Are there Unmeasured Declines in Prices of Imported Final Consumption Goods?

Notes to accompany presentation by Marshall Reinsdorf and Robert Yuskavage on November 7, 2009

Introduction

One of the most remarkable changes in the US economy has been the dramatic growth in its engagement in international trade. The growth in imports of non-petroleum goods is particularly striking. Imports goods other than petroleum rose from about 10 percent of final domestic uses of goods in personal consumption expenditures and gross investment in 1975, to about 20 percent in 1991-2, and to about 30 percent in 2008 (figure 1).

Growth in imports of a commodity does not necessarily mean that buyers have substituted imported sources of supply for domestic ones because the former have become cheaper. Demand for imports of a commodity can increase because the demand curve for that commodity has shifted out or the domestic supply has contracted, leaving a gap to be filled by imports. In these cases, rising imports will coincide with rising relative prices, as has happened, for example, with petroleum. Yet price-induced substitution does indeed seem to play an important role in the growth of non-petroleum imports. Among the underlying factors that have been found to contribute to US import growth are: lower transport costs, lower communications costs, better ability to manage logistics of fragmented supply chains, multi-lateral trade liberalizations, scale economies, growth in varieties, and rapid capital deepening and productivity growth in key Asian trading partners. Many of these factors can be expected to act to lower prices of imports to domestic buyers. It is therefore reasonable to presume that price competition accounts for at least some of the growth in the share of US consumption that is supplied by imports.

Nevertheless, at least at an aggregate level, import price indexes do not decline relative to domestic price indexes in a way that would help to explain buyers' willingness to substitute towards imports. Assuming that goods prices at the consumer level are a kind of average of prices of domestic and import sources of supply, if the prices of the domestic suppliers are rising relative to those of the imports, the price index for goods in personal consumption expenditures in the National Income and Product Accounts (NIPAs) should rise relative to the price index for imports. Yet an index for the goods portion of personal consumption expenditures excluding energy rises less than the price index for imports nonpetroleum consumer goods in the NIPAs (figure 2).

Comparisons of aggregate indexes must be interpreted with caution because they reflect both differences in commodity composition or weights and differences in the growth rates of price indexes for comparable detailed items. A difference between aggregate indexes is therefore not an average of differences between detailed indexes covering similar items. As a result declines in relative prices of imports might be evident in comparisons of indexes for similar detailed items but not evident in comparisons of aggregate indexes.

Two Hypotheses concerning the Behavior of the Import Price Index

Although differences in composition could account for the faster rise of the imports index in figure 2, it is also possible that the imports indexes fail to reflect the price differences that motivated buyers to substitute imports for domestically produced items. Because we do not have a buyers' price index at the wholesale level, when substitution from a domestic supplier to a foreign supplier involves a product that was not previously imported, that product constitutes a new good for purposes of the import price index. As a new good, it will be linked into the import price index in a way that does not affect the index's level. However from the buyer's point of view, the new opportunity to obtain the product for a lower price amounts to a reduction in import prices.

Linking is a standard practice for introducing new goods into a price index. Yet ignoring the gains to the buyer from the opportunity to buy the new good results in an upward bias for purposes of welfare measurement. For purposes of welfare measurement, new goods should be introduced into the price index with a Hicksian virtual price—defined as the price that is just high enough to drive demand to zero—in the period before purchases of the good begin to be observed. The consumer surplus from the drop from the Hicksian virtual price to the initial observed price can then be measured by integrating the area under a compensated demand curve, or it can be approximated by use of a Tornqvist or Fisher index that pairs the virtual price with an initial quantity of zero.

In the case of competing suppliers who offer identical quality levels, the Hicksian virtual price for the entering supplier equals the price of the incumbent supplier. This principle was, for example, used by Griliches and Cockburn (1995) to argue that when a branded pharmaceutical goes off patent, the low-priced generic should not be linked into the CPI. Instead, the prices of the generic and its branded counterpart should be directly compared, with a quality adjustment for the generic that attributes half of the savings enjoyed by those consumers who substitute to the generic to a quality decline and counts the other half as a pure price reduction. Similarly, Reinsdorf (1993) argued that when consumers change their purchasing patterns to lower-priced discount outlets, linking the lower-priced outlets into the CPI would result in outlet substitution bias. As in the case of generic pharmaceuticals, the Hicksian virtual price for those consumers who substitute the discount outlet for the full-service outlet can be estimated by the price of the full-service outlet.

A second hypothesis also implies the presence of bias in the detailed import indexes caused by linking, but in this case the sign of the bias depends on the sign of the change in the true price index. According to this hypothesis, linking in of altered versions of items that are already in the imports price index results in attenuated measures of price change. Therefore this hypothesis implies that upward bias in the import prices indexes arises only for items whose price trend is downwards. Many electronic and technology-intensive goods do, in fact, have falling price trends, so a bias towards zero in the measured rate of price change could plausibly have a positive effect on the rate of growth of the aggregate import index for non-petroleum goods.

Nakamura and Steinsson (2008) find that in the samples used to construct the imports indexes, prices frequently remain constant for the life of a quote (that is, for the length of time that the

specific version of an item remains in the sample). Respondents tend to report a price change only at the time of a change in the version of the item that they import. When price and characteristics change simultaneously, separating the reported change in price into a quality change component and a pure price change component is difficult. Consequently, the new version of the product is typically linked into the index, which is equivalent to attributing *all* of the reported price change to quality change. Nakamura and Steinsson (2008) find that linking in of items experiencing version changes occurs more frequently in the import and export price indexes than in the CPI or the PPI. Indeed, the fraction of the observed price changes that are treated as price changes of zero is high in some of the import and export indexes.

Comparisons with CPIs

Although no buyer's index where comparisons of prices of foreign-sourced and domestic-sourced products are possible exists at the wholesale level or for intermediate inputs, buyer's indexes for final consumer goods do exist in the form of CPIs. The CPI undoubtedly brings in some foreign-sourced items by the standard kind of linking, but it may be less subject to linking bias than the import price index. In the CPI, a foreign-sourced item would be directly compared to a domestic-sourced if the consumer is thought to perceive their quality level as the same. Furthermore, the CPI makes more use of direct quality adjustment techniques, such as hedonic regressions and supplier's cost estimates, than the import and export indexes, and when linking is unavoidable, the CPI sometimes imputes a price change for the linked item using an appropriately selected subsample of quotes (the so-called cell relative method).

On the assumption that some declines in prices paid by buyers from substitutions from domestic to imported versions of products and from substitutions between imported versions of products are reflected in the CPI but not in the imports price indexes, CPIs should tend to show lower inflation rate than import price indexes covering similar detailed items. For example, in figure 3, the average rate of growth of tire prices is 4.1 percent in the import price indexes, but only 3.2 percent in the CPI. Moreover, the much lower rate of growth of the CPI than of the PPI in figure 3 seems to suggest that import prices have actually grown at a slower rate than the CPI.

To take a more systematic approach to comparing import prices and CPIs for detailed items, we used BEA's Industry Accounts data to identify commodities that are used in PCE and that are supplied at least partly from imports. The industry accounts also show the proportion of total domestic supply of each commodity that come from imports. Using this weighting information we constructed Fisher indexes that combine prices received by domestic producers (which BEA measures based on PPIs from BLS) and prices received by suppliers of imports (which BEA measures based on import price indexes from BLS). We term these indexes *suppliers' price indexes*, because the term "producer prices" has a different meaning in BEA's industry accounts than it does at BLS, where "producer price indexes" do not include imports.

Prices at the retail level include transportation margins, wholesale and retail distributions margins, and commodity taxes. Therefore, in addition to our indexes of supplier's prices, we constructed *purchaser's price indexes* that combine the suppliers prices with price indexes for transportation and distribution margins and that adjust for changes in commodity taxes. Our

purchaser's price indexes represent predicted CPIs based on prices and weights from BEA's industry accounts. However, we compare both our supplier's price index and our purchaser's price index for a commodity with the CPI for that commodity because we are not entirely confident of the quality of some of the price indexes for distribution margins.

If we assume that the CPI is correct and that the supplier price index is correct, the equation that expresses the log-change in the CPI as a weighted average of log-changes in the supplier price index and the price index for transportation and distribution margins and taxes contains only one unknown value, that of the price index for margins and taxes. We can therefore solve this equation for the implied price index for the margin industry services and taxes. Under the assumption that the prices of inputs into transportation and distribution are not changing and that tax rates are not changing, the rate of decline in the implied price index for the margin industries is equal to their rate of productivity growth. For example, if the CPI for a commodity is falling and all other prices are flat, the implied index for transportation and distribution services will fall faster than the CPI and the absolute value of its rate of decline will represent an estimate of the growth rate of productivity in transportation and distribution using the dual approach. If the implied productivity growth rates in transportation and distribution are implausibly high, that is evidence of either upward bias in the suppliers price index, downward bias in the CPI, or mismatch between the micro-level composition of the detailed CPI that we used and the micro-level composition of our suppliers index.

Another advantage of using industry accounts data is that these data show the importance of each commodity in final uses in personal consumption expenditures (PCE). We can therefore aggregate over commodities using appropriate weights to estimate effects on broader aggregates such as durable goods, nondurable goods and all items with imported sources of supply.

The indexes that we construct are subject to a number of limitations, so the empirical results should be interpreted as suggestive rather than as definitive proof of the existence of bias in the import price indexes. In particular, a consistent pattern of substantial discrepancies would constitute evidence of the existence of a problem in the import indexes, but individual discrepancies are not necessarily meaningful.

The most important limitation of our indexes is that the most detailed CPIs that are available are generally broader in coverage than the commodity categories in the industry accounts. For example, fur coats is a commodity in our industry accounts data, but BLS does not publish a CPI for fur coats. We therefore had to match fur coats to a CPI for women's coats in general. To give another example, we matched boat building in the industry accounts to a CPI for recreational vehicles including bicycles. The unavailability of sufficiently detailed CPIs means that at the level of individual items, many of the comparisons of CPIs to our suppliers and purchasers indexes do not hold the commodity mix constant. But this problem becomes less severe when detailed items in the industry accounts are aggregated.

Second, the import price indexes exclude tariffs, but tariffs undoubtedly influence the retail prices for imported items that are measured by the CPI. Tariff rates have trended down in recent decades, so declines in tariffs have probably acted to reduce the growth rate of the CPIs compared to those of the import price indexes. Nevertheless, for most items with significant

volumes of imports, tariff rates are low or zero, leaving little room for reductions in tariffs to have a substantive effect. In a future paper we plan to include estimates of the effects of tariffs on our comparisons.

Third, in interpreting the comparisons, it is important to note that all of the indexes have positive variances, even though that we have not attempted to estimate these variances.

Empirical Results

Supplier price index comparisons

- Index of suppliers' prices for commodities agrees with matched CPI in cases of food, alcoholic beverages, and vehicles and parts.
- At more aggregated level, also have near-agreement for non-durables excluding apparel.
- For durables other than vehicles and parts and for apparel items, CPIs grow more slowly in almost every case.
- Difference is 6.4 percent per year for computer-related items, 4.2 percent per year for other electric equipment, and 3 percent per year for miscellaneous durables.
- Difference is 1.5 percent per year for apparel.
- Difference is 1 percent per year for all items.

Purchaser price index comparisons

- Purchasers' price index matches CPI for paper products and grows more 0.6 more slowly for non-durables ex apparel because of negative growth of distribution margin indexes.
- For apparel, difference from CPI growth drops to 1.4 percent.
- For durables, difference rises to 2 percent because of higher differences for computers and other electrical equipment.
- For all items ex tobacco, difference drops to 0.7 percent, implying that falling transportation and distribution margins explain 0.4 percentage points of gap between CPIs and our supplier prices.
- Items in our sample have imports, a matching CPI, and long history, so "all items" refers to about 20 percent of PCE non-energy goods.

Similarity of Price Indexes for Domestic Producers to those for Imports

- Except for durables, import indexes are not higher than domestic producer indexes.
- For all products combined, import index growth is closer to CPI than domestic index, but with tobacco excluded, gaps are similar.
- For apparel and textile items, import and domestic supply prices have very similar differences from CPI growth rates, about 1.5 %.
- For non-durables other than apparel and textiles, growth rate of import prices is 1.2 percentage points lower than growth rate of domestic supplier prices.
- But for durables, growth rate of import indexes is 2.3 percentage points *above* matched CPIs, while growth of domestic supply indexes is just 1.6 points higher.
- For computers and peripherals, domestic producer index has growth rate that is 8 percent per year lower than the import price index, which makes it relatively close to the CPI.
- Domestic producer index is also closer to the CPI in case of motor vehicles and parts.

Implied Productivity Growth in Transportation and Wholesale and Retail Distribution

Under neo-classical assumptions, the difference between the growth rate of the price index for the output of an industry and the price index for the inputs that it uses is an estimate of its productivity growth. Price indexes for labor and other inputs are unlikely to have growth rates below zero, so reversing the sign of the growth rate of the implied price index for transportation and distribution services gives a lower bound estimate of productivity growth in these services.

Solving for the price index for transportation and distribution services that would explain the difference between our suppliers price index and the matched CPI, we find a plausible positive rates of growth for non-durables other than apparel of 1.3 percent per year and a not impossible rate of growth for apparel and textile products of -2.5 percent per year. On the other hand, for durable goods the implied price change for transportation and distribution is about -8 percent per year, which seems too low to be believed. For computers and peripherals, the implied growth rate is almost -30 percent per year. Although strong productivity growth in distribution services is plausible, rates as high as 8 percent per year or more are not plausible. They therefore suggest that difference between the growth rates of the import and domestic producer price indexes and the growth rate of the CPI is too large to be correct.

Relation between Imports and Wholesale and Retail Distribution Margins

Price reductions that are realized by substituting foreign sources of supply for final consumption items for domestic ones are unlikely to be completely passed on to consumers. Instead, the some

of these price reductions are likely to result in expansions of margins received by the wholesale and retail distribution sectors. One reason for this is that more distribution services are required to set up and manage international supply chains. In addition, distributors are likely to have higher inventory costs and greater risks of being stuck with unwanted inventory when suppliers are distant and turnaround times for restocking are long. In addition, while the process of switching to foreign sources of supply is underway, markets are likely to be in a temporary disequilibrium that allows early switchers to earn economic rents.

To test whether higher proportions of imports in the overall domestic supply of a commodity are associated with higher distribution margins, we regress trade margin levels and growth rates on import share levels and growth rates. The regression in table 3 implies that 10 percent increase in the share of domestic supply sourced from imports is associated with a 1.3 percentage point expansion in the distribution margin.

Commodities that are heavily imported—such as apparel—might also have characteristics that require lots of distribution services. If so, import share could be a proxy for the types of characteristics that make a commodity require more distribution services, resulting in upward bias in the regression coefficient in table 3. We therefore also test for a relation between the growth of imports as a share of total commodity supply and the growth of distribution margins. The growth rate regression also shows a positive and statistically significant relationship between imports and distribution margins (table 4). The regression coefficient implies that a commodity with a 10 percentage point increase in its import share would have 0.93 percentage points more growth in its margin rate than an commodity with no change in its import share. Thus, the theoretical prediction of a link between imports and margins received by the distribution industries finds some empirical support.

Conclusion

The increased international engagement of the US economy has given the import and export price indexes important roles in the measurement of real output growth. For most final goods included in personal consumption expenditures (PCE) in the NIPAs, a bias in the PPI would not affect the measurement of real GDP, but a bias in the import index would. That is because most imported items in PCE are deflated by CPIs in measuring the C component of the equation for GDP as GDP = C + I + G + X – M, and deflated by an import index when measuring the M component. As a result, overstated import prices for final consumer goods would result in an overestimate of GDP growth.

Comparisons of import indexes and CPIs at as detailed a level as is possible do not suggest that a price measurement problem exists in the case of nondurable goods other than apparel and textile items. But for apparel and textile items, the import prices seem to grow faster than CPIs by about 1.5 percent per year, and for durable goods they seem to grow faster by more than 2 percent year. A very large discrepancy of over 11 percent per year contributes significantly to the overall discrepancy for durable goods, but for most other kinds of durable goods, the import price indexes also grow significantly faster, with discrepancies ranging from 0.7 to 3.5 percent per year.

These patterns are consistent with Nakamura and Steinsson's finding that the rate of growth of the import price indexes tends to be biased towards zero because many price changes in the sample are linking out of these indexes. The large positive discrepancies between the growth of the import index and the growth of the CPIs occur for apparel and durable goods that have falling CPIs. However, the fact that similar discrepancies also exist between CPIs and prices indexes for domestic production suggests a role for substitutions between domestic and foreign sources of supply in driving down the growth rate of the CPI.

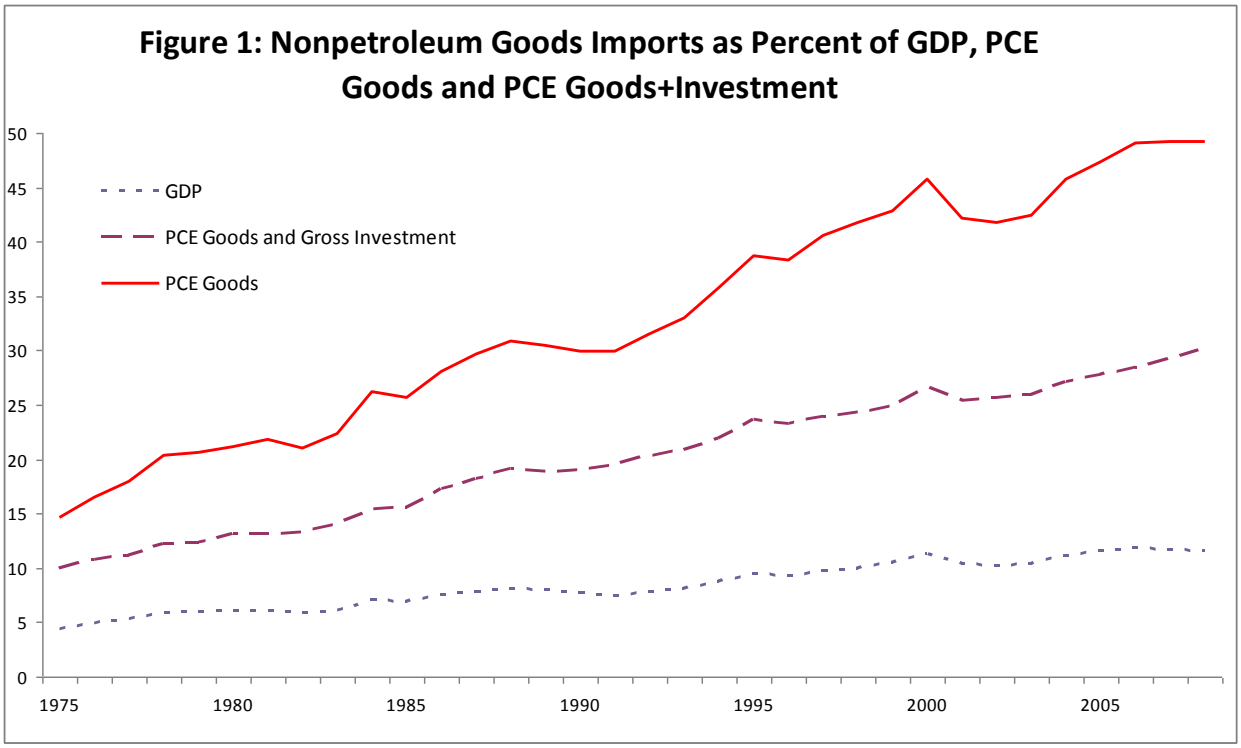
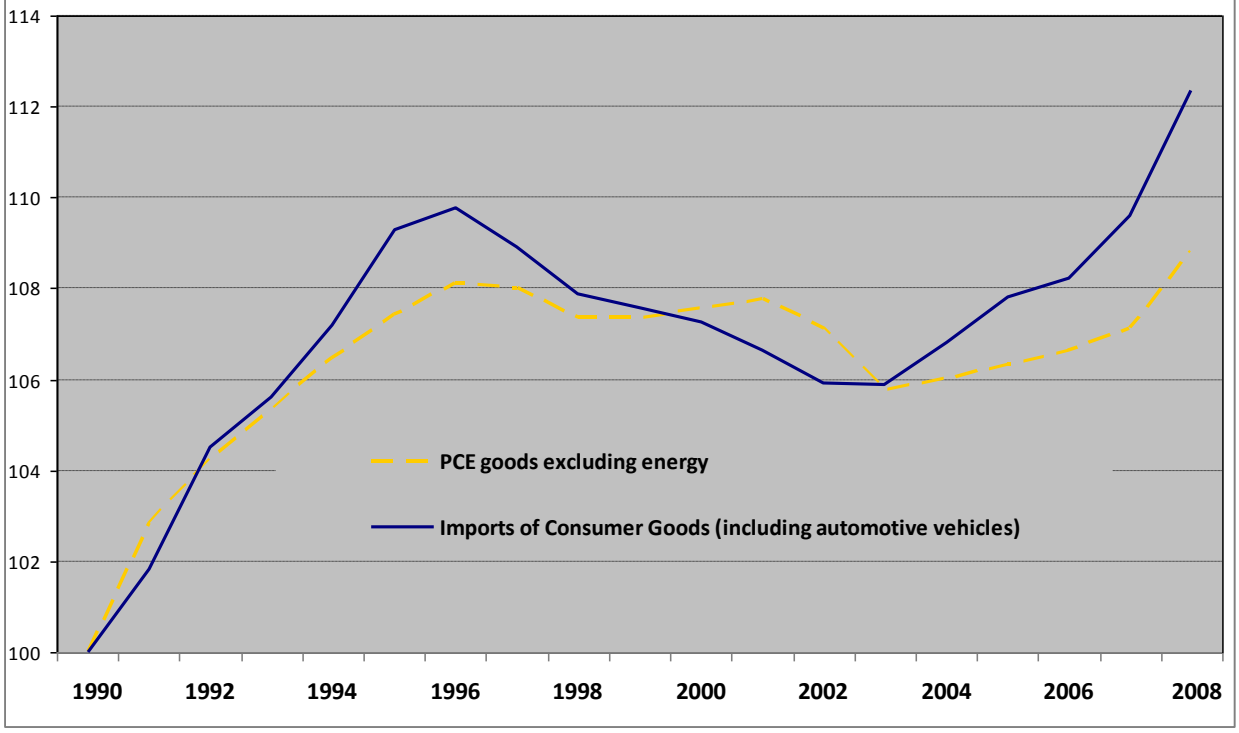


Figure 1: Nonpetroleum Goods Imports as Percent of GDP, PCE Goods and PCE Goods+Investment
50
45
40
35
30
25
20
15
10
5
0
GDP
PCE Goods and Gross Investment
PCE Goods
1975
1980
1985
1990
1995
2000
2005

Figure 2: Price Indexes for Consumer Good Imports and for Personal Consumption Expenditure Goods ex Energy



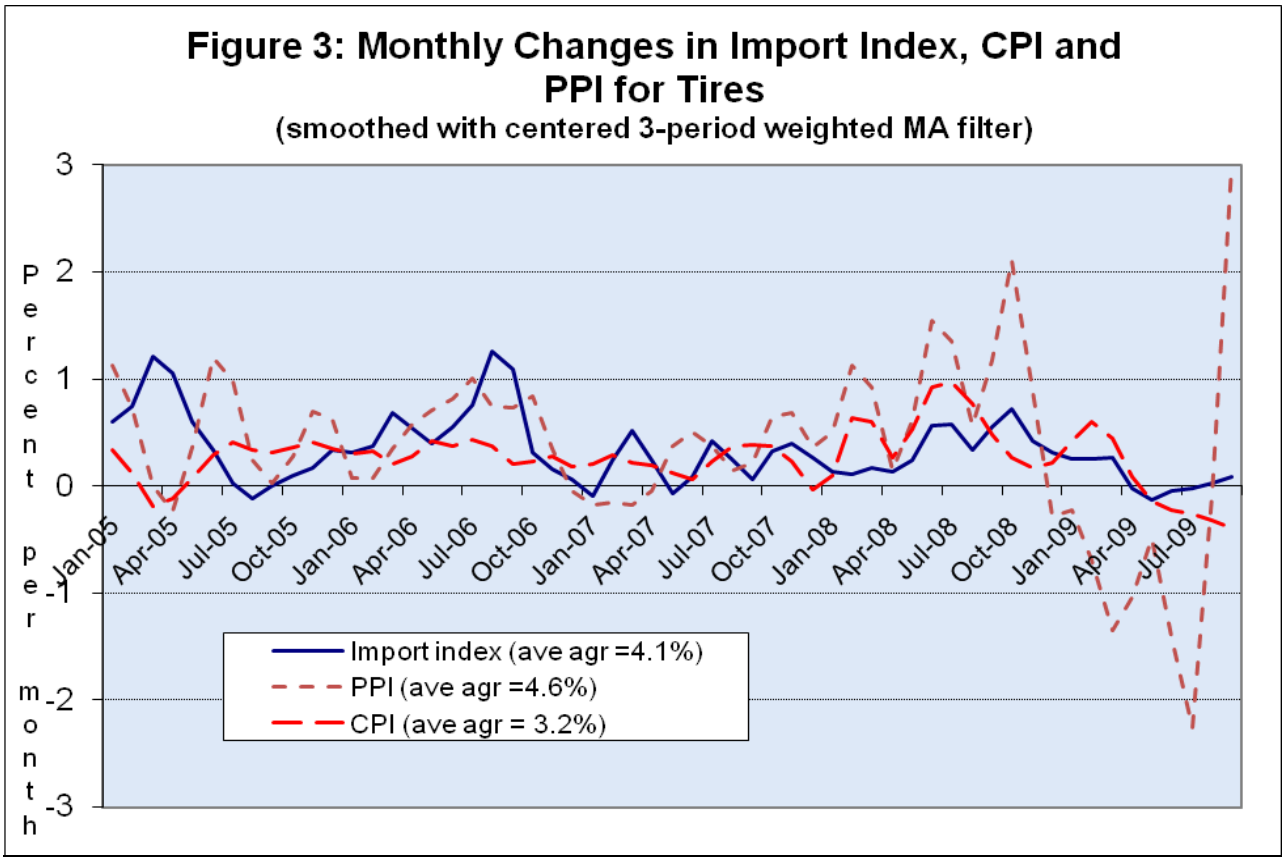


Figure 3: Monthly Changes in Import Index, CPI and PPI for Tires
(smoothed with centered 3-period weighted MA filter)
Percent per month
3
2
1
0
-1
-2
-3
Jan-05
Apr-05
Jul-05
Oct-05
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Import index (ave agr =4.1%)
PPI (ave agr =4.6%)
CPI (ave agr = 3.2%)

Table 1: Growth Rate Differences from Matched CPIs of Suppliers and Purchasers Price Industry

	Difference from Matched CPI				MEMO: Index of Matched CPIs
	Supplier's prices	Purchaser's prices	Import Prices	Domestic Prices	
Nondurables ex apparel	**0.3**	**-0.6**	**-0.6**	**0.6**	**2.2**
Food	0.0	-0.7	0.1	0.0	2.1
Alcohol	0.0	-0.6	-0.5	0.0	1.9
Misc. household supplies	0.6	-0.1	-0.2	1.3	1.5
Paper products, books and magazines	1.1	0.2	-0.4	1.1	1.4
Tobacco products	-0.6	-3.3	-6.6	-0.5	8.1
Durables	**1.9**	**2.0**	**2.3**	**1.6**	**-2.2**
Motor vehicles and parts	0.2	0.2	0.7	-0.1	-0.1
New cars and trucks	0.4	0.5	1.2	-0.2	-0.6
Electrical equipment ex. computers	4.2	4.8	3.5	4.3	-5.6
Computers, peripherals and software	6.4	11.7	11.8	3.8	-20.8
Furniture and wood products	2.3	1.4	1.5	2.5	-0.6
Clocks and watches	1.8	1.7	1.8	1.9	-1.4
Tools, hardware and supplies	1.8	0.9	1.7	1.7	-0.2
Other durables	3.0	1.9	3.1	2.4	-0.8
Apparel and textiles	**1.5**	**1.4**	**1.5**	**1.5**	**-1.2**
Women's and girls' apparel	1.9	1.7	1.9	1.8	-1.5
Men's and boy's apparel	1.3	1.4	1.4	0.7	-1.5
Other apparel	2.4	1.7	2.4	2.4	-1.2
Footwear	0.6	0.5	0.6	1.2	-0.4
Textile and sewing products	1.5	1.1	1.4	1.6	-0.8
All products	**1.0**	**0.6**	**0.7**	**1.1**	**0.2**
All products ex tobacco	**1.1**	**0.7**	**1.0**	**1.1**	**-0.1**

Table 2: Growth Rates of Price Index for Transportation and Distribution Services implied by Difference between Suppliers Price Index and Matched CPI

	Implied price index for Transport & Distribution	Actual price index for Transport & Distribution
Nondurables ex. apparel	**1.3**	**0.5**
Food	2.2	0.2
Alcohol	1.9	0.9
Misc. household supplies	1.1	0.3
Paper products, books and magazines	0.3	0.4
Tobacco products	8.7	2.4
Durables	**-7.9**	**0.1**
Motor vehicles and parts	-1.3	0.3
New cars and trucks	-1.8	0.4
Electrical and electronic equipment ex. Computers	-11.0	0.2
Computers, peripherals and software	-29.7	0.1
Furniture and wood products	-2.7	0.0
Clocks and watches	-1.7	0.1
Tools, hardware and supplies	-1.8	0.0
Other durables	-3.3	0.1
Apparel and textiles	**-2.5**	**-0.0**
Women's and girls' apparel	-3.0	-0.0
Men's and boy's apparel	-2.6	-0.0
Other apparel	-3.0	0.0
Footwear	-0.9	0.0
Textile and sewing products	-2.2	0.0
All products	**-0.8**	**0.3**
All products ex tobacco	**-1.2**	**0.2**

Table 3: Regression of Average Level of Distribution Margin on Share of Domestic Supply from Imports

	Coefficient	t statistic
Intercept	0.3663	29.8
Share supplied by imports	0.1290	4.3
Growth of share of imports	0.0985	1.4

Table 4: Regression of Growth of Distribution Margin from 1997 to 2006 on Share of Domestic Supply from Imports

	Coefficient	t statistic
Intercept	0.0067	1.2
Share supplied by imports	0.0272	1.9
Growth of share of imports	0.0934	2.8