

Commodity Price Booms: Macroeconomic and Distributional Implications

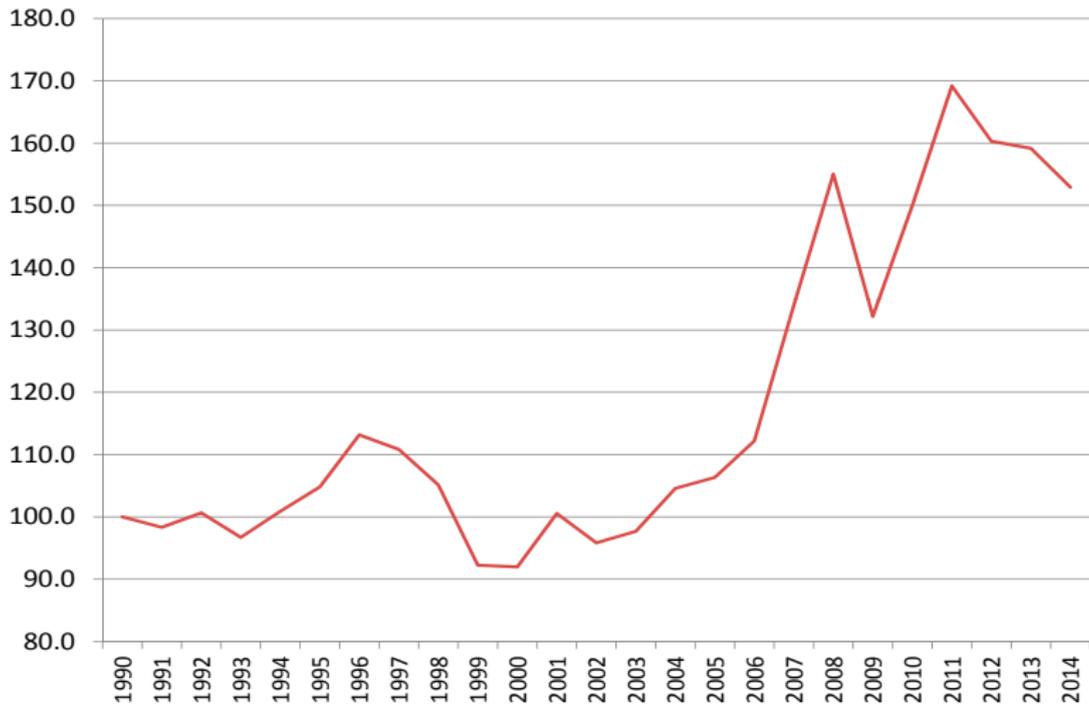
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Workshop on Macroeconomic Policy and Income Inequality

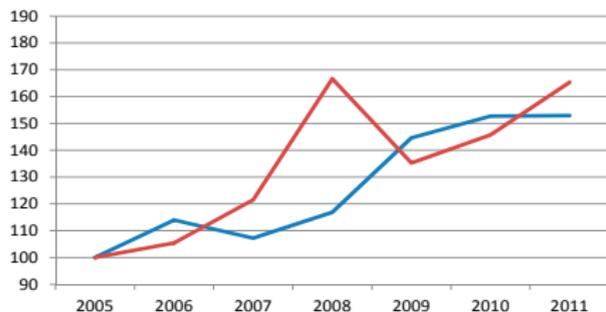
This paper is part of a research project on macroeconomic policy in low-income countries supported by U.K.'s Department for International Development (DFID), and it should not be reported as representing the views of the International Monetary Fund or of DFID.

FAO FOOD PRICE INDEX (1990 = 100)

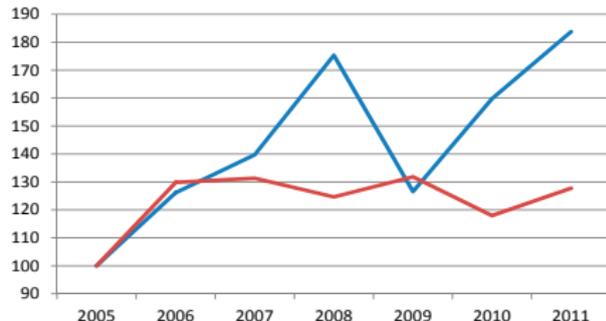


IMPORT AND EXPORT PRICES

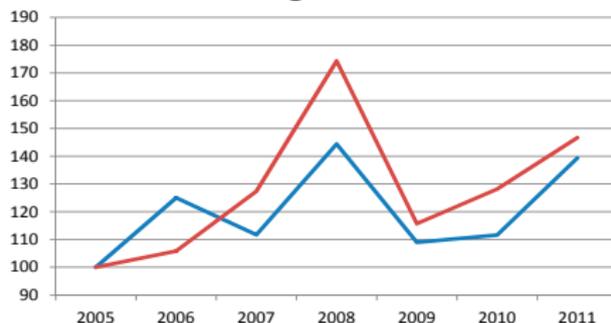
Ghana



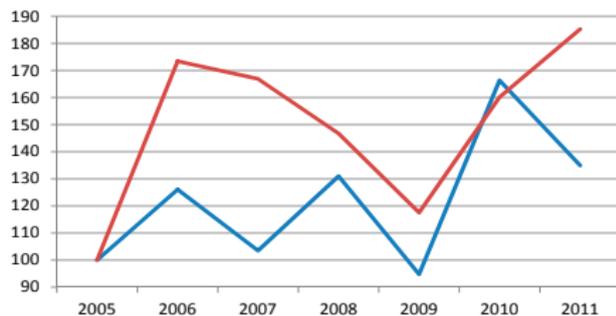
Vietnam



Uganda



Zimbabwe



— Exports Price — Imports Price

INCREASE IN FOOD PRICES IMPLICATIONS

- Expenditure of household in food:
 - ① 13 % high-income countries
 - ② 29 % middle-income countries
 - ③ 47 % low-income countries

- Share of the population in rural areas:
 - ① 20 % high-income countries
 - ② 50 % middle-income countries
 - ③ 62 % lower-middle income countries
 - ④ 72 % low-income countries

RESPONSE TO THE SHOCK

- Government response:
 - 1 Reduction in taxes and tariffs, Increase in food subsidies, Price controls, Increase public wage
 - 2 Producer credit, Minimum produces price, Subsidy to inputs
 - 3 Export tax, Quantitative export controls, Export price controls

OBJECTIVES

Quantitative implications of the food and commodity price shocks in LICs?

- For the macroeconomy
- At a more granular level, for the distribution of income
- under key policies actually followed
- ... and what would have happened under alternative policies

METHODOLOGY

- Pose general-equilibrium multi-sector heterogeneous agent model
- Estimate the model using macro and household-level survey data
- Long-run and dynamic comparisons

PREVIEW OF RESULTS

- In Ghana, observed shocks and tax policies
 - ① Have important consequences for aggregate consumption and investment
 - ② Increase consumption inequality
- LIC specific features matter for these conclusions
 - ① Financial market frictions behind increase in consumption inequality
 - ② Structure of the economy (exports are low value added commodities) behind fall in investment

CONNECTIONS TO LITERATURE

- Food Price Shocks

- Adam (2011), Aksoy and Isik-Dikmelik (2008), Regmi et al. (2001), Rakotoarisoa, Iafrate, and Paschali (2011), Caselli et al. (2012) Adam et al. (2013), Cudjoe et al. (2008), Ivanic et al. (2008)

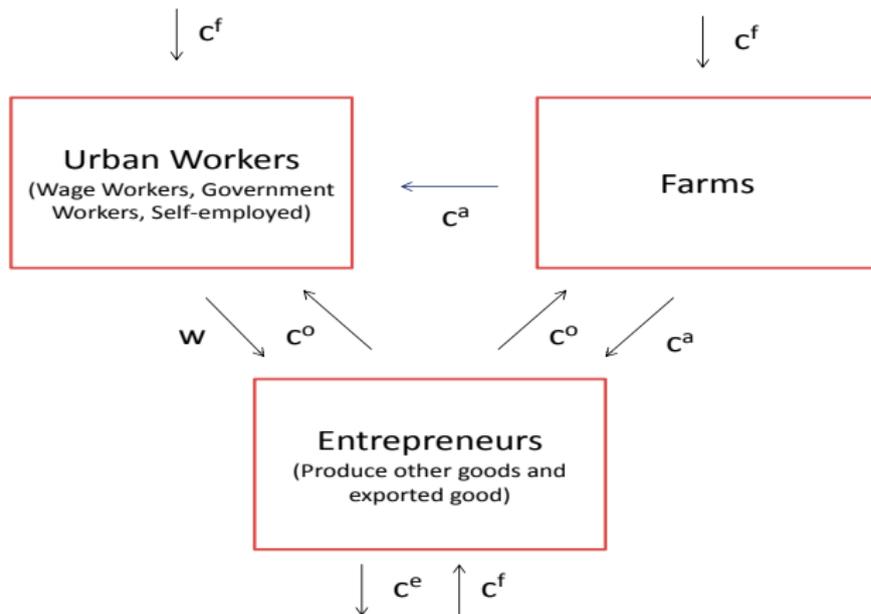
- Structural Transformation

- Adamopoulos and Restuccia (2011), Caselli (2005), Gollin et al. (2012), Gollin et al. (2010) Restuccia (2008), Herrendford et al. (2012), Kongsamunt et al. (2000), Ngai and Pissarides (2008)

- Income Inequality

- Ayiagari (1994), Imrohoroglu (1989)
- Heathcote, Storessletten and Violante (2009), Guvenen (2013)

MODEL FRAMEWORK



MODEL: ENTREPRENEURS

$$\max_{\{c^a, c^*, c^o, M, H^o, H^r, K\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t^{F,f}, c_t^{F,o})$$

s.t.

$$c^{F,f} = A(c^{F,a}, c^{F,*})$$

$$p^a(c^{F,a} + M) + p^* c^{F,*} + c^{F,o} + x + = \pi^o + \pi^r - T^F(\pi^o, \pi^r)$$

$$\pi^o = z^o F^o(K^o, H_d^o) - w H_d^o$$

$$\pi^r = p^r z^r F^r(H_d^r, M) - w H_d^r$$

$$K_{+1} = x + (1 - \delta)K$$

$$x \geq 0, 0 < \delta \leq 1$$

MODEL: HOUSEHOLDS

$$\max_{\{c^a, c^*, c^o, b, h^g, h\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t^{H,f}, c_t^{H,o})$$

s.t.

$$c^{H,f} = A(c^{H,a}, c^{H,*})$$

$$p^a c^{H,a} + p^* c^{H,*} + c^{H,o} + (1 + R)b^H = b_{+1}^H + s^W (w^g h^g + wh) + Y^H - T^H(wh, Y^H)$$

$$Y^H = z^o s^E F(H - h - h^g)$$

$$h \in [0, H - h^g]$$

$$b_{+1}^H \leq B^H.$$

MODEL: FARMERS

$$\max_{\{c^a, c^*, c^o, b\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t^{A,f}, c_t^{A,o})$$

s.t.

$$c^{A,f} = A(c^{A,a}, c^{A,*})$$

$$p^a c^{A,a} + p^* c^{A,*} + c^{A,o} + (1 + R)b^A = b_{+1}^A + p^a Y^A - T^A(Y^A)$$

$$Y^A = s^A z^a l^\xi$$

$$b_{+1}^A \leq B^A$$

EQUILIBRIUM

An equilibrium for this economy is a vector of allocations of consumption, investment, time use and bond holding to farmers, urban workers, and entrepreneurs, together with prices $\{p^a, w, R\}$. Such that given the international interest rates $\{r^*\}$, the price of imported food $\{p^*\}$, the price of exported goods $\{p^r\}$, public employment and their wages $\{w^g, H^g\}$, a sequence of sectorial productivity shocks, and predetermined tax/transfers functions $\{T^F, T^H, T^A\}$, the vector of allocations of consumption, investment, time use and bond holding to farmers, urban workers, and entrepreneurs, together with prices $\{p^a, w, R\}$, solves the agents optimization problem and market clears.

TRANSMISSION MECHANISM

Macro

- Higher natural resource prices shift productive resources into this sector (Dutch disease?)
- For labor to shift, pressure for wages to go up
- For intermediates to shift, pressure for price of food to go up
- Shock is a positive terms of trade shock, consumptions go up
- Relative price of manufacturing goes down and labor goes out, investment falls

TRANSMISSION MECHANISM

Distribution

- Under complete markets all consumptions grow at par
- Farmers have a positive shock via the price of food
- Entrepreneurs face a negative shock (in eqn no profits from nat. res.)
- ... but lower investment means higher consumption in the short run
- Households face higher prices and higher wages

QUANTITATIVE EXPERIMENTS

- Unexpected shock: increase in prices
- .. and key policies observed (captured as changes in value added taxes)
- Use macro data and the richness of the model together with survey data to estimate model parameters
- ... eventually consider counterfactual experiments

DATA

- Ghana Urban Household Panel Survey (GUHPS): annual 2004-2012
1,156 - 2,100 workers, i.e. 400-600 households, depending on year
- Information on income, assets, occupation, sector, financial, household activity
- Ghana Living Standards Survey (GLSS): repeated cross-section, 2005-6, 2012-13. 18,000 households in last wave. (Just obtained 2005 wave from WB)

DATA: URBAN LABOR FORCE DISTRIBUTIONS

- 23% of *urban* labor force – wage-employed;
- ... of them 7% – public sector
- Urban labor force < 1/2 population. Mostly non-agricultural.
- In 2012 GLSS, 51% of labor force is in agriculture.

POPULATION SHARE

Parameter	Value
Pop. share wage earners μ^h	0.12
Pop. share agriculture μ^a	0.48
Pop. share non-ag hh. enterprises $\mu^{o,h}$	0.34
Pop. share firms μ^e	0.05

SPECIFICATION

- Functional forms:

$$u(c^a, c^*, c^o) = \lambda(\log(c^*)) + (1 - \lambda)(\log(c^a)) + \mu \log(c^o)$$

$$F^r(M, H) = z^r M^{\alpha^1} H^{1-\alpha^1}$$

$$F^o(K, H) = z^o K^{\alpha} H^{1-\alpha}$$

$$F^{o,H}(H) = s^e z^{o'} H^{\chi}$$

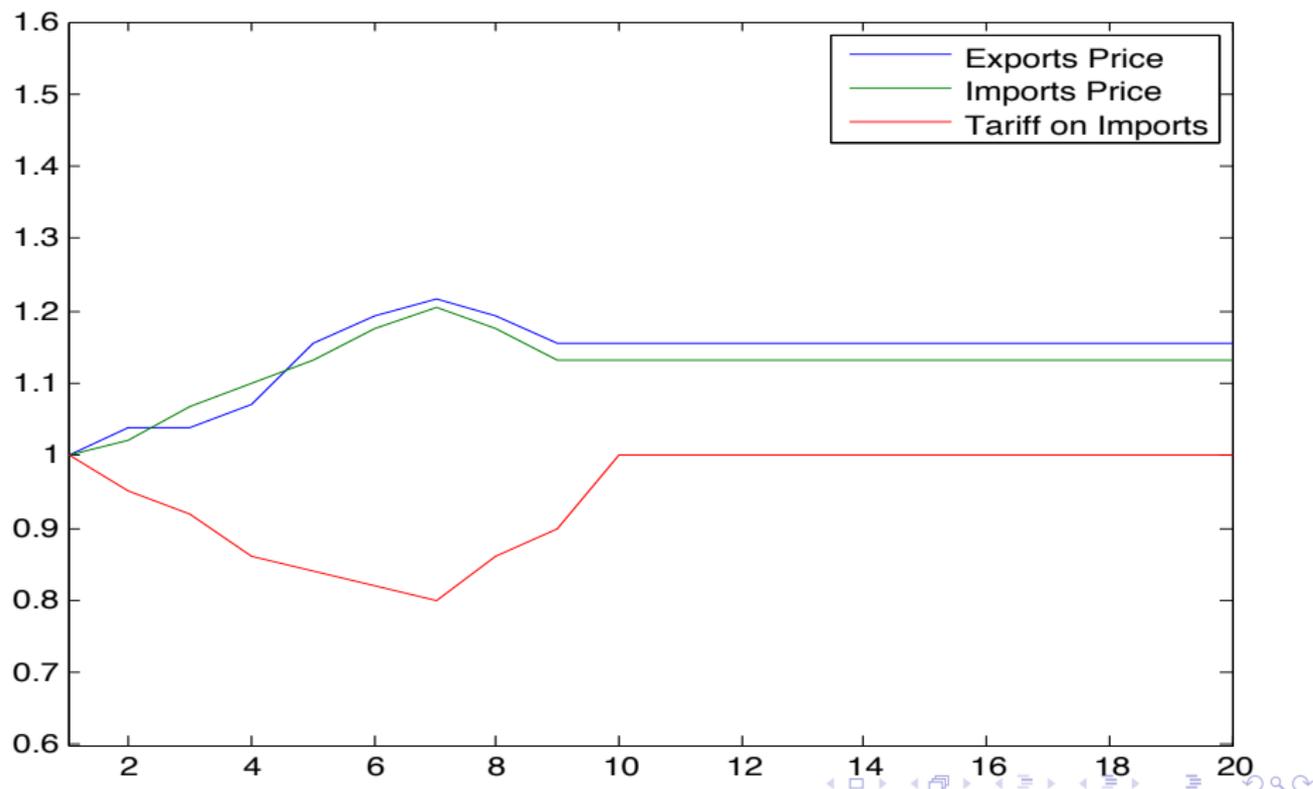
$$F^A(H) = s^a z^a H^{\xi}$$

CALIBRATION

Parameter	Value	Target
Preferences		
Discount factor β	0.96	Period = 1 year
Weight of numeraire in utility μ	0.91	Food Expenditure
Share of imported food in utility λ	0.16	Imported food expenditure
Technology		
Agricultural productivity z^a	0.5	Share of urban to rural income
Household enterprise productivity $z^{o'}$	0.9	Share of firm's productivity
Household enterprise prod. fn. χ	0.67	Standard range (U.S)
External sector productivity $p^r z^r$	1.7	Share of total exports in GDP
External sector production fn. labor share α_1	0.62	Standard range (U.S.)
Numeraire productivity z^o	1	Normalization
Numeraire production labor share η	0.59	Standard range (U.S.)
Depreciation in the Numeraire sector δ	0.06	Standard range (U.S)
Relative prices and wages		
Import price p^*	11	Exchange rate $p^*/p^a = 2.71$
Public wage premium w^g/w	1.5	Earnings data

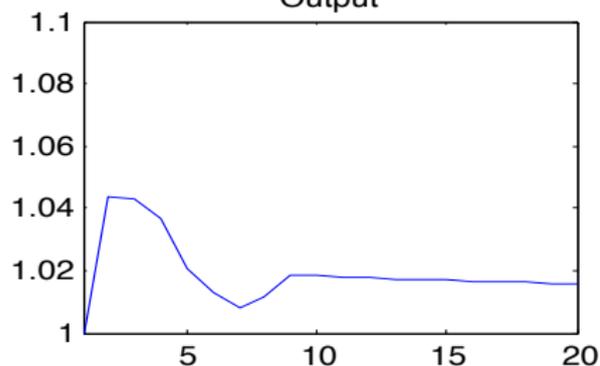
- Productivity states to inequality data (HH level).

BENCHMARK EXPERIMENT: SHOCKS

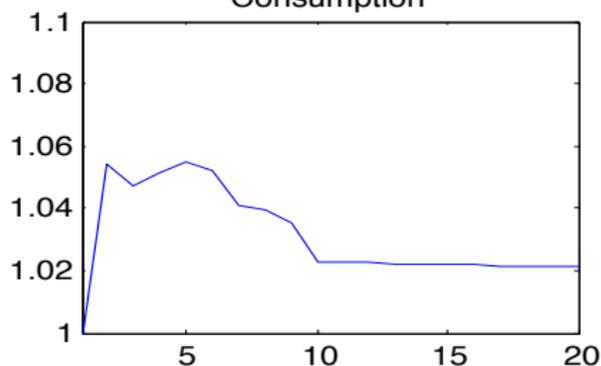


BENCHMARK EXPERIMENT: MACRO IMPLICATIONS

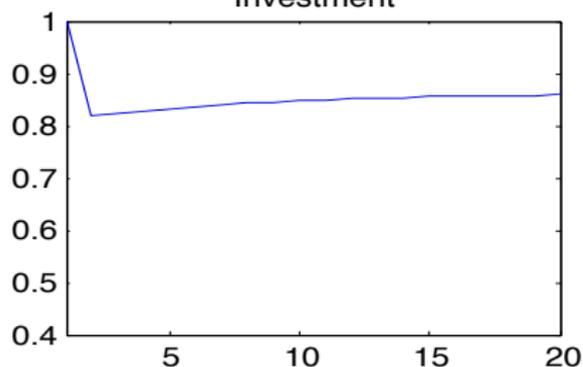
Output



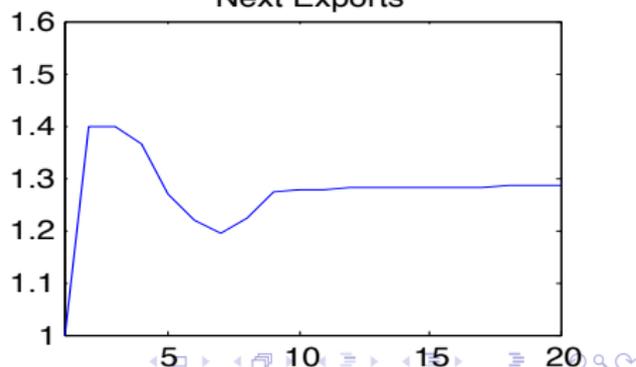
Consumption



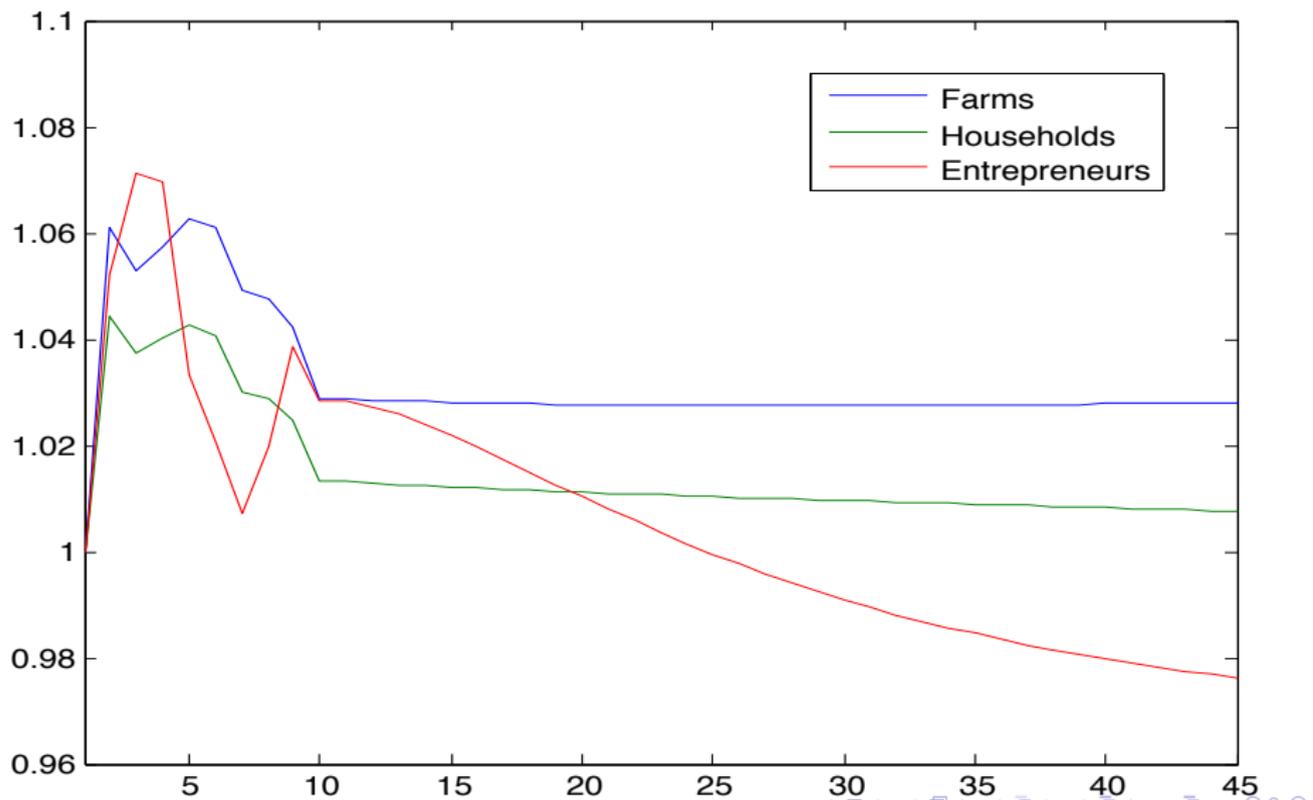
Investment



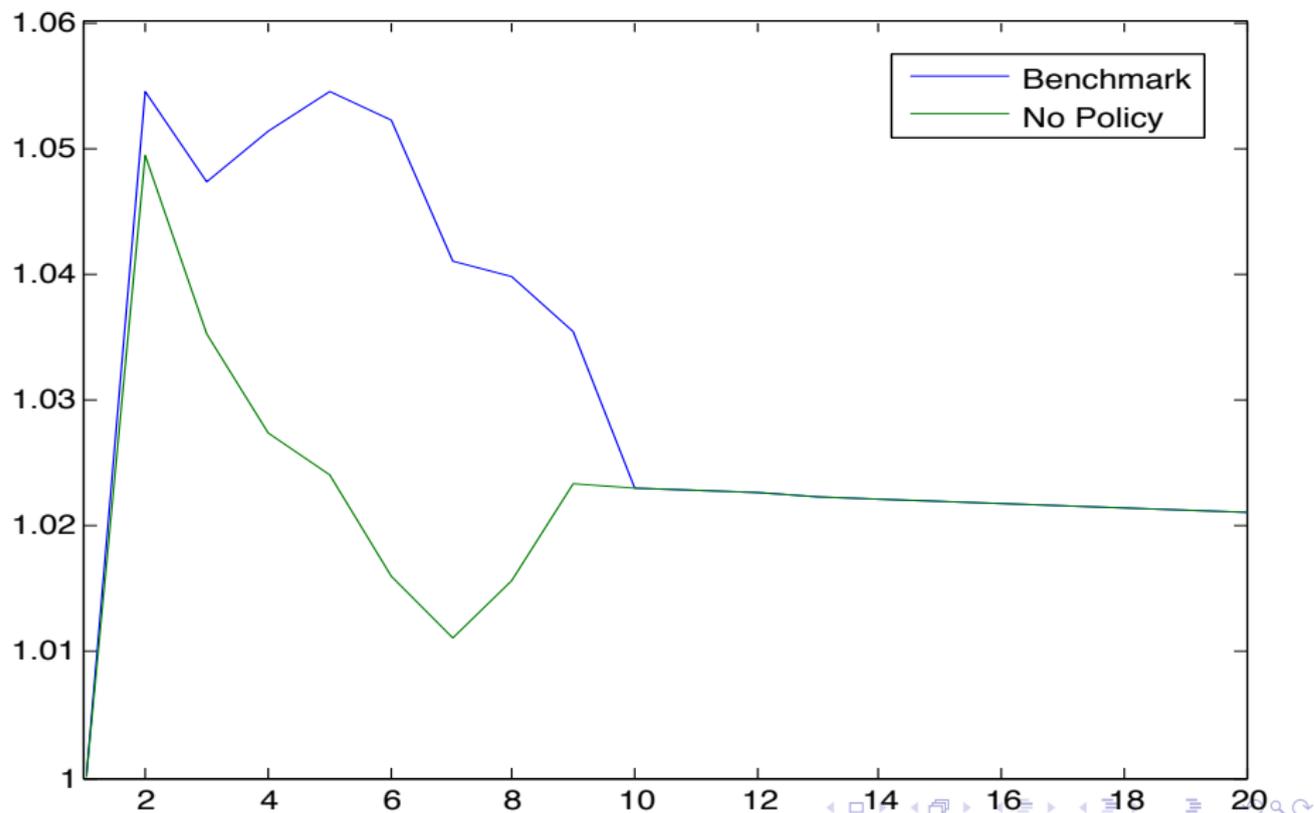
Next Exports



BENCHMARK EXPERIMENT: INEQUALITY IMPACT



THE ROLE OF - LACK OF -POLICY



CONCLUSION

- Build a general-equilibrium framework designed to study interactions of macroeconomic forces and disaggregated distributions
- Calibrate the model to Ghana
- Quantify the impact of an increase in the price of imported food
- Quantify the impact of a subsidy of domestic produced food

DATA: URBAN LABOR FORCE DISTRIBUTIONS

Employment Type Distribution, 2004-2012 avg.

Self-Employed	Unpaid	Wage-Employed
28.5	48.5	23.0

Sector Distribution of Wage Employees, 2006-2012 avg.

Manuf.	Agriculture	Other	Public
18.5	2.6	71.7	7.2

Sector Distribution of Self-Employed, 2006-2012 avg.

Manuf.	Services	Trading
17.8	24.9	57.3

- 23% of *urban* labor force – wage-employed; of them 7% – public sector
- Urban labor force < 1/2 population. Mostly non-agricultural.
- In 2012 GLSS, 51% of labor force is in agriculture.
- There are trends over the period, not sure how reliable.