The long-run behaviour of the terms of trade between primary commodities and manufactures: A panel data approach

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Motivation

Starting point: The Prebisch & Singer (PS) hypothesis

- Secular decline in commodity prices relative to manufactures (TOT).
- Why is the PS hypothesis important?
  - Because it challenges the conventional classical view, according to which TOT should actually increase due to:
    - Rapid technical progress in the production of manufactures.
    - Diminishing returns in the production of primary goods.
    - Growing population.

Motivation

- Early evidence. Bowley (1903) reveals that in the UK:
  - $\left(\frac{P^M}{P^X}\right) \uparrow$ between 1873 and 1881, but also that
  - $\left(\frac{P^M}{P^X}\right) \downarrow$ between 1881 and 1901. This is abnormal (Keynes, 1912).
  - $\left(\frac{P^M}{P^X}\right) \uparrow$ during the first decade of the twentieth century.

Motivation

- Two main factors explain the PS hypothesis:
  - Benefits from technical progress are transferred from developing to developed countries.
    - Developed countries: Technical progress results in higher wages (due to trade unions), but not in lower prices.
    - Developing countries: Technical progress does not result in higher wages (due to excess supply of labour), but in lower prices.
  - Low price and income elasticities of demand for primary commodities relative to those of manufactures.
    - If increases in income shift the demand curve for primary commodities to the right by less than the corresponding shift in the demand curve for manufactures, the price of primary commodities relative to manufactures would tend to decline.

Motivation

- Key aspect. Main policy recommendation of the PS hypothesis:

  Developing countries should avoid specialisation according to their Ricardian comparative-advantage.

- How have developing countries compensated declining TOT?
  - Exploiting monopoly power in the production of primary products that face an inelastic demand in developed countries.
  - Adopting an inward-oriented development strategy to reduce dependence on imports from developed countries (infant industry).

Motivation

- Being the validity of the PS hypothesis an empirical question, early criticisms focused on:
    - Inappropriateness and quality of the data.
    - Results were not based on formal statistical procedures but on informal approaches (e.g. visual inspection of the data).
- These shortcomings have been addressed in two main ways:
    - Creating a consistent dataset.
        - Grilli & Yang (GY) (1988) use 24 non-fuel commodities to construct a commodity price index (1900–1986).
    - Applying recent developments of modern time-series econometrics.
        - Fitting regressions against time.
        - Estimating structural time-series models.
        - Testing for unit roots (with or without breaks).

Objective

- We examine commodity prices as a panel of data.
  - Examine cross-sectional dependence among commodity prices (which may arise from common shocks).
  - Use more powerful tests (because panel data combine time-series and cross-section information).
- We apply tests that take stationarity as the null hypothesis.
  - Hadri (2000), Hadri & Rao (2008).
  - This approach appears more suitable because the PS hypothesis, as originally postulated, implies the existence of a long-run declining deterministic trend in relative commodity prices.

Plan of the presentation

- Brief review of the existing empirical literature on the PS hypothesis.
- Outline the Hadri-based approaches to test panel stationarity (with one-time breaks and cross section dependence).
- Describe the data, present the results and discuss some policy considerations.
- Offer some concluding remarks.

Literature review

- Prebisch (1950) & Singer (1950) study British imports and exports prices (proxy for the world prices of commodities and manufactures).
  - From the 1870's to WWII the trend of prices moved against producers of commodities, and in favour of producers of manufactures.
- Spraos (1980) observes that early criticism on the PS hypothesis focused on data issues. Four main criticisms:
  - Britain cannot be used as a representative of all industrial countries.
  - Primary products are also produced by developed countries.
  - Exports are valued *f.o.b* while imports are valued *c.i.f*, so that changes in prices can be partly (or wholly) due to changes in transport costs.
  - Price indices do not adequately account for new products that are traded nor for improvements in the quality of existing ones.

Literature review

- Kindleberger (1958) builds industrial European export and import unit value indices, by commodity group and by trading area, from 1872 to 1952.
  - Industrial Europe includes BE, FR, DE, IT, LU, NL, SE, CH, UK.
  - Although few generalisations can be made on the evolution of the TOT, they tend to turn against developing countries.
  - Caution must be exercised when interpreting these findings, because they do not necessarily imply that the TOT of developing countries should be subjected to compensatory policies.

Literature review

- Since the 1980s there has been a revival of interest in the PS hypothesis using more formal statistical procedures.
    - Both Spraos (1980) and Sapsford (1985) fit:

      $$\log TOT_t = a + bt + \epsilon_t$$

      where the latter also tests for structural instability using the Chow (1960) test.

Literature review

- GY collect price data on 24 non-fuel commodities ($\approx$ 54% of non-fuel commodity traded between 1977–1979). Sample period: 1900–1986.
  - This dataset has been widely used to assess the PS hypothesis.
    - Cuddington & Urzúa (1989), Perron (1990), Helg (1991), Powell (1991), Ardeni & Wright (1992), Bleaney & Greenaway (1993), Newbold & Vougas (1996), León & Soto (1997), Kim et al. (2003), Zani (2005), Kellar & Wohar (2006), Ghoshray (2011).
  - But, GY is also important because they apply the ADF test to determine whether commodity prices are TS (or DS) series.
    - See also Bleaney & Greenaway (1993), Reinhart & Wickham (1994), Kim et al. (2003), Cuddington (1992), Newbold & Vougas (1996).

- ADF with assumed known one-time break.
  - Cuddington & Urzúa (1989), Perron (1990), Helg (1991), Newbold & Vougas (1996).
- Engle-Granger & Johansen cointegration (between prices of commodities & manufactures).
  - Powell (1991), also assuming known breaks.
- Harvey structural time-series models.
  - Ardeni & Wright (1992), Reinhart & Wickham (1994).
- Zivot-Andrews unit root test with one (unknown) break.
  - León & Soto (1997).
- Lumsdaine-Papell unit root test with one (unknown) break.
  - Zani (2005), Kellar & Wohar (2006).
- Lee-Strazicich unit root test with two (unknown) breaks.
  - Ghoshray (2011).

Literature review

Panel approach

- Hadri (2011) employs the Hadri & Rao (2008) panel stationarity approach with breaks and cross-section dependence.
- However, this study leaves scope for further research and analysis, because Hadri:
  - Examined only nine commodities over the period 1960–2007.
  - Studied commodity prices relative to the US CPI, which cannot be regarded as an appropriate proxy to validate the PS hypothesis.

Literature review

- Not surprisingly, support for the PS hypothesis is mixed.
  - Spraos (1980), Sapsford (1985), Grilli & Yang (1988), Ardeni & Wright (1992), Bleaney & Greenaway (1993), Reinhart & Wickham (1994), León & Soto (1997) confirm the negative sign (but not the magnitude) of the trend implicit in PS.
  - Cuddington & Urzúa (1989), Perron (1990), Helg (1991), Powell (1991), Zani (2005) find that the TOT can be best characterised as a trendless process with a one-time negative shift. This does not support the views of PS, because PS refer to a secular deterioration.
  - Cuddington (1992), Newbold & Vougas (1996), Kim et al. (2003), Kellar & Wohar (2006), Ghoshray (2011) do not find strong support for the PS hypothesis.

Testing for stationarity without breaks

Kwiatkowski, Phillips, Schmidt & Shin (1992) – KPSS (univariate test)

Let y_t denote a commodity price series $(t = 1, ..., T)$:

k	Model	Break
1	$y_t = \alpha + r_t + \varepsilon_t$	No
2	$y_t = \alpha + r_t + \beta t + \varepsilon_t$	No

where $r_t = r_{t-1} + u_t$; and ε_t and u_t are mutually independent normal distributions. Also, ε_t and u_t are i.i.d. over t, with $E\left[\varepsilon_t\right] = 0$, $E\left[\varepsilon_t^2\right] = \sigma_\varepsilon^2 > 0$, $E\left[u_t\right] = 0$ and $E\left[u_t^2\right] = \sigma_u^2 \geq 0$.

The null and alternative hypotheses are:

$H_0: \quad \sigma_u^2 = 0$ Series is stationary

$H_1: \quad \sigma_u^2 > 0$ Series is non-stationary

Testing for panel stationarity without breaks

Hadri (2000)

Let y_{it} denote commodity price i at time t $(i = 1, ..., N,\ t = 1, ..., T)$:

k	Model	Break
1	$y_{it} = \alpha_i + r_{it} + \varepsilon_{it}$	No
2	$y_{it} = \alpha_i + r_{it} + \beta_i t + \varepsilon_{it}$	No

where $r_{it} = r_{it-1} + u_{it}$; and ε_{it} and u_{it} are mutually independent normal distributions. Also, ε_{it} and u_{it} are i.i.d. across i and over t, with $E[\varepsilon_{it}] = 0$, $E[\varepsilon_{it}^2] = \sigma_{\varepsilon,i}^2 > 0$, $E[u_{it}] = 0$ and $E[u_{it}^2] = \sigma_{u,i}^2 \geq 0$.

The null and alternative hypotheses are:

$$H_0: \quad \sigma_{u,i}^2 = 0 \quad i = 1, ..., N \qquad \text{All series are stationary}$$

$$H_1: \quad \begin{array}{ll} \sigma_{u,i}^2 > 0 & i = 1, ..., N_1 \\ \sigma_{u,i}^2 = 0 & i = N_1 + 1, ..., N. \end{array} \qquad \text{Some series are non-stationary}$$

Testing for panel stationarity with and without breaks

Hadri (2000) & Hadri-Rao (2008)

k	Model	Break
1	$y_{it} = \alpha_i + r_{it} + \varepsilon_{it}$	No
2	$y_{it} = \alpha_i + r_{it} + \beta_i t + \varepsilon_{it}$	No
3	$y_{it} = \alpha_i + r_{it} + \delta_i D_{it} + \varepsilon_{it}$	Change in level (no trend)
4	$y_{it} = \alpha_i + r_{it} + \delta_i D_{it} + \beta_i t + \varepsilon_{it}$	Change in level
5	$y_{it} = \alpha_i + r_{it} + \beta_i t + \gamma_i DT_{it} + \varepsilon_{it}$	Change in slope
6	$y_{it} = \alpha_i + r_{it} + \delta_i D_{it} + \beta_i t + \gamma_i DT_{it} + \varepsilon_{it}$	Change in level and slope

$$D_{it} = \begin{cases} 1, & \text{if } t > T_{B,i}, \\ 0 & \text{otherwise} \end{cases} \qquad DT_{it} = \begin{cases} t - T_{B,i}, & \text{if } t > T_{B,i}, \\ 0, & \text{otherwise} \end{cases}$$

where $T_{B,i}$ is the break date; δ_i and γ_i denote the size of the break.

Let $0 < \omega_i = \frac{T_{B,i}}{T} < 1$ (this allows for different breaking dates across i).

Testing strategy:

- Estimate $\hat{T}_{B,i,k}$ for each commodity i and for each model $k = 1, ..., 6$

$$\underset{0<\omega_i<1}{Min} \text{ RSS from the relevant regression under } H_0.$$

- Choose the preferred model specification

$$Min \text{ SIC.}$$

- Let $\hat{\varepsilon}_{it}$ be the residuals of the chosen model (with or without a break).

- The KPSS test is:

$$\eta_{i,T,k}\left(\hat{\omega}_i\right) = \frac{\sum_{t=1}^{T} S_{it}^2}{T^2 \hat{\sigma}_{\varepsilon_i}^2},$$

where $S_{it} = \sum_{j=1}^{t} \hat{\varepsilon}_{ij}$ is the partial sum process of the residuals, and $\hat{\sigma}_{\varepsilon_i}^2$ is a consistent estimator of the LRV of $\hat{\varepsilon}_{it}$ from the appropriate model.

- To estimate $\hat{\sigma}_{\varepsilon_i}^2$ we follow Sul et al. (2005).

Testing for panel stationarity with and without breaks

Hadri (2000) & Hadri-Rao (2008)

- First, an AR model for the residuals is estimated, that is:

$$\hat{\varepsilon}_{it} = \rho_{i,1}\hat{\varepsilon}_{i,t-1} + \ldots + \rho_{i,p_i}\hat{\varepsilon}_{i,t-p_i} + v_{it} \quad (1)$$

where p_i can be determined e.g. applying the GTS algorithm.

- Second, the long-run variance estimate of $\hat{\sigma}^2_{\varepsilon_i}$ is obtained with the boundary condition rule:

$$\hat{\sigma}^2_{\varepsilon_i} = \min\left\{ T\hat{\sigma}^2_{v_i}, \frac{\hat{\sigma}^2_{v_i}}{\left(1 - \hat{\rho}_i\,(1)\right)^2} \right\},$$

where $\hat{\rho}_i\,(1)$ is a pth-order AR polynomial evaluated at $L = 1$; $\hat{\sigma}^2_{v_i}$ is an estimate of the LRV of v_{it} (obtained using a QS window HAC estimator).

- The Hadri & Rao (2008) test is then:

$$\widehat{LM}_{T,N,k}\left(\hat{\omega}_i\right) = \frac{1}{N}\sum_{i=1}^{N}\eta_{i,T,k}\left(\hat{\omega}_i\right).$$

- After a suitable standardisation:

$$Z_k\left(\hat{\omega}_i\right) = \frac{\sqrt{N}\left(\widehat{LM}_{T,N,k}\left(\hat{\omega}_i\right) - \bar{\bar{\xi}}_k\right)}{\bar{\bar{\zeta}}_k} \Rightarrow N\left(0,1\right)$$

where $\bar{\bar{\xi}}_k = \frac{1}{N}\sum_{i=1}^{N}\xi_{i,k}$ and $\bar{\bar{\zeta}}_k^2 = \frac{1}{N}\sum_{i=1}^{N}\zeta_{i,k}^2$ are appropriate moments.

Important: $\xi_{i,k}$ and $\zeta_{i,k}^2$ depend on $\hat{\omega}_i$ if there is a break.

- Correct for serial correlation using (1) and obtain $\hat{\upsilon}_{it}$, which are centred around zero.

- The residuals $\hat{\upsilon}_{it}$ are re-sampled with replacement with the cross-section index fixed, so that their cross-correlation structure is preserved; the resulting bootstrap innovation $\hat{\upsilon}_{it}$ is denoted $\hat{\upsilon}^*_{it}$.

- $\hat{\varepsilon}^*_{it}$ is generated recursively as $\hat{\varepsilon}^*_{it} = \hat{\rho}_{i,1}\hat{\varepsilon}^*_{i,t-1} + \ldots + \hat{\rho}_{i,p_i}\hat{\varepsilon}^*_{i,t-p_i} + \upsilon^*_{it}$.

- The bootstrap samples of y^*_{it} are calculated by adding $\hat{\varepsilon}^*_{it}$ to the deterministic component of the corresponding model

- The Hadri LM statistic is calculated for each y^*_{it}.

Data

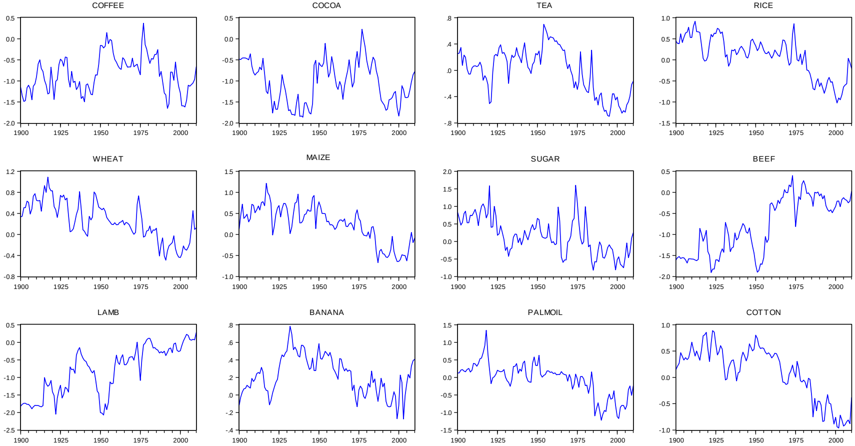
- We use the GY dataset, as extended to 2003 by Pfaffenzeller et al. (2007), and then to 2010 by Pfaffenzeller. $T = 111$ obs.
- As in GY and many others, commodity prices are deflated using a (trade-weighted) unit value index of manufactures.
- All relative prices are in logs.

Data

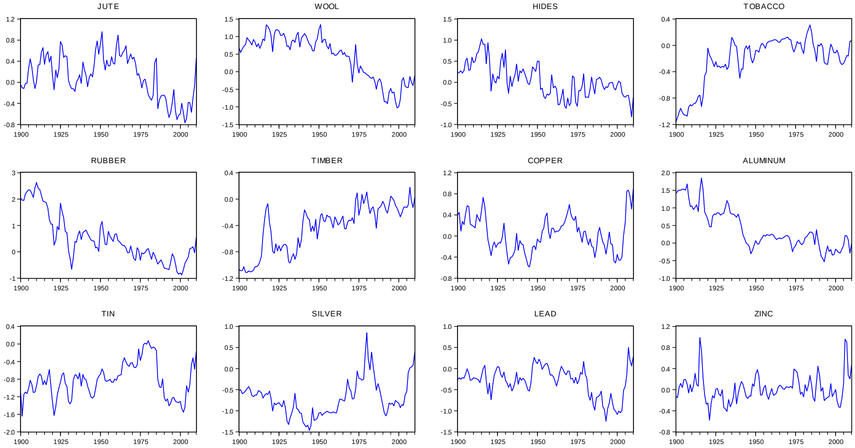
List of commodities

Food	Nonfood	Metals
Banana	Cotton	Aluminum
Beef	Hides	Copper
Cocoa	Jute	Lead
Coffee	Rubber	Silver
Lamb	Timber	Tin
Maize	Tobacco	Zinc
Palm oil	Wool	
Rice		
Sugar		
Tea		
Wheat		

Plots of relative commodity prices (in logs)



Plots of relative commodity prices (in logs)



Testing for cross-sectional independence.

Pesaran (2004) CD test

- Fit an ADF(p) type regression model for each cross section unit i separately, and take the resulting residuals as individual series $\hat{e}_{it}$ (this allows us to get rid of any serial correlation).

- Compute the cross-correlation coefficient between the residuals of cross section units i and j as:

$$\hat{\rho}_{ij} = \frac{\sum_{t=1}^{T} \hat{e}_{it} \hat{e}_{jt}}{\left(\sum_{t=1}^{T} \hat{e}_{it}^2\right)^{1/2} \left(\sum_{t=1}^{T} \hat{e}_{jt}^2\right)^{1/2}}. \qquad (2)$$

- Calculate the CD statistic as:

$$\mathrm{CD} = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right) \sim N(0,1). \qquad (3)$$

Cross-sectional independence. CD statistic

Panel	ADF(1)		ADF(2)		ADF(3)	
	Statistic	*p*-value	Statistic	*p*-value	Statistic	*p*-value
Food	11.980	[0.000]	11.693	[0.000]	11.700	[0.000]
Nonfood	11.402	[0.000]	11.489	[0.000]	11.568	[0.000]
Metals	14.769	[0.000]	15.419	[0.000]	15.427	[0.000]
All	31.086	[0.000]	31.886	[0.000]	32.153	[0.000]

- The null hypothesis that commodity price innovations are cross sectionally independent is strongly rejected in all cases.
- The highest degree of cross section dependence is found to be across all 24 commodities, followed by that observed in the group of metals.

Cross-sectional independence. CD statistic

- Rejecting the CD test is important because:
  - It justifies analysing commodity prices jointly, within a panel data framework, rather than as individual time series.
  - It highlights the importance of allowing for cross section dependence when performing inference.

Hadri & Rao panel stationarity test

Panels	Statistic	p-value
Food	1.658	[0.151]
Nonfood	0.867	[0.136]
Metals	-0.440	[0.769]
All commodities	0.765	[0.364]

- The null hypothesis that commodity prices are jointly stationary around a (broken) trend cannot be rejected.
- Note: Incorrectly ignoring the cross section dependence issue, then the null would not be rejected for Food commodities.
- The relevance of the stationarity result is that it is valid to apply standard tools of econometric analysis to examine the PS hypothesis.

Identifying structural breaks

- The occurrence of structural breaks on individual commodity prices has already been considered by:
  - León & Soto (1997); 1900–1992.
  - Kellar & Wohar (2006); 1900–1998.
  - Ghoshray (2011); 1900–2003.

- We carry out our estimations over four sample periods:
  - 1900–1992.
  - 1900–1998.
  - 1900–2003.
  - 1900–2010 (the longest sample period currently available).

- This approach allows us to:
  - Examine the effect of extending the sample period on break date.
  - Compare our results to previous findings.

Identifying structural breaks

Main findings

- Evidence of one-time break in all commodities (i.e. models (1) & (2) are never selected). By contrast, León & Soto (1997), Kellar & Wohar (2006), Ghoshray (2011) find no breaks in some commodities.
- Extending the sample does not affect the position of the break:
  - Coffee, cocoa, beef, lamb, banana, palm oil, cotton, rubber, timber, aluminum.
- Extending the sample does affect the position of the break:
  - Tea, rice, wheat, maize, sugar, jute , wool, hides, tobacco, copper, tin, silver, lead, zinc.
  - Within this last group, there are 7 commodities (tea, sugar, wool, tobacco, copper, lead, zinc) for which including data for 2004–2010 changes the break dates.

Estimated models and structural breaks

Commodity	1900–1992		1900–1998		1900–2003		1900–2010	
	Model	Date	Model	Date	Model	Date	Model	Date
Coffee	6	1950	6	1950	6	1950	6	1950
Cocoa	6	1947	6	1947	6	1947	6	1947
Tea	6	1954	6	1954	6	1954	6	1968
Rice	6	1973	4	1982	6	1982	4	1982
Wheat	6	1973	6	1921	4	1986	6	1987
Maize	5	1975	4	1986	4	1986	6	1986
Sugar	6	1972	6	1972	6	1972	4	1925
Beef	4	1959	3	1959	3	1959	3	1959
Lamb	4	1947	4	1947	4	1947	4	1947
Banana	6	1926	6	1926	6	1926	6	1926
Palmoil	4	1986	6	1986	4	1986	6	1986
Cotton	6	1946	6	1946	6	1946	6	1946
Jute	6	1947	5	1966	6	1947	6	1973
Wool	5	1952	5	1952	5	1952	5	1942
Hides	6	1921	6	1952	6	1952	6	1921
Tobacco	6	1918	6	1918	6	1918	6	1919
Rubber	4	1918	4	1918	4	1918	4	1918
Timber	6	1921	6	1921	6	1921	6	1921
Copper	4	1953	4	1953	4	1953	4	2006
Aluminum	6	1942	6	1942	6	1942	6	1942
Tin	6	1977	6	1977	6	1986	4	1986
Silver	4	1967	6	1974	6	1974	4	1967
Lead	6	1947	6	1947	6	1947	6	1982
Zinc	6	1918	6	1918	6	1918	3	2006

Notes: The columns labelled "Model" indicate the chosen model specifications $k = 1, \ldots, 6$.

Identifying structural breaks
Main findings

- Are break dates similar to those found by other authors?
- Focusing on the commodities for which there is evidence of one structural break, and regarding discrepancies of up to two years in the break date (in either direction) as negligible:

León & Soto (1997) 1900–1992	Kellar & Wohar (2006) 1993–1998	Ghoshray (2011) 1900–2003
Cocoa	Rice	Tea
Beef	Palm oil	Hides
Banana	Aluminum	Zinc
Palm oil		
Wool		
Tobacco		
Rubber		
Copper		
Aluminum		

Identifying structural breaks

Main findings

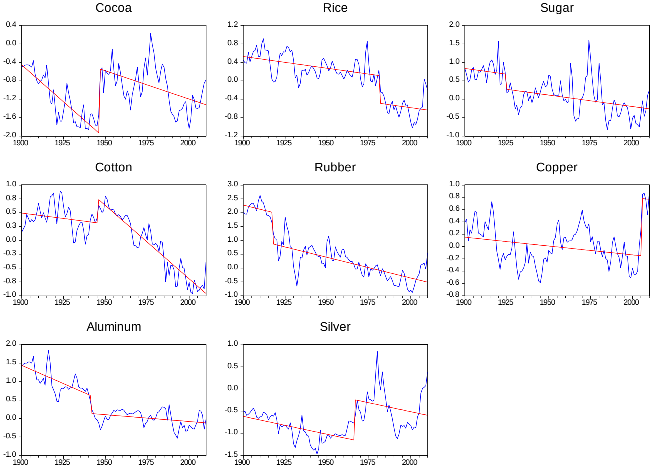
- Timing of breaks depends on the econometric strategy that is used for estimation, and on how the breaks are characterised (level change, slope change, both).
- Extending the sample period implies that new important events and/or changes in commodity markets are included in the analysis, and these in turn make previously chosen functional forms no longer appropriate.

Estimated long-run trends of commodity prices, 1900–2010

Commodity	Model	Const.	(s.e.)	D_{it}	(s.e.)	Trend	(s.e.)	DT_{it}	(s.e.)	R^2
Coffee	6	-1.066	(0.092)	0.861	(0.122)	0.002	(0.003)	-0.020	(0.004)	0.47
Cocoa	6	-0.423	(0.102)	1.398	(0.132)	-0.032	(0.004)	0.020	(0.004)	0.53
Tea	6	-0.028	(0.048)	-0.428	(0.076)	0.006	(0.001)	-0.019	(0.003)	0.69
Rice	4	0.533	(0.052)	-0.602	(0.079)	-0.005	(0.001)			0.75
Wheat	6	0.691	(0.047)	-0.500	(0.101)	-0.007	(0.001)	0.024	(0.006)	0.66
Maize	6	0.687	(0.049)	-0.730	(0.104)	-0.006	(0.001)	0.016	(0.006)	0.75
Sugar	4	0.840	(0.082)	-0.411	(0.130)	-0.006	(0.002)			0.44
Beef	3	-1.354	(0.037)	1.194	(0.054)					0.82
Lamb	4	-1.923	(0.068)	-0.793	(0.126)	0.028	(0.002)			0.76
Banana	6	0.064	(0.060)	0.397	(0.065)	0.004	(0.004)	-0.011	(0.004)	0.56
Palm oil	6	0.382	(0.053)	-0.951	(0.113)	-0.005	(0.001)	0.026	(0.007)	0.74
Cotton	6	0.498	(0.059)	0.446	(0.076)	-0.004	(0.002)	-0.023	(0.003)	0.85
Jute	6	0.107	(0.063)	-0.534	(0.108)	0.006	(0.001)	-0.019	(0.004)	0.58
Wool	5	0.786	(0.072)	-0.032	(0.003)	0.006	(0.002)			0.84
Hides	6	0.180	(0.114)	-0.697	(0.119)	0.033	(0.009)	-0.039	(0.009)	0.58
Tobacco	6	-1.160	(0.072)	0.534	(0.074)	0.024	(0.006)	-0.022	(0.006)	0.83
Rubber	4	2.291	(0.090)	-1.141	(0.126)	-0.015	(0.001)			0.83
Timber	6	-1.355	(0.076)	-0.355	(0.079)	0.047	(0.006)	-0.038	(0.006)	0.78
Copper	4	0.155	(0.056)	0.934	(0.139)	-0.003	(0.001)			0.30
Aluminium	6	1.461	(0.070)	-0.491	(0.087)	-0.020	(0.003)	0.016	(0.003)	0.85
Tin	4	-1.262	(0.059)	-0.953	(0.091)	0.012	(0.001)			0.53
Silver	4	-0.612	(0.074)	0.914	(0.120)	-0.008	(0.002)			0.40
Lead	6	-0.255	(0.057)	-0.934	(0.112)	0.002	(0.001)	0.025	(0.006)	0.47
Zinc	3	-0.005	(0.022)	0.564	(0.104)					0.21

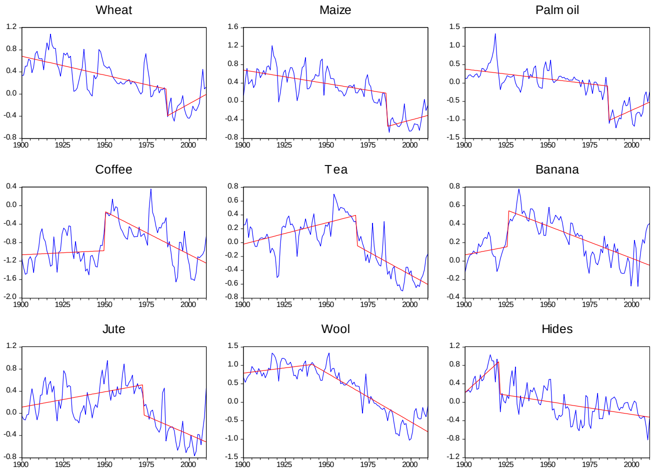
Support for the PS hypothesis

{cocoa, rice, sugar, cotton, rubber, copper, aluminum, silver}



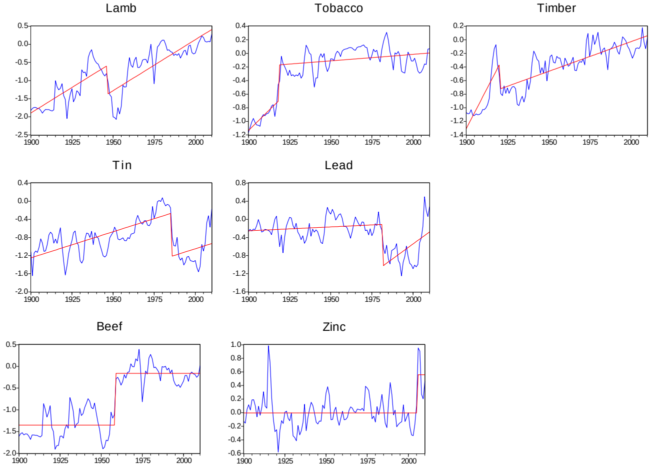
Partial support for the PS hypothesis

{wheat, maize, palm oil} and also {coffee, tea, banana, jute, wool, hides}



No support for the PS hypothesis

{lamb, tobacco, timber, tin, lead} and also {beef, zinc}



Policy considerations

- Why is it important whether commodity prices are TS (DS) series?
  - Statistically: Effect of a shock.
    - Transitory for a TS series.
    - Permanent for a DS series.
  - Economically: Appropriate policy response to booms or busts.
    - Stabilisation in case the shock is transitory.
    - Adjustment in case it is permanent.

Policy considerations

- In practice, implementing stabilisation policies can be difficult because of uncertainties surrounding the magnitude and (perhaps more importantly) the duration of shocks.
- Deaton & Miller (1996). High degree of persistence of commodity prices complicates macroeconomic management.
  - Good times: Countries need to accumulate reserves over prolonged periods of time, and this could be expensive and possibly not even politically feasible (or sustainable).
  - Bad times: Countries may face limitations in their ability to borrow to finance their consumption levels.
- Thus, it is interesting to measure the persistence of commodity price shocks after accounting for structural breaks.

Measuring persistence

- Specify VAR models for each primary commodity group (i.e. food, nonfood, metals), using de-trended commodity prices.
- Compute the Pesaran & Shin (1998) GIRs, which plot the time profile of the effect of an own shock in a commodity price.
  - GIRs are invariant to the ordering of the variables in the VAR.
- Normalise the statistically significant lag weights.
- Calculate the half-life of a shock as the number of years required for 50% (or the first half) of the adjustment to take place.

Half-life estimates (in years) from GIR functions

Food	Half-life	Nonfood	Half-life	Metals	Half-life
Coffee	2	Cotton	2	Copper	4
Cocoa	2	Jute	2	Aluminum	2
Tea	1	Wool	2	Tin	3
Rice	2	Hides	1	Silver	5
Wheat	2	Tobacco	2	Lead	3
Maize	2	Rubber	2	Zinc	2
Sugar	2	Timber	2		
Beef	2				
Lamb	2				
Banana	2				
Palm oil	2				

- Food & nonfood: 2y, except tea & hides where it is 1y.
- Metals: Avg.≈3y, Min.2y (aluminum, zinc), Max.5y (silver).

Measuring persistence

Main results

- Compared to other studies, our half-life estimates are much shorter.
  - e.g. Collier & Gunning (1999) find in a sample of 19 positive shocks that in 2/3 cases the duration is $\simeq$3-8y.
- Low persistence rates (after allowing for breaks) suggest that there is scope for using stabilisation mechanisms to smooth the path of export revenues in developing countries.

Conclusions

- We examine the validity of the PS hypothesis of a long-run negative trend in the terms of trade between primary commodities and manufactures. For this:
  - We use an up-to-date version of the widely used commodity price dataset assembled by GY
  - We employ a panel stationarity testing procedure that addresses both structural breaks and cross-sectional dependence.

- This modelling approach differs from that used in the existing literature, where univariate non-stationarity tests are applied to individual commodity prices.

- We confirm the presence of cross section dependence among commodity prices; thus, it is not appropriate to assume that they are independent from each other, due to the existence of market linkages.

Conclusions

- All commodity prices have been subject to a one-time structural break (in 14/24 cases break dates depend on the time span of data).
- Commodity prices are jontly stationarity after allowing for structural breaks and cross section dependence.
- Support for the PS hypothesis is mixed:
  - Strong support (negative trend before & after break): Cocoa, rice, sugar, cotton, rubber, copper, aluminum, silver.
  - Partial suport (negative trend before or after break): Wheat, maize, palm oil (before); coffee, tea, banana, jute, wool, hides} (after)
  - No support: Lamb, tobacco, timber, tin, lead, beef, zinc.
- Persistence of commodity price shocks (as measured by their half-life) is shorter than that obtained in other studies using alternative methodologies.

Conclusions

- From an economic policy standpoint, our results support the adoption of prudent macroeconomic policies.
- Long-run: All 24 prices exhibit abrupt breaks of one form or another.
  - It is in the interest of developing countries to implement policies to diversify their production structure, so that their dependence on few commodities as a source of foreing exchange is reduced.
- Short-run: Low rates of persistence of commodity price shocks.
  - There is scope for developing countries to design and use stabilisation mechanisms in response to trade shocks.