

Commodity Inflation and Monetary Policy

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V Monetary Conference
Central Bank of Bolivia

July 2011

Overarching Question: To which extent should CBs accommodate imported commodity inflation?

Nominal (fixed) peg: Full accommodation.

Within IT: CBs have a number of choices entailing different degrees of accommodation.

E.g.: Targeting (explicitly or implicitly through the limits of IT bands) “core” (ex-commodities) CPI vs. broad (“headline”) CPI.

Aim of the Talk:

Examine the merit of “core” vs. strict “broad” CPI targeting (as well as full accommodation through pegging) from the viewpoint of economy-wide welfare as in Catão & Chang (2010).

We tackle this question on two fronts:

- First , the nature of the price shock according to a broad set of global indicators and historical experience;
- Second, in terms of a SOE DSGE model where food (or a relevant commodity composite) enters consumers’ utility separately – i.e., unlike any other (highly substitutable) good.

Presentation's Road Map

- I. Stylized Facts on global commodity prices and IT
- II. Literature overview on IT under commodity shocks
- III. Proposed model and differences viz others
- IV. Welfare assessment
- V. Conclusions

I. Six Stylized Facts on Commodity Prices

SF 1: Highly volatile (much emphasized) but also very persistent!

SF2: Highly responsive to world output and particularly i^* .

SF3: Food more inflationary than oil.

SF4: Relative to oil and other commodities, food remains cheap.

SF5: Prolonged lower stock-to-user ratios (as now) --> higher z^* .

SF 6: Large z^* shocks recently associated with IT breaches and weakening of Taylor rules (relative to baseline).

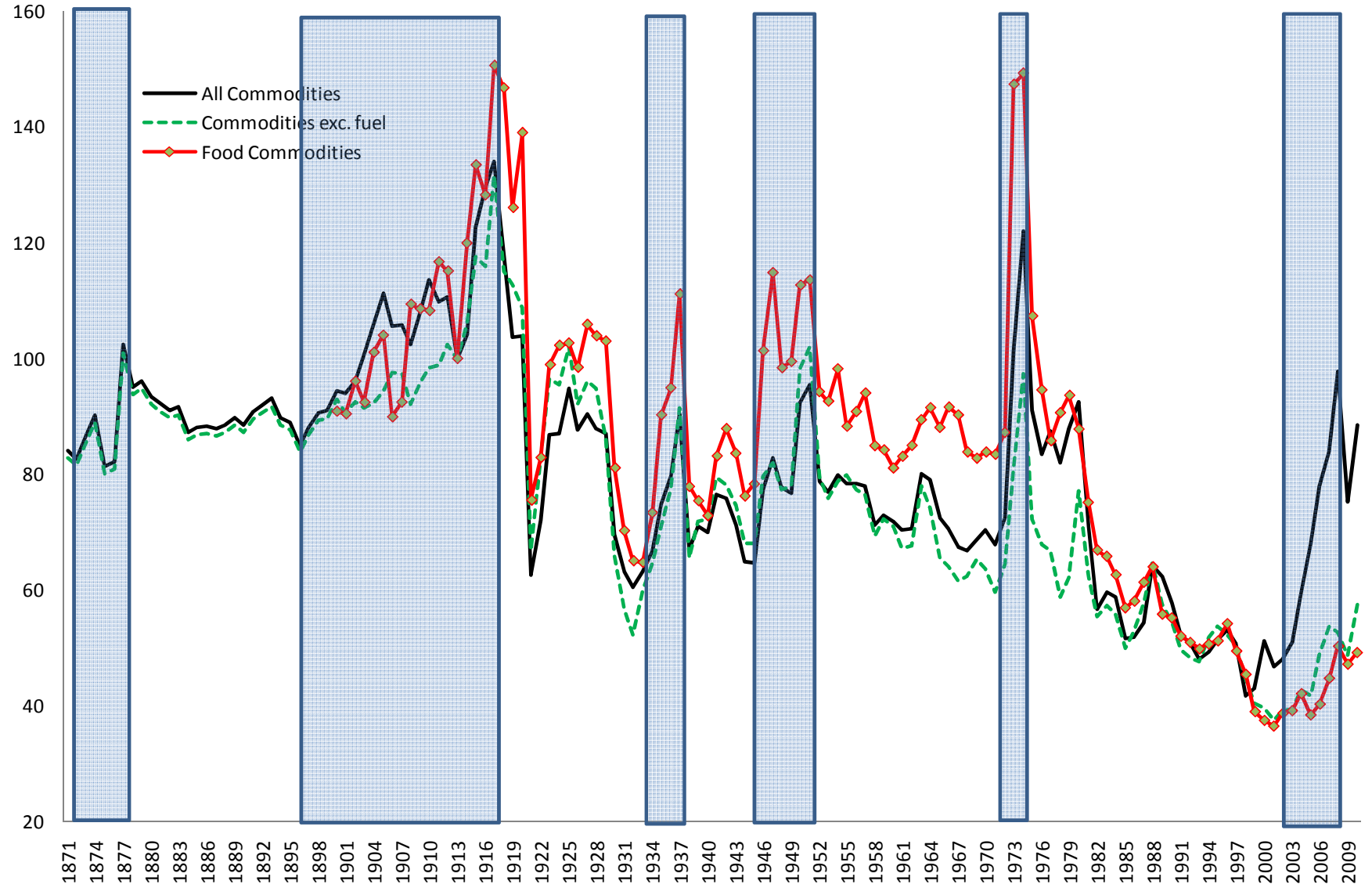
SF 1

| Table 1. Commodity Prices: AR(1) Persistence Measures | | | |
|--|------------|--------|--------------|
| | log-levels | HP Gap | Growth Rates |
| 1900-2010 | | | |
| All Commodity TOT | 0.90 | 0.46 | 0.04* |
| Food TOT | 0.94 | 0.45 | 0.19 |
| Food Prices | 0.98 | 0.54 | 0.19 |
| Man Prices | 1.00 | 0.63 | 0.38 |
| 1960-2010 | | | |
| All Commodity TOT | 0.88 | 0.47 | 0.11* |
| Food TOT | 0.95 | 0.52 | 0.21 |
| Food Prices | 0.94 | 0.54 | 0.23 |
| Oil Prices | 0.97 | 0.40 | -0.04* |
| Man Prices | 0.99 | 0.64 | 0.41 |
| * Not statistically significant | | | |

SF 2

| Table 2: Correlations between Food and Oil Prices and G8 Real GDP | | | | | | |
|--|-------------|---------------|--------------|----------------|-------------|---------------|
| (1960-2010) | | | | | | |
| ***** | | | | | | |
| | OILt | OILt-1 | FOODt | FOODt-1 | YWOt | YWOt-1 |
| OILt | 1.00 | 0.34 | 0.20 | 0.46 | -0.03 | 0.22 |
| OILt-1 | 0.34 | 1.00 | -0.19 | 0.21 | -0.39 | -0.05 |
| FOODt | 0.20 | -0.19 | 1.00 | 0.52 | 0.19 | 0.24 |
| FOODt-1 | 0.46 | 0.21 | 0.52 | 1.00 | -0.21 | 0.21 |
| YWOt | -0.03 | -0.39 | 0.19 | -0.21 | 1.00 | 0.56 |
| YWOt-1 | 0.22 | -0.05 | 0.24 | 0.21 | 0.56 | 1.00 |
| ***** | | | | | | |
| * All variables HP-detrended | | | | | | |

**Figure 1. World Commodity Terms of Trade
(relative to manufacturing prices, 1913=100)**



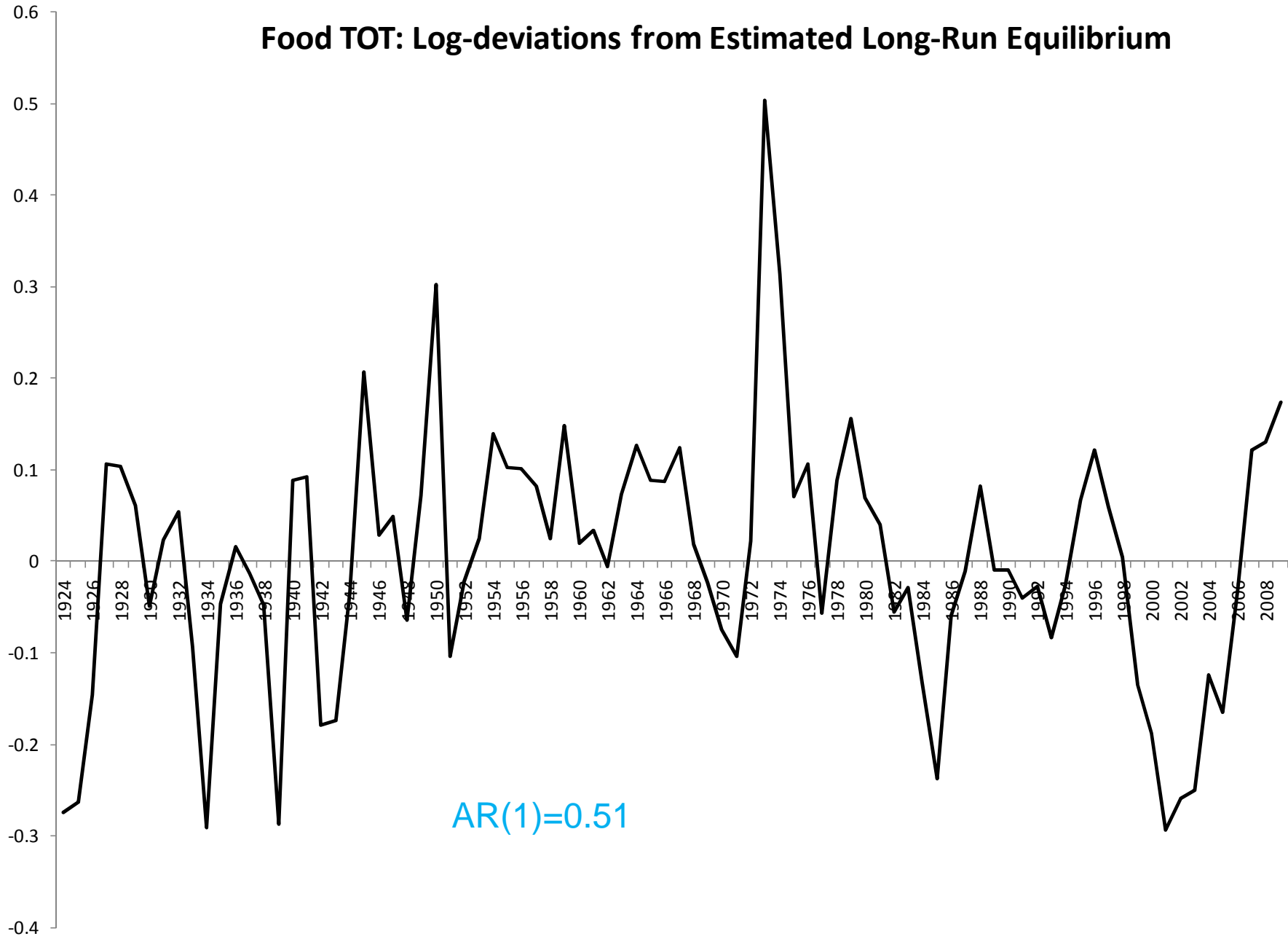
SF2

| Table 4. Determinants of Food Prices: OLS Regressions | | | |
|---|-------------|-----------------|---------------|
| a) Log-levels | | | |
| ***** | | | |
| Dependent variable is LOFOOD | | | |
| 86 observations used for estimation from 1924 to 2009 | | | |
| ***** | | | |
| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
| IRWORLD | -.027272 | .0070603 | -3.8627[.000] |
| LOYWO | .15257 | .069238 | 2.2036[.030] |
| LOUSREER | .80736 | .093793 | 8.6079[.000] |
| USSTOCKR | -.29089 | .056295 | -5.1672[.000] |
| ***** | | | |
| R-Squared | .60199 | R-Bar-Squared | .58743 |
| S.E. of Regression | .21263 | F-Stat. F(3,82) | 41.3417[.000] |
| DW-statistic | .38255 | | |
| ***** | | | |
| b) Log-levels (with trend and Dwar) | | | |
| ***** | | | |
| Dependent variable is LOFOOD | | | |
| 86 observations used for estimation from 1924 to 2009 | | | |
| ***** | | | |
| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
| INPT | -4.7905 | 1.1685 | -4.0997[.000] |
| IRWORLD | -.050366 | .0054662 | -9.2140[.000] |
| LOYWO | 1.3157 | .16634 | 7.9098[.000] |
| LOUSREER | .57537 | .12990 | 4.4293[.000] |
| USSTOCKR | -.20428 | .054826 | -3.7259[.000] |
| DWAR | -.53053 | .072415 | -7.3263[.000] |
| TREND | -.044511 | .0057085 | -7.7973[.000] |
| ***** | | | |
| R-Squared | .82162 | R-Bar-Squared | .80807 |
| S.E. of Regression | .14502 | F-Stat. F(6,79) | 60.6466[.000] |
| DW-statistic | .93360 | | |
| ***** | | | |

SF 2

| c) Deviations from HP trend | | | | | | | |
|---|-------------|-----------------|---------------|--|--|--|--|
| ***** | | | | | | | |
| Dependent variable is FOODGAP | | | | | | | |
| 85 observations used for estimation from 1925 to 2009 | | | | | | | |
| ***** | | | | | | | |
| Regressor | Coefficient | Standard Error | T-Ratio[Prob] | | | | |
| IRWORLD | -.0071345 | .0030910 | -2.3081[.024] | | | | |
| YWOGAP | .071909 | .21338 | .33699[.737] | | | | |
| LOUSREER | -.15980 | .078589 | -2.0334[.045] | | | | |
| STOCKGAP | .017232 | .065785 | .26195[.794] | | | | |
| FOODGAP(-1) | .43662 | .094170 | 4.6365[.000] | | | | |
| ***** | | | | | | | |
| R-Squared | .35376 | R-Bar-Squared | .31286 | | | | |
| S.E. of Regression | .092502 | F-Stat. F(5,79) | 8.6492[.000] | | | | |
| DW-statistic | .5420 | | | | | | |
| ***** | | | | | | | |

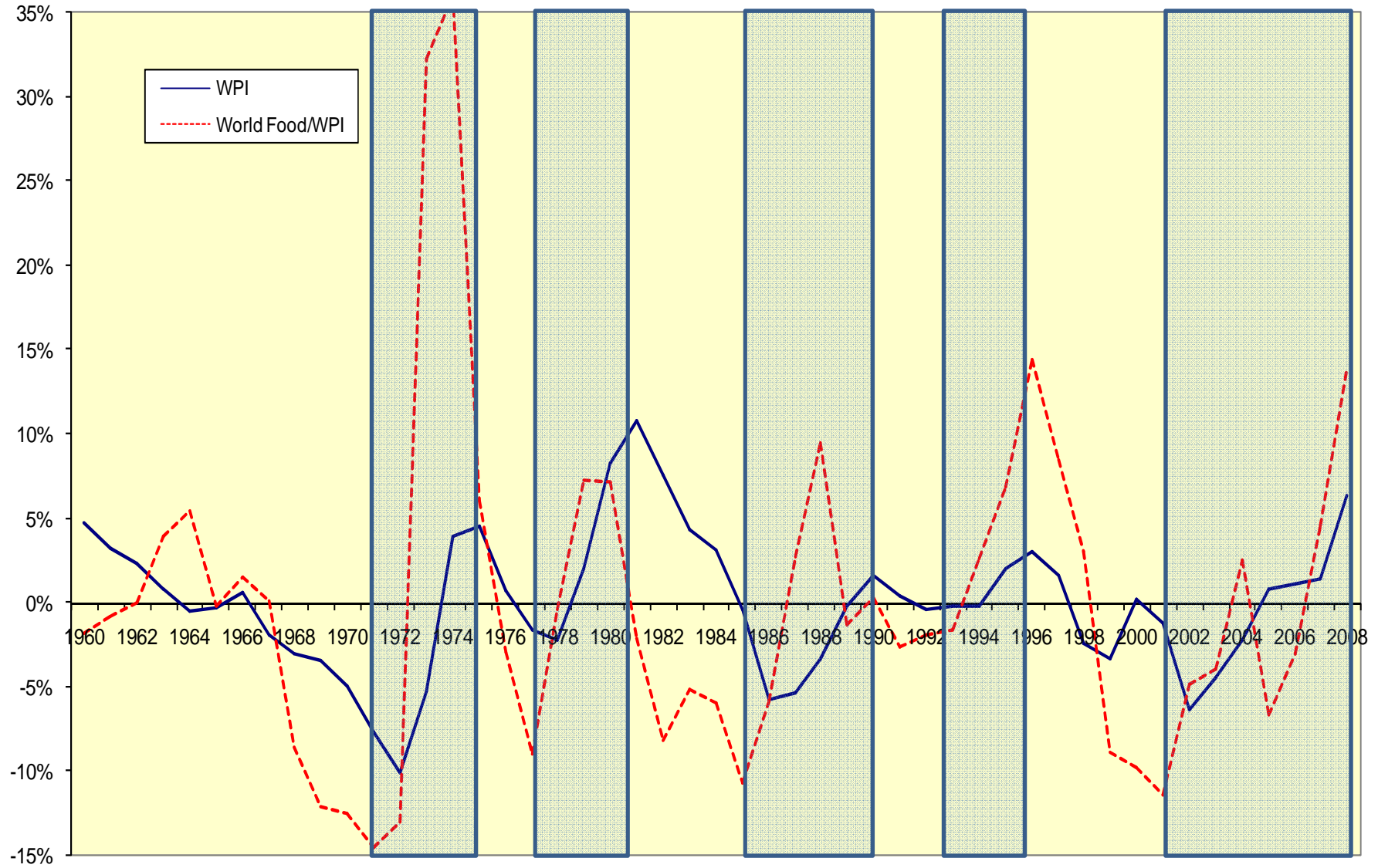
Food TOT: Log-deviations from Estimated Long-Run Equilibrium



AR(1)=0.51

SF3

Figure 2. World WPI and World Relative Food Prices
(in deviations from HP-trend)



SF3

Table 1. Correlations between World Inflation Indicators and Food and Oil Prices, 1990-2008
(all series HP detrended)

Contemporary Correlations

| | USWPI | World WPI | World CPI | Pfood | Poil |
|-----------|--------|-----------|-----------|--------|--------|
| USWPI | 1.0000 | .83689 | .74349 | .61911 | .72550 |
| World WPI | .83689 | 1.0000 | .66171 | .63273 | .46531 |
| World CPI | .74349 | .66171 | 1.0000 | .55970 | .39451 |
| Pfood | .61911 | .63273 | .55970 | 1.0000 | .17133 |
| Poil | .72550 | .46531 | .39451 | .17133 | 1.0000 |

Lagged Correlations

| | USWPI | World WPI | World CPI | Pfood | Poil |
|------------|--------|-----------|-----------|----------|----------|
| USWPI | 1.0000 | .83689 | .74349 | .44189 | .29036 |
| World WPI | .83689 | 1.0000 | .66171 | .46337 | .27692 |
| World CPI | .74349 | .66171 | 1.0000 | .36737 | .52542 |
| Pfood(t-1) | .44189 | .46337 | .36737 | 1.0000 | -.031275 |
| Poil(t-1) | .29036 | .27692 | .52542 | -.031275 | 1.0000 |

*

SF3

Table 3. Granger Causality Tests

A. Food Prices → US WPI

```
*****
Dependent variable is WPIGAP
List of the variables added to the regression:
ZGAP(-1)      ZGAP(-2)
47 observations used for estimation from 1962 to 2008
*****
Joint test of zero restrictions on the coefficients of additional
variables:
Lagrange Multiplier Statistic      CHSQ( 2)= 10.4873[.005]
Likelihood Ratio Statistic         CHSQ( 2)= 11.8668[.003]
F Statistic                         F( 2, 42)= 6.0317[.005]
*****
```

B. Oil Prices → US WPI

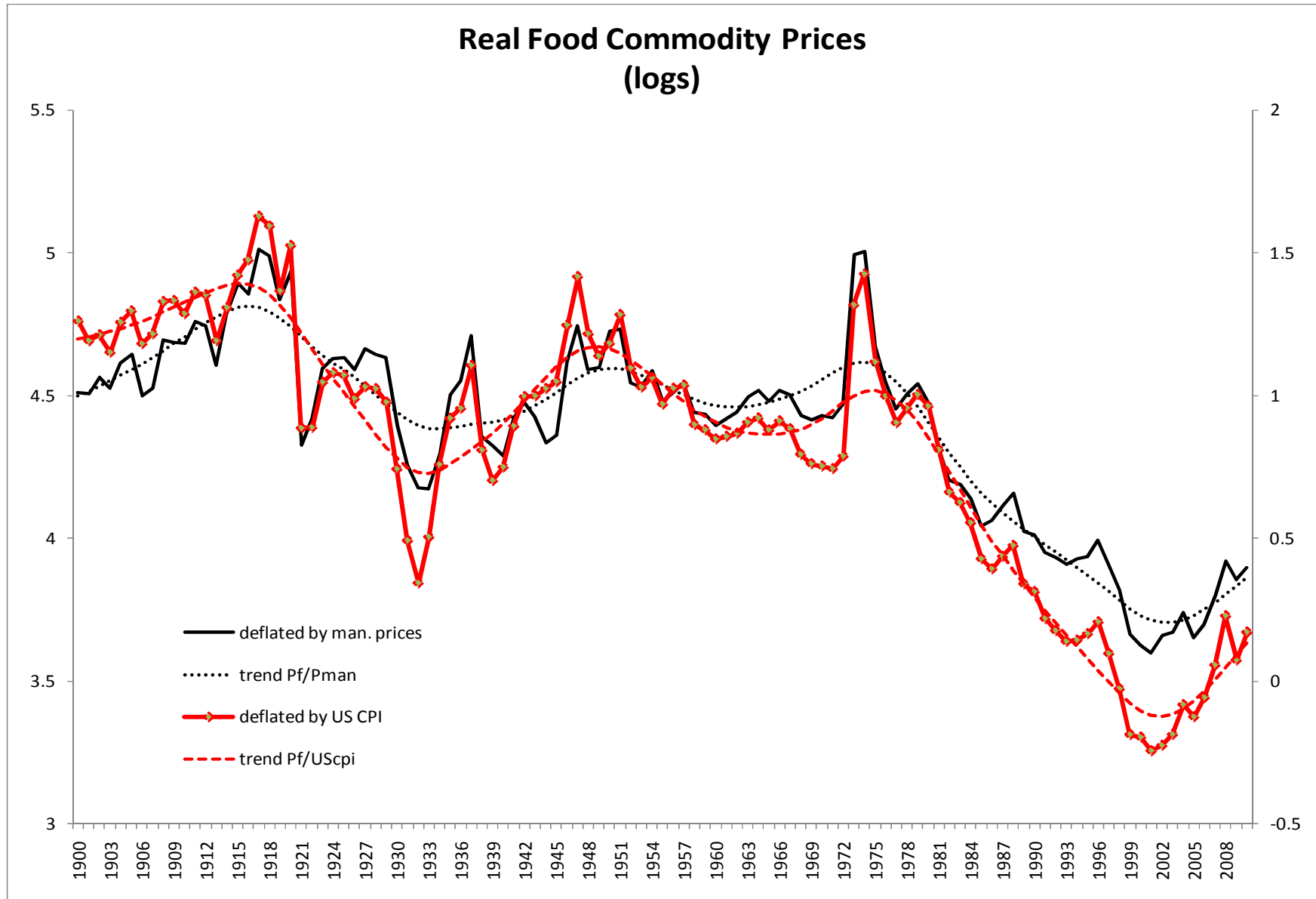
```
*****
Dependent variable is WPIGAP
List of the variables added to the regression:
PROILGAP(-1)  PROILGAP(-2)
47 observations used for estimation from 1962 to 2008
*****
Joint test of zero restrictions on the coefficients of additional
variables:
Lagrange Multiplier Statistic      CHSQ( 2)= 1.4879[.475]
Likelihood Ratio Statistic         CHSQ( 2)= 1.5119[.470]
F Statistic                         F( 2, 42)= .68653[.509]
*****
```

C. Oil → Food

```
*****
Dependent variable is ZGAP
List of the variables added to the regression:
PROILGAP(-1)  PROILGAP(-2)
47 observations used for estimation from 1962 to 2008
*****
Joint test of zero restrictions on the coefficients of additional
variables:
Lagrange Multiplier Statistic      CHSQ( 2)= 1.1923[.551]
Likelihood Ratio Statistic         CHSQ( 2)= 1.2077[.547]
F Statistic                         F( 2, 42)= .54659[.583]
*****
```

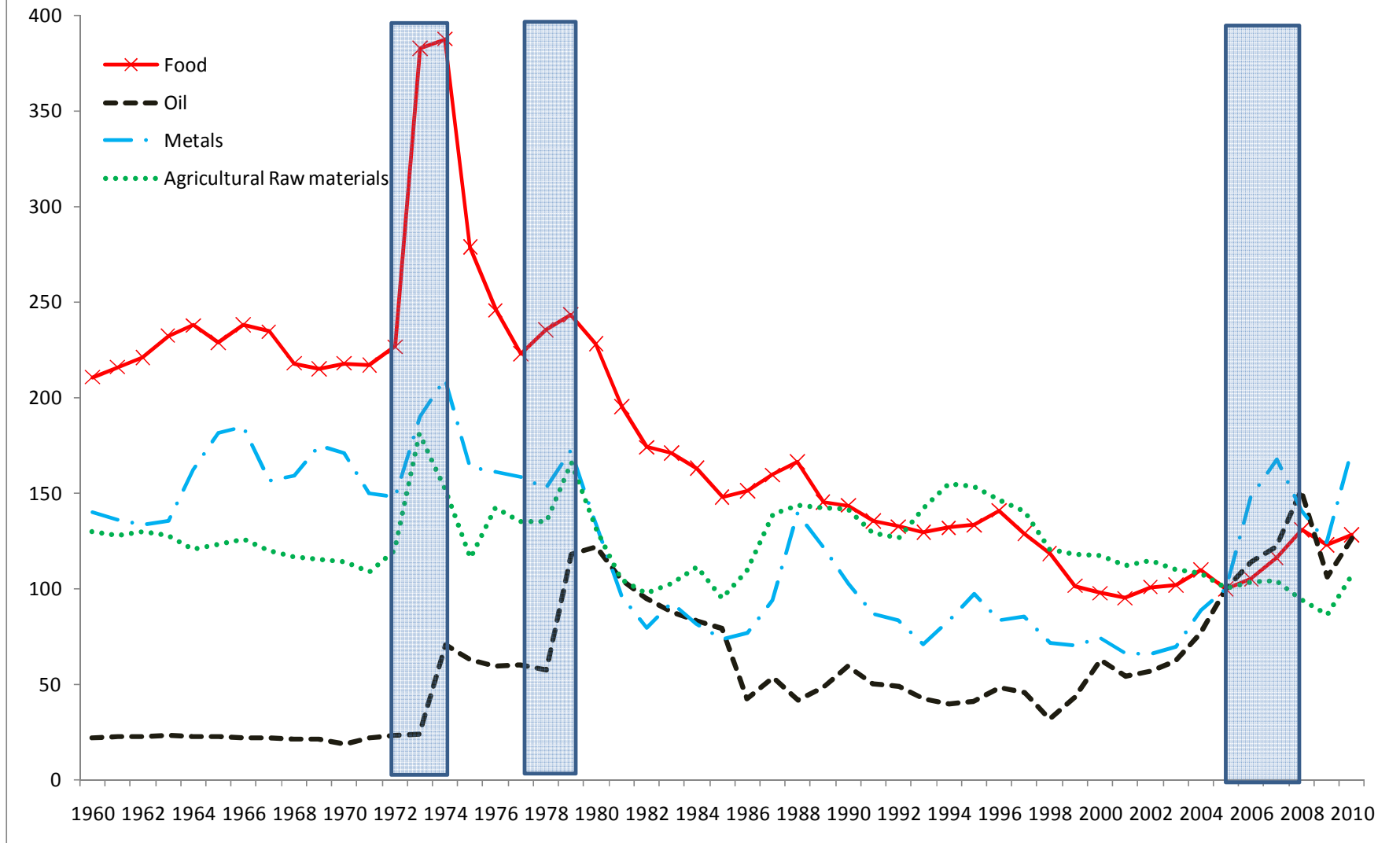
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SF 4



SF 4

**Figure 2. Food Prices vs Other Commodities Prices
(all deflated by manufacturing prices, 2005=100)**



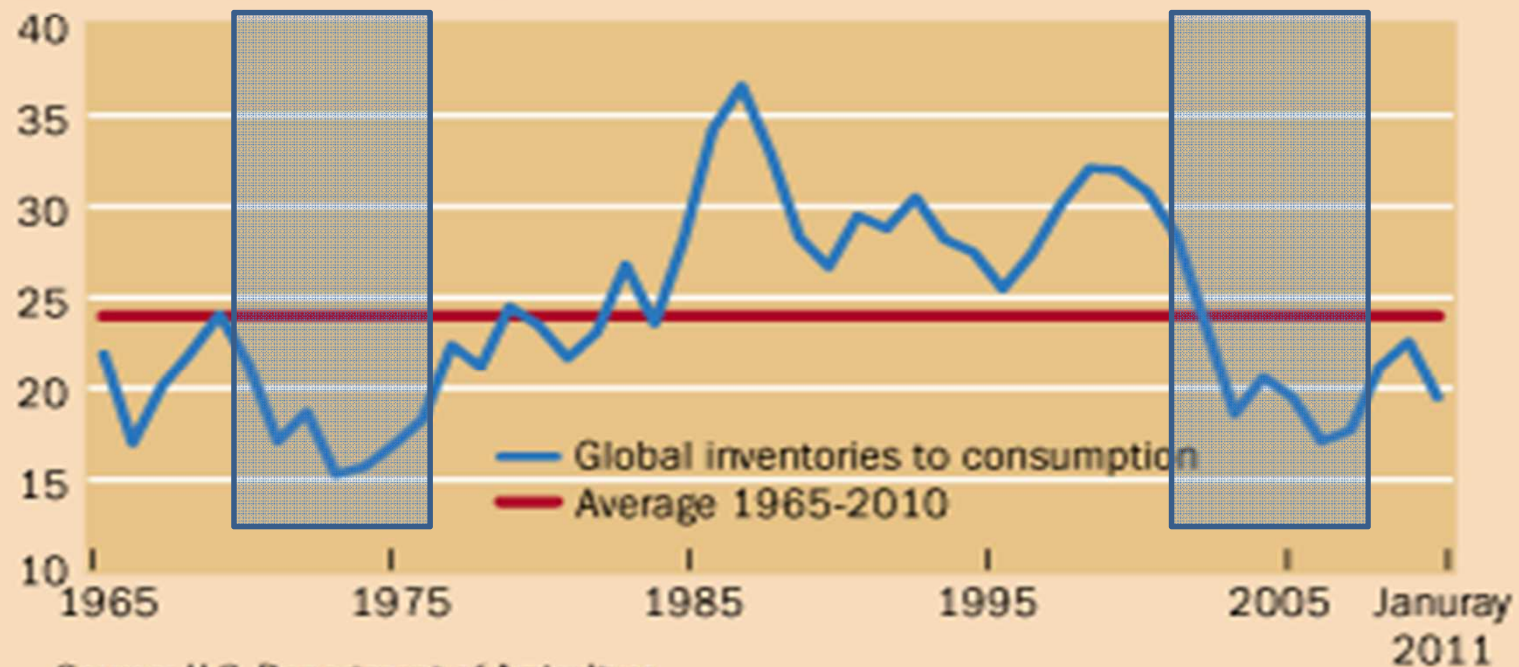
SF 5

Chart 4

Stocking up

Global grain inventories have been below average for the past decade.

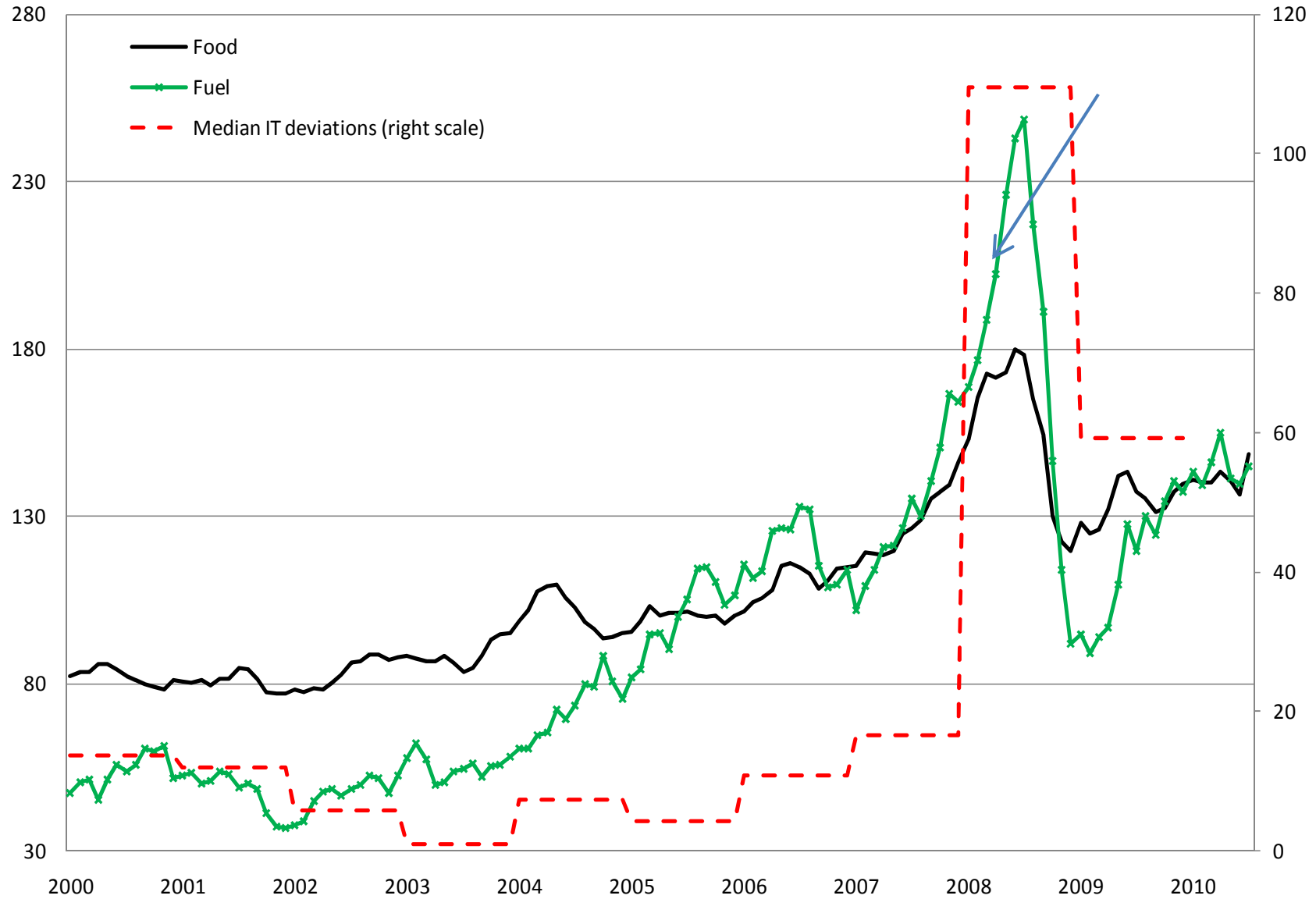
(global end-year stocks in percent of global consumption, percent)



Source: U.S. Department of Agriculture.

SF 6

Figure 1. World Commodity Prices and Deviations from Central Inflation Targets
(Price indices in US\$, 2005=100; IT deviations: cross-country median of % dev. from central target)



| Table 2. Descriptive Taylor Rule Estimates | | | | | |
|---|-----------------|----------------|-----------------|----------------------------------|--|
| (t-ratios in brackets) | | | | | |
| Coefficients on: | i(t-1) | ygap | CPI infl | D07-08*CPI inf | |
| 1) Australia: (1994q3-2010q2) | 0.9 (19.72) | 0.33 (3.41) | 0.12 (4.15) | -0.06 (-0.71) | |
| 2) Canada: (1995q1-2010q2) | 0.91 (26.40) | 0.26 (2.86) | 0.05 (1.51) | -0.19 (-1.77)* | |
| 3) Euro Area: (1999q1-2010q2) | 0.91 (17.10) | 0.23 (2.01) | 0.20 (2.91) | -0.22 (-1.73)* | |
| 4) New Zealand: (1993q1-2010q2) | 0.83 (13.20) | 0.32 (2.67) | 0.23 (3.55) | 0.13 (0.79) | |
| 5) UK: (1992q1-2010q2) | 0.93 (26.63) | 0.17 (1.80) | 0.09 (3.76) | -0.09 (-1.23) | |
| 6) Switzerland: (1996q1-2010q1) | 0.8 (10.4) | 0.23 (1.87) | 0.13 (2.18) | -0.22 (-1.68)* | |
| 7) Brazil (1999q2-2010q1) | 0.66 (11.93) | 0.25 (1.08) | 0.32 (4.89) | -0.11 (-1.08) | |
| 8) Chile: (2000q1-2010q2) | 0.86 (11.56) | 0.25 (1.93) | 0.19 (3.29) | -0.10 (-1.12) | |
| 9) Czech Rep.: (1998q1-2010q2) | 0.82 (38.7) | 0.01 (0.15) | 0.12 (6.63) | -0.09 (-2.17)** | |
| 10) Mexico: (1999q1-2010q2) | 0.76 (14.64) | 0.39 (1.90) | 0.15 (1.46) | -0.13 (-0.51) | |
| 11) South Africa: (2001q1-2010q2) | 0.85 (23.3) | 0.72 (6.18) | 0.14 (5.96) | -0.12 (-3.11)** | |
| 12) Thailand: (2000q1-2010q2) | 0.97 (18.0) | 0.08 (1.91) | 0.04 (1.77) | -0.06 (-1.66)* | |

II. What to Target: Previous Work

Closed economy DSGEs: Stabilize PPI (or core CPI), as it reproduces flex-price allocation under price stickiness (Goodfriend and King, 2001).

Open economy DSGEs : Not so straightforward because of OE imperfections (TOT externality, incomplete world capital markets, pricing to market).

Yet, a main result is that PPI targeting is often optimal even then (Kollman, 2002; Gali and Monacelli, 2005; Bergin et al, 2007)

Policy Implications of this literature:

CBs should be less hawkish about (accommodate) imported food price inflation, up to when inflationary pressures percolate through domestic sticky price sectors (manufacturing and services).

Such a “dovish” approach is recommendable even if food shocks are domestic rather than imported. This is because commodity sectors are typically flex-price and hence pricing is much less inertial (Aoki, 2001)!

Here we show this is not the case: **broad CPI is typically welfare superior!**

We obtain this result in the canonical model once:

- Commodities like food be a distinctive good in utility [large weight in consumption basket and basically non-substitutable, $\varepsilon \sim (0.1, 0.4)$].
- The SOE faces imported relative price commodity shocks which are as large and as persistent as in real world data.
- Food has a much higher weight in domestic CPI than in main trading partners. Very important because of RER!
- A variety of plausible elasticities and functional forms for $U(C,N)$.

All the rest remains the same as in the canonical model!

Table 5. Food Expenditure Shares in National Consumption Baskets

| | | | | |
|------------------------|--------------|--|----------------|-------|
| | | | | |
| | | | | |
| Austria | 15.5% | | Latvia | 40.4% |
| Belgium | 16.1% | | Lithuania | 45.5% |
| Bulgaria | 43.4% | | Luxemburg | 13.6% |
| Chile | 18.9% | | Malta | 34.2% |
| Cyprus | 26.4% | | Mexico | 32.7% |
| Czech Republic | 24.2% | | Netherlands | 11.9% |
| Denmark | 14.0% | | Panama | 34.9% |
| Estonia | 30.8% | | Poland | 30.4% |
| Finland | 15.6% | | Portugal | 22.2% |
| France | 15.1% | | Romania | 58.7% |
| Germany | 15.6% | | Slovakia | 33.3% |
| Greece | 21.3% | | Slovenia | 22.9% |
| Hungary | 29.4% | | Spain | 25.4% |
| Ireland | 18.0% | | Sweden | 12.1% |
| Italy | 28.3% | | United Kingdom | 12.9% |
| | | | | |
| Overall Median | 23.6% | | | |
| Overall Mean | 25.5% | | | |
| | | | | |
| EM Median | 32.7% | | | |
| EM Mean | 33.7% | | | |
| | | | | |
| Advanced Median | 15.5% | | | |
| Advanced Mean | 16.3% | | | |

III. Model

$$U_t = \frac{C_t^{1-\sigma}}{\zeta(1-\sigma)} - \int_0^1 \frac{N_t(j)^{1+\varphi}}{1+\varphi} dj$$

$$C_t = \left[(1-\alpha)^{1/\eta} C_{ht}^{(\eta-1)/\eta} + \alpha^{1/\eta} C_{ft}^{(\eta-1)/\eta} \right]^{\eta/(\eta-1)}$$

$$P_t = \left[(1-\alpha)P_{ht}^{1-\eta} + \alpha P_{ft}^{1-\eta} \right]^{1/(1-\eta)} \quad (1)$$

$$P_{ft} = S_t P_{ft}^*$$

where η is low and α is openness.

Other Building Blocks from (now) canonical SOE DSGE model (cf. Gali and Monacelli, 2005 and others):

Production: $Y_t(j) = A_t N_t(j)$

Euler Eq.: $\frac{1}{1+i_t} = \beta E_t \left[\left(\frac{C_{t+1}}{C_t} \right)^{-\sigma} \frac{P_t}{P_{t+1}} \right]$ (2)

Asset markets: $\frac{1}{1+i_t^*} = \beta E_t \left[\left(\frac{C_{t+1}^*}{C_t^*} \right)^{-\sigma} \frac{P_t^*}{P_{t+1}^*} \right]$

$$\frac{E(S_{t+1}/S_t)}{1+i_t} = \frac{1}{1+i_t^*} \quad (\text{UIP})$$

Hence:

$$C_t = \kappa C_t^* X_t^{1/\sigma}$$

where

$$X_t = S_t P_t^* / P_t \quad (3)$$

and

$$Z_t^* = P_{f_t}^* / P_t^*$$

Importantly, X may move in opposite directions with TOT:

$$x_t = (1 - \alpha)q_t - z_t^*$$

Domestic goods market clearing:

$$Y_{ht} = (1 - \alpha) \left(\frac{P_{ht}}{P_t} \right)^{-\eta} C_t + \phi X_t^\gamma \left(\frac{P_{ht}}{P_t} \right)^{-\gamma} C_t^* \quad (4)$$

Friction 2: Calvo Pricing.

$$P_{ht} = \left[\int_0^1 P_t(j)^{1-\varepsilon} dj \right]^{1/(1-\varepsilon)}$$

$$P_{ht} = \left[(1-\theta)\bar{P}_t^{1-\varepsilon} + \theta P_{h,t-1}^{1-\varepsilon} \right]^{1/(1-\varepsilon)} \quad (5)$$

Friction 3 : TOT Externality.

Sticky Prices and Imperfect substitution among non-food varieties across countries allow:

$$\frac{P_{ht}}{S_t P_t^*} \neq 1$$

Taylor rule:
$$\bar{i}_t = \rho + \phi_y \tilde{y}_t + \phi_\pi \pi_t + v_t \quad (6)$$

(or a peg rule: $i = i^*$, with $p_t^* = \rho^p p_{t-1}^* + v_t^p$)

then equations (1)-(6) plus the monetary policy rule solve for:

$$C, X, (P_h/P), Y_h, (\bar{P}/P_h), \Pi_h$$

Log-Linearized Solution: Key equations

NKPC:
$$\pi_{ht} = \beta E_t \pi_{h,t+1} + \lambda mc_t$$

But where
$$mc_t = \varphi(y_t - y_{ht}^n) + (q_t - q_t^n)$$

So, a rise in world food prices (z^*) raises costs, ceteris paribus!

Further, natural or trend output will depend on z^* :

$$y_{ht}^n = \frac{1}{(\varphi + \Theta)} (-\mu - (\sigma - \Theta)c_t^* + \Theta[\omega\alpha(\eta - 1/\sigma)]z_t^* + v - \log\zeta - \sigma \log\kappa + (1 + \varphi)a_t)$$

Only when $\eta=1/\sigma$, y becomes like a closed economy output!

However, in an open economy with international asset trading will never be isomorphic to the closed one even if all intra and intertemporal elasticities are identical ($\eta = \gamma = 1/\sigma$).

Proof:

i)
$$q_t^n = \frac{\Theta[1+\varphi(\frac{\omega}{\sigma}+(1-\omega)\gamma)]}{(\varphi+\Theta)} z_t^* = z_t^* \quad \text{when } \eta=(1/\sigma)=1.$$

ii) since output will not move and $\Theta(y_t - y_{ht}^n) = (q_t - q_t^n)$, it must be that $q_t^n = q_t$

iii) from RER definition ($x_t = (1 - \alpha)q_t - z_t^*$), RER will move (appreciate if z^* shock positive).

iv) from risk sharing ($c_t = c_t^* + \frac{1}{\sigma}x_t$), home consumption will move (unless c^* moves to exactly offset).

So, full isomorphism only if $\text{var}(z^*) = 0!$

As RER and TOT can move in opposite directions, the impact of TOT change on output is ambiguous:

$$y_{h_t} = y_t^* + \left[\frac{1}{\Theta} - (1 - \alpha)\phi \right] q_t + \phi x_t$$

If Q and X move together, then Y will typically move in the same direction: a depreciation is expansionary. As seen above, this is the case when $Z^*=1$ (like in all previous work)

Otherwise, Q and RER (X) can move in different directions, in which case the effect of a TOT shift on output is ambiguous and will depend on the policy rule, since different policy rules will have a distinct impact on X and q.

Again, this does not feature in previous work and may be empirically very important, as illustrated by IRs below.

IV. Welfare

As mentioned, the model closes with specification of the processes of shocks and a monetary policy rule:

PPI, CPI:

$$\bar{i}_t = \rho + \phi_y \tilde{y}_t + \phi_\pi \pi_t + v_t$$

PEG:

$$i = i^*$$

$$p_t^* = \rho^p p_{t-1}^* + v_t^p$$

We consider 3 shocks:

$$v_t = \rho_v v_{t-1} + \varepsilon_t^v$$

$$a_t = \rho_a a_{t-1} + \varepsilon_t^a$$

$$z_t^* = \rho_z z_{t-1}^* + \varepsilon_t^z \quad (\text{New!})$$

Also note the differences between PPI and CPI Taylor rules:

$$\text{PPI:} \quad i_t = \phi_y \tilde{y}_t + \phi_\pi \pi_{ht}$$

$$\begin{aligned} \text{CPI:} \quad i_t &= \phi_y \tilde{y}_t + \phi_\pi \pi_t \\ &= \phi_y \tilde{y}_t + \phi_\pi \pi_{ht} + \phi_\pi \alpha \Delta q_t \\ &= \phi_y (1 + \alpha \Theta) \tilde{y}_t - \alpha \phi_y \Theta \tilde{y}_{t-1} + \phi_\pi \pi_{ht} + \phi_\pi \alpha \Delta q_t^n \end{aligned}$$

Also note for future reference, recall that UIP holds:

$$i_t = E_t[\sigma \Delta c_{t+1} + \pi_{t+1}]$$

$$i_t = E_t[\sigma \Delta c_{t+1}^* + \Delta x_{t+1} + \pi_{t+1}]$$

$$\therefore \boxed{i_t - i_t^* = E_t[\Delta s_{t+1}]}$$

Figure 3: Impulse Responses of a 100% increase in world food prices with $\sigma = 2$ and $\eta = [0.25, 0.5, 0.5, 2]$ and $\gamma = 1$ with PPI

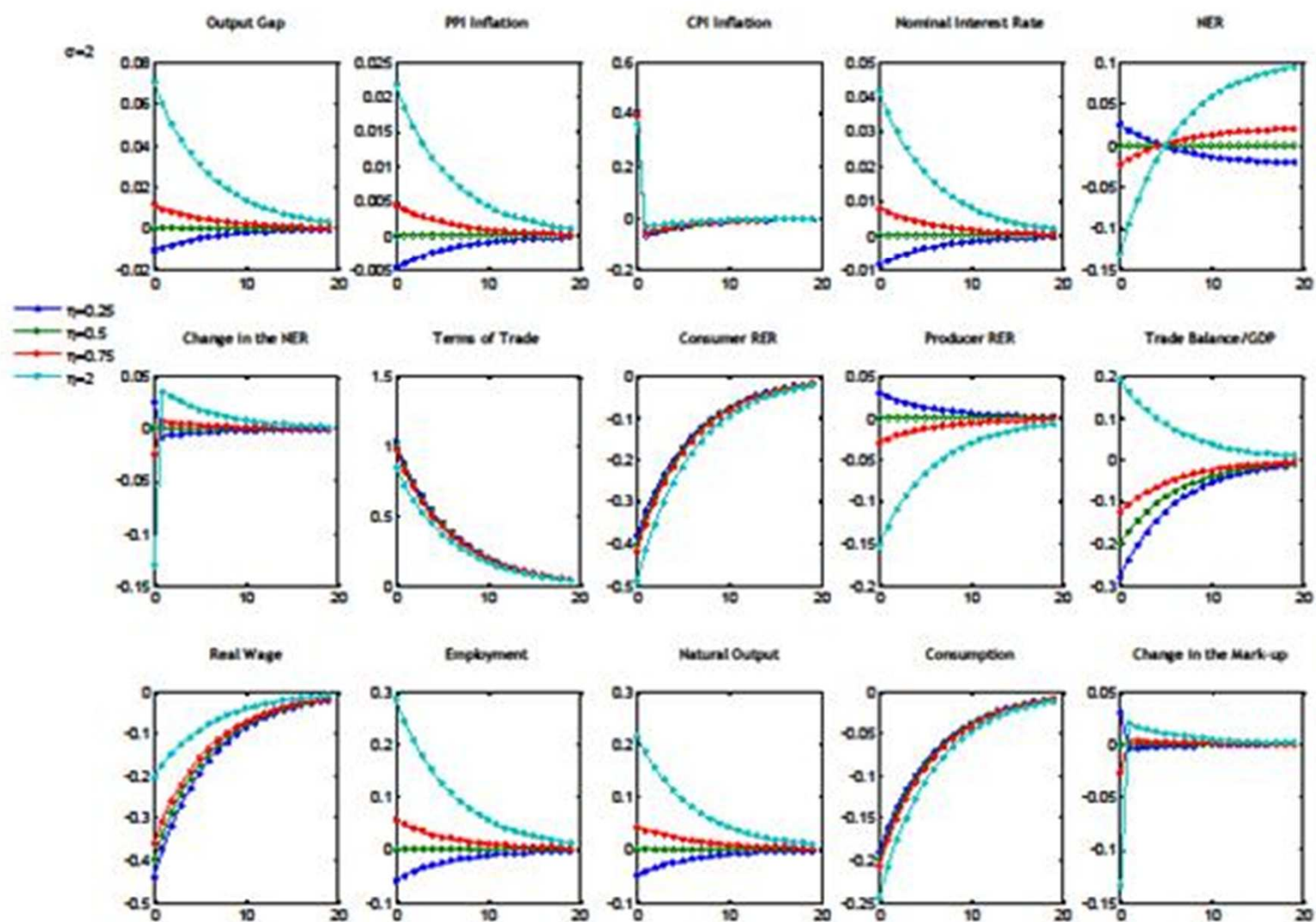
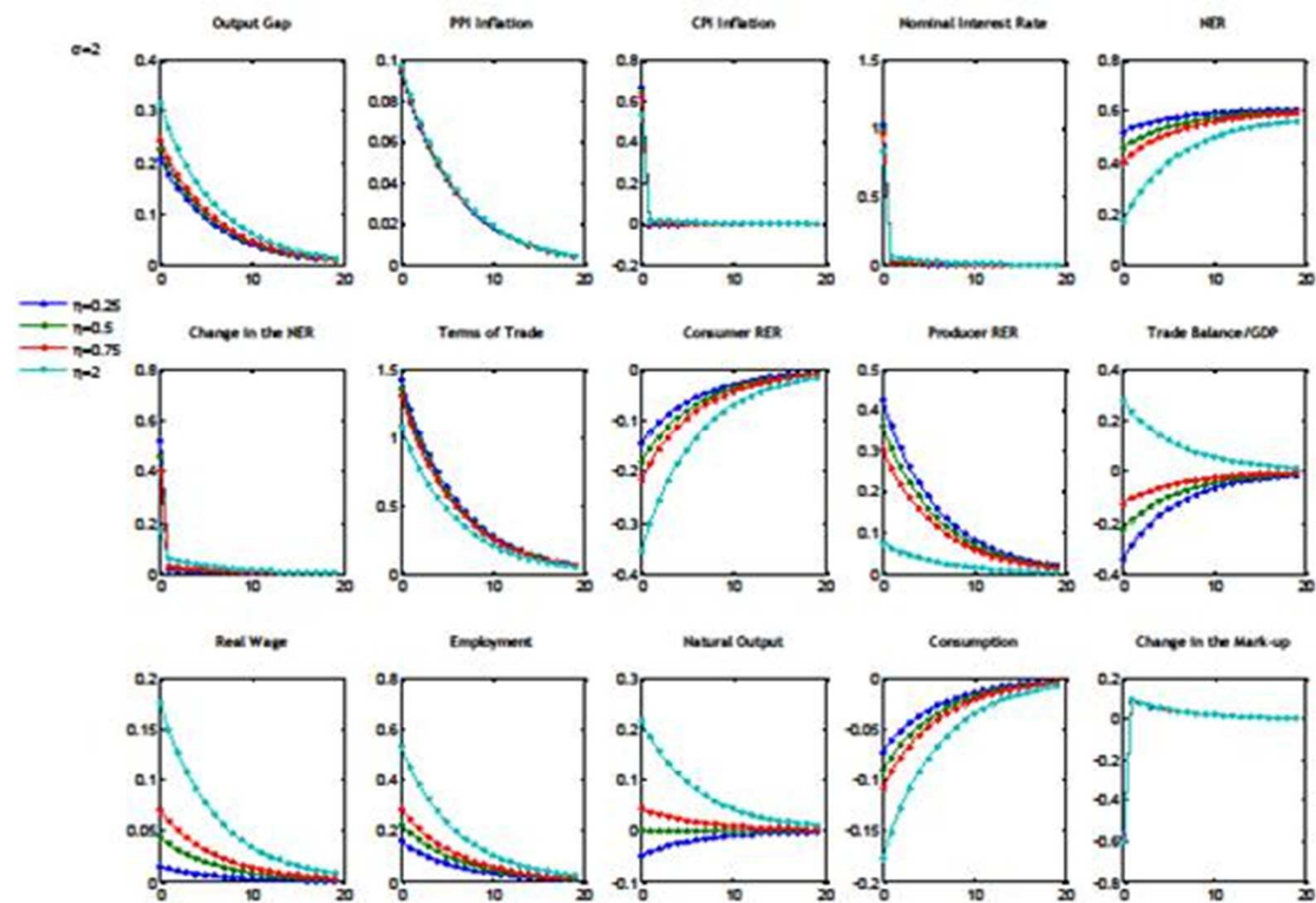


Figure 4: Impulse Responses of a 100% increase in world food prices with $\sigma = 2$ and $\eta = [0.25, 0.5, 0.5, 2]$ and $\gamma = 1$ with CPI rule



We show in the paper:

$$\begin{aligned}
 U_t = U + E \sum_{t=0}^{\infty} \beta^t \left\{ \frac{C^{1-\sigma}}{\zeta} (c_t + \frac{1-\sigma}{2} c_t^2) - N^{1+\varphi} [y_{ht} - a_t \right. \\
 \left. + \frac{1+\varphi}{2} y_{ht}^2 - (1+\varphi) a_t y_{ht} + \frac{1+\varphi}{2} a_t^2 + \Theta [\pi_{ht}^2] \right\}
 \end{aligned}$$

where:

$$U = \frac{1}{(1-\beta)} \left(\frac{C^{1-\sigma}}{\zeta(1-\sigma)} - \frac{N^{1+\varphi}}{(1+\varphi)} \right)$$

The presence of linear terms requires us to use numerical methods to obtain the solution (Smitt-Ghroe-Urbe algorithm)

This welfare function implies:

- As the closed economy setting, welfare decreases on $\text{var}(\pi_h)$ and $\text{var}(n)$.
- But here welfare will **decrease** on the volatility of consumption and hence on $\text{var}(\text{RER})$.
- But welfare will also rise on the level of consumption and decline on labor effort; recalling that $Y=AN \rightarrow$ welfare will rise in $c-y$;
- To the extent that a more appreciated RER rises $c-y$, there is then an incentive for the national planner to exploit the TOT externality.
- Further (formally shown in the paper), there is a key interaction between level and volatility: lower $\text{var}(\text{RER})$ will be associated with a more appreciated RER.

- So, if a policy rule (like CPI targeting) better stabilizes RER in the face of z^* shocks, it will stabilize domestic consumption, appreciate the RER on average.
- In turn, a more appreciated RER will allow the country to explore its TOT externality and raise C/Y .
- But the same rule may not do as well viz others (e.g. PPI targeting or PEG) in stabilizing inflation and consumption if productivity or monetary shocks are overwhelming.

So, the jury is out: ranking superiority will depend on the importance of z^* shocks relative to others!

Table 6: Welfare Comparisons with Baseline Calibration

$$\phi_\pi = 1.5, \rho_\nu = 0.6, \sigma_\nu = 0.6\%, \phi_y = 0.0, \rho_z = 0.85, \\ \rho_\alpha = 0.7, \sigma_\alpha = 1.2\%, \phi = 0.25, \gamma = 1, \varphi = 1, \sigma_z = 5\%, \omega = 0.75$$

Domestic Inflation-CPI Inflation

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | -0.2165 | -0.2166 | -0.2146 | -0.2106 | -0.1801 |
| 0.75 | -0.0222 | -0.0102 | 0.0052 | 0.0235 | 0.1153 |
| 1 | 0.0068 | 0.0232 | 0.043 | 0.0656 | 0.1729 |
| 2 | 0.061 | 0.0859 | 0.114 | 0.1443 | 0.2784 |
| 4 | 0.0955 | 0.1256 | 0.1585 | 0.1934 | 0.3422 |

CPI Inflation -PEG

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | 0.2107 | 0.2218 | 0.2285 | 0.2315 | 0.2142 |
| 0.75 | 0.025 | 0.0135 | -0.0021 | -0.0210 | -0.1184 |
| 1 | -0.0069 | -0.0236 | -0.0442 | -0.0679 | -0.183 |
| 2 | -0.0673 | -0.0937 | -0.1236 | -0.1565 | -0.3046 |
| 4 | -0.1062 | -0.1386 | -0.1745 | -0.2130 | -0.3817 |

Domestic Inflation-PEG

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | -0.0057 | 0.0052 | 0.014 | 0.0209 | 0.0341 |
| 0.75 | 0.0028 | 0.0033 | 0.0031 | 0.0025 | -0.0031 |
| 1 | -0.0002 | -0.0004 | -0.0011 | -0.0023 | -0.01 |
| 2 | -0.0063 | -0.0077 | -0.0097 | -0.0122 | -0.0262 |
| 4 | -0.0107 | -0.013 | -0.016 | -0.0196 | -0.0395 |

Dominance relative to SS

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|------|-----|------|---|---|
| 0.5 | 1 | 3 | 3 | 3 | 3 |
| 0.75 | 3 | 3 | 2 | 2 | 2 |
| 1 | 2 | 2 | 2 | 2 | 2 |
| 2 | 2 | 2 | 2 | 2 | 2 |
| 4 | 2 | 2 | 2 | 2 | 2 |

Table 7: Welfare Comparisons with Low Variance of Food Prices

$$\phi_\pi = 1.5, \rho_\nu = 0.6, \sigma_\nu = 0.6\%, \rho_\alpha = 0.7, \sigma_\alpha = 1.2\%$$

$$\phi_y = 0.0, \rho_z = 0.85, \phi = 0.25, \gamma = 1, \varphi = 1, \sigma_z = 0.01\%, \omega = 0.75$$

Domestic Inflation-CPI Inflation

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | -0.008 | -0.0076 | -0.0072 | -0.0067 | -0.0049 |
| 0.75 | -0.0028 | -0.0027 | -0.0026 | -0.0024 | -0.0012 |
| 1 | -0.0025 | -0.0025 | -0.0024 | -0.0023 | -0.0011 |
| 2 | -0.0026 | -0.0027 | -0.0027 | -0.0026 | -0.0015 |
| 4 | -0.003 | -0.0031 | -0.0032 | -0.0032 | -0.0021 |

CPI Inflation -PEG

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | 0.0507 | 0.0498 | 0.0489 | 0.0477 | 0.0426 |
| 0.75 | 0.0093 | 0.008 | 0.0067 | 0.0052 | -0.0013 |
| 1 | 0.0043 | 0.0029 | 0.0015 | 0 | -0.0068 |
| 2 | -0.0035 | -0.005 | -0.0067 | -0.0083 | -0.0154 |
| 4 | -0.0077 | -0.0094 | -0.0111 | -0.0127 | -0.02 |

Domestic Inflation-PEG

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | 0.0427 | 0.0422 | 0.0417 | 0.041 | 0.0377 |
| 0.75 | 0.0065 | 0.0053 | 0.0041 | 0.0028 | -0.0025 |
| 1 | 0.0018 | 0.0004 | -0.0009 | -0.0023 | -0.008 |
| 2 | -0.0061 | -0.0077 | -0.0093 | -0.0109 | -0.017 |
| 4 | -0.0107 | -0.0125 | -0.0142 | -0.0159 | -0.0221 |

Dominance relative to SS

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|------|-----|------|---|---|
| 0.5 | 3 | 3 | 3 | 3 | 3 |
| 0.75 | 3 | 3 | 3 | 3 | 1 |
| 1 | 3 | 3 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 | 1 | 1 |
| 4 | 1 | 1 | 1 | 1 | 1 |

Table 8: Model statistics Under Simulated Random Shocks
(SS with Balance Trade and $\omega=0.75$)

| | $\sigma=4; \eta=0.25; \gamma=1$ | | | $\sigma=4; \eta=0.25; \gamma=1$ | | | $\sigma=4; \eta=0.25; \gamma=1$ | | $\sigma=4; \eta=0.25; \gamma=1$ | | |
|-----------------------------------|---------------------------------|-----------------------|-----------------------|---------------------------------|-----------------------|-----------------------|---------------------------------|-----------------------|---------------------------------|------------------|------------------|
| | PPI rule Shocks to | CPI rule Shocks to | PEG rule Shocks to | PPI rule Shocks to | CPI rule Shocks to | PEG rule Shocks to | PPI rule Shocks to | CPI rule Shocks to | To all Shocks | To all Shocks | To all Shocks |
| | $z_{\{t\}}$ | $z_{\{t\}}$ | $z_{\{t\}}$ | $a_{\{t\}}$ | $a_{\{t\}}$ | $a_{\{t\}}$ | $v_{\{t\}}$ | $v_{\{t\}}$ | | | |
| Standard deviations (in %) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| Domestic Output | 0.000 | 0.936 | 0.945 | 0.269 | 0.315 | 0.313 | 0.424 | 0.497 | 0.501 | 1.101 | 0.887 |
| Consumption | 0.606 | 0.584 | 0.292 | 0.115 | 0.135 | 0.134 | 0.182 | 0.213 | 0.642 | 0.634 | 0.725 |
| CPI-based Real Exchange rate | 2.420 | 2.328 | 1.164 | 0.461 | 0.539 | 0.537 | 0.726 | 0.851 | 2.562 | 2.525 | 2.898 |
| Home Good Price/CPI | 2.432 | 2.684 | 2.940 | 0.154 | 0.180 | 0.179 | 0.242 | 0.284 | 2.448 | 2.704 | 2.471 |
| Domestic Inflation | 0.000 | 0.540 | 0.213 | 0.224 | 0.192 | 0.142 | 0.088 | 0.132 | 0.241 | 0.593 | 0.398 |
| Means in % of SS deviation | | | | | | | | | | | |
| Domestic Output | 0.000 | -0.194 | -0.033 | -0.048 | -0.039 | -0.031 | -0.013 | -0.022 | -0.061 | -0.254 | 0.005 |
| Consumption | -0.008 | -0.097 | -0.034 | -0.021 | -0.017 | -0.013 | -0.006 | -0.010 | -0.035 | -0.124 | -0.008 |
| CPI-based Real Exchange rate | -0.008 | -0.368 | -0.129 | -0.082 | -0.067 | -0.053 | -0.023 | -0.039 | -0.113 | -0.472 | 0.000 |
| Home Good Price/CPI | 0.067 | -0.027 | 0.088 | -0.027 | -0.022 | -0.017 | -0.007 | -0.012 | 0.033 | -0.061 | 0.069 |
| Domestic Inflation | 0.000 | -0.014 | 0.000 | 0.001 | 0.001 | 0.000 | -0.005 | -0.005 | -0.004 | -0.018 | 0.002 |
| Consumption/Output ratio | 99.99 | 100.10 | 100.00 | 100.03 | 100.02 | 100.02 | 100.01 | 100.01 | 100.03 | 100.13 | 99.99 |

Table 15: Welfare Comparisons with Taylor Rule with Moderate Reaction to Output Gap

$$\phi_\pi = 1.5, \rho_\nu = 0.6, \sigma_\nu = 0.6\%, \rho_\alpha = 0.7, \sigma_\alpha = 1.2\%$$

$$\phi_y = 0.125, \rho_z = 0.85, \phi = 0.25, \gamma = 1, \varphi = 1, \sigma_z = 5\%, \omega = 0.75$$

Domestic Inflation-CPI Inflation

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | -0.1187 | -0.1146 | -0.1102 | -0.1226 | -0.0867 |
| 0.75 | -0.0197 | -0.0139 | -0.0068 | 0.0046 | 0.0384 |
| 1 | -0.0035 | 0.0045 | 0.0137 | 0.0238 | 0.0679 |
| 2 | 0.0311 | 0.0439 | 0.0577 | 0.0564 | 0.1288 |
| 4 | 0.0574 | 0.0736 | 0.0904 | 0.0749 | 0.171 |

Gaps smaller!

CPI Inflation -PEG

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | 0.0193 | 0.038 | 0.0523 | 0.0776 | 0.0789 |
| 0.75 | 0.0194 | 0.0181 | 0.0144 | 0.0058 | -0.0189 |
| 1 | 0.0074 | 0.0028 | -0.0038 | -0.0121 | -0.0457 |
| 2 | -0.0244 | -0.0351 | -0.0471 | -0.0435 | -0.1046 |
| 4 | -0.0515 | -0.0661 | -0.0815 | -0.0615 | -0.1487 |

Domestic Inflation-PEG

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | -0.0994 | -0.0766 | -0.0579 | -0.0450 | -0.0078 |
| 0.75 | -0.0003 | 0.0042 | 0.0076 | 0.0104 | 0.0195 |
| 1 | 0.0039 | 0.0073 | 0.0099 | 0.012 | 0.0222 |
| 2 | 0.0067 | 0.0088 | 0.0106 | 0.0129 | 0.0242 |
| 4 | 0.006 | 0.0075 | 0.009 | 0.0134 | 0.0223 |

Dominance relative to SS

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|------|-----|------|---|---|
| 0.5 | 1 | 1 | 1 | 1 | 1 |
| 0.75 | 1 | 3 | 3 | 3 | 2 |
| 1 | 3 | 3 | 2 | 2 | 2 |
| 2 | 2 | 2 | 2 | 2 | 2 |
| 4 | 2 | 2 | 2 | 2 | 2 |

More PPIs!

Table 20: Welfare Comparisons with Lower Food Import Share

$$\phi_{\pi} = 1.5, \rho_{\nu} = 0.6, \sigma_{\nu} = 0.6\%, \rho_{\alpha} = 0.85, \sigma_{\alpha} = 1.2\%$$

$$\phi_{\mathbf{y}} = 0.0, \rho_{z} = 0.85, \phi = 0.1, \gamma = 1, \varphi = 1, \sigma_z = 5\%, \omega = 0.9$$

$$\sigma_p = 1.3\%, \rho_p = 0.99$$

Domestic Inflation-CPI Inflation

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | -0.0394 | -0.0392 | -0.039 | -0.0379 | -0.0363 |
| 0.75 | -0.0063 | -0.0063 | -0.0058 | -0.0062 | 0.0025 |
| 1 | -0.0034 | -0.003 | -0.0021 | -0.0027 | 0.0091 |
| 2 | 0.0011 | 0.0024 | 0.0044 | 0.0030 | 0.0219 |
| 4 | 0.0037 | 0.0057 | 0.0084 | 0.0063 | 0.0301 |

CPI Inflation -PEG

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | -0.0982 | -0.0933 | -0.089 | -0.0736 | -0.0734 |
| 0.75 | -0.0199 | -0.0165 | -0.0138 | -0.0047 | -0.006 |
| 1 | -0.0111 | -0.0082 | -0.006 | 0.0005 | -0.0007 |
| 2 | 0.0006 | 0.0024 | 0.0036 | 0.0031 | 0.0032 |
| 4 | 0.0052 | 0.0063 | 0.0067 | -0.0001 | 0.002 |

Domestic Inflation-PEG

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|---------|---------|---------|---------|---------|
| 0.5 | -0.1376 | -0.1326 | -0.128 | -0.1115 | -0.1097 |
| 0.75 | -0.0262 | -0.0228 | -0.0196 | -0.0109 | -0.0035 |
| 1 | -0.0145 | -0.0112 | -0.0081 | -0.0022 | 0.0085 |
| 2 | 0.0017 | 0.0049 | 0.008 | 0.0061 | 0.0251 |
| 4 | 0.009 | 0.012 | 0.0152 | 0.0062 | 0.0321 |

Dominance relative to SS

| $\sigma \setminus \eta$ | 0.25 | 0.5 | 0.75 | 1 | 2 |
|-------------------------|------|-----|------|---|---|
| 0.5 | 1 | 1 | 1 | 1 | 1 |
| 0.75 | 1 | 1 | 1 | 1 | 2 |
| 1 | 1 | 1 | 1 | 1 | 2 |
| 2 | 3 | 3 | 3 | 3 | 3 |
| 4 | 3 | 3 | 3 | 2 | 3 |

More PPIs!

V. Conclusions

Food prices are highly persistent and have long been a main source of global inflationary/deflationary pressures.

Recent experience (2007-08) and now suggest that IT CBs have a hard time in meeting central targets.

But this is also because of some weakening of Taylor rules relative to baseline (normatively speaking).

These imported price pressures unlikely to abate for quite some time, as i^* remain low, world growth picking up, and the US dollar depreciating in real terms.

Previous studies advocating accommodation through core CPI targeting.

Yet, they did not consider the peculiar role of food in utility, nor large differences in CPI baskets inducing RER volatility, nor the relative magnitude of z^* shocks viz others.

When this is done, broad CPI targeting often wins out welfare-wise.

Intuition of our results:

Given large z^* shocks, broad CPI targeting emerge as a “compromise” between mitigating some of the sticky price distortion, stabilize the CPI-based RER and hence consumption, and allow exploitation of TOT externality.

Hence CPI targeting will be the more welfare-dominant, the larger $\text{var}(z^*)$ shocks, the higher the coefficient of risk aversion in consumption (lower inter-temporal substitution), and the greater the disutility of labor.

Bottom-line: *leniency toward imported food price inflation not optimal in most cases!*

3 things to like about this result:

- Avoids ad-hoc and non-transparent ways of purging CPI and identifying core inflation.
- Mitigates some of the regressive distributional implications of PPI targeting.
- If applied by all central banks, it would eliminate the externality problem associated with PPI targeting and hence help keep global inflationary pressures at bay.