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Charles Dale, Victor B. Bailey, Timothy M. Baxter, and Elizabeth W. King
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Abstract: *This article describes and compares the three most popular indices that are used to measure export prices—Wholesale Price Indices, unit value indices, and export price indices. It includes a brief discussion of the methodology used in constructing the different types of indices and the relative merits of each, as well as a review of the relevant literature. Two of these price measures, Wholesale Price Indices and unit value indices, are used to analyze the "pass-through" question. A proper measurement of the extent to which exporters pass-through the price effects of changes in exchange rates in the prices they charge their foreign customers is essential to an understanding of (1) export pricing behavior of individual industry sectors when exchange rates fluctuate and (2) the impact of exchange rate changes on a country's trade balance.*

Biographies

The authors are all International Economists in the Office of Planning and Research, International Trade Administration, U.S. Department of Commerce.

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Timothy M. Baxter has extensive experience in the design and construction of forecasting models. He was formerly employed by SRI International.

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The appropriate measurement of export prices is essential for understanding many important issues in international trade, such as the effects of devaluation or revaluation on a country's balance of trade. Furthermore, the accuracy of equations used in trade forecasting models also depends on the appropriate measurement of export prices. This article surveys the state of the art of the most widely used measures of export prices and demonstrates that even a simple comparison of price measures can provide useful insights into the pricing behavior of industry sectors following a currency devaluation.

EXPORT PRICE MEASURES

The three most popular types of export price measures are Wholesale Price Indices (now called Producer Price Indices), unit value indices, and export price indices.[1] All three are continually being revised and improved.

Wholesale Price Indices (WPI's), compiled by the Bureau of Labor Statistics, are Laspeyres indices based on Standard Industrial Classification (SIC) codes. They measure

average changes in the prices charged (i.e., list prices) in primary markets by producers of goods in all stages of processing.

The monthly sample used for compiling WPI's includes 2800 commodities, and approximately 10,000 price quotations. The sample universe covers both domestically produced commodities and goods imported for sale in primary markets.

The Bureau of Labor Statistics changed the name of WPI's to Producer Price Indices in 1978 to reflect more accurately the nature of the data. Since the use of the term WPI is so widespread, and because there has been little initial difference in the way the indices are calculated (see Cormier and Early, 1976), we will continue to use the term WPI throughout this study.

Unit value indices (UVI's), compiled by the Bureau of the Census, are Fisher indices. The indices, covering several Schedule B commodity groups, are based on average values derived by dividing the aggregate FAS value of exports by the volume exported. The share of the goods covered within a category varies considerably among categories. For example, the prices for a particular category may be determined by 10% of the goods in that category, whereas the prices for another category may be determined by 80% of the goods. In the occasional instances that using the quantity reported on the export manifest results in an unreasonable unit value, shipping weight is substituted for quantity. Until recently, Census used regression analysis when computing UVI's from shipping weights. Use of this method has been discontinued, however, because it is unsatisfactory when weights vary substantially within a category.

Finally, early in the 1970s the Bureau of Labor Statistics began compiling export price indices (EPI's). These are Laspeyres indices constructed from survey data of transaction prices collected from exporters. The BLS uses a method similar to the pioneering methods of Lipsey (1963) and Kravis and Lipsey (1971, 1974, 1977, 1979). Since these indices are

specifically designed to measure export transaction prices, they would, in principle, be the most satisfactory measures to use in international trade analysis. However, these indices do not yet have the breadth of coverage or the historical depth needed for many analytical purposes.

STUDIES OF EXPORT PRICE MEASURES

Concern about the quality of official price statistics led to a study by the Price Statistics Review Committee of the National Bureau of Economic Research (1961). The Committee's report, known as the "Stigler Report," concluded that price data on U.S. trade was woefully inadequate, but it recommended the use of UVI's as deflators. The report began a debate on the relative merits of WPI's and UVI's, the only export price measures then available.[2]

The Interagency Committee on Measurement of Real Output (1970), in a study known as the "Searle Report," recommended that preference be given to WPI's over UVI's as deflators. This recommendation was made since UVI's are essentially average values that can be greatly affected by changes in product mix.[3] The WPI sampling procedure, on the other hand, has specific provisions that take into account changes in product mix and quality. The report also acknowledged that, in certain instances, WPI's would be unsuitable. In such cases, and under certain strict criteria, UVI's may be preferred.

Based on a comparison of WPI's and UVI's, Gordon (1971) recommended the use of UVI's as deflators for fixed capital goods, believing that the UVI's reflected transaction prices. Gordon argued that his comparison of the two price indices showed that the WPI's, which are based on sellers' list prices rather than buyers' transaction prices, were biased upward and were therefore unacceptable.

Popkin and Gillingham (1971), in a rejoinder, pointed out that many of the product categories used in Gordon's paper were

broadly enough defined so a͟ susceptible to the product c problems suffered by UVI's. that, given the product qualit͟ lems, the UVI's used in Gord͟ not unbiased measures of tra As a result, a comparison of ͟ cannot show that it is the ͟ Indices that are biased, nor ca that the UVI's are valid def͟ capital goods.

In a subsequent paper, ͟ concluded that neither WPI's totally satisfactory as meas͟ prices, while acknowledging mix problem will cause UVI's ͟ ing measure of transaction p͟ Gordon argued that in the e͟ UVI does represent a tra͟ its comparison with a WPI ca insights into economic ques͟ argued that notable deviatioͅ growth rates of UVI's that do͟ tion prices and WPI's indic͟ research needs to be condͅ which index provides the b͟ export prices.

The importance of havinͅ available has led to attempts construction of the indices. Kiehn (1966) offered early id͟ improving UVI's, and Etkin (1 to derive UVI's for bilateral tra͟ most significant improvemen͟ been the development, by ͟ Labor Statistics, of export pric͟ on surveys of transaction pric͟

Murphy (1971) made an e͟ of BLS' export price indices, ͟ Indices, and unit value indic͟ lated the unit value indices us͟ formula in order to obtain coͅ the WPI's and EPI's. Murphy͟ his specially constructed UV͟ more volatile than the EPI's, ͟ to-year changes and freque͟ direction. Furthermore, he ͟ UVI's had a product mix prob͟

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lems, the UVI's used in Gordon's study were
not unbiased measures of transaction prices.
As a result, a comparison of UVI's and WPI's
cannot show that it is the Wholesale Price
Indices that are biased, nor can one conclude
that the UVI's are valid deflators for fixed
capital goods.

In a subsequent paper, Gordon (1973)
concluded that neither WPI's nor UVI's were
totally satisfactory as measures of export
prices, while acknowledging that a product
mix problem will cause UVI's to be a mislead-
ing measure of transaction prices. However,
Gordon argued that in the event a particular
UVI does represent a transaction price
its comparison with a WPI can offer valuable
insights into economic questions. Also he
argued that notable deviations between the
growth rates of UVI's that do reflect transac-
tion prices and WPI's indicate that further
research needs to be conducted to decide
which index provides the best measure of
export prices.

The importance of having accurate data
available has led to attempts to improve the
construction of the indices. For example,
Kiehn (1966) offered early ideas on means of
improving UVI's, and Etkin (1974) attempted
to derive UVI's for bilateral trade. Perhaps the
most significant improvement, however, has
been the development, by the Bureau of
Labor Statistics, of export price indices based
on surveys of transaction prices.

Murphy (1971) made an early comparison
of BLS' export price indices, Wholesale Price
Indices, and unit value indices. He recalcu-
lated the unit value indices using a Laspeyres
formula in order to obtain comparability with
the WPI's and EPI's. Murphy concluded that
his specially constructed UVI's were much
more volatile than the EPI's, with wide year-
to-year changes and frequent reversals of
direction. Furthermore, he too noted that
UVI's had a product mix problem. The WPI's

were found to include the prices of goods that
are not traded. Moreover, he also found that
the WPI's and the EPI's movements were
generally differing in magnitude from year to
year, though always in the same direction.
Murphy concluded that neither UVI's nor
WPI's are good proxies for EPI's in all in-
stances.

Further discussions of the Bureau of Labor
Statistics' export price indices may be found
in Murphy (1978) and Kasper and Pratt
(1978). Murphy compared UVI's to EPI's but,
contrary to the methodology applied in his
1971 article, he used official data for the
UVI's. As a result, he was comparing a Fisher
index (UVI's) to a Laspeyres index (EPI's).
From this analysis he concluded that due to a
gradual shift to higher quality products the
UVI's tended to climb more rapidly than the
EPI's. As a result, using UVI's as deflators will
tend to understate the growth of real exports.

Kasper and Pratt described the sampling
techniques being utilized by BLS to construct
the new export and import price indices and
discussed the status of various parts of the
program. For example, they pointed out that
introduction of indices for commodity classes
was scheduled for completion in fiscal year
1981.

Murphy and Perez-Lopez (1977) sum-
marized the literature on UVI's. One of their
conclusions was that an inverse relationship
exists between the relative importance of each
economic class of exports to total trade and
the share of the value of exports in the
category from which the particular UVI's are
calculated. For example, the UVI's for crude
foods were based on products comprising
90% of the value of exports in that category,
whereas crude foods comprised only about
12% of U.S. exports. On the other hand,
UVI's were calculated using products that
covered only about 24% of the value of the
finished manufactures category, which ac-
counted for some 58% of total exports. This
coverage raises the question whether UVI's
accurately reflect the movement of the aver-
age unit values of some export categories, a

question quite distinct from whether UVI's represent actual transaction price movements.

Finally, it should be noted that both BLS and Census are constantly examining their price measures. BLS is upgrading its survey techniques, while Census is broadening its coverage of unit values. In the next section we will describe how measuring pass-through, a significant issue in international trade theory, critically depends on the availability of a suitable price measure.

THE PASS-THROUGH ISSUE

One significant economic issue that arises under both fixed and floating exchange rate regimes is the question of when and how exchange rate changes affect trade balances. In this regard, the critical determinant is the pricing policies of individual firms. If firms resist altering their export prices to reflect exchange rate changes, they are said to absorb the differences. On the other hand, if they adjust their export prices immediately following major exchange rate changes, they are said to pass-through the exchange rate effects.[4] The timing and extent of pass-through help determine the short-run effects that exchange rate changes will have on trade balances.

In this section we describe how two export price measures may be used to study the pass-through issue. We conclude that industrial sectors differ greatly in their pricing behavior, with some sectors exhibiting a great deal more pass-through than others.

To look for pass-through, we first divide total merchandise exports into the end-use categories devised by the Commerce Department's Bureau of Economic Analysis.[5] These categories are: Foods, Feeds, and Beverages; Industrial Supplies and Materials; Capital Goods; Automotive Vehicles, Parts, and Engines; and Consumer Goods.[6]

Two price indices are shown on Figure 1 and Table 1: Wholesale Price Indices and unit value indices. The WPI's are aggregates chosen to approximate each end-use category

and thus are composites of tradable and nontradable goods. The UVI's are compiled by the Bureau of the Census specifically for these end-use categories. They are, however, subject to all the defects described earlier.[7] Of course, the best price measure to use would be a survey-type index such as the Bureau of Labor Statistics' export price index. However, BLS currently is compiling indices primarily for highly disaggregated SITC categories, not aggregate end-use categories.

Figure 1 compares the movement of the two price indices during the period 1972–1979. The results reveal a striking difference in the pricing behavior of different industry sectors.

The most dramatic example, and the one that is easiest to interpret, is end-use group 3, Automotive Vehicles, Parts, and Engines. The divergence of the WPI and UVI since 1973 is very clear. Since relatively few subgroups comprise this end-use category, and the total value of automobile exports and the value of parts exports are very similar, the aggregation problems commonly experienced by UVI's are likely to be minor.

Before 1973, the price indices moved together, even through the Smithsonian agreement period of late 1971. During 1973, when the fixed exchange rate system ended, the WPI and UVI for automobiles began to diverge markedly, with the UVI increasing significantly faster. One possible explanation is this: If, after the 1973 dollar devaluation, U.S. auto exporters had maintained similar pricing schemes for cars and parts to be sold domestically and cars and parts to be exported, the WPI and UVI would have continued to move together. Possibly, the UVI began to increase more rapidly than the WPI because U.S. automakers did not pass through the exchange rate benefits to foreign customers, but instead raised the dollar prices of their exported cars. This, in turn, suggests that U.S. automakers were attempting to maximize profits by increasing prices, rather than trying to expand market share by taking advantage of the cheaper dollar. Although this is conjec-
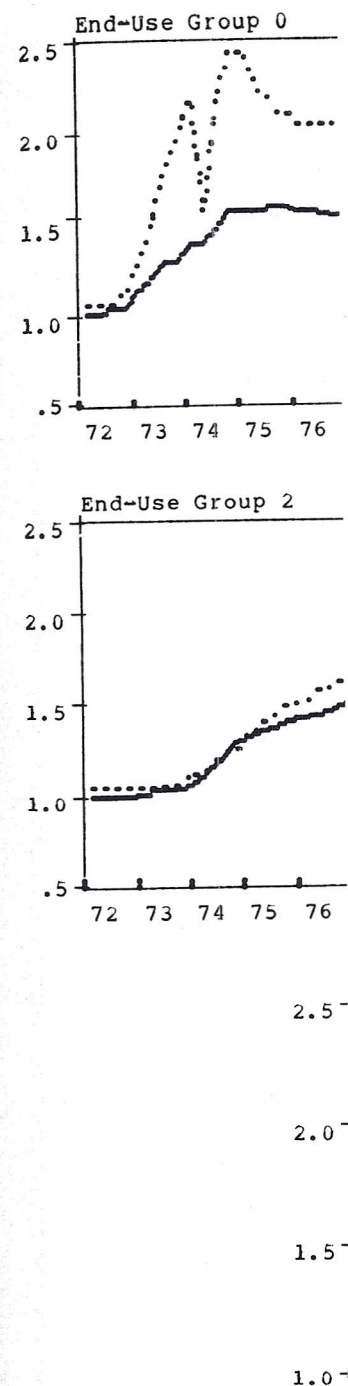

Figure 1. End-Use Category

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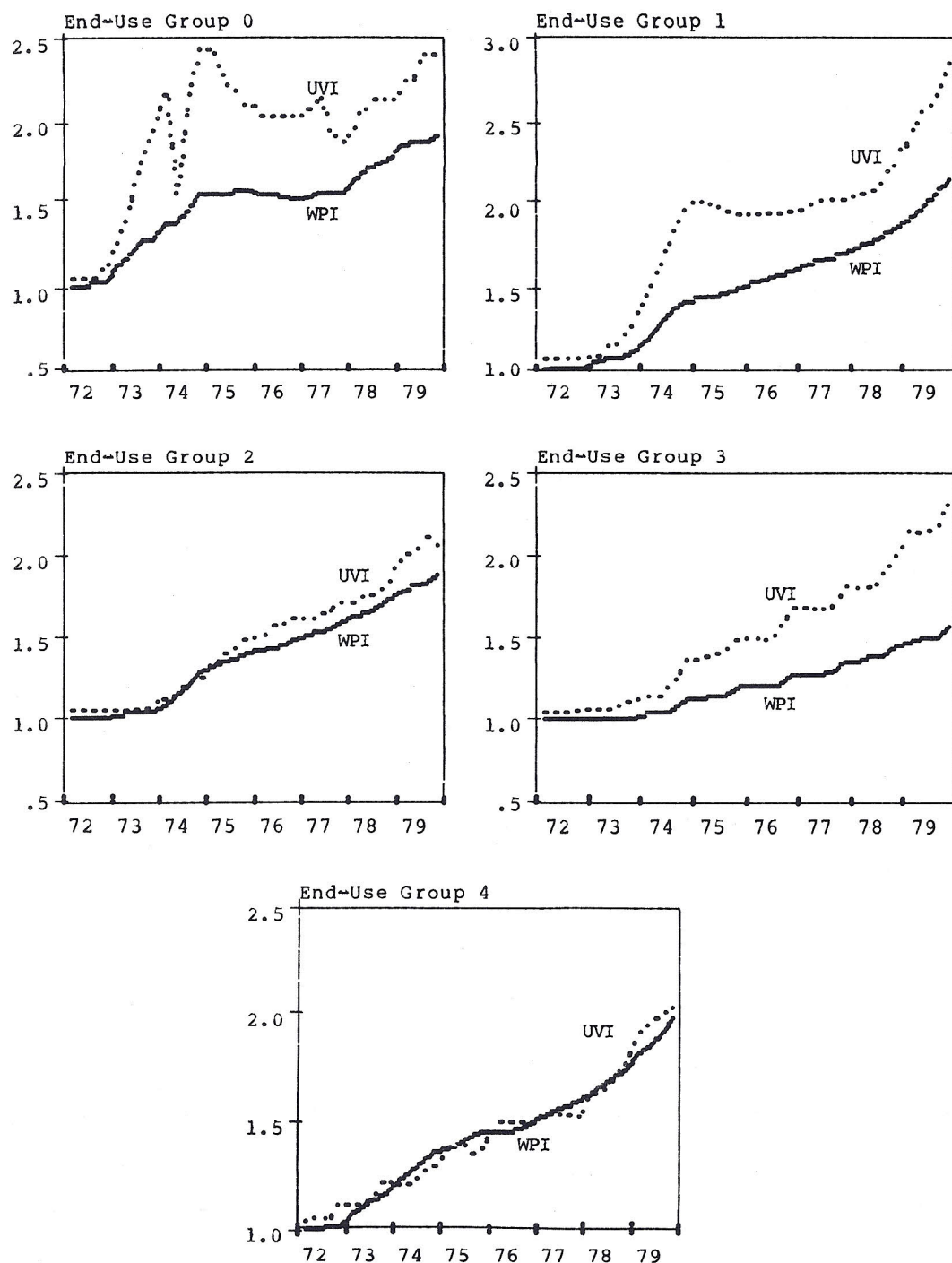ollar. Although this is conjec-

Figure 1. End-Use Category Price Indices, 1972 = 1.0.

Table 1. End-Use Category Price Indexes, 1972 = 1.0 (Not Seasonally Adjusted)

	Foods, Feeds, and Beverages End-Use Group 0		Industrial Supplies and Materials End-Use Group 1		Capital Goods End-Use Group 2		Automotive Vehicles, Parts, and Engines End-Use Group 3		Consumer Goods End-Use Group 4	
	UVI	WPI	UVI	WPI	UVI	WPI	UVI	WPI	UVI	WPI
72:1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
72:2	1.0223	0.9975	1.0107	1.0103	0.9989	1.0059	0.9819	0.9983	1.0462	1.0026
72:3	1.0406	1.0323	1.0208	1.0175	0.9858	1.0090	1.0045	0.9974	1.0218	1.0200
72:4	1.1198	1.0412	1.0335	1.0232	1.0000	1.0104	1.0474	0.9847	1.1092	1.0255
73:1	1.2984	1.1318	1.0791	1.0427	1.0011	1.0205	1.0429	0.9945	1.0973	1.0703
73:2	1.4849	1.1983	1.1160	1.0753	1.0338	1.0354	1.0418	1.0006	1.1152	1.1056
73:3	1.7932	1.2905	1.1945	1.0888	1.0289	1.0432	1.0977	0.9945	1.1564	1.1470
73:4	1.9614	1.2911	1.2958	1.1191	1.0747	1.0598	1.1350	1.0075	1.2269	1.1644
74:1	2.1813	1.4011	1.4688	1.1910	1.1423	1.0907	1.1525	1.0283	1.1753	1.2356
74:2	1.5138	1.3872	1.6465	1.2907	1.1587	1.1426	1.1462	1.0346	1.1961	1.2622
74:3	2.1774	1.4699	1.8538	1.3812	1.2219	1.2204	1.2242	1.0638	1.2607	1.3175
74:4	2.4326	1.5696	1.9805	1.4224	1.2470	1.2951	1.3721	1.1371	1.2910	1.3699
75:1	2.3966	1.5443	2.0322	1.4456	1.3304	1.3346	1.3845	1.1397	1.3684	1.3826
75:2	2.1819	1.5281	1.9437	1.4625	1.4073	1.3577	1.3958	1.1486	1.3992	1.3991
75:3	2.0975	1.5836	1.9081	1.4791	1.4444	1.3739	1.4320	1.1440	1.3332	1.4385
75:4	2.0556	1.5607	1.8706	1.5069	1.4940	1.4090	1.4896	1.2136	1.3699	1.4614
76:1	1.9954	1.5070	1.9195	1.5306	1.5044	1.4326	1.5189	1.2176	1.4791	1.4567
76:2	1.9686	1.5139	1.9423	1.5524	1.5518	1.4475	1.4641	1.2127	1.4950	1.4669
76:3	1.9961	1.4864	1.9256	1.5788	1.5840	1.4624	1.5404	1.2118	1.4906	1.4732
76:4	1.9719	1.4713	1.9591	1.6060	1.6265	1.4986	1.6691	1.2811	1.4752	1.4958
77:1	2.0537	1.5237	1.9906	1.6326	1.5916	1.5185	1.6798	1.2788	1.5407	1.5305
77:2	2.1492	1.5752	2.0154	1.6672	1.6249	1.5368	1.6285	1.2851	1.5492	1.5656
77:3	1.8770	1.5688	2.0342	1.6913	1.6778	1.5573	1.6917	1.2898	1.5179	1.5797
77:4	1.8246	1.5766	2.0201	1.7136	1.7165	1.6075	1.7950	1.3613	1.4975	1.6012
78:1	1.9764	1.6471	2.0604	1.7428	1.7110	1.6325	1.7679	1.3648	1.6316	1.6324
78:2	2.0916	1.7267	2.0724	1.7818	1.7644	1.6589	1.7702	1.3873	1.6360	1.6808
78:3	2.1368	1.7443	2.1496	1.8156	1.7683	1.6864	1.8888	1.3911	1.6917	1.7091
78:4	2.0995	1.7805	2.2837	1.8554	1.8435	1.7333	1.9831	1.4519	1.7661	1.7459

76:1	1.9954	1.5070	1.9195	1.5306	1.5044	1.4326	1.5189	1.2176	1.4791	1.4307
76:2	1.9686	1.5139	1.9423	1.5524	1.5518	1.4475	1.4641	1.2127	1.4950	1.4669
76:3	1.9961	1.4864	1.9256	1.5788	1.5840	1.4624	1.5404	1.2118	1.4906	1.4732
76:4	1.9719	1.4713	1.9591	1.6060	1.6265	1.4986	1.6691	1.2811	1.4752	1.4958
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77:2	2.1492	1.5752	2.0154	1.6672	1.6249	1.5368	1.6285	1.2851	1.5492	1.5656
77:3	1.8770	1.5688	2.0342	1.6913	1.6778	1.5573	1.6917	1.2898	1.5179	1.5797
77:4	1.8246	1.5766	2.0201	1.7136	1.7165	1.6075	1.7950	1.3613	1.4975	1.6012
78:1	1.9764	1.6471	2.0604	1.7428	1.7110	1.6325	1.7679	1.3648	1.6316	1.6324
78:2	2.0916	1.7267	2.0724	1.7818	1.7644	1.6589	1.7702	1.3873	1.6360	1.6808
78:3	2.1368	1.7443	2.1496	1.8156	1.7683	1.6864	1.8888	1.3911	1.6917	1.7091
78:4	2.0995	1.7805	2.2837	1.8554	1.8435	1.7333	1.9831	1.4519	1.7661	1.7459

Table 1. End-Use Category Price Indexes, 1972 = 1.0 (Not Seasonally Adjusted) *continued*

	Foods, Feeds, and Beverages End-Use Group 0		Industrial Supplies and Materials End-Use Group 1		Capital Goods End-Use Group 2		Automotive Vehicles, Parts, and Engines End-Use Group 3		Consumer Goods End-Use Group 4	
	UVI	WPI	UVI	WPI	UVI	WPI	UVI	WPI	UVI	WPI
79:1	2.2147	1.8685	2.4091	1.9127	1.9831	1.7720	2.1124	1.4762	1.9012	1.8101
79:2	2.2631	1.8883	2.5674	1.9891	2.0289	1.8083	2.1265	1.5048	1.9638	1.8570
79:3	2.4136	1.8903	2.6385	2.0684	2.0758	1.8282	2.1485	1.4947	1.9866	1.9120
79:4	2.3973	1.9195	2.8478	2.1555	2.0398	1.8855	2.3179	1.5654	2.0303	1.9890

Source: WPI's—Bureau of Labor Statistics, Producer Prices and Price Indexes.
UVI's—Bureau of the Census, FT990.

Note: The WPI's for end-use group 0 through 4 are the Wholesale Price Indexes for All Foods, Industrial Commodities, Capital Equipment, Passenger Cars, and Finished Consumer Goods, respectively.

ture, such behavior is not improbable in oligopolistic industries.

Figure 1 reveals a similar pattern for end-use group 2, Capital Goods. The WPI and UVI moved together until the 1973 dollar devaluation, after which U.S. firms may have marked up the prices of their export goods relative to their products sold domestically.

The opposite situation is shown in end-use category 4, Consumer Goods. The WPI and UVI moved together fairly well through the 8 year period shown, although there were temporary divergences possibly due to currency fluctuations. This behavior is consistent with the theory that competitive pressures generally kept export prices in line with domestic prices.

Figure 1 also includes an intermediate case. Firms that chiefly manufactured goods in end-use group 1, Industrial Supplies and Materials, appear to have begun increasing their export prices relative to domestic prices in 1973. The closeness of the UVI and WPI indicates, however, that the markups in this industry were not as great as those in the auto industry.

Finally, Figure 1 shows end-use category 0, Foods, Feeds, and Beverages. Here again the WPI and UVI diverge sharply in 1973. The two indices moved up together before 1973 reflecting the general commodity inflation that occurred in that period. The indices began moving back in line at the end of 1979—this development is not surprising since agricultural markets are generally highly competitive.

The huge differences in the behavior of prices for the various end-use categories have implications for both theory and policy. At the theoretical level, the graphs indicate that whether or not a depreciating currency will improve the trade balance, and if so how long it will take, is difficult to measure because of different pricing strategies among sectors. At the policy level, strategies to increase exports can only be devised if policymakers have a clear understanding of how individual sectors price exports.

Of course, we emphasize that our discussion of Table 1 is conjecture.[8] Nonetheless, it is remarkable just how illustrative a few simple comparisons may be when the nature of the data being used is understood. As the Bureau of Labor Statistics and the Bureau of the Census improve their price measures, it should be possible to reach more definitive conclusions about the nature of pass-through in various industrial sectors.

CONCLUSIONS

This article has examined three price measures to reach the following conclusions: (1) The best measure of export prices would be the Bureau of Labor Statistics' export price index, which is constructed using data from surveys of exporters' transaction prices. This BLS index is, however, not yet adequate in either its commodity or historical coverage; (2) Of the two remaining price measures, Wholesale Price Indices are usually, but not always, superior to unit value indices. The composition and behavior of the individual export categories being measured must be carefully examined to be certain that WPI's are preferable to UVI's; (3) To measure pass-through, i.e., the extent to which firms alter their export prices to reflect exchange rate changes, requires analyzing the export price indices of separate industry groups, as opposed to just examining aggregate export price indices. The evidence in this study indicates that some sectors, such as autos, may have been holding up their export prices after the dollar devaluation, while other sectors, such as consumer goods, may have passed on the effectively lower prices to their prospective customers.

The measurement of export price movements in general, and the analysis of issues such as pass-through in particular, require the construction of accurate price indices. Both the Bureau of Labor Statistics, which produces EPI's and WPI's, and the Bureau of the Census, which constructs UVI's, are actively working to raise the quality of these measures. Such improvements are vital to economists'

efforts to understand the the(
of international trade.

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1. These are only the most v
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   UVI's for his work.
   Goldstein and Officer (19
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3. See Bailey (1975).

4. The seminal article on
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5. For a discussion of variou
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efforts to understand the theoretical structure
of international trade.

NOTES

1. These are only the most widely used price
   measures. Hooper (1976) derived his own
   UVI's for his work. More recently,
   Goldstein and Officer (1979) devised new
   price indices for tradable and nontradable
   goods. However, they concluded that their
   price measures behave very similarly to
   more conventional measures.

2. For a representative sample of studies in
   which the choice of price indices may have
   had a profound effect on the results see
   Ahluwalia and Hernandez-Cata (1975),
   Grossman (1980), Isard (1977), Summers
   (1973), Suomela (1978), and U.S. Bureau
   of Labor Statistics (1971).

3. See Bailey (1975).

4. The seminal article on pass-through is
   Branson (1972). Also see related articles
   by Magee (1973) and Miles (1979).

5. For a discussion of various trade classifica-
   tions see Dale et. al. (1981), Kwack
   (1975), and Bureau of International Eco-
   nomic Policy and Research (1978).

6. There are two other end-use export
   categories: Special Category (Military
   Goods), and Reexports and Miscellane-
   ous. These categories either do not have
   adequate public data or behave too errati-
   cally to be useful for our purposes.

7. The Commerce Department's Interna-

tional Trade Administration (ITA) is cur-
rently experimenting with a "price proxy,"
which is a composite of disaggregated
wholesale prices weighted by the share of
exports of each commodity. In some
cases, the ITA price proxy more closely
follows movements in the WPI, in other
instances it tracks better with the UVI. The
price proxy is, therefore, an area of con-
tinuing research within ITA.

8. For example, one alternative explanation
   for divergences in the indices might be
   business-cycle considerations. Both 1973
   and 1978 were years of fairly intensive
   capacity utilization worldwide, which may
   have had an abnormal effect on the vari-
   ous price indices. This type of situation
   could cause short-run abnormal pricing
   behavior.

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