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Terms of Trade Volatility and Persistence to Shocks in the United States

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Introduction

Since the publication of the Prebisch-Singer hypothesis, the declining trend of commodity terms of trade (CTT) is used to explain the gap between developed and developing countries with a strong presumption that developing countries are primary commodity exporters (Cashin and Pattillo 2006). There are three main points to consider on the policy implication of studies on the trend of the CTT:

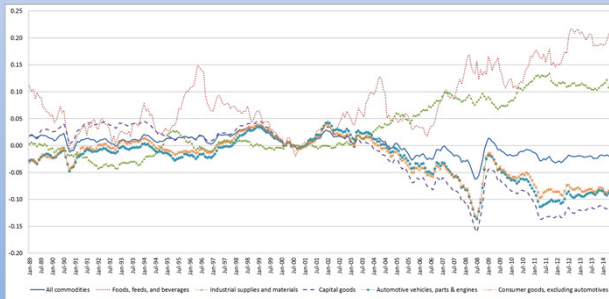
- I. CTT (relative price of primary commodities and manufactured goods) is not the same as the terms of trade between developing countries and developed countries (Diakosavvas and Scandizzo 1991).
- II. The effect of government policies is not typically addressed in the studies using CTT.
- III. Studies using CTT are different, in their policy implications, from studies applying a national index of terms of trade; because the movements in primary goods prices would not completely pass through to a country's terms of trade.

Determining the long run trend and identifying the shocks to the terms of trade of a country is not sufficient enough for policy making. Detecting the persistence of the shocks to a country's terms of trade is substantial in developing suitable policy responses to shocks.

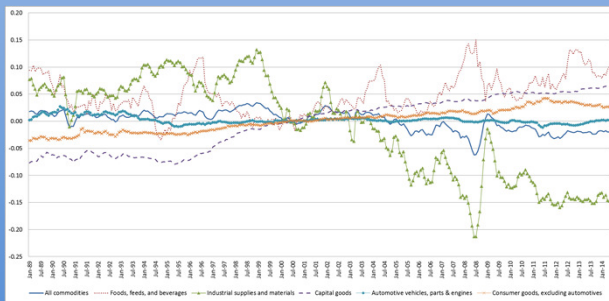
This paper investigates the trend in terms of trade of the United States. Also, the presence of any shocks during the study period is examined. Finally, persistence of the U.S. terms of trade to the shocks is investigated and the sources of terms of trade volatility are determined.

In this study, two types of terms of trade are calculated for United States:

- 1) The export price of each category of goods is deflated by the aggregate import price of all commodities.



- 2) The export price of each category is deflated by the import price of the same category of commodities.



Methods

The data used in this paper are import and export price indexes published by the International Price Program (IPP), U.S. Bureau of Labor Statistics (BLS) from January 1989 to May 2014 (U.S. BLS 2014).

Long-run trend estimation

$$\Delta T o T_t = \alpha + \beta t + \mu T o T_{t-1} + \sum_{i=1}^{p-1} \psi_i \Delta T o T_{t-i} + \varepsilon_t$$

where $T o T$ is logarithm of terms of trade and t is the time trend variable. Two hypothesis can be tested:

- I. $\beta = 0; \mu < 0$; which shows no long-run trend in terms of trade. However, $T o T$ tends towards its historical mean.
- II. $\beta \neq 0; \mu < 0$; which shows reversion of terms of trade towards a nonzero long-run trend.

Persistence of shocks

- I. Estimate using the observations between λT and τT

$$\Delta T o T_t^d = \hat{\rho}_i T o T_{t-1}^d + \sum_{s=1}^S \delta_{i,j} \Delta T o T_{t-s}^d + \varepsilon_t$$

where $\lambda \in (0,1)$ and $\tau \in (\lambda, 1]$. Denote the ADF t-statistic on $\hat{\rho}_i = DF_G(\lambda, \tau)$.

- II. Calculate:

$$M \equiv \inf_{\lambda \in (0,1)} \inf_{\tau \in (\lambda,1]} DF_G(\lambda, \tau)$$

minimizes the doubly recursive sequence of $\{DF_G(\lambda, \tau), \lambda \in (0,1), \tau \in (\lambda, 1]\}$ over λ and τ . Therefore $(\hat{\lambda}, \hat{\tau}) \equiv \arg \inf_{\lambda \in (0,1)} \inf_{\tau \in (\lambda,1]} DF_G(\lambda, \tau)$ will be consistent with the start and end points of the most prominent I(0) regime.

- III. Repeat the process:

Test subintervals $[0, \hat{\lambda}]$ and $[\hat{\tau}, 1]$ for further I(0) regimes.

- IV. Calculate half-life shock:

$$AR(1): HLS = ABS[\ln 0.5 / \ln \rho]$$

$$AR(q): HLS = ABS[\ln(0.5b(1)) / \ln \rho]$$

Decompose terms of trade volatility

Terms of trade, in log form, can be formed from import and export price indexes:

$$p^x - p^m = \alpha_f^x p_f^x + \alpha_i^x p_i^x + \alpha_{ca}^x p_{ca}^x + \alpha_a^x p_a^x + \alpha_c^x p_c^x - (\alpha_f^m p_f^m + \alpha_i^m p_i^m + \alpha_{ca}^m p_{ca}^m + \alpha_a^m p_a^m + \alpha_c^m p_c^m)$$

f = foods, feeds, and beverages; i = industrial supplies and materials; c = capital goods; a = automotive vehicles, parts and engines; co = consumer goods excluding automotive.

Decompose to **country price effect** and **goods price effect**:

$$p^x - p^m = \alpha_f^x (p_f^x - p_f^m) + \alpha_i^x (p_i^x - p_i^m) + \alpha_{ca}^x (p_{ca}^x - p_{ca}^m) + \alpha_a^x (p_a^x - p_a^m) + \alpha_c^x (p_c^x - p_c^m) + (\alpha_f^x - \alpha_f^m)(p_f^x - p_f^m) + (\alpha_i^x - \alpha_i^m)(p_i^x - p_i^m) + (\alpha_{ca}^x - \alpha_{ca}^m)(p_{ca}^x - p_{ca}^m) + (\alpha_a^x - \alpha_a^m)(p_a^x - p_a^m) + (\alpha_c^x - \alpha_c^m)(p_c^x - p_c^m)$$

or

$$p^x - p^m = \alpha_f^m (p_f^x - p_f^m) + \alpha_i^m (p_i^x - p_i^m) + \alpha_{ca}^m (p_{ca}^x - p_{ca}^m) + \alpha_a^m (p_a^x - p_a^m) + \alpha_c^m (p_c^x - p_c^m) + (\alpha_f^x - \alpha_f^m)(p_f^x - p_f^m) + (\alpha_i^x - \alpha_i^m)(p_i^x - p_i^m) + (\alpha_{ca}^x - \alpha_{ca}^m)(p_{ca}^x - p_{ca}^m) + (\alpha_a^x - \alpha_a^m)(p_a^x - p_a^m) + (\alpha_c^x - \alpha_c^m)(p_c^x - p_c^m)$$

Volatility is measured by the standard deviation of the monthly growth rate.

Results & Discussion

- a) The overall terms of trade of the United States have a negative long run trend while disaggregated commodity categories have mixed trends. This implies that disaggregating the overall terms of trade to its commodity components reveal more detailed information about the long-run trend of the U.S. terms of trade.
- b) Only the overall terms of trade series include an internal I(0) regime for (July2008 – May2014). The effect of the shocks for the I(0) subsample would be transitory comparing to the I(1) period.



- c) The effect of shocks to the Foods etc. category would dissipate faster than others while it takes longer for the shocks to the Industrial supplies etc., Capital goods, and Consumers goods categories.
- d) Volatility in the import price of Capital goods relative to Foods etc. is the major source of variations in the goods price component of the terms of trade.
- e) Country price effect is greater than the goods price effect on the volatility of U.S. terms of trade.
- f) Among the country price components, export price of Industrial supplies etc. to its import price accounts for the majority of the volatilities.

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