Effects of China's Growth on the Food Prices and Food Exports of other Developing Countries.

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Motivation

Two debates about the consequences of the growth in China's food demand for the agricultural prices facing other countries.

Debate # 1

China's rapid economic emergence is a source of inflation in food prices:

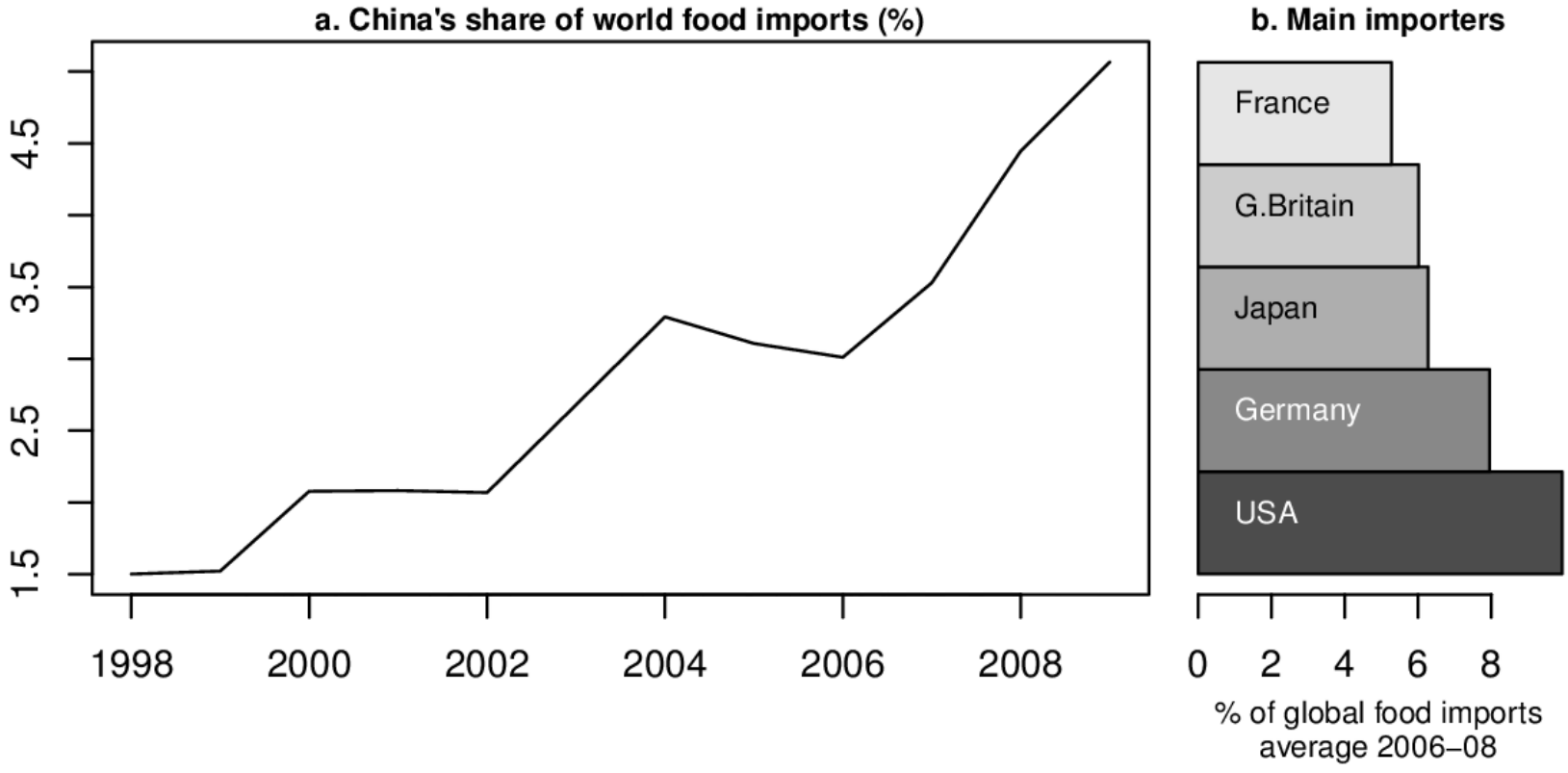
- Limited grain imports because of self-sufficiency policies [Abbott, Hurt, and Tyner(2008), Headey and Fan(2008)]
- Food consumption expenditures have risen more slowly than income [Wright(2008)]
- China's increased food demand may be one of many factors contributing to high world food prices [Carter, Rausser, and Smith(2008)]

Debate # 2

China is an engine of growth for the agricultural exports of developing nations [Goldstein et al.(2006), Obwona and Chirwa(2006), Jenkins, Peters, and Moreira(2008), Villoria(2009), Villoria et al.(2009)]:

- By directly exporting ag./food to China
- By benefiting from China-induced high food prices

China's share of global food markets 1998-2009 (I)



China's share of global food markets 1998-2009 (II)

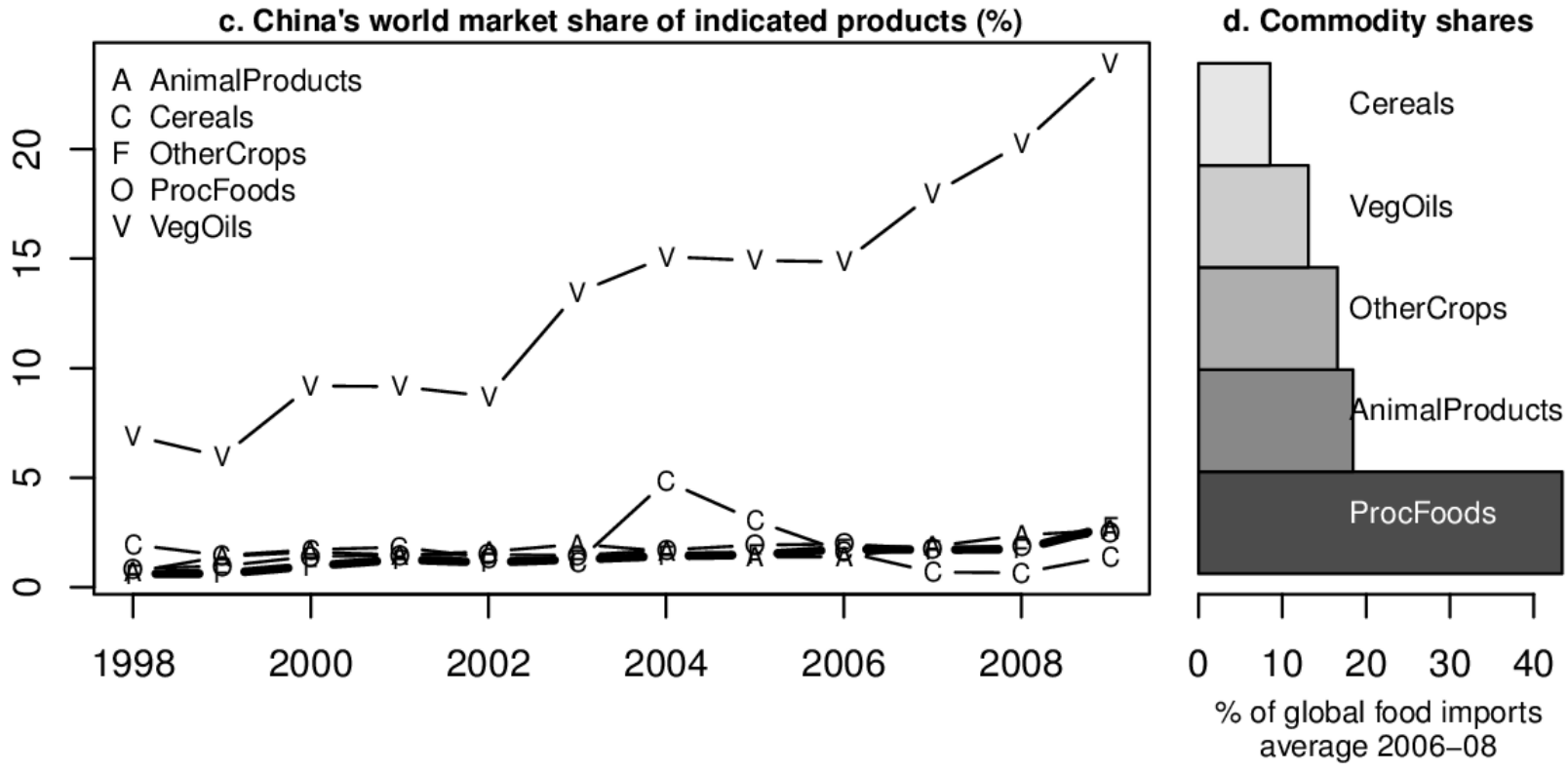
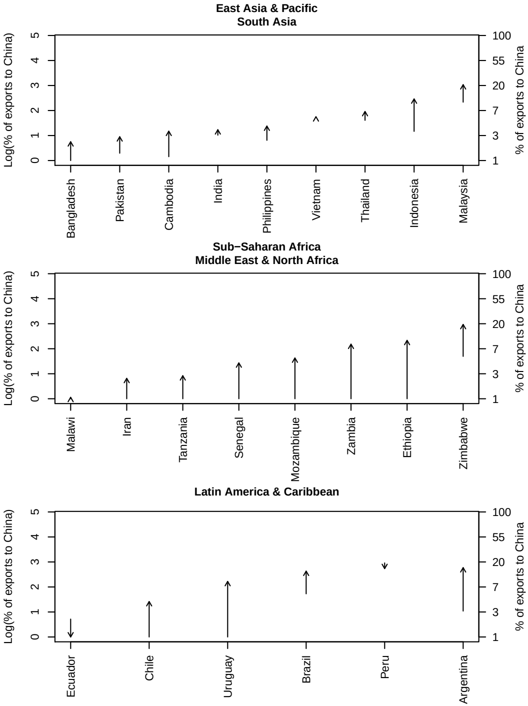


Table: China's main suppliers by commodity group (as % of total food imports in 1995-1997 and in 2007-2009.)

1995-97	Animal Prod.	Cereals	Other Crops	Proc. Foods	Veg. Oils	Total
Argentina	0.00	0.40	0.00	0.50	3.30	4.20
Brazil	0.20	0.00	0.10	0.70	9.30	10.20
Canada	0.20	9.20	0.30	0.40	0.20	10.30
Indonesia	0.00	0.00	0.80	0.20	1.30	2.30
Malaysia	0.10	0.00	0.30	0.20	6.60	7.20
Thailand	0.10	2.90	0.60	2.80	0.00	6.40
USA	1.90	8.60	0.70	3.10	7.20	21.60
Rest of the world	3.40	8.00	3.00	19.70	3.70	37.80
Total	5.90	29.10	5.80	27.50	31.80	100.00
2007-09	Animal Prod.	Cereals	Other Crops	Proc. Foods	Veg. Oils	Total
Argentina	0.40	0.00	0.10	0.20	12.70	13.40
Brazil	0.20	0.00	0.80	0.30	15.90	17.20
Canada	0.40	0.30	0.20	0.40	2.90	4.20
Indonesia	0.10	0.00	0.30	0.20	4.70	5.20
Malaysia	0.00	0.00	0.00	0.30	7.50	7.90
Thailand	0.00	0.50	1.90	0.80	0.00	3.20
USA	3.00	0.10	0.80	2.40	17.70	23.90
Rest of the world	4.80	0.80	3.10	13.80	2.40	25.00
Total	8.90	1.60	7.30	18.40	63.80	100.00

Notes: China's imports by food group and exporter during 1995-1997 (upper panel) and 2007-2009 (lower panel). In each panel, the row total describes the structure of food imports by product, while the column totals describe the structure of food imports by exporter. Source: COMTRADE, 2010.


East Asia & Pacific
South Asia
Sub−Saharan Africa
Middle East & North Africa
Latin America & Caribbean
Log(% of exports to China)
% of exports to China
0
1
2
3
4
5
1
3
7
20
55
100
Bangladesh
Pakistan
Cambodia
India
Philippines
Vietnam
Thailand
Indonesia
Malaysia
Malawi
Iran
Tanzania
Senegal
Mozambique
Zambia
Ethiopia
Zimbabwe
Ecuador
Chile
Uruguay
Brazil
Peru
Argentina

Research Questions

- What are the inflationary effects of China's growth on food prices in developing countries?
- Has (so far) China been an engine of growth to developing countries' exports?
  - Are these effects direct or indirect?

Short-Run Partial Equilibrium Model of International Trade in Agricultural Products

Supply:

$Y_i = p_i \bar{Q}_i$

$\bar{Q}_i = \sum_j q_{ij}$

Demand:

$E_j = \left[\sum_i \bar{\beta_{ij}}^{\sigma} p_{ij}^{1-\sigma} \right]^{1/(1-\sigma)}$

$U_j E_j = S_j$

Market Clearing:

$S_i - \sum_{m \neq i} p_{mi} q_{mi} = Y_i - p_i \sum_j q_{ij}$

Y_i = agricultural output value in region i (endogenous)

Q_i = fixed supply of the ag. sector in country i (exogenous)

p_i = ag. output price (endogenous)

q_{ij} = sales from region i to market j.

$\beta_{ij} > 0$ = (exogenous) distribution parameters (bilateral preference weights)

$\sigma > 1$ is the elasticity substitution

S_j = food expenditures in region j (endogenous)

U_j = Utility (endogenous)

E_j = CES Price Index (endogenous)

$p_{ij} = p_i \bar{t}_{ij}, t_{ij} - 1 =$ *ad-valorem* tariff equivalent of trade costs. (exogenous)

As an artifact of the equilibrium recover bilateral demands:

$$q_{ij} = \beta_{ij}^{\sigma} p_{ij}^{-\sigma} E_j^{1-\sigma} S_j.$$

Anderson and Wincoop (2003)' gravity theory:

$$X_{ij} = \beta_{ij}^{\sigma} \frac{Y_i S_j}{MA_i} \left(\frac{t_{ij}}{E_j} \right)^{1-\sigma},$$

where market access (MA_i) (aka OMR) is:

$$MA_i = \sum_j \beta_{ij}^{\sigma} t_{ij}^{1-\sigma} E_j^{\sigma-1} S_j$$

and (IMR):

$$E_j = \left[\sum_i \beta_{ij}^{\sigma} t_{ij}^{1-\sigma} Y_i MA_i^{-1} \right]^{1/(1-\sigma)}.$$

Trade costs function:

$$t_{ij} = (DIST_{ij}^{\delta_1} WT_{ij}^{\delta_2} \exp \sum_{k=3}^{K} \delta_k ind_k).$$

Model Implementation

- Mixed complementarity program (MCP) using the *calibrated share form* of the CES function of Rutherford(1995)
- Calibrated share form decomposes β_{ij} in terms of the value shares θ_{ij}, income terms ϕ_j,
- Trade costs t_{ij} and E_j estimated from gravity:

$$\widehat{t_{ij}^{1-\sigma}} = (DIST_{ij}^{\hat{\delta}_1} \exp \sum_{k=2}^{K} \hat{\delta}_k ind_k)$$

- Rest of the variables are observed

Estimation

Santos-Silva and Tenreyro(2006)'s critique: Heterokedasticity and zero trade flows
Poisson Pseudo-Maximum Likelihood (PPML) $X_{ij} \sim Poisson(\lambda_{ij})$

$$X_{ij} = \exp\left(\beta_0 + \alpha_i EXP_i + \alpha_j IMP_j + \gamma_1 \log(DIST_{ij}) + \gamma_2 \log(WT_{ij}) + \sum_{k=3} \gamma_k ind_k + \varepsilon_{ij}\right)$$

Data

- Normalize $p_i^0 = 1 \rightarrow Q_i^0 = Y_i^0$
- Y_i^0, S_j^0 come from GTAP V. 8.2 (91 countries in 2007)
- Bilateral imports in 2007 from COMTRADE (2010)
- Sample (91 countries) aprox. 94% of total food output value and global food expenditures, and 94% and 96% of global food imports and exports
- $91 \times 90 = 8,190$ potential trade flows. 1,579 (19.28% of the sample) are either NA/0

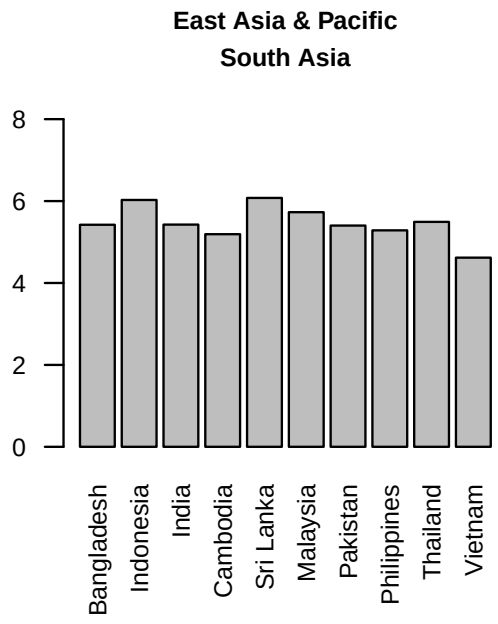
Results

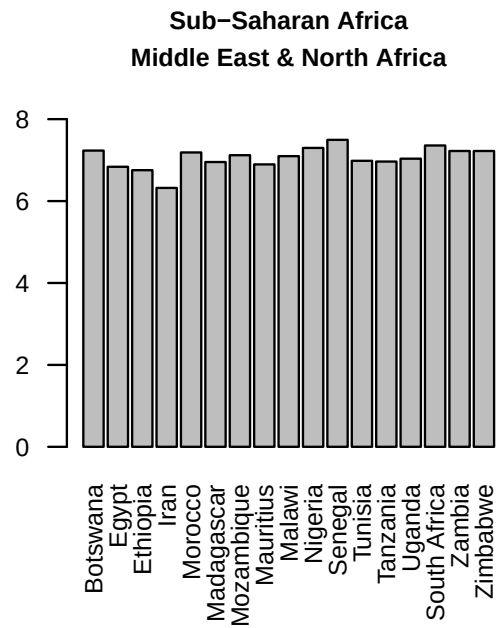
Table: Regression results

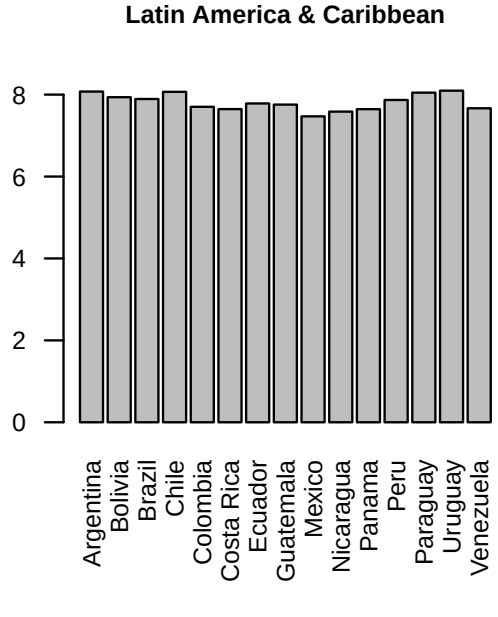
	Estimate	Std.Err	p-value	Lower	Upper
$\log(DIST_{ij})$ (bilateral distance)	-0.82	0.05	0.00	-0.92	-0.73
$\log(WT_{ij})$ (bilateral import tariffs)	-0.33	0.33	0.31	-0.97	0.31
ind_1: share a border	0.37	0.08	0.00	0.22	0.53
ind_2: both are landlocked	0.67	0.21	0.00	0.27	1.08
ind_3: speak the same language	0.03	0.10	0.77	-0.17	0.23
ind_4: belong in the same preferential trade agreement	0.55	0.09	0.00	0.36	0.73
ind_5: have the same legal system	0.17	0.06	0.01	0.05	0.30
ind_6: have the same currency	0.15	0.10	0.14	-0.05	0.35
ind_7: shared a colonizer	0.38	0.22	0.09	-0.05	0.82
ind_8: have had a colonial relationship	0.40	0.12	0.00	0.17	0.64
ind_9: have been part of the same empire	0.24	0.17	0.15	-0.09	0.58

Notes: n =8,190, 19.28% of the sample are either NA/0. "Lower" and "Upper" are the limits of a 95% confidence interval. pseudo-R^2=91.2%.

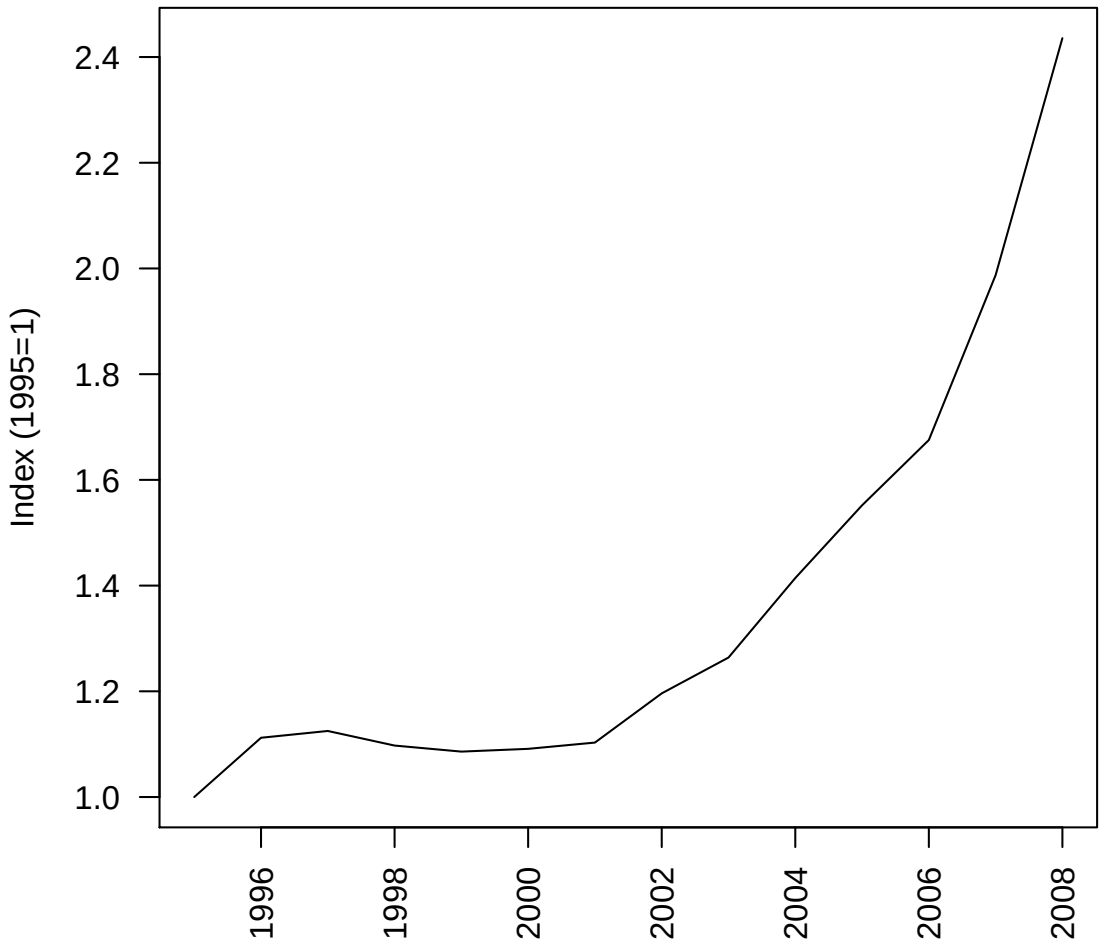
Estimated Trade Costs





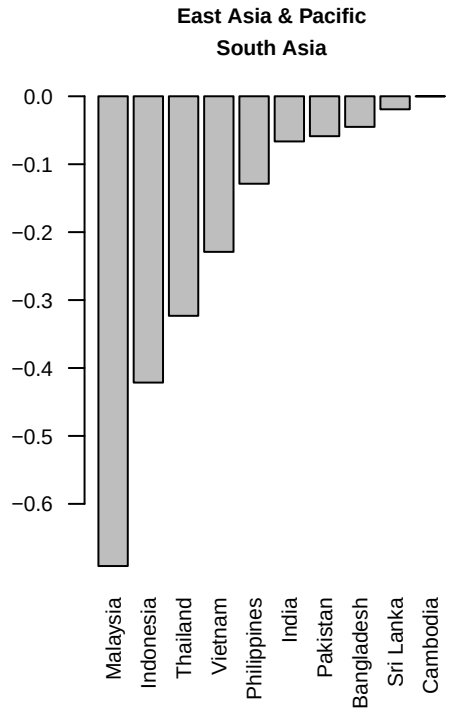


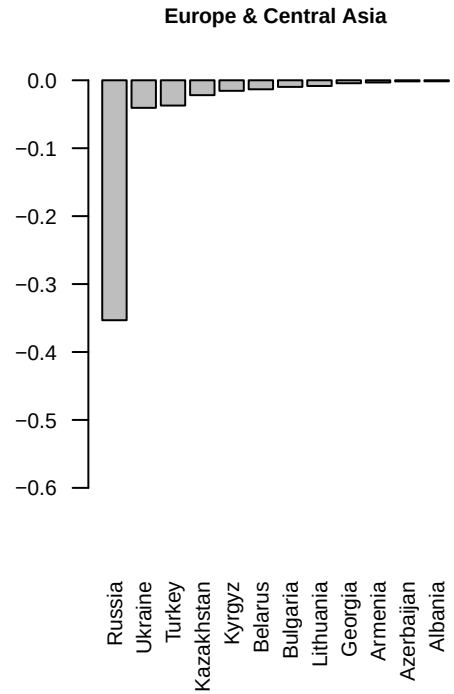
Counterfactual: Evolution of food expenditures in China during 1995-2008

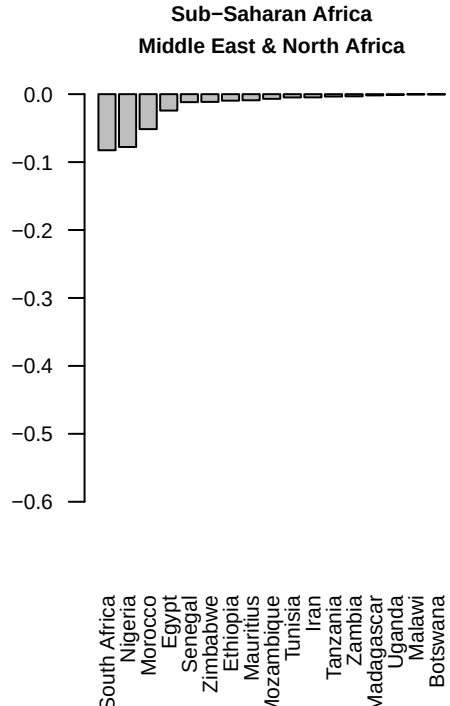


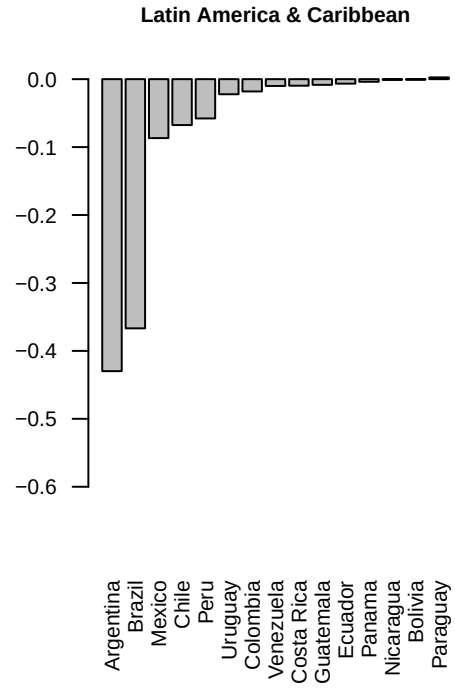
Index 1995=1 of

Supply
Prices

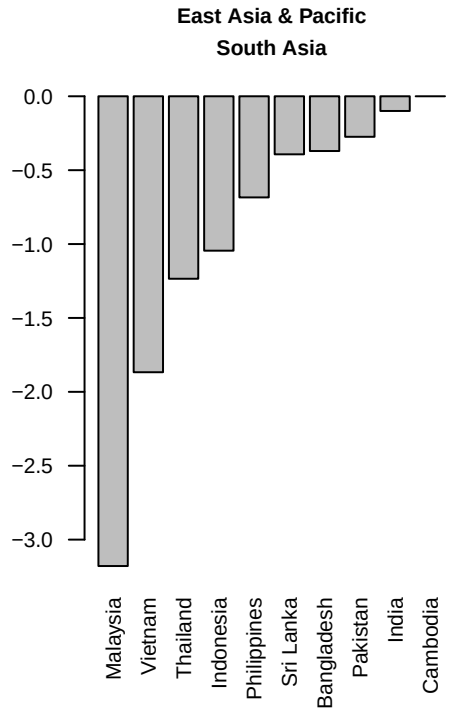


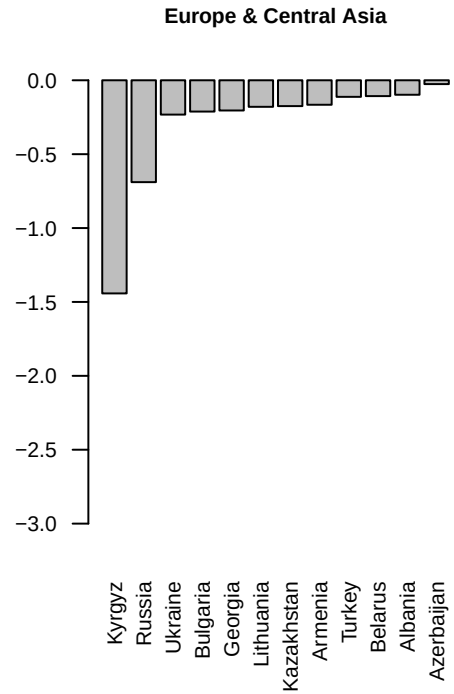


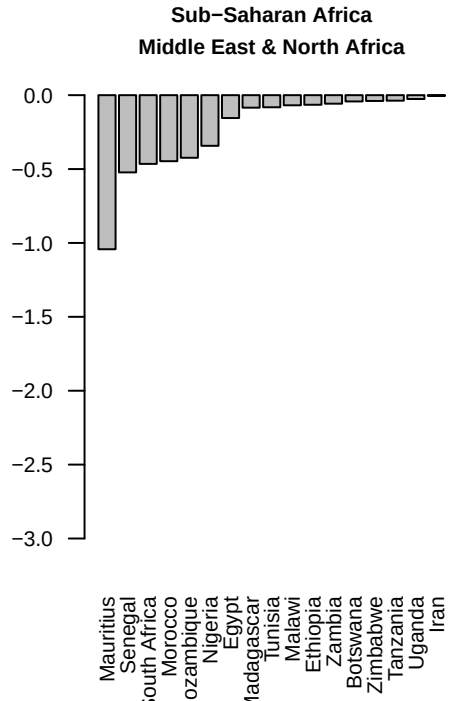


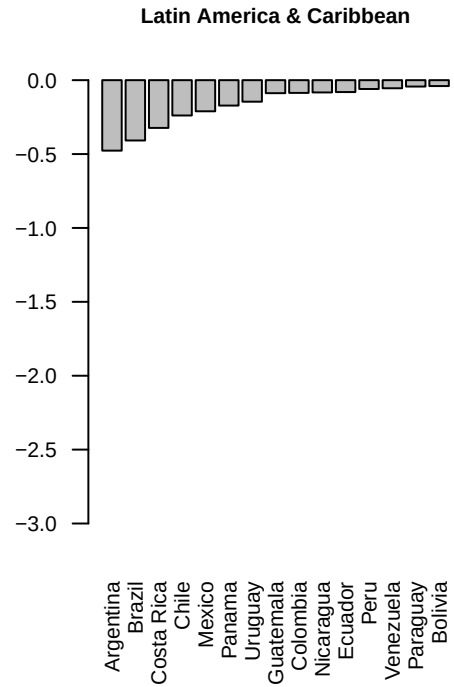


CES Prices

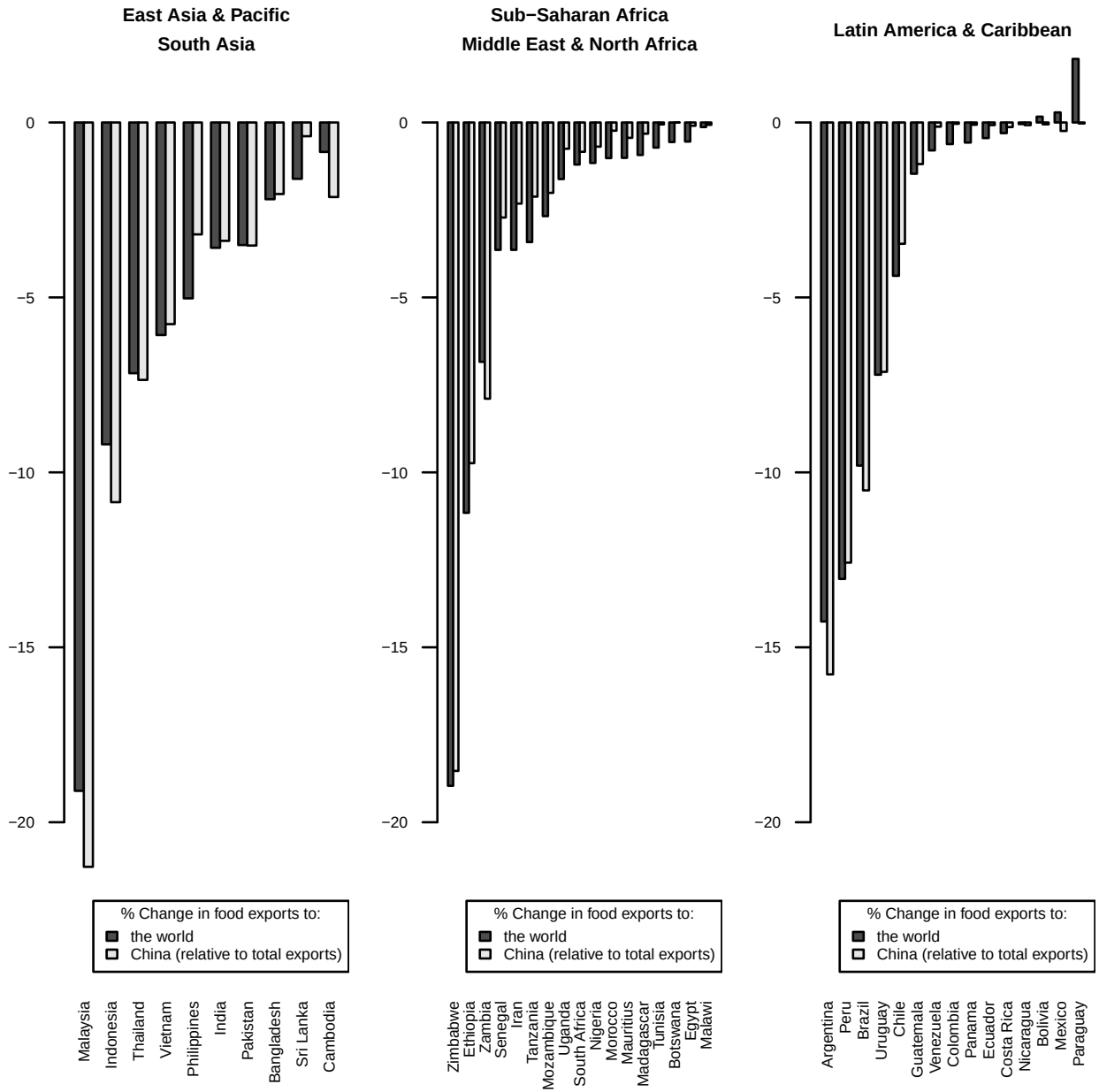

East Asia & Pacific
South Asia
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
Malaysia
Vietnam
Thailand
Indonesia
Philippines
Sri Lanka
Bangladesh
Pakistan
India
Cambodia


Europe & Central Asia
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
Kyrgyz
Russia
Ukraine
Bulgaria
Georgia
Lithuania
Kazakhstan
Armenia
Turkey
Belarus
Albania
Azerbaijan


Sub−Saharan Africa
Middle East & North Africa
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
Mauritius
Senegal
South Africa
Morocco
Mozambique
Nigeria
Egypt
Madagascar
Tunisia
Malawi
Ethiopia
Zambia
Botswana
Zimbabwe
Tanzania
Uganda
Iran


Latin America & Caribbean
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
Argentina
Brazil
Costa Rica
Chile
Mexico
Panama
Uruguay
Guatemala
Colombia
Nicaragua
Ecuador
Peru
Venezuela
Paraguay
Bolivia

Changes in Exports



Conclusions

- China has been a source of some food price inflation; on average (weighted by import volumes), CES prices fell by 1.27%, 0.32%, and 0.22% in ASIA, MENA-SSA, and LATAM, respectively.
- On the export side, Asian and Latin American exporters of vegetable oils have benefited from China's growth. In Africa, we find sizable effects on the exports coming from Ethiopia, Zimbabwe, Zambia, and Mozambique, countries that export tobacco, cotton, and also oilseeds to China.
- Effects are directly driven by China's growth in demand, no evidence of benefits from an overall China-induced higher level of food prices attributable to the growth in China.