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# Monetary Policy Responses to Food and Fuel Price Volatility

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## Presentation draws on:

- Joint work with Rahul Anand (IMF):  
“Optimal Price Indices for Targeting Inflation under Incomplete Markets”, NBER Working Paper No. 16290
  - “Rethinking Central Banking”:  
Sept. 2011 Report of Committee on International Economic and Policy Reform
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## Motivation

- Low and stable inflation is a key objective of monetary policy
  - Choosing appropriate price index important operational issue in implementing any version of monetary policy
  - Operational issues I do not look at:
    - Level of inflation
    - Point vs. band target
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## Related literature

- Targeting core (excl. food and energy prices) is optimal
    - It is a suitable measure of inflation (Wynne, 1999)
    - Food and energy shocks are supply shocks, so no monetary intervention is required (Mishkin, 2007,2008)
  - Theoretical Basis
    - Goodfriend and King (1997)
    - Aoki (2001)
  - Major assumption - complete markets
    - Price stickiness is the only distortion
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## But...

- Markets are far from complete
  - Consumers are credit constrained
  - Unable to smooth consumption over time
    - Campbell and Mankiw (1989, 1990, 1991); Fuhrer (2000); Muscatelli et. al (2003)
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## Share of population with access to formal finance

Emerging Markets	Percent with access	Advanced Economies	Percent with access
Argentina	28	Belgium	97
Brazil	43	Canada	96
Chile	60	Denmark	99
China	42	France	96
Egypt	41	Germany	97
India	48	Italy	75
Indonesia	40	Netherlands	100
Iran	31	Spain	95
Korea	63	Sweden	99
Malaysia	60	Switzerland	88
Mexico	25	United Kingdom	91
South Africa	46	United States	91
Average	44	Average	94

## High share of expenditure on food in household expenditure in EMs

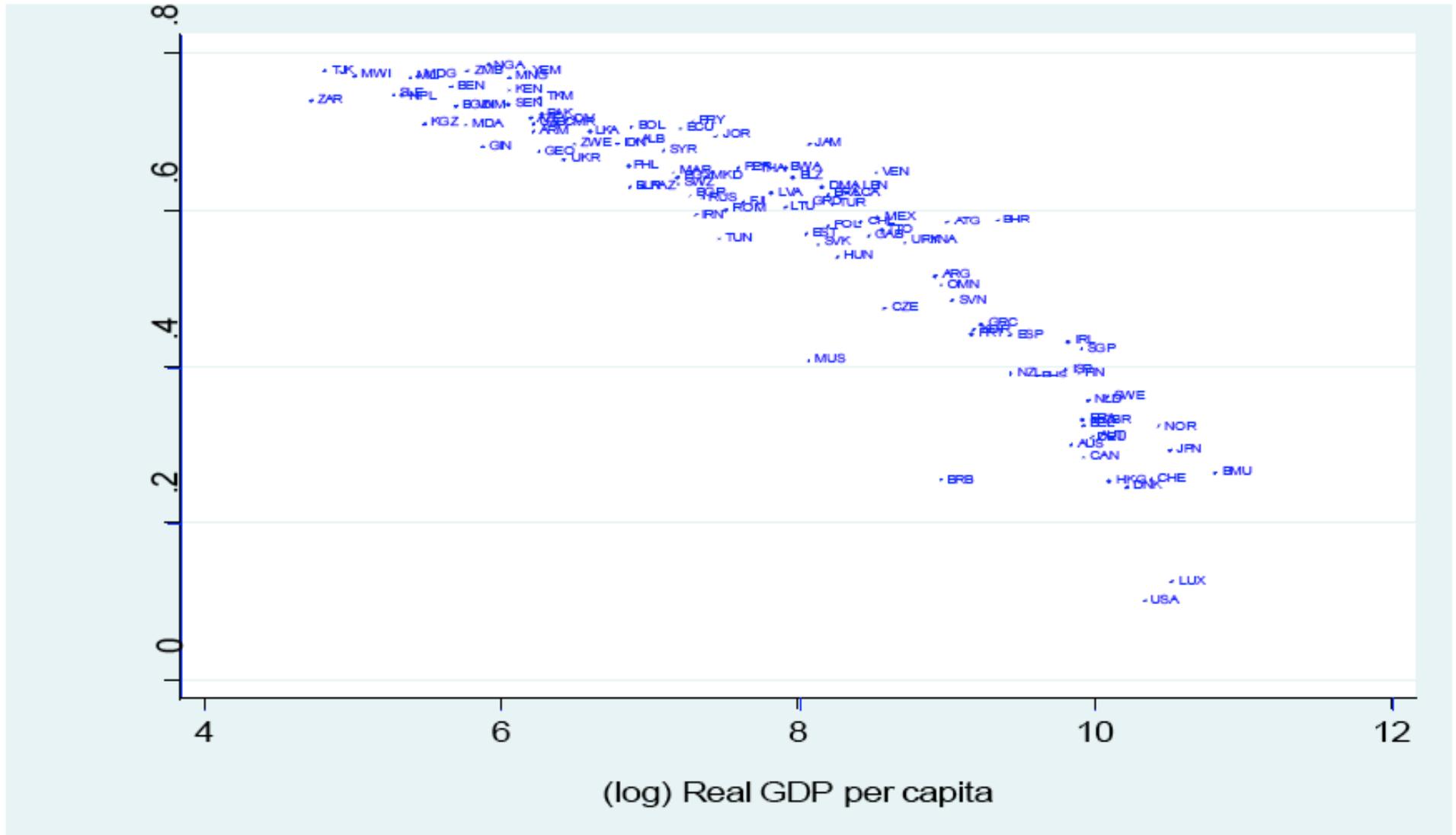
<i>Emerging Markets</i>		<i>Advanced Economies</i>	
Indonesia	53.0	Japan	14.7
Vietnam	49.8	Germany	11.5
India	48.8	Australia	10.8
China	36.7	Canada	9.3
Russia	33.2	United Kingdom	8.8
Malaysia	28.0	USA	5.7
<b>Average</b>	<b>41.6</b>	<b>Average</b>	<b>10.1</b>

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## Financial frictions imply...

- Idiosyncratic shocks matter for consumption choice
  - Income and expenditure of households depend on
    - Composition of household expenditure
    - Price elasticity of demand for goods
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Figure 2. Income Elasticity of Demand for Food, 1996



Source: WDI and International Food Consumption Patterns Dataset, Economic Research Service, USDA.



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# Contributions

- Analytically determine choice of appropriate price index in an economy with financial frictions
  - More realistic modeling of emerging market economies
  - Results more generally applicable to economies with significant financial frictions
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## Model incorporates these features:

- Incomplete markets – “rule of thumb consumers”
  - Subsistence level food consumption
  - Low elasticity of substitution for food
  - Share of expenditure on food in total household expenditure high
  - Closed economy, no physical capital
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# Model

- Two sector, two good closed economy new Keynesian model
- Sectors
  - Flexible price sector (food)
  - Sticky price sector (non food)
- Goods
  - one type of flexible price good ( $C_F$ )
  - continuum of monopolistically produced sticky price goods

$c(z)$  indexed in  $z \in (0,1)$

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- $1+\lambda$  Continuum of infinitely lived households
    - Heterogeneous in terms of borrowing opportunities
    - No storage technology or investment
  
  - $\lambda$  fraction face liquidity constraint: consume their wage income every period
  
  - Others are free to borrow
  
  - Each household owns a firm and produces one good (labor immobile between sectors)
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- Households, indexed by  $i$ , maximize the discounted stream of utility

$$E_0 \sum_{t=0}^{\infty} \beta^t [U(C_t^i, N_t^i)]$$

- $u(\cdot)$  represents the utility of the form

$$U(C_t^i, N_t^i) = \frac{(C_t^i)^{1-\sigma}}{1-\sigma} - \phi_n \frac{(N_t^i)^{1+\psi}}{1+\psi}$$

$$C_t^i = \left[ \gamma^{\frac{1}{\eta}} (C_{f,t}^i - C^*)^{-\frac{1}{\eta}} + (1-\gamma)^{\frac{1}{\eta}} (C_{s,t}^i)^{1-\frac{1}{\eta}} \right]^{\frac{1}{1-\frac{1}{\eta}}}$$

$$C_{s,t}^i = \left[ \int_0^1 c_t^i(z)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}$$

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- Monetary policy rule (Taylor rule)

$$\log(R_t / \bar{R}) = \rho_i \log(R_{t-1} / \bar{R}) + \rho_\pi \log(\Pi_t / \bar{\Pi}) + \rho_y \log(Y_t / \bar{Y})$$

- Flexible price sector shock

$$A_{f,t+1} = \rho_{af} A_{f,t} + \xi_t, \xi_t \approx i.i.d (0, \sigma_{a,f})$$

- Sticky price sector shock

$$A_{s,t+1} = \rho_{as} A_{s,t} + v_t, v_t \approx i.i.d (0, \sigma_{a,s})$$

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# Two market specifications

- Complete financial markets
  
  - Incomplete financial markets
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# Policy regimes

- Strict core inflation targeting

$$\log(R_t / \bar{R}) = \rho_i \log(R_{t-1} / \bar{R}) + \rho_\pi \log(\Pi_{s,t} / \bar{\Pi}_s)$$

- Strict headline inflation targeting

$$\log(R_t / \bar{R}) = \rho_i \log(R_{t-1} / \bar{R}) + \rho_\pi \log(\Pi_t / \bar{\Pi})$$

- Flexible core inflation targeting

$$\log(R_t / \bar{R}) = \rho_i \log(R_{t-1} / \bar{R}) + \rho_\pi \log(\Pi_{s,t} / \bar{\Pi}_s) + \rho_y \log(Y_t / \bar{Y})$$

- Flexible headline inflation targeting

$$\log(R_t / \bar{R}) = \rho_i \log(R_{t-1} / \bar{R}) + \rho_\pi \log(\Pi_t / \bar{\Pi}) + \rho_y \log(Y_t / \bar{Y})$$

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## Calculating welfare gains

- Welfare under strict core inflation targeting as baseline
- Welfare cost,  $\omega^c$ , is defined as consumption needed to make consumers as well off under strict core inflation targeting as under regime  $a$

$$V_0^a = E_0 \sum_{t=0}^{\infty} \beta^t U((1 + \omega^c)C_t^r, N_t^r)$$

- Positive number indicates welfare is higher under regime  $a$
  - $\omega^c * 100$  gives the percentage of life time consumption
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## Results: Welfare cost of targeting different price indices

	<i>Complete Markets</i>			<i>Incomplete Markets</i>		
	Strict Headline Targeting	Flexible Headline Targeting	Flexible Core Targeting	Strict Headline Targeting	Flexible Headline Targeting	Flexible Core Targeting
Welfare gain (in % of strict core inflation targeting consumption)	-0.07	-0.22	-0.19	3.21	4.18	1.58

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## Explanation of results

- Constrained households' demand insensitive to interest rate fluctuations, determined by real wages
  - Financial friction – establishes a link between real income of constrained consumers and aggregate demand
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- So, price in flexible price sector affects aggregate demand
  - In order to affect aggregate demand, central bank must stabilize prices in flexible price sector
  - Also, inflation and output may move in opposite directions – stabilizing output gap is welfare improving
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## Sensitivity analysis

- Without subsistence level of food consumption
- Elasticity of substitution between food and non food
- Lots of additional analysis of sensitivity to model parameters

Results hold up quite well

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# Extensions

- Alternate characterization of complete markets
  - More general setting – where households in either sector can be credit constrained
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# Alternate complete market setting

- In most models – households can insure fully against income risks *ex-ante*
  - We look at setting– when households can insure only *ex-post*
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# Results under alternate complete market settings

<i>Elasticity of Substitution</i>	<i>Flexible Headline Inflation Targeting</i>
0.6 <sup>a</sup>	0.24
0.7	0.05
0.8	-0.02

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# Complete general market setting

- A fraction of people in both sectors are credit constrained
  - We choose the fractions such that overall 50% of the households in the economy are credit constrained
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# Results of general market setting

<i>Fraction of households in sticky price sector with access to formal finance</i>	<i>Fraction of households in flexible price sector with access to formal finance</i>	<i>Welfare gains from flexible headline inflation targeting</i>
0.10	0.90	0.38
0.20	0.80	0.22
0.30	0.70	0.21
0.40	0.60	0.22
0.50	0.50	0.24
0.60	0.40	0.26
0.70	0.30	0.28
0.80	0.20	0.29
0.90	0.10	0.30

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## Conclusions

- In the presence of financial frictions – core inflation targeting not optimal
  - Presence of credit constrained consumers – establishes a link between price in the flexible price sector and aggregate demand
  - Since inflation and output may move in opposite direction – targeting flexible headline inflation optimal
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# Policy implications, broader intuition

- In real world, central bank has to respond to food price volatility from a pure welfare perspective
  - Inflation expectations another channel
  - Sub-optimal response to supply shocks  
Yes, but...
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# Rethinking Central Banking

## Committee on International Economic Policy and Reform

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# New challenges facing central banks

- Sovereign debt rising; financial repression?
  - Exchange rate
  - And...food/fuel/commodity price increases
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# The Art of Central Banking

