

Measuring Terms of Trade Effects in National Accounts

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Measuring the Nation's Economy.



Note on Terminology in this Paper

Paper is written for a journal that is read by European national income accountants, so it uses SNA terminology.

BEA	SNA
Command-basis GDI	Real GDI*
Command-basis GNP	Real GNI*
Quantity index	Volume index

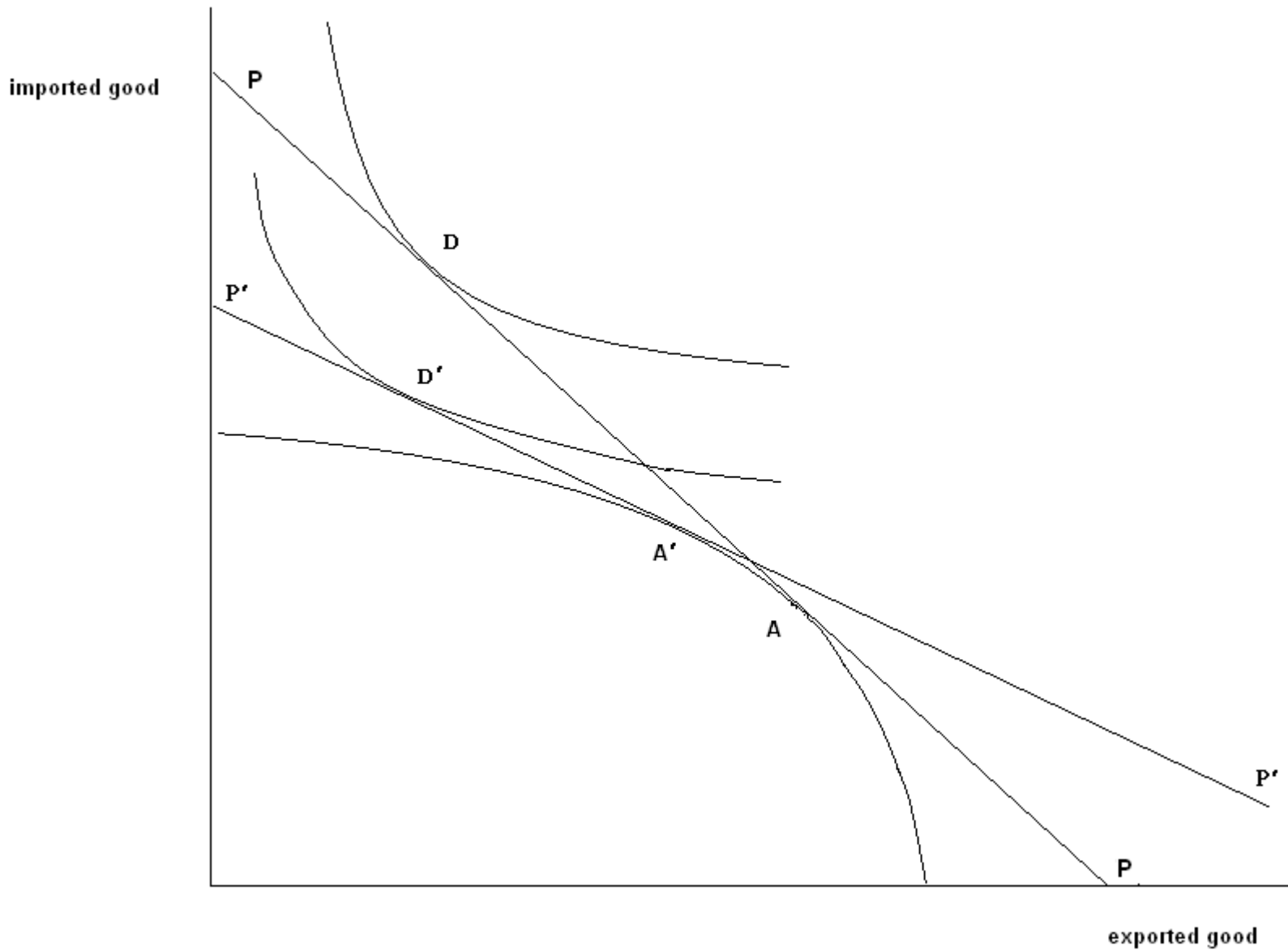
* In the NIPAs “real GDI” and “real GNI” are income-side estimates of production concepts, so they equal:

$(\text{GDP} + \text{the statistical discrepancy}) / (\text{GDP deflator})$, or
 $(\text{GNP} + \text{the statistical discrepancy}) / \text{GNP deflator}$.

In contrast, in the SNA they are income concepts.

Real Income depends on Production and Gains from Trade

- Current-dollar GDP = $D + X - M$,
where $D = C+I+G$, gross domestic purchases.
- Price index for GDP is:
$$P_{\text{GDP}} \approx S_D P_D + S_X P_X - S_M P_M$$
- P_X and P_M have no direct effect on real GDP, but they affect D compatible with current account balance.
- “*Command-basis GNP*” (“*real gross national income*”) tracks command over goods and services that is made possible by domestic production and foreign trade.



Change in Terms of Trade from PP to P'P' Reduces Real Consumption from D to D' but Shift in Production from A to A' has no Effect on Real GDP

Common Deflator for X and M required for Real GDI

- If trade is always balanced, so that income = expenditures, D/P_D is correct measure of real gross domestic income.
- Real GDP = $D/P_D + X/P_X - M/P_M$.
- Real GDI = $D/P_D + X/P^* - M/P^*$.
- Same deflator P^* for X and M ensures that real GDI = D/P_D if $X = M$ since it equals $D/P_D + (X - M)/P^*$.

Disagreement on Choice of Deflator for the Current Account Balance

- NIPAs deflate by imports index P_M .
- But Denison (1981) said other definitions for P^* (the deflator for net exports) are possible.
- The 1993 SNA lists 3 acceptable choices:
 - P_M
 - P_D
 - Average of P_M and P_X .

P_D is recommended definition for P^*

- Deflating income by different deflators depending on its source makes no sense if the problem is to measure the purchasing power of income.
- Use of P_M understates the impact of import price changes if there is a trade deficit.
- P_D is simple to use, and permits analysis of contributions to change in real income.
- Assumption of uniform expansion or contraction of gross domestic purchases to eliminate a trade imbalance is reasonable.

Analytical Concepts

- $P^* \equiv P_D \Rightarrow \text{Real GDI} = \text{GDP} / P_D.$

- *Terms of trade:* $\text{ToT} = P_X / P_M.$

- *Trading gains index:*

$$\text{TGI} = \text{real GDI} / \text{real GDP} = P_{\text{GDP}} / P_D.$$

- With constant real GDP, Percent Δ in real GDI
= (real GDP)(Percent Δ in TGI)

- *Relative price of tradables:* $\text{RPT} = \text{ave}(P_X, P_M) / P_D.$

Contribution of X & M to Change in TGI

- Using share weights and indexes from the additive “contributions to change” formula, the Fisher price index for GDP can be written as:

$$P_{GDP} = s_D P_D(\mathbf{p}_D, P_{GDP}) + s_X P_X(\mathbf{p}_X, P_{GDP}) - s_M P_M(\mathbf{p}_M, P_{GDP})$$

where P_{GDP} is Fisher index used to find weights on Laspeyres and Paasche indexes of D in $P_D(\mathbf{p}_D, P_{GDP})$.

$$P_{GDP} = P_D + s_X(P_X - P_D) - s_M(P_M - P_D)$$

$$TGI - 1 = s_X(P_X/P_D - 1) - s_M(P_M/P_D - 1).$$

Contributions of ToT & RPT to ΔTGI

Use Fisher formula for P_D, P_X and P_M .

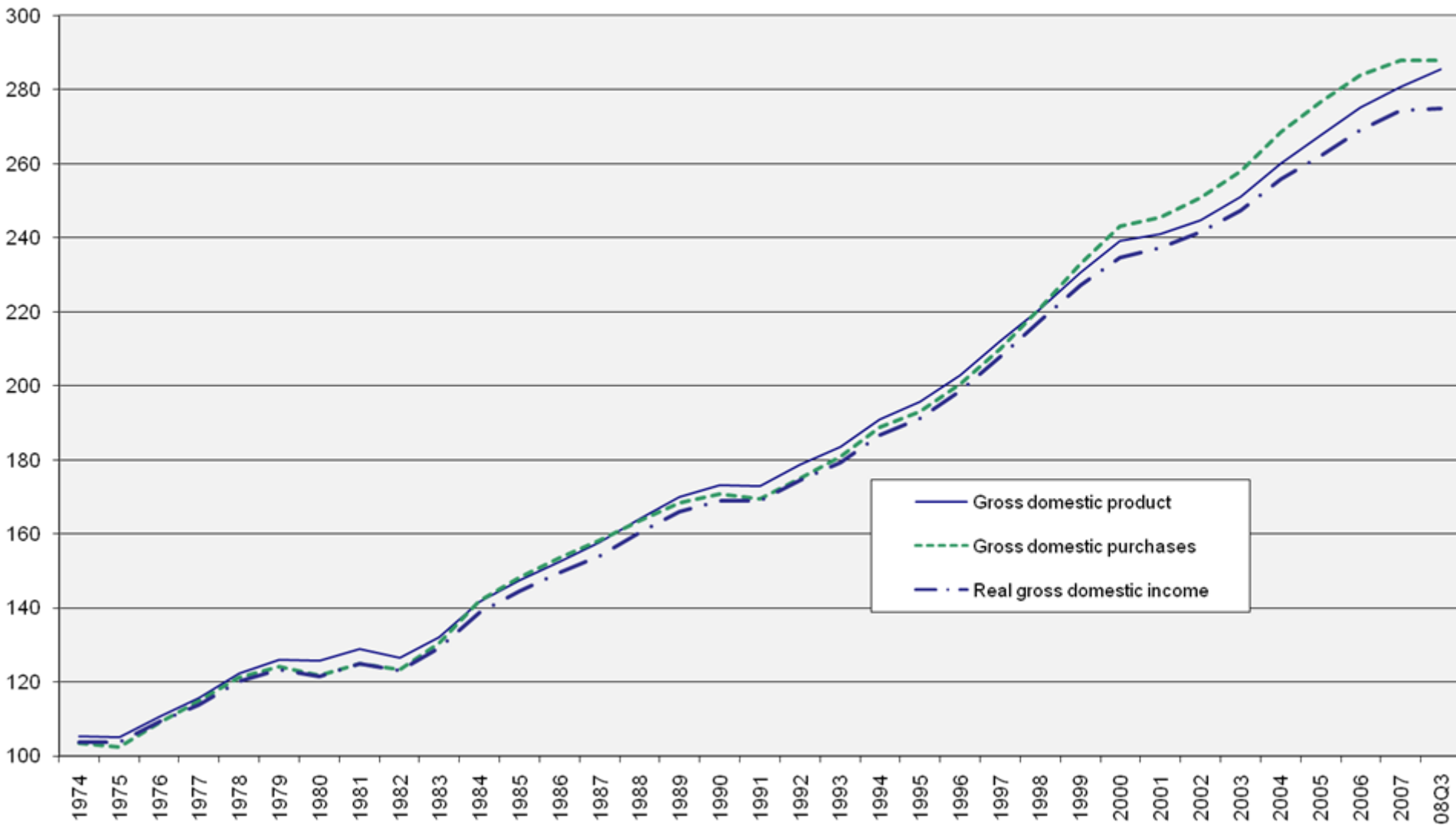
Then equality becomes approximate.

$$\text{If } s_X = s_M, \quad \Delta TGI \approx s_M (P_M / P_D) (\Delta ToT)$$

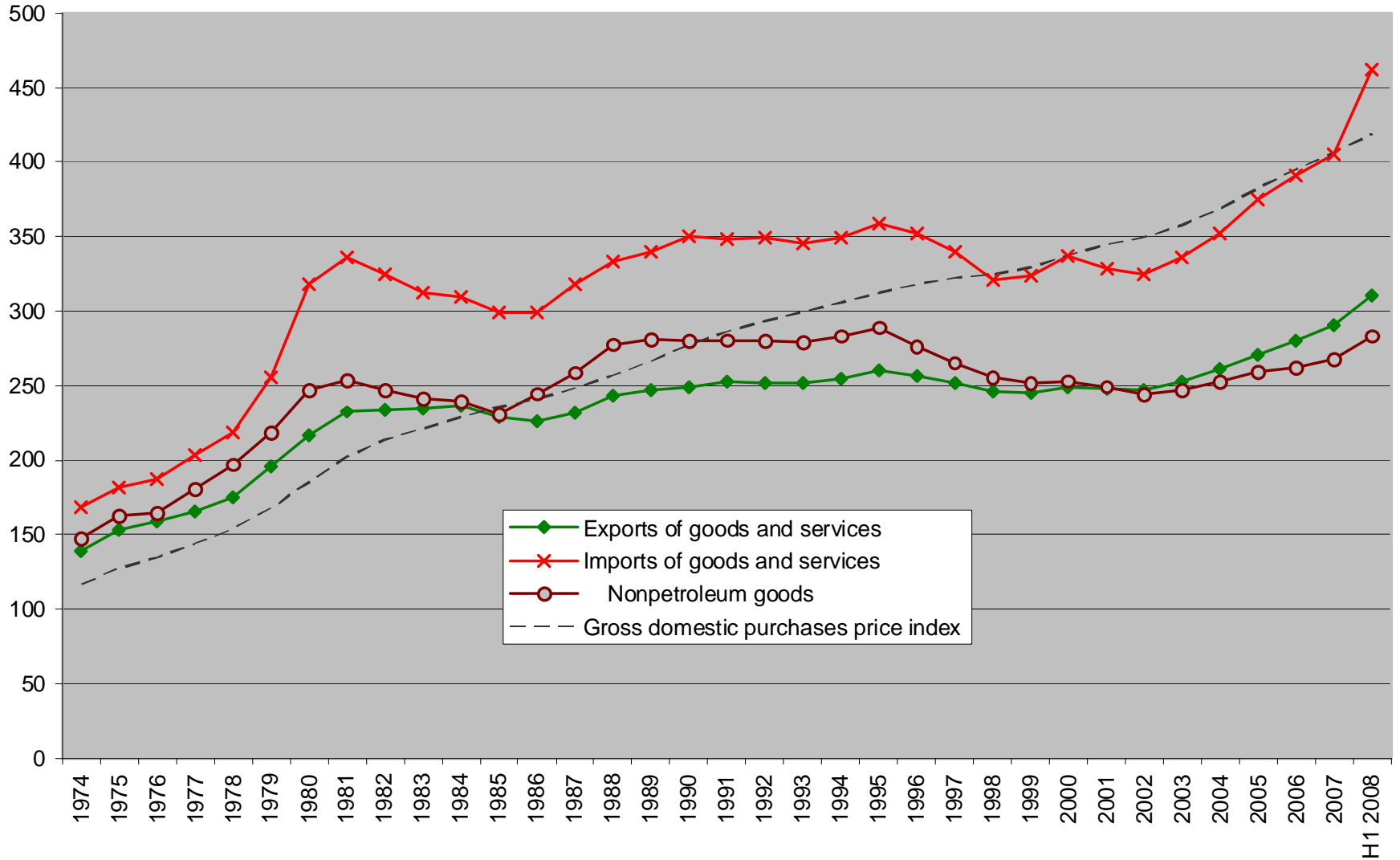
In general case, where $s_X \neq s_M$,

$$\Delta TGI \approx \text{ave}(s_X, s_M) (P_M / P_D) \Delta ToT + (s_X - s_M) \Delta RPT$$

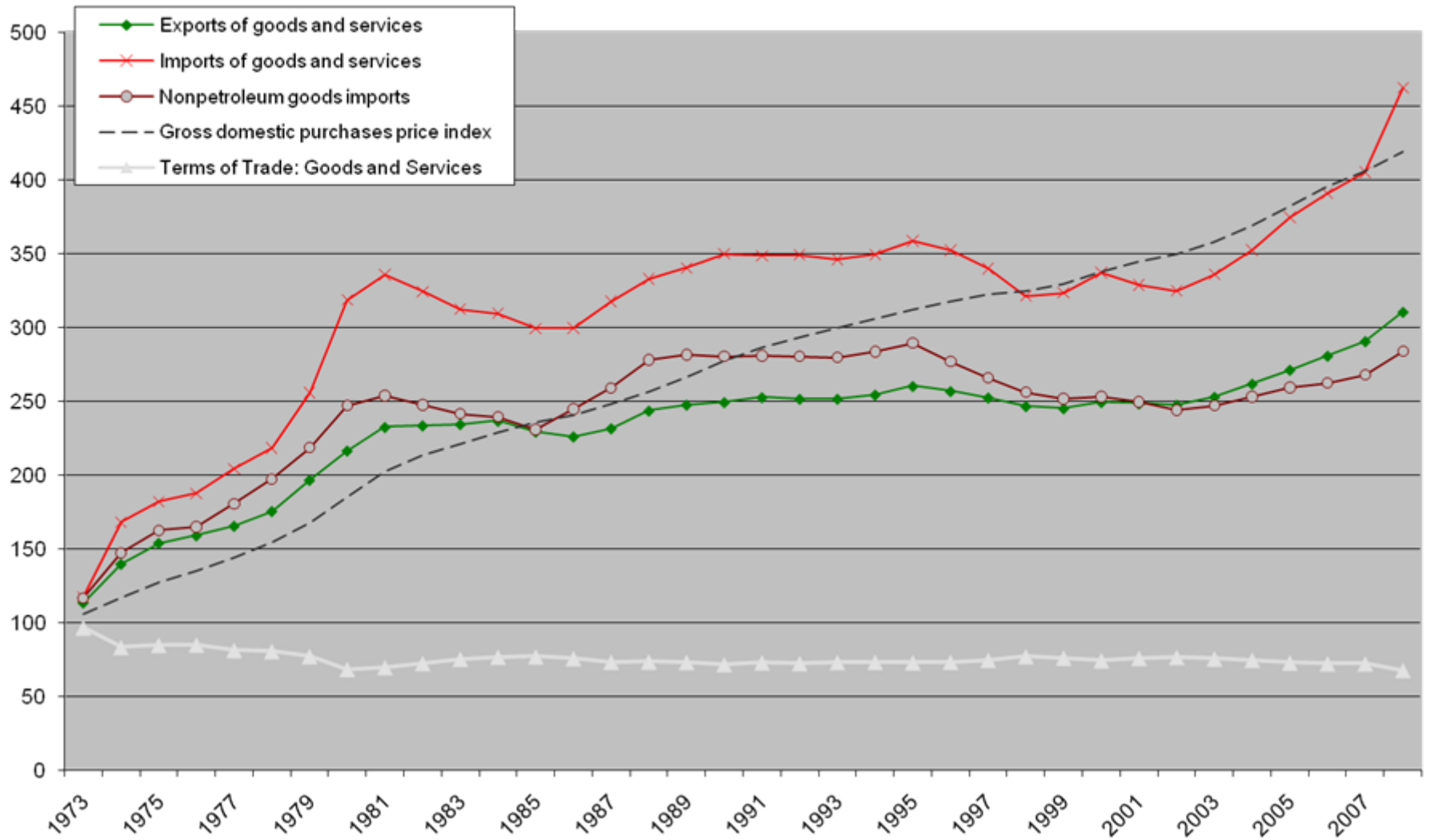
Figure 1: Volume Indexes of U.S. GDP, GDA and GDI
(1972=100)



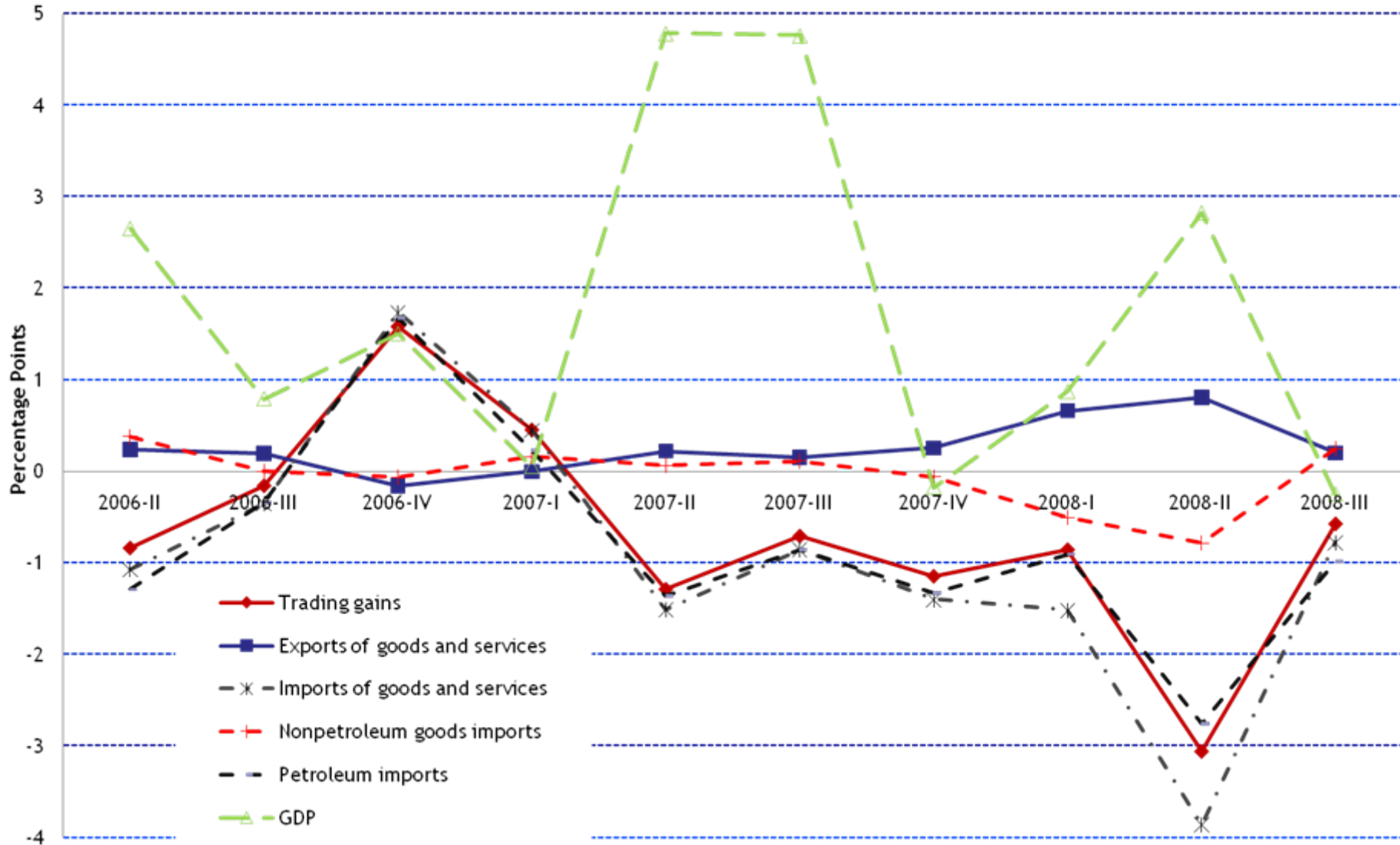
Price Indexes for Exports and Imports (1972=100)



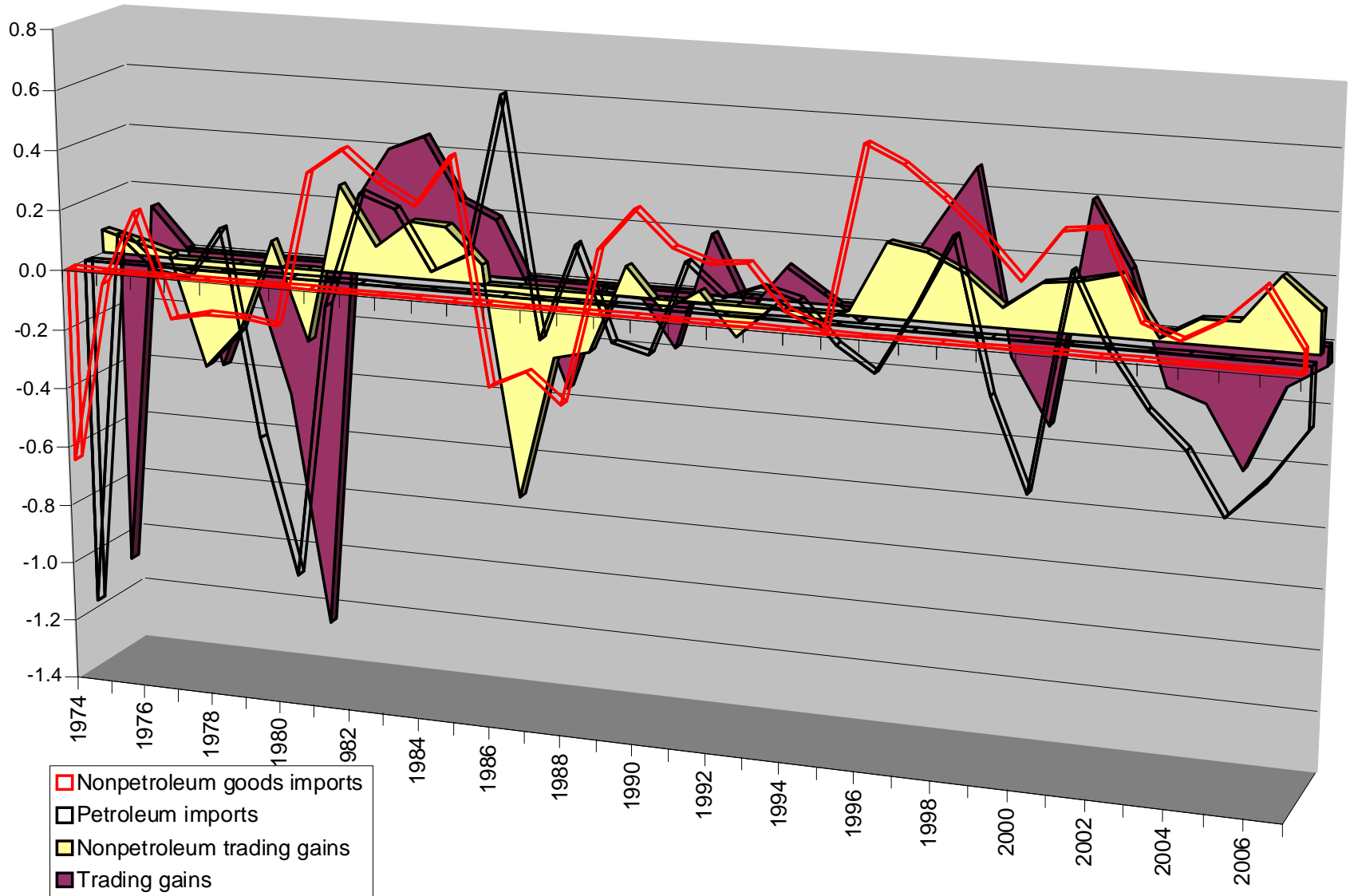
Price Indexes for Exports and Imports (1972=100)



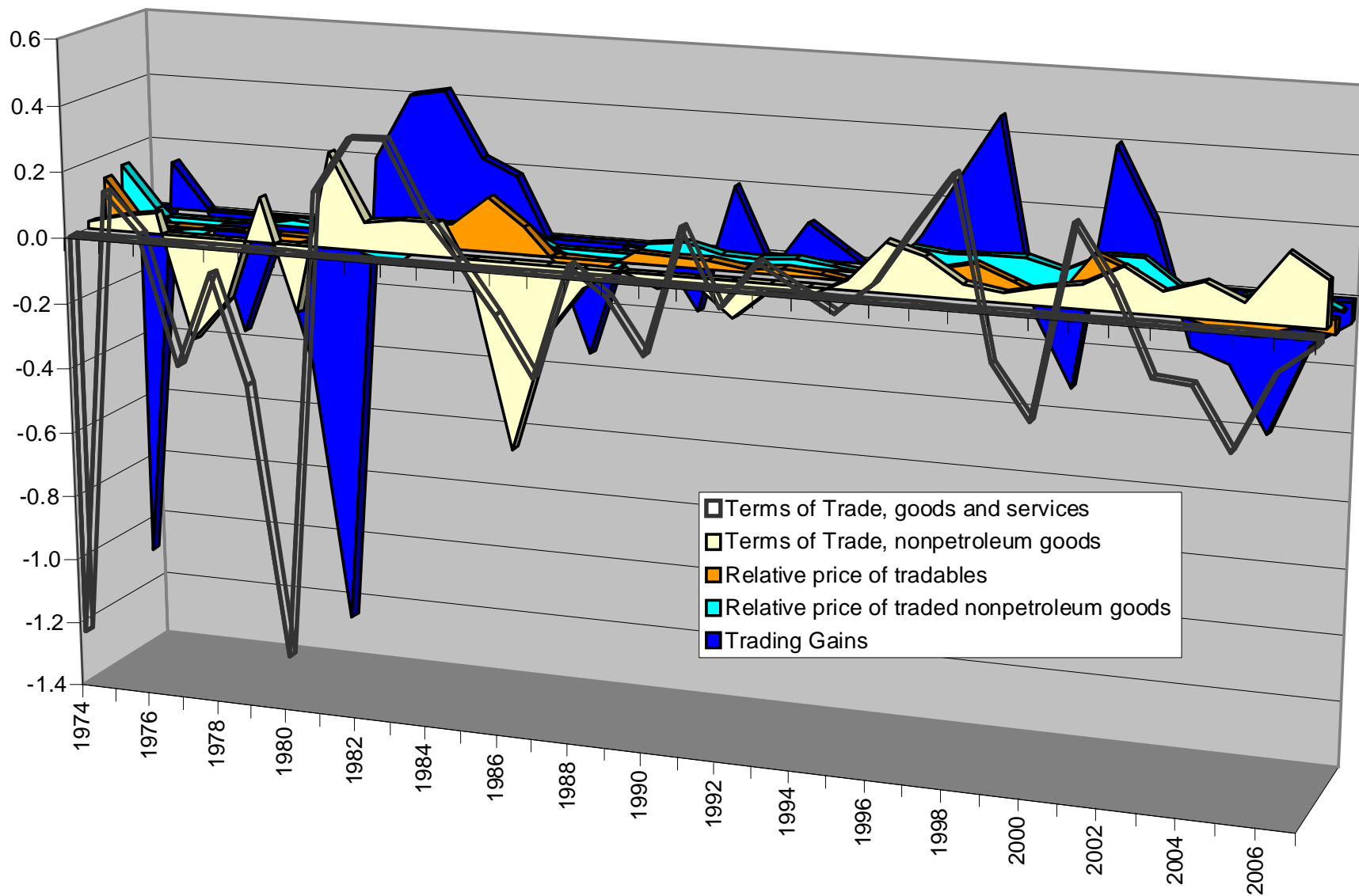
Contributions to Percent Change in Real GDI (Quarterly, At Annual Rate)



Contributions of Petroleum and Nonpetroleum Trade Prices to Real GDI



Contributions of Terms of Trade and Relative Price of Tradables to US Real GDI



Conclusions

- Changes in Terms of Trade (and in the Relative Price of Tradables) add or subtract 0.2 percentage points from real GDI half the time.
- They subtracted over 1 percentage point during the oil price spikes of 1973-4 and 1980.
- They subtracted 2 percentage points at annual rate, resulting in fall in real GDI, in 2008 H1.
- But excluding petroleum, the US has enjoyed positive trading gains since 1996, boosting real GDI by a cumulative 1.7 percentage points.