

Industry Specific Exchange Rates for the United States

Abstract

The trade-weighted exchange rates constructed for the aggregate U.S. economy are not always able to capture the changes in industry competitive conditions induced by movements in specific bilateral exchange rates. Exchange rates constructed using information on industry-specific trade partners are better suited for this task. In this paper, we present alternative industry-specific real exchange rate measures and their construction methods. We demonstrate the differences between such measures and ones that exclude industry details. As one example, we consider the differences between such measures in tracking industry changes in corporate profits. We provide additional variants on exchange-rate index construction that might be valuable to analysts and researchers.

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1. Introduction

The significant declines in the trade-weighted U.S. dollar raises anew questions regarding what exchange rate fluctuations mean for U.S. producers and for U.S. economic activity more generally. When the dollar depreciates, the prices of goods imported into the United States rise, except to the extent that foreign producers maintain stable dollar prices while absorbing the exchange rate movements in their profit margins in order to sustain their U.S. market share.¹ All else equal, exchange-rate induced U.S. import price increases generally improve the competitiveness of U.S. producers in manufacturing and non-manufacturing industries relative to their foreign competitors. While some industries are made worse off from real dollar depreciation, perhaps due to net reliance on imported productive inputs, on average the profits of U.S. producers rise.

At the national level, discussions of exchange rate movements generally rely on aggregate trade-weighted exchange rates like the carefully constructed measures computed by the Federal Reserve Board for the aggregate economy.² Construction of these indices relies on weighting schemes applied to trade-partner exchange rates, with weights based on all of the imports and exports of the entire U.S. economy. While extremely useful at a macroeconomic level, this focus on national aggregates necessarily omits industry-specific distinctions in trade partners or competition. The importance of particular countries as competitors can differ substantially from the aggregate importance. As a consequence aggregate trade-weighted indices may give misleading indications of exchange-rate related competitiveness changes applicable to specific industries. For example, the share of the euro area is 18 percent in U.S. overall imports, but 25 percent in the imports of precision instruments and 13 percent of imports of toys and miscellaneous manufacturing (Table 1).³ By contrast, while China represents 11 percent of overall U.S. imports, it accounts for 9 percent and 38 percent of imports of

¹ Exchange rate “pass-through” into import prices may be complete as occurs under “producer currency pricing”, partial, or negligible as occurs under “local currency pricing”. Campa and Goldberg (2002) analyze the degree of exchange rate pass through into import prices for the United States and other OECD countries. Campa and Goldberg (2003) explore the reasons behind the relative stability of consumer prices with respect to exchange rates.

² See <http://www.federalreserve.gov/releases/H10/Summary/> .

³ The Census recently changed over to the NAICS (North American Industry Classification System) and has dropped reporting of SIC. By industry trade data by SIC is available only up to 2001 while by industry trade data by NAICS is available up to 2002. Both systems are reported in Table 1.

precision instruments and toys/miscellaneous manufacturing, respectively. Because of these differences, we expect corresponding currencies and their exchange rates relative to the dollar to play distinct roles in the relative competitive conditions for different U.S. industries.

Table 1 Country/Region Shares in Trade by Industry

a) U.S. Export Destinations by SIC, 2001

	sic	Euro-area	Japan	China
Electronics	36	13	8	3
Industrial Machinery	35	20	8	4
Precision Instruments	38	28	15	3
Toys and Sporting Goods	39	20	10	1
Transportation Equipment	37	18	5	3
All U.S. Exports		18	9	3

b) U.S. Sources of Imports by SIC, 2001

	sic	Euro-area	Japan	China
Electronics	36	8	15	15
Industrial Machinery	35	17	20	11
Precision Instruments	38	25	23	9
Toys and Sporting Goods	39	13	11	38
Transportation Equipment	37	19	23	1
All U.S. Imports		18	13	11

c) U.S. Export Destinations by NAICS, 2002

	naics	Euro-area	Japan	China
Computer and Electronics	334	17	8	4
Machinery	333	16	6	4
Electrical Equipment	335	14	5	3
Toys and Sporting Goods	339	26	11	1
Transportation Equipment	336	18	6	3
All U.S. Exports		17	8	3

d) U.S. Sources of Imports by NAICS, 2002

	naics	Euro-area	Japan	China
Computer and Electronics	334	8	13	16
Machinery	333	27	23	8
Electrical Equipment	335	12	9	27
Toys and Sporting Goods	339	15	7	35
Transportation Equipment	336	17	23	1
All U.S. Imports		17	12	13

The present paper shows how “industry-specific” exchange rates can be constructed and presents the recent paths of these indices. Some basic examples are used to demonstrate that a researcher might miss the empirical importance of exchange rates for specific U.S. industries – for example, for producer profits – in analyses that use aggregate exchange rate indices instead of industry specific ones. Large qualitative differences in results are apparent even with data on U.S. industries disaggregated at the 2-digit SIC level. Such differences presumably would be even more pronounced if trade-weighted exchange rates were constructed at much finer levels of industry disaggregation. We present three basic real exchange rate measures for each industry: one uses export partner weights only, a second uses import partner weights, and a third uses an average of export and import weights by industry.

After detailing construction methods for industry-specific exchange rates, this paper presents diagnostics on the extent to which each construct co-moves or diverges from aggregated economy-wide constructions. One basic and well-known observation is that there is a large divergence in exports and imports of the U.S. across country trade partners. Compared with the partners of U.S. exporters, U.S. importers tend to purchase a larger share of goods from less developed countries. Even within an industry, such differences mean that producers involved in exporting may experience an exchange-rate induced change in competitive conditions that is quite distinct from that to U.S. producers facing import competition or using imported components in production.⁴ The distinctions across industries are sometimes even larger, since specific bilateral exchange rate changes can trigger vastly different pressures on producers engaged in different types of activities.

All of these points underscore the potential for industry-specific exchange rates to be very different, depending on whether they are constructed using import or export data. A goal throughout this article is to drive home the point that movements in bilateral exchange rates – for example, between the dollar and the euro, the dollar and the yen, or the dollar and the Chinese yuan – mean different things to different producers. Because of this, the trade-weighted exchange rate series relevant for a producer or an industry

⁴ Campa and Goldberg (1995, 1997, 1999, 2001) show that a “net external orientation” measure accounting for both the export orientation and use of imported inputs by producers is appropriate in some analyses, including analysis of investment sensitivity to exchange rates.

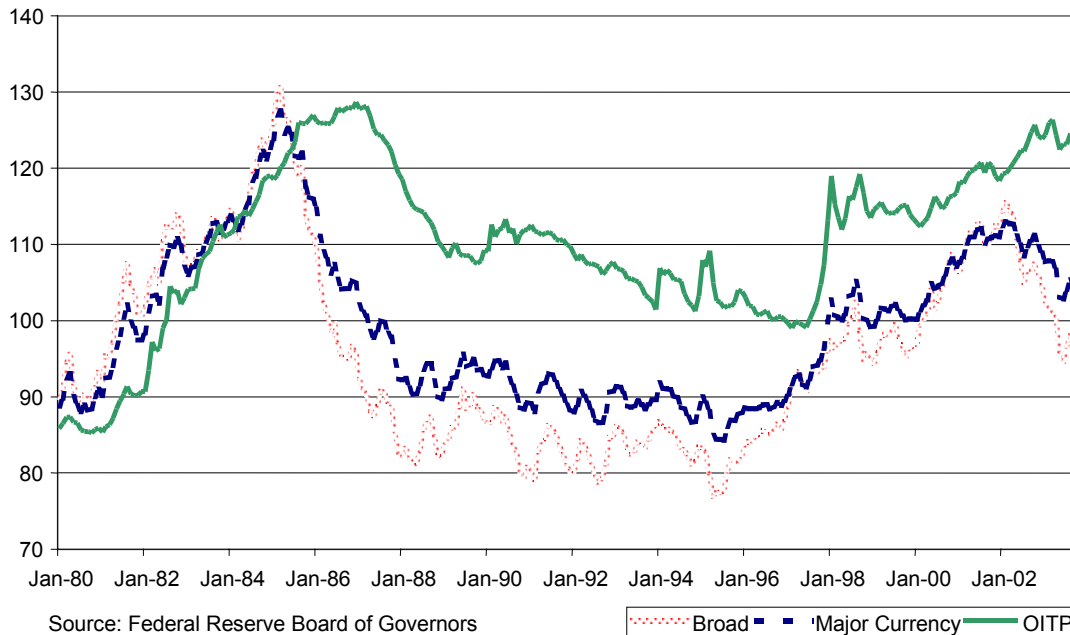
depends on the industry and the issue that is being considered by an economist or analyst, and this idea is borne out by our analysis of the sensitivity of corporate profits and exchange rates. With the available data and construction methods, this paper facilitates a better matching of exchange rate indices to industry-specific concerns.⁵ The lessons from this discussion and the availability of these series should encourage more widespread and informed analysis of issues related to the effects on U.S. industries of movements in the real value of the U.S. dollar.

2. Aggregate Real Exchange Rate Indices

The Federal Reserve Board makes available a number of very useful and carefully constructed aggregate exchange rate indices that provide a window into the overall value of the U.S. dollar. Among these alternative measures, we focus exclusively on the “real” indices, meaning that exchange rates input into the calculations are adjusted for aggregate price inflation in the markets of partner countries. The Federal Reserve’s “Broad Index” is a weighted average of the foreign exchange values of the U.S. dollar against the currencies of a large group (approximately 35) of major U.S. trading partners. The index weights change over time and are derived from U.S. export shares and from U.S. foreign import shares. Two other real exchange rate series constructed by the Federal Reserve Board differ from this Broad Index in the trading partner weights used in constructing the series. The Major Currencies index reflects the value of the dollar against the currencies of countries in the euro area, and Australia, Canada, Japan, Sweden, Switzerland and the United Kingdom. The OITP (“Other Important Trading Partners”) index shows the dollar value against other currencies that are not heavily traded outside of their home markets. These indices are shown in Figure 1.

⁵ <http://www.newyorkfed.org/rmaghome/economist/goldberg/index.html>

Figure 1: Board of Governors Price-Adjusted Dollar Monthly Index, March



Without yet addressing the important issue of different partners for different U.S. industries, these alternative aggregate series from the Federal Reserve illustrate the importance of properly tracking trading partners of the U.S. Since January 2000, the real Broad and Major Currency indices show substantial movements in the U.S. dollar value. The Broad index appreciated by 12 percent through January 2002, then depreciated by a cumulative 9 percent through October 2003. The Major Currency Index, which has more of a concentration on the industrialized countries, showed more overall volatility during this same period, appreciating by 18 percent before depreciating 19 percent overall. By contrast, the dollar appreciated against the currencies in the OITP index through most of the same period.

3. Industry-Specific Real Exchange Rates

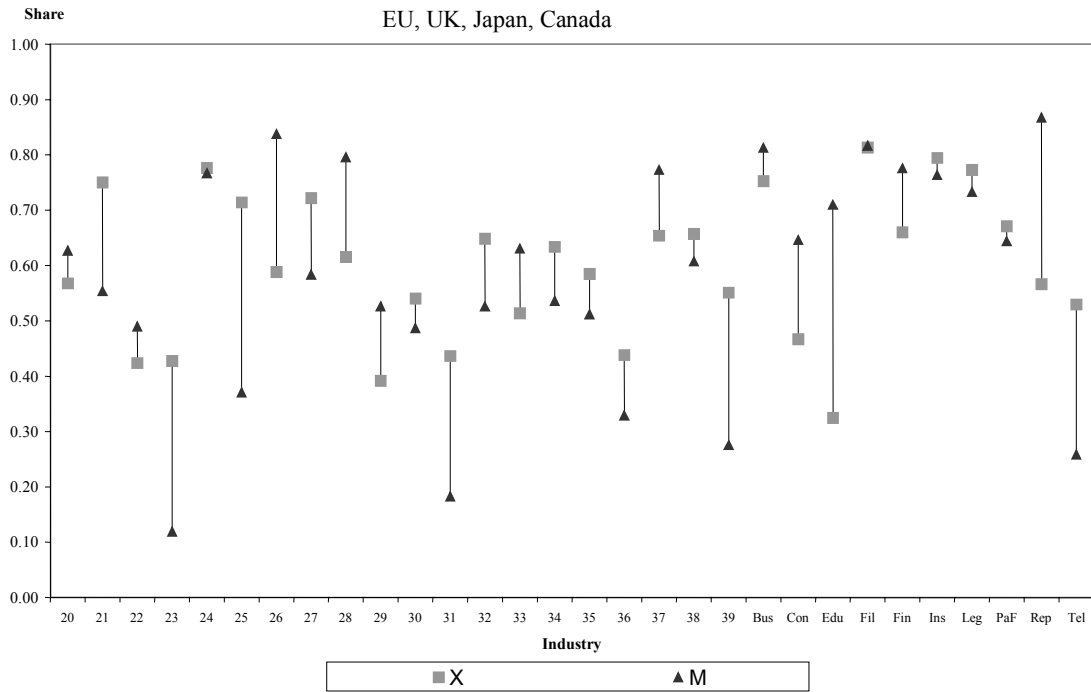
Just as the alternative Federal Reserve Board series show the general importance of different groups of currencies in computing real exchange rate series, additional distinctions are highly relevant for particularly industries. As Table 1 highlights, these distinctions arise because industries have different trading partners, and because the

export destinations of an industry can differ dramatically from the import sources of products of that same industry.

For U.S. manufacturing industries, industrialized countries often are more important as export markets than as import suppliers. Generally, the non-oil developing countries enter more prominently as sources of U.S. imports than as destinations for U.S. exports. These observations indicate that movements in major currencies like the euro and yen generally have a stronger presence in U.S. exports than in U.S. imports. Table 1 provides data on the presence of particular countries/regions in the international trade transactions of specific U.S. industries. For illustrative purposes, the euro-area, Japan and China are presented as our country/region choices, and five U.S. manufacturing industries are shown as the industry choices. Euro-area countries account for a large share of U.S. exports, and, with the exception of machinery, a slightly smaller share of U.S. imports of products in these industrial categories. For Japan and China, however, the comparisons between export markets and import source shares in these industries are far more dramatic. An import-competing producer, therefore, may assign a higher weight to the Japanese yen or Chinese yuan in its relevant trade-weighted exchange rate, as compared with producers in non-competing industries.

Figure 2 further illustrates the general point is that some industrialized countries (for example, the euro area, United Kingdom, Canada, and Japan) have very different representation in the exports versus the imports of U.S. industries. This comparison of the 2001 shares of these countries/regions in U.S. exports (denoted by squares) and U.S. imports (denoted by triangles) shows that these industrialized countries account for 32 percent of total exports for Education, up through 81 percent of U.S. exports for the Film sector. The corresponding share of these countries as sources of U.S. imports ranges from 12 percent in Apparel to 87 percent in Repair Services.

Figure 2 Select Industrialized Country Weights in U.S. Exports and Imports, 2001



Industry-Specific Exchange Rate Construction

We can construct exchange rate measures that reflect these industry-by-industry distinctions by utilizing the time histories of the weights of U.S. trading partners in the exports and imports of each U.S. industry. Denote each industry by an index j and each country / trade partner of that industry by index c . The *industry-specific* real exchange rate indices depart from the aggregate indices in that the weights on each partner currency (country c) are the shares X_t^{jc} or M_t^{jc} of that partner c in the U.S. exports or imports of that specific industry j . By way of contrast, aggregate indices instead use the weights of each trade-partner country in the total international trade activity of the entire U.S. economy.

While numerous constructions are possible, in this section our exposition concentrates on three real exchange rate measures, by industry. These three measures differ primarily in the choice of weights that are applied to bilateral real exchange rates, rer_t^c with respect to each trading partner c . The formulas for these indices are provided in equations (1) to (3):

$$\text{Export Weighted: } xer_t^j = \sum_c w_t^{jc} \cdot rer_t^c \quad \text{where } w_t^{jc} = \frac{X_t^{jc}}{\sum_c X_t^{jc}} \quad (1)$$

$$\text{Import Weighted: } mer_t^j = \sum_c w_t^{jc} \cdot rer_t^c \quad \text{where } w_t^{jc} = \frac{M_t^{jc}}{\sum_c M_t^{jc}} \quad (2)$$

$$\text{Trade Weighted: } ter_t^j = \sum_c \left(\left(.5 \frac{X_t^{jc}}{\sum_c X_t^{jc}} + .5 \frac{M_t^{jc}}{\sum_c M_t^{jc}} \right) \cdot rer_t^c \right) \quad (3)$$

where rer_t^c are the bilateral real exchange rates of each U.S. trading partner c . The bilateral real exchange rates are constructed by multiplying a country's nominal exchange rate (local currency per dollar) with the ratio of the consumer price indices of the U.S. against that partner country.⁶ For any industry indexed by j , these define the export real exchange rate xer_t^j , the import real exchange rate mer_t^j , and the trade-average real exchange rate ter_t^j , with each construction using industry-specific and time-varying trade weights.⁷ An increase in the value of any index implies a real appreciation of the U.S. dollar in trade-weighted terms.

The construction method for each industry has the flavor of the method used in the Federal Reserve Board of Governors' construction of the "Broad Index of the Foreign Exchange Value of the Dollar".⁸ Instead of that single aggregate measure, we instead compute separate series for each of the 20 two-digit manufacturing and 10 non-manufacturing industries of the United States (Appendix Table 1 provides the complete industry list). The countries indexed by c in (1) to (3) are up to 34 trade partners of the United States in manufacturing, and up to 29 trade partners in nonmanufacturing industries.⁹ These countries are: Canada, Euro area (Germany, France, Italy, Netherlands,

⁶ The resulting series are converted into indices (based at 100 in Q1 1990).

⁷ The averaging of export and import weights in (3) is an ad hoc convention. Another variant could be to use as weights the sum of bilateral exports and imports, taken relative to total exports plus imports of a particular industry.

⁸ <http://www.federalreserve.gov/releases/H10/Summary/>. From the *Federal Reserve Bulletin*, October 1998, "The currencies of all foreign countries or regions that had a share of U.S. non-oil imports or nonagricultural exports of at least ½ percent in 1997 are included in the broad indices, as rankings of U.S. trading partners by share of U.S. trade in that year show."

⁹ Industry-specific export and import data for 20 manufacturing industries and 34 major U.S. trading partners from 1972-1994 were downloaded from: <http://www.econ.ucdavis.edu/faculty/fzfeens/> with 1970,

Belgium, Luxembourg,¹⁰ Spain, Ireland, Austria, Finland, Portugal), Japan, Mexico, China, United Kingdom, Taiwan, Korea, Singapore, Hong Kong, Malaysia, Brazil, Switzerland, Thailand, Australia, Indonesia, Philippines, Russia¹¹, India, Sweden, Saudi Arabia, Israel, Argentina, Venezuela, Chile, Colombia. The nonmanufacturing indices do not include Austria, Colombia, Ireland, Portugal, Russia and Finland since disaggregated data on these countries is absent in our source data from the *Survey of Current Business*.

4. Do industry-specific and aggregate real exchange rate indices track each other?

Since the export and import partners of specific industries can differ substantially, the weights of partner currencies in the industry exchange rates correspondingly vary. These distinctions are apparent both across industries and over time as the importance of different partner country currencies grows or shrinks.

Using basic correlation analysis, it is clear that various industry-specific exchange rates and the aggregate Broad index are highly positively correlated. Table 2 presents four sets of correlations, with each cell going down the columns showing the number of industries in the correlation range depicted in that row. Compared with import exchange rates, the export exchange rate series are more highly correlated with the Broad index. These correlations exceed 0.90 for 5 of the 30 industries, and exceed 0.80 for an additional 16 industries. Across all of the manufacturing and nonmanufacturing industries, roughly a third of the industries have correlations with the Board exchange rate that are below 0.8. The industry exchange rate, *ter*, constructed using both export and import shares in partner weights, tracks the Board series more closely than the indices using either export or import weights alone.

1971 and 1972 manufacturing trade weights set at 1972 shares. Post-1994 data come from the U.S. international trade commission website http://205.197.120.17/scripts/user_set.asp. Some weighting observations for some countries in some years have been suppressed for confidentiality reasons. Manufacturing sector data are from U.S. Department of Commerce and the International Trade Commission and nonmanufacturing data are from the Bureau of Economic Analysis as reported in the *Survey of Current Business* for 1986 onward. For lack of appropriate earlier data, in nonmanufacturing industries the 1986 country partner weights are assumed for pre-1986 years. We use economy-wide price indices for deflating bilateral exchange rates. Post 2001 weights utilize NAICs conversions on industry definitions.

¹⁰ The trade data treat Belgium and Luxembourg as one country. When referenced in this paper, it is also counted as one country.

Table 2: Correlations between alternative Industry Exchange Rate Series

Using Manufacturing NAICS trade data for 1997-2002, SIC 1973-1996.

Measured contemporaneous correlations (corr)	# of industries in each correlation grouping out of 30 industries			
	Xrer with Broad	Mrer with Broad	Xrer with Mrer	Ter with Broad
$\text{corr} \geq 0.90$	5	2	8	9
$0.90 > \text{corr} \geq 0.80$	16	13	4	14
$0.80 > \text{corr} \geq 0.70$	4	8	6	6
$0.70 > \text{corr}$	5	7	12	1

N=120 for Manufacturing, 68 for Non-Manufacturing

Note: The four data columns report the number of industries in any size range of correlations between: (i) an industry's export exchange rate and the aggregate Broad Index; (ii) an industry's import exchange rate and the aggregate Broad Index; (iii) an industry's export exchange rate and its import exchange rate (iv) an industry's trade-weighted exchange rate and the aggregate Broad index . Very similar correlation patterns are observed for analyses using manufacturing SIC trade classifications only, for 1973 to 2001.

While correlations above 0.80 can be construed as strong, the industry exchange rates can register big differences in changes in the industry-specific exchange rates over dollar swings. To illustrate this point, in Table 3 we provide real exchange rate movements since January 2002 consider the same subset of industries presented in Table 1. To illustrate this point, we provide real exchange rate movements since January 2002 in Table 3 for the same subset of industries presented in Table 1. Precision instruments and transportation equipment industries have export- and import- exchange rates that have depreciated more than the Broad index, with each of these showing a 10 to 11 percent trade-weighted dollar depreciation since 2002Q1. On the other hand, the movements in the exchange rates for the electronics and computer industries register a smaller real dollar depreciation than the Board measure during this same period. This may be due to the fact that the euro-area (and the euro) comprises a smaller weight in the trade of the computer and electronic industries compared to the precision instruments and industrial machinery categories. In the case of many import-weighted series and even exports of electronics, industrial machinery, and toys and sporting goods (miscellaneous

¹¹ Problems with time series price data led us to remove Russia from this sample.

manufacturing) the Broad index can grossly misrepresent the apparent change in currency valuation.

Table 3 Percentage Change in Real Trade-Weighted Exchange Rate from 2002Q1

a) to 2003Q3*, using SIC Classifications

	Xrer	Mrer	Trer	Broad Index
Electronics	-6%	-4%	-5%	-7%
Industrial Machinery	-9%	-7%	-8%	-7%
Precision Instruments	-11%	-10%	-11%	-7%
Toys and Sporting Goods	-11%	-5%	-8%	-7%
Transportation Equipment	-11%	-11%	-11%	-7%

*Trade Weights for 2002 and 2003 are based on 2001 figures from the ITC and BEA

b) to 2003Q3** using NAICS Classifications

	Xrer	Mrer	Trer	Broad Index
Computer and Electronics	-7%	-3%	-5%	-7%
Machinery	-9%	-11%	-10%	-7%
Electrical Equipment	-7%	-4%	-6%	-7%
Toys and Sporting Goods	-12%	-5%	-9%	-7%
Transportation Equipment	-11%	-10%	-11%	-7%

**Trade Weights for 2003 are based on 2002 figures from the ITC and BEA

The advantage in using industry-specific constructs is immediately apparent in an examination of the relationships between U.S. producer profits and exchange rates. The data on corporate profits, compiled by the Bureau of Economic Analysis,¹² cover the period 1970:Q1 through 2003:q2 and 10 manufacturing disaggregates, plus disaggregates within transportation and public utilities, wholesale trade, and retail trade.¹³ We convert

¹² Profits from current production is estimated by the Bureau of Economic Analysis as the sum of profits before tax, the inventory valuation adjustment, and the capital consumption adjustment. For data discussion, see the *Survey of Current Business*, p. 13-14 September 2003.

¹³ These industries are Primary Metal Industries, Fabricated Metal Products, Industrial Machinery and Equipment, Electronic and other Electrical Equipment, Motor Vehicles and Equipment, Other Durables, Food and Kindred Products, Chemicals and allied Products, Petroleum and coal products, Transportation, Communications, Electric Gas etc, Wholesale trade, Retail trade.

these profit aggregates into real values by deflating by the seasonally adjusted U.S. consumer price index and run regression specifications of the form

$$\Delta CorporateProfits_t^i = \alpha^i + \beta_0^i \Delta realexchange rate_t^i + \beta_{0,I}^i Trade_t^i \cdot \Delta realexchange rate_t^i + \beta_1 \Delta GDP_t + \beta_2 rint_t + \varepsilon_t \quad (4)$$

where Δ refers to a change in logarithms of all variables except for interest rates (change in levels), and all variables are represented in real terms. The regressions introduce controls for the effects of the business cycle (via real GDP) and real interest rates (via 10 year bonds) and use alternative real exchange rates ($xrer_t^i, mrrer_t^i, trer_t^i$ or $Broad_t^i$). We alternatively introduce one or both of the exchange rate terms, non-interacted or interacted with the overall level of trade exposure of an industry $Trade_t^i$, a slower moving (annual) series constructed as the total trade (exports plus imports) of a specific broad industry i relative to its annual shipments (GPO in the case of nonmanufacturing industries). When the multiplicative $Trade_t^i$ variable is excluded from the regression, the exchange rate term picks up the effects on profits of changes over time in the composition of an industry's trade partners (except in the Broad measure) and the relative values of their currencies. By including the $Trade_t^i$ variable, we also capture changes over time in an industry's overall level of exposure to international trade. The latter term permits the influence of exchange rates on profits to grow as the overall role of trade grows relative to an industry's shipments.

In the full sample of fourteen industries, a dollar depreciation on average raises U.S. corporate profits but this average effect is noisy and generally not statistically different from zero. Table 4 provides the results of time-series panel regressions run using data for the profits of five high-trade orientation industries, with only the regressions reported wherein the trade variable is interacted with the exchange rate terms. In these selected high trade orientation industries, we observe that the Broad measure is statistically insignificant in the regressions: a dollar appreciation on average lowers the profits of U.S. corporates, but this effect remains noisy and statistically insignificant. By contrast, the industry-specific exchange rates all enter statistically significant, so that the

profit effects of dollar movements are more precisely identified: dollar appreciations (depreciations) reduce (stimulate) corporate profits.

Table 4 Corporate Profits and Exchange Rates: High Trade Exposure Industries

	Xrer	mrer	Trer	Board
Constant	-0.037*** (0.008)	-0.037*** (0.008)	-0.037*** (0.008)	-0.038*** (0.008)
Trade x Δreal exchange rate	-1.428* (0.783)	-1.198* (0.627)	-1.387* (0.717)	-0.539 (0.569)
Δ Real GDP	3.520*** (0.742)	3.431*** (0.742)	3.468*** (0.742)	3.502*** (0.743)
Δ Real interest rate	0.020* (0.011)	0.021* (0.011)	0.021* (0.011)	0.018* (0.011)
Adjusted R2	0.047	0.048	0.048	0.043
Degrees of Freedom	624	624	624	624

Standard errors in parentheses.

*,**,*** indicate statistical significance at the 10,5,1 levels respectively

More pointed results come from analysis of specific industries. In Table 5 presents industry-by-industry corporate profit regressions, with the columns respectively showing regression results for Chemicals & Allied Products, Primary Metal Products, Machinery & Equipment (NonElectrical), Electrical Machinery and Electronics, and Transportation Equipment. We again report the results of regressions using the interacted exchange rate term since the most pronounced effects of exchange rates generally are evident in regressions that allow for changes over time in industry exposure to international trade. These regression results suggest that the strong relationship between import exchange rates and the profits of specific highly trade exposed industries may have been driven by the Machinery & Equipment (NonElectrical) and Electrical Machinery and Electronics industries.

<insert Table 5>

6. Other considerations in constructing industry-specific real exchange rates

Other types of exchange rate index constructs may be useful for answering different questions regarding industries and exchange rates. In this section, we raise a couple of issues that might be relevant in that analysis of specific questions regarding industries. First, we consider the possibility that our index construction is corrupted by contemporaneous changes in the trade-orientation or partner weights of an industry as induced by exchange rate changes. In this case, it may be appropriate to consider the alternative time-stamps on the weights to be used in exchange rate construction. Second, we address the issue of what type of bilateral exchange rate is appropriate to use within equations (1) to (3). Specifically, we note that some analysts may be concerned with underlying *trends* in real exchange rates, instead of period-to-period current values. We address this concern by noting a couple of techniques that are frequently applied for the purpose of decomposing exchange rate movements into their permanent and transitory components.

Endogeneity of trade weights. Equations (1) through (3) use contemporaneous weights, meaning that each calculation of an industry-specific exchange rate employs the pattern of trade partners that is in place during that same period of time (for that year, for that industry). Contemporaneous trade weights have the advantage of providing the most current information on real changes in currency values that would be useful for future production and revenue decisions. One valid concern regards the issue of whether today's exchange rate movements effect today's trade patterns, so that using weights that are contemporaneous to the exchange rate movement may introduce undesirable simultaneity biases in the data. This objection is theoretically valid if the current trade-partner weights are endogenous to current exchange rates.

For U.S. industries, we observe considerable stability and persistence in partner share weights in annual data. We nonetheless turn to the data to determine the extent to which this observation is supported across industries.¹⁴ We conduct two suggestive exercises. First, we correlate industry-specific exchange rates constructed with

¹⁴ Within the database posted with this paper, we provide export and import data that permit researchers to choose their own weighting schemes and timing decisions for these weights.

contemporaneous trade weights with ones constructed using one year *lagged* trade shares as weights on the contemporaneous bilateral exchange rates of the 34 trading partners of the United States. Second, we construct a trade weighting scheme that uses a three-year moving average of the shares of each country partner in an industry’s international trade. This measure has export exchange rates for an industry constructed as

$$xer_t^j = \sum_c w_t^{jc} \cdot rer_t^c \quad \text{where } w_t^{jc} = \frac{\sum_{T=t-1}^{t-3} X_t^{jc}}{\sum_{T=t-1}^{t-3} \sum_c X_T^{jc}} \quad (5)$$

We regress the industry exchange rates using contemporaneous trade weights against industry exchange rates constructing using the two alternative methods. Most of the year-on-year variability in industry specific exchange rates is due to fluctuations in the component bilateral real exchange rates. As a consequence, Table 6 correlations suggest that small changes in weighting do very little to the final real exchange rate series for each industry. Contemporaneous and lagged constructions of industry-specific exchange rates are highly correlated, and typically in excess of 0.95. The data speak to marginally more potential for instability of trade partner shares in import exchange rates than export exchange rates.

Table 6	Correlations between Contemporaneous and Lagged Trade Weight Constructs of Industry Exchange Rates		
	(# of industries in each correlation grouping out of 30 industries)		
	Xrer with Xler	Mrer with Mlrer	Trer with Tlrer
corr ≥ 0.98	27	23	27
0.95 > corr ≥ 0.98	2	3	2
0.95 > corr	1	4	1

Permanent versus Transitory Exchange Rates. Some analyses might focus on industry adjustments when fluctuations in exchange rates are perceived by interested observers as “permanent” (expected to persist), as opposed to those fluctuations perceived as “transitory” (expected to be soon reversed). In pricing, employment, and investment

decisions, producers may make decisions that have a fixed cost component only in response to that part of an exchange rate fluctuation that is expected to persist, with other modes of adjustment to more transitory fluctuations. For example, Campa and Goldberg (2001) studied the U.S. labor market implications of dollar movements and found that overtime hours and earnings in the United States were highly sensitive to the transitory component of the exchange rate. Permanent fluctuations had a more visible impact on regular employment and hours of U.S. workers.

There are alternative techniques available for decomposing exchange rate movements into their transitory versus permanent components. Two popular alternatives are provided in Box 1. The bilateral exchange rates pass-through a filter, and for each currency pair the filter delivers a permanent component $rer_t^{c,p}$ or transitory component. The relevant component is substituted back into the exchange rate formulas of (1) to (3) and weighted up using the import or export weights, yielding a variant like

$$xer_t^{j,p} = \sum_c w_t^{jc} \cdot rer_t^{c,p} \quad \text{where } w_t^{jc} = \frac{X_t^{jc}}{\sum_c X_t^{jc}} \quad (6)$$

Note that this construction considers the permanent versus transitory components of the bilateral exchange rates, but not of the underlying trade weights.

Consistent with the findings of an expansive literature on dollar exchange rates against major currencies, the permanent component closely tracks the actual real exchange rate over most dates. As a consequence, correlations between industry-specific exchange rates and the permanent-component version of these rates are typically very high.

Box 1 Alternatives for Filtering Out the Permanent Component of a Time Series

Many methods are available for undertaking this type of time series decomposition, with much debate about the merits of these alternative methods. Below, we apply the Beveridge-Nelson procedure, which decomposes an I(1) time series into its transitory and permanent components using lags of the real exchange rate. We follow precedent in the literature on exchange rate processes and assume that the first differences of the quarterly (log) real exchange rate follow an AR(4) process. In this case so that the transitory departure of the real exchange rate from its expected long-run equilibrium, $rer_t^{c,BN}$, is given by:

$$E_t(rer_t^{c,BN}) = -E_t\left(\sum_{j=1}^{\infty} \Delta rer_{t+j}^c \mid \Delta rer_t^c, \Delta rer_{t-1}^c, \Delta rer_{t-2}^c, \Delta rer_{t-3}^c\right)$$

As Cogley (2001) notes, the intuition behind this definition is that expected growth in the exchange rate should be higher than average when the exchange rate is below its trend level.

This type of Beveridge and Nelson (1981) procedure is frequently compared with a Hodrick and Prescott (1997) filter, as in the exchange between Pedersen and Cogley in the *Journal of Economic Dynamics and Control* (August 2001). The H-P filter assumes an alternative definition of the cycle in the underlying data, and “removes a smooth trend as one would draw it with a free hand drawing” (Pedersen 2001).

7. Concluding Remarks

The industry-specific measures that we have described, while cumbersome and data-intensive in construction, enable us to take important steps forward in analyses of exchange rate effects for U.S. industries. Despite such progress, these indices should not be viewed as perfect indicators of changes in producer competitiveness over time relative to foreign competitors. Our measures do not adjust for industry-specific changes in productivity or the strategic pricing actions attributable to specific industries or partners.

These measures also do not directly track changes in the third-country competitiveness of U.S. producers, for example how the U.S. competes with non-euro area competitors within the euro-area market.

Alternative constructs of industry specific exchange rates are sometimes appropriate for understanding the effects of exchange rate fluctuations on specific U.S. industries. Pollard and Coughlin (2003) showed that such choices have important implications for the conclusions drawn about the real effects of exchange rates. In a study of the responsiveness of U.S. import prices to exchange rates, industry-specific exchange rate measures statistically outperform aggregate trade-weighted exchange rates in explaining patterns in industry-level import price adjustment. In this particular example, import price elasticities to exchange rates exhibited a significantly greater range (with a higher overall level) when industry-specific exchange rates were applied. These types of differential responses arise, because, as we demonstrated, the respective indices present different pictures of the apparent recent depreciation of the U.S. dollar. These differences arise because partners in trade vary across industries, and differ for exporters and import-competing firms in specific industries.

Overall, this paper has provided a range of construction methodologies and made available the underlying data in order to facilitate more informed discussions of the currency valuation changes influencing specific industries. While numerous alternative methods could be applied for such constructions, our contributions contains a number of concrete steps forward in data availability and tools for appropriately analyzing the real and financial effects of exchange rate movements.

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Appendix Table 1 Correlations Industry-Specific Exchange Rate Measures,
Manufacturing and Nonmanufacturing, 1973-2002

	Industry Title	xer^j <i>Broad RER</i>	mer^j <i>BroadRER</i>	xer^j mer^j	ter^j <i>BroadRER</i>
20	FOOD AND KINDRED PRODUCTS	0.916	0.837	0.84	0.909
21	TOBACCO MANUFACTURES	0.873	0.861	0.725	0.934
22	TEXTILE MILL PRODUCTS	0.792	0.906	0.827	0.9
23	APPAREL AND RELATED PRODUCTS	0.693	0.844	0.713	0.831
24	LUMBER AND WOOD PRODUCTS	0.732	0.559	0.318	0.799
25	FURNITURE AND FIXTURES	0.553	0.834	0.71	0.73
26	PAPER AND ALLIED PRODUCTS	0.914	0.589	0.679	0.796
27	PRINTING, PUBLISHING	0.782	0.904	0.776	0.898
28	CHEMICALS AND ALLIED PRODUCTS	0.907	0.928	0.956	0.928
29	PETROLEUM REFINING	0.888	0.523	0.495	0.77
30	RUBBER AND PLASTIC PRODUCTS	0.822	0.894	0.788	0.909
31	LEATHER AND LEATHER PRODUCTS	0.883	0.892	0.873	0.917
32	STONE, CLAY, GLASS, AND CONCRETE PRODUCTS	0.812	0.888	0.745	0.912
33	PRIMARY METAL PRODUCTS	0.893	0.889	0.918	0.91
34	FABRICATED METAL PRODUCTS	0.767	0.849	0.629	0.898
35	MACHINERY, EXC. ELECTRICAL	0.885	0.867	0.757	0.934
36	ELECTRICAL AND ELECTRONIC	0.854	0.741	0.649	0.873
37	TRANSPORTATION EQUIPMENT	0.804	0.839	0.715	0.887
38	SCIENTIFIC INSTRUMENTS	0.934	0.737	0.792	0.871
39	MISCELLANEOUS MANUFACTURES	0.925	0.919	0.97	0.929
Bus	ADVERTISING; COMPUTER DATA	0.921	0.849	0.895	0.903
Con	CONSTRUCTION, ENGINEERING, MINING	0.600	0.751	0.204	0.858
Edu	EDUCATIONAL SERVICES	0.878	0.853	0.746	0.924
Fil	FILM AND TAPE RENTAL	0.922	0.888	0.956	0.915
Fin	FINANCIAL SERVICES	0.878	0.752	0.939	0.823
Leg	LEGAL SERVICES	0.853	0.808	0.983	0.832
Ins	NET INSURANCE	0.846	0.835	0.841	0.875
PaF	PASSENGER FARES	0.837	0.929	0.935	0.898
Rep	INSTALLATION, MAINTENANCE, REPAIR	0.77	0.752	0.919	0.777
Tel	TELECOMMUNICATIONS	0.808	0.832	0.877	0.847

Appendix Table 2

Correlations between Contemporaneous and Lagged Weight Exchange Rates

	Industry Title	xer^j $xler^j$	mer^j mle^j	ter^j tle^j
20	FOOD AND KINDRED PRODUCTS	0.992	0.997	0.996
21	TOBACCO MANUFACTURES	0.997	0.964	0.992
22	TEXTILE MILL PRODUCTS	0.988	0.996	0.996
23	APPAREL AND RELATED PRODUCTS	0.991	0.996	0.997
24	LUMBER AND WOOD PRODUCTS	0.998	0.999	0.998
25	FURNITURE AND FIXTURES	0.989	0.997	0.995
26	PAPER AND ALLIED PRODUCTS	0.998	0.999	0.999
27	PRINTING, PUBLISHING	0.998	0.999	0.999
28	CHEMICALS AND ALLIED PRODUCTS	0.994	0.999	0.999
29	PETROLEUM REFINING	0.991	0.988	0.990
30	RUBBER AND PLASTIC PRODUCTS	0.994	0.999	0.999
31	LEATHER AND LEATHER PRODUCTS	0.991	0.997	0.997
32	STONE, CLAY, GLASS, AND CONCRETE PRODUCTS	0.996	1.000	0.999
33	PRIMARY METAL PRODUCTS	0.994	0.994	0.998
34	FABRICATED METAL PRODUCTS	0.993	0.999	0.998
35	MACHINERY, EXC. ELECTRICAL	0.997	1.000	0.999
36	ELECTRICAL AND ELECTRONIC	0.997	0.998	0.998
37	TRANSPORTATION EQUIPMENT	0.995	0.998	0.998
38	SCIENTIFIC INSTRUMENTS	0.999	1.000	1.000
39	MISCELLANEOUS MANUFACTURES	0.997	0.997	0.999
Bus	ADVERTISING; COMPUTER DATA	0.991	0.991	0.993
Con	CONSTRUCTION, ENGINEERING, MINING	0.969	0.986	0.988
Edu	EDUCATIONAL SERVICES	0.996	0.935	0.978
Fil	FILM AND TAPE RENTAL	0.975	0.886	0.947
Fin	FINANCIAL SERVICES	0.999	0.965	0.989
Leg	LEGAL SERVICES	0.999	0.999	1.000
Ins	NET INSURANCE	0.983	0.942	0.964
PaF	PASSENGER FARES	0.999	0.999	1.000
Rep	INSTALLATION, MAINTENANCE, REPAIR	0.996	0.976	0.993
Tel	TELECOMMUNICATIONS	0.935	0.942	0.995

Table 5 Corporate Profits and Exchange Rates: High-Trade Oriented Manufacturing Industries

	Chemical Products		Primary Metal Products		NonElectrical Machinery		Electronics		Transportation Equipment	
	Mrer	Broad	Mrer	Broad	Mrer	Broad	Mrer	Broad	Mrer	Broad
Constant	-0.020** (0.010)	-0.020** (0.010)	-0.039*** (0.011)	-0.038*** (-1.119)	-0.042*** (0.014)	-0.043*** (0.014)	-0.025* (0.013)	-0.026* (0.013)	-0.059* (0.033)	-0.061* (0.033)
Trade x ΔReal exchange rate	0.570 (1.236)	-0.598 (1.281)	1.316 (1.445)	-1.119 (1.196)	-1.50* (0.871)	-0.976 (0.809)	-1.477* (0.759)	-1.034 (0.695)	-2.016 (2.553)	1.020 (2.200)
Δ Real GDP	1.573* (0.895)	1.570* (0.895)	3.443*** (1.002)	3.354*** (0.998)	3.768*** (1.268)	3.880*** (1.274)	2.331* (1.197)	2.468** (1.203)	6.087* * (2.997)	6.252** (2.995)
Δ Real interest rate	0.012 (0.013)	0.014 (0.013)	-0.001 (0.015)	0.002 (0.015)	0.011 (0.019)	0.006 (0.019)	0.005 (0.017)	0.004 (0.018)	0.074 (0.074)	0.065 (0.044)
Adjusted R2	0.021	0.021	0.075	0.075	0.078	0.0661	0.042	0.030	0.049	0.045
Degrees of Freedom	124	124	124	124	124	124	124	124	124	124
2001 SIC Trade share	0.33		0.34		0.63		0.75		0.58	