \alpha\left(\frac{X}{Q}\right)^{\gamma} C^* \\
&\equiv \Omega(X, Z)
\end{aligned}
$$

   since $Q = Q(X, Z)$

2. Risk Sharing:

$$C = C^* X^{1/\sigma}$$

3. The *Ramsey Planner* maximizes $u(C) - v(N)$, so the first order condition is:

$$\frac{1}{\sigma} C u'(C) = \frac{X\Omega_X}{\Omega} N v'(N)$$

==> The *Ramsey outcome* is the solution (C, N, X) to the previous equations

Under flexible prices, (1) and (2) must hold, but also the *fixed markup* condition:

$$\frac{\varepsilon - 1}{\varepsilon(1-\nu)} Cu'(C) = \left[\frac{C}{QY}\right] Nv'(N)$$

==> The preceding condition, together with (1) and (2), pin down the *natural* (flex price) outcome.

Remarks

Remarks

- The Ramsey and natural outcomes are the same if (at the common solution):

$$\frac{\varepsilon - 1}{\varepsilon(1-\nu)} \frac{QY}{C} = \sigma \frac{X\Omega_X}{\Omega}$$

Remarks

- The Ramsey and natural outcomes are the same if (at the common solution):

$$\frac{\varepsilon - 1}{\varepsilon(1-\nu)} \frac{QY}{C} = \sigma \frac{X\Omega_X}{\Omega}$$

- If they do, PPI stabilization is optimal

Remarks

- The Ramsey and natural outcomes are the same if (at the common solution):

$$\frac{\varepsilon-1}{\varepsilon(1-\nu)}\frac{QY}{C}=\sigma\frac{X\Omega_X}{\Omega}$$

- If they do, PPI stabilization is optimal
- This happens if $\eta=\gamma=1/\sigma$ and :

$$\frac{\varepsilon-1}{\varepsilon(1-\nu)}=1-\alpha$$

Remarks

- The Ramsey and natural outcomes are the same if (at the common solution):

$$\frac{\varepsilon - 1}{\varepsilon(1-\nu)}\frac{QY}{C} = \sigma\frac{X\Omega_X}{\Omega}$$

- If they do, PPI stabilization is optimal
- This happens if $\eta = \gamma = 1/\sigma$ and :

$$\frac{\varepsilon - 1}{\varepsilon(1-\nu)} = 1 - \alpha$$

- The previous case includes the example in Gali-Monacelli (2005) and Gali (2008)

Remarks

- The Ramsey and natural outcomes are the same if (at the common solution):

$$\frac{\varepsilon - 1}{\varepsilon(1-\nu)} \frac{QY}{C} = \sigma \frac{X\Omega_X}{\Omega}$$

- If they do, PPI stabilization is optimal
- This happens if $\eta = \gamma = 1/\sigma$ and :

$$\frac{\varepsilon - 1}{\varepsilon(1-\nu)} = 1 - \alpha$$

- The previous case includes the example in Gali-Monacelli (2005) and Gali (2008)
- Likewise, if ν can be chosen optimally, it can be adjusted so that the previous condition holds at all times, which makes PPI stabilization optimal (Hevia and Nicolini 2013).

Implications of the Analysis

1. The particular structure of the economy matters (productive structure, parameters and elasticities, international risk sharing)
2. The result that PPI stabilization is optimal appears is quite special and fragile
3. But this analysis yields no presumption that an alternative rule, should as CPI targeting or an exchange rate peg, beats PPI targeting

Numerical Ilustration (from CC)

- This is borrowed from Catao and Chang (2013)
- Calibration in that paper
- More involved model: Calvo pricing; imports are a factor of production; enclave exports sector

Perfect Risk Sharing

Welfare Comparison

The Table gives the difference in welfare (in % of SS consumption) implied by the **PPI rule** *vis a vis* an **expected CPI rule**.

$\sigma \backslash \eta$	**0.75**	**1**	**5**
2	0.001	-0.004	-0.007
4	-0.021	-0.026	-0.089
6	-0.029	–0.034	-0.095

- The expected CPI rule wins for most parametrizations
- The superiority of expected CPI increases with η and σ
- The welfare differences are small

Impulse responses reveal that the Ramsey policy relies more than the PPI rule on exchange rate stabilization, *and* that the expected CPI rule gets closer to Ramsey in this respect.

This is so especially if shocks to *imports* prices dominate.

Policy and Welfare Under Portfolio Autarky

$\sigma \backslash \eta$	**0.75**	**1**	**5**
2	0.295	0.278	0.151
4	0.376	0.354	0.189
6	0.415	0.391	0.208

==> PPI Targeting easily beats expected CPI targeting in this case
==> The impulse responses show that there are still sizable discrepancies between PPI targeting and Ramsey, but also that expected CPI targeting is even worse.

Alternative Approach: Linear-Quadratic Approximation

- Woodford (2003) has suggested that a linear-quadratic approximation to the optimal policy problem yields useful insights

Alternative Approach: Linear-Quadratic Approximation

- Woodford (2003) has suggested that a linear-quadratic approximation to the optimal policy problem yields useful insights
- One hopes, in particular, that such an approximation will identify appropriate objectives and targets for the Central Bank

Approximating Welfare

Here, a second order approximation of the welfare of the representative agent is given by:

$$\mathcal{W} = \mathcal{E}\left\{c - n + \frac{1}{2}[(1-\sigma)c^2 - (1+\varphi)n^2]\right\} + \mathcal{O}^3$$

where $c = \log C - \log \bar{C}$, etc. and $\mathcal{O}^3$ includes a cubic residual (with terms like $c^3, n^3, c^2 n, cn^2$)

Approximating Welfare

Here, a second order approximation of the welfare of the representative agent is given by:

$$\mathcal{W} = \mathcal{E}\left\{c - n + \frac{1}{2}[(1-\sigma)c^2 - (1+\varphi)n^2]\right\} + \mathcal{O}^3$$

where $c = \log C - \log \bar{C}$, etc. and $\mathcal{O}^3$ includes a cubic residual (with terms like c^3, n^3, c^2n, cn^2)

- The presence of the linear terms c and n is inconvenient, because one cannot use a *linear* approximation to the equilibrium to correctly evaluate $\mathcal{W}$

Approximating Welfare

Here, a second order approximation of the welfare of the representative agent is given by:

$$\mathcal{W} = \mathcal{E}\left\{c - n + \frac{1}{2}[(1-\sigma)c^2 - (1+\varphi)n^2]\right\} + \mathcal{O}^3$$

where $c = \log C - \log \bar{C}$, etc. and $\mathcal{O}^3$ includes a cubic residual (with terms like c^3, n^3, c^2n, cn^2)

- The presence of the linear terms c and n is inconvenient, because one cannot use a *linear* approximation to the equilibrium to correctly evaluate $\mathcal{W}$
- One solution: use a quadratic approximation to the equilibrium to substitute out c and n, and then write $\mathcal{W}$ as a pure quadratic (Sutherland 2005)

Quadratic Approximation to the Model

1. Follow Sutherland (2005). Details in paper

Quadratic Approximation to the Model

1. Follow Sutherland (2005). Details in paper
2. Some insight is obtained about the role of uncertainty on expected values; for instance

$$p_h = \mathcal{E}\left[\varphi y + \sigma c + p + \lambda_p\right]$$

with

$$\lambda_p = \frac{1}{2}\left\{(1+\varphi)^2 y^2 - (y - \sigma c - p)^2\right\}$$

Quadratic Approximation to the Model

1. Follow Sutherland (2005). Details in paper
2. Some insight is obtained about the role of uncertainty on expected values; for instance

$$p_h = \mathcal{E}\left[\varphi y + \sigma c + p + \lambda_p\right]$$

with

$$\lambda_p = \frac{1}{2}\left\{(1+\varphi)^2 y^2 - (y - \sigma c - p)^2\right\}$$

3. Expected welfare can then be written in the form:

$$\begin{aligned} \mathcal{W} &= \mathcal{E}\{ \quad (\phi_{cy} - \phi_{yy})\lambda_y + (\phi_{cp} - \phi_{yp})\lambda_p + (\phi_{cx} - \phi_{yx})\lambda_x \\ &\quad + \frac{1}{2}[(1-\sigma)c^2 - (1+\varphi)n^2]\} \end{aligned}$$

where ϕ_{cy}, ϕ_{yy} etc. are functions of parameters

Linear Approximation

- The purely quadratic expression for $\mathcal{W}$ can now be examined with only a linear approximation to the equilibrium

Linear Approximation

- The purely quadratic expression for $\mathcal{W}$ can now be examined with only a linear approximation to the equilibrium
- In our case, the linear approximation is simple, and summarized by

$$x = (\frac{1}{\alpha} - 1)p - z$$

$$c = \frac{1}{\sigma}x = \frac{1}{\sigma}\left[(\frac{1}{\alpha} - 1)p - z\right]$$

$$y = \frac{\Theta}{\alpha}p - \Psi z$$

Linear Approximation

- The purely quadratic expression for $\mathcal{W}$ can now be examined with only a linear approximation to the equilibrium
- In our case, the linear approximation is simple, and summarized by

$$x = (\frac{1}{\alpha} - 1)p - z$$

$$c = \frac{1}{\sigma}x = \frac{1}{\sigma}\left[(\frac{1}{\alpha} - 1)p - z\right]$$

$$y = \frac{\Theta}{\alpha}p - \Psi z$$

- Optimal policy is now of the form $p = \kappa z$

Targets, Gaps, and Rules

Alternatively, one can rewrite:

$$\mathcal{W} = -\mathcal{E}\left[\left(\frac{1}{2}\tilde{V}'D\tilde{V} + \tilde{V}'Fz\right) + \frac{1}{2}w_p p^2\right]$$

where $\tilde{V} = (y, c, q, x)'$ collects *real* variables

Targets, Gaps, and Rules

Alternatively, one can rewrite:

$$\mathcal{W} = -\mathcal{E}\left[\left(\frac{1}{2}\tilde{V}'D\tilde{V} + \tilde{V}'Fz\right) + \frac{1}{2}w_p p^2\right]$$

where $\tilde{V} = (y, c, q, x)'$ collects *real* variables

- This is useful, because one can express *any three* of the real variables in $\tilde{V}$ as a function of the fourth one and the shock z

Targets, Gaps, and Rules

Alternatively, one can rewrite:

$$\mathcal{W} = -\mathcal{E}\left[\left(\frac{1}{2}\tilde{V}'D\tilde{V} + \tilde{V}'Fz\right) + \frac{1}{2}w_p p^2\right]$$

where $\tilde{V} = (y, c, q, x)'$ collects *real* variables

- This is useful, because one can express *any three* of the real variables in $\tilde{V}$ as a function of the fourth one and the shock z
- For instance, one can write:

$$\Phi_y \tilde{V} = \psi_y y + \psi_z z$$

Then, in $\mathcal{W}$, one can eliminate all real variables except for y :

$$\begin{aligned}
\frac{1}{2}\tilde{V}'D\tilde{V} + \tilde{V}'Fz &= \frac{1}{2}(N_y y + N_z z)'D\,(N_y y + N_z z) + (N_y y + N_z z)'\,Fz \\
&= \frac{1}{2}(N_y' D N_y)y^2 + (N_y' D N_z + N_y' F)yz + t.i.p. \\
&= \frac{1}{2}w_y[y^2 - 2\chi yz] + t.i.p.
\end{aligned}$$

An Optimal Central Bank Objective

One finally obtains:

$$\mathcal{W} = -\frac{1}{2}\mathcal{E}\left[w_y(y - y^T)^2 + w_p p^2\right]$$

An Optimal Central Bank Objective

One finally obtains:

$$\mathcal{W} = -\frac{1}{2}\mathcal{E}\left[w_y(y - y^T)^2 + w_p p^2\right]$$

- In this sense, monetary policy should seek to keep an *inflation target* of zero and to minimize an appropriately defined *output gap*

An Optimal Central Bank Objective

One finally obtains:

$$\mathcal{W} = -\frac{1}{2}\mathcal{E}\left[w_y(y - y^T)^2 + w_p p^2\right]$$

- In this sense, monetary policy should seek to keep an *inflation target* of zero and to minimize an appropriately defined *output gap*
- $y^T = \chi z$ is the "welfare relevant *output* target "

An Optimal Targeting Rule

Minimizing the loss function subject to the "Phillips Curve":

$$y = \frac{\Theta}{\alpha} p - \Psi z$$

leads to

An Optimal Targeting Rule

Minimizing the loss function subject to the "Phillips Curve":

$$y = \frac{\Theta}{\alpha} p - \Psi z$$

leads to

$$(y - y^T) + \varkappa p = 0$$

with $\varkappa = \alpha w_p / \Theta w_y$

An Optimal Targeting Rule

Minimizing the loss function subject to the "Phillips Curve":

$$y = \frac{\Theta}{\alpha} p - \Psi z$$

leads to

$$(y - y^T) + \varkappa p = 0$$

with $\varkappa = \alpha w_p / \Theta w_y$

- A "flexible targeting rule" in terms of inflation and an output gap (Svensson 2008)

Implications

- The last expression for $\mathcal{W}$, as well as the preceding ones, are just transformations of the utility of the representative agent, which fundamentally depends on c and n

Implications

- The last expression for $\mathcal{W}$, as well as the preceding ones, are just transformations of the utility of the representative agent, which fundamentally depends on c and n
- Hence the weight w_y and w_p depend in many parameters of the economy, such as the degree of openness and trade elasticities

Implications

- The last expression for $\mathcal{W}$, as well as the preceding ones, are just transformations of the utility of the representative agent, which fundamentally depends on c and n
- Hence the weight w_y and w_p depend in many parameters of the economy, such as the degree of openness and trade elasticities
- Likewise, the "target " $y^T = \chi z$ is a function of the world price shocks as well as of parameters (through ϖ)

Implications

- The last expression for $\mathcal{W}$, as well as the preceding ones, are just transformations of the utility of the representative agent, which fundamentally depends on c and n
- Hence the weight w_y and w_p depend in many parameters of the economy, such as the degree of openness and trade elasticities
- Likewise, the "target " $y^T = \chi z$ is a function of the world price shocks as well as of parameters (through ϖ)
- There is *no presumption* that y^T is equal to the *flexible price outcome (natural level of output)*

Implications

In fact, $\mathcal{W}$ can be represented *in many other ways*: following the same derivation as before, but expressing (c, q, y) in terms of x, one would arrive to an expression such as

$$\mathcal{W} = -\frac{1}{2}\mathcal{E}\left[w_x(x - x^T)^2 + w_p p^2\right]$$

and a target rule of the form

$$(x - x^T) + \varkappa p = 0$$

where the *exchange rate target* is $x^T = \chi z$, but the parameters χ, w_x, w_p, and $\varkappa$ would be different in this case.

A Practical Lesson

Any statement such as:

- The central bank should react to domestic inflation rather than headline inflation

A Practical Lesson

Any statement such as:

- The central bank should react to domestic inflation rather than headline inflation
- Monetary policy should respond to the real exchange rate in addition to inflation and the output gap

A Practical Lesson

Any statement such as:

- The central bank should react to domestic inflation rather than headline inflation
- Monetary policy should respond to the real exchange rate in addition to inflation and the output gap
- The central bank should have the real exchange rate as an additional objective

A Practical Lesson

Any statement such as:

- The central bank should react to domestic inflation rather than headline inflation
- Monetary policy should respond to the real exchange rate in addition to inflation and the output gap
- The central bank should have the real exchange rate as an additional objective

A Practical Lesson

Any statement such as:

- The central bank should react to domestic inflation rather than headline inflation
- Monetary policy should respond to the real exchange rate in addition to inflation and the output gap
- The central bank should have the real exchange rate as an additional objective

is *neither right nor wrong*.

Each of these statements *can* be correct in the context of this analysis, *if one defines targets and social weights correctly*. (In fact, all of them can be correct!)

Final Remarks

1. The arguments above are quite general

Final Remarks

1. The arguments above are quite general
2. The analysis suggests that we might want to examine alternative reasons ("transparency ", "credibility", "communication ") that can justify why some variables may be better than others as objectives and targets of monetary policy