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9 U.S. Manufacturing and the Real Exchange Rate

William H. Branson and James P. Love

9.1 Introduction and Summary

In the spring of 1981 the U.S. dollar began a four-year period of real appreciation that took it to a peak of more than 50% by first quarter of 1985. The appreciation of the dollar in real terms was part of the adjustment process by which the increase in the structural budget deficit in the United States was financed. By mid-1985, the current account deficit was about $120 billion at an annual rate, providing a significant source of finance for the $200 billion Federal budget deficit. The links from the shift in the budget to the appreciation of the dollar are discussed in Branson (1985) and chapter 1 in this volume.

The appreciation of the dollar in real terms reduces the competitiveness of U.S. output in all U.S. industry that is directly or indirectly substitutable for foreign output. It is these effects that are the topic of this paper.

The appreciation of the dollar was a prolonged but temporary phenomenon that is reversible when the structural deficit is reduced or when international investors resist absorption of additional dollar-denominated debt into their portfolios. This reversal began in late 1985. The depression of output and employment in previously competitive U.S. industries may not be completely reversible, however. The protracted period of a high dollar has provided an opportunity for non-U.S. competitors in industries with increasing returns—due to fixed

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costs, learning, or other factors—to establish themselves in the world market. Thus, when the dollar returns to its 1980 level in real terms, U.S. firms will face new international competition that has worked its way down its cost curves while the dollar was high. This is the hysteresis possibility in trade. The estimates provided in this paper of the effects of real appreciation on employment and output do not take this potential asymmetry into account.

In this paper, using time series data through the first quarter of 1986, we use a simple model of supply and demand to estimate the impact of the dollar appreciation on manufacturing employment, disaggregated by industry sectors and by production and non–production workers. These initial results are part of a larger research project to estimate the effects of movements in the real exchange rate on U.S. manufacturing industries.

Section 9.2 of the paper provides a brief theoretical background for the estimation procedure. In section 9.3 we discuss the estimating equation and the data. Section 9.4 presents the basic results at the 2-digit level of manufacturing. These are estimated over three time periods. In section 9.5 the equations are used to decompose changes in employment from 1980 to 1985 into effects due to trend, aggregate unemployment, relative energy prices, and the real exchange rate. We estimate a loss of about 1 million jobs due to the dollar appreciation. Finally, in section 9.6 we present the estimates for non–production and production workers and find that employment of the latter is more sensitive to the real exchange rate, especially in the durable goods sectors. This raises the possibility of hysteresis.

We find significant and substantial effects of the dollar appreciation on employment in U.S. manufacturing. In particular, we find that exchange rate movements have had important effects on the durable goods sector, including primary metals, fabricated metal products, and nonelectrical machinery. Other sectors that suffer large employment losses when the dollar appreciates are stone, clay, and glass products, transportation, instruments, textiles and apparel, chemicals, rubber, and leather goods. We also find especially significant effects on production workers.

9.2 Theoretical Outline

In this section we sketch the theoretical basis for the estimating equations. The discussion is brief, as the basic ideas are well known from trade and computable general equilibrium (CGE) models that distinguish three sectors: exportables X, import-competing goods M, and nontraded goods N. We employ this sectorization for two reasons.

First, to study output and employment effects, we must focus on exportables and import-competing production, rather than on trade in exports and imports. Second, given this focus, we must provide a minimum model of the nontraded sector of the economy to ensure consistency.

The general line of the analysis can be stated simply. In each of the three sectors, demand is sensitive to the relative price of home and foreign goods. In the short run at least, we assume that a change in the nominal exchange rate E moves that relative price, which we interpret as the "real" exchange rate $e \equiv EP^*/P$, where P (P^*) is the relevant home (foreign) price. It is important to note the limiting force of this assumption. If we were to assume that exportables and import-competing goods were perfect substitutes in demand for foreign goods, then a change in the nominal rate E would have no effect on the relative price e, since $P_x = EP^*$ and $P_m = EP^*$, where P^* is the relevant foreign price. Even in this case, in the short run we would see a change in the relative price of nontraded goods when E changes. In the long run, as wages adjust to the change in goods prices, a cost-based model of pricing in the nontraded goods sector would result in the restoration of the original relative price in that sector. The change in P_n would be equal to the initial change in E, in percentage terms. A rational-expectations model with instantaneous market clearing would collapse in this long run into the short run, leaving no effect of E on e in any of the three sectors. We do not assume perfect substitution or instantaneous market clearing in the empirical work, but rather assume that changes in the nominal rate move the U.S. real exchange rate in the short run and attempt to estimate the consequences.

An appreciation of the home currency (the U.S. dollar), reducing e, reduces the relative price of foreign to home goods. This tends to shift demand from home to foreign goods, reducing output and employment in all three producing sectors. Changes in home and foreign real income, Y and Y^*, respectively, also enter the demand for exportables, while we assume that only home income Y is relevant for importables and nontraded goods.

On the supply side, we assume that the output of each sector depends on its price relative to the nominal wage. As the real product wage falls, supply increases. We do not attempt to model intersectoral supply reactions as relative prices change, given the common nominal wage rate. The supply functions below should in theory contain all relative prices.

In the theoretical background to our empirical work, then, is a model of supply and demand in each of the three sectors, with supply sensitive to the product wage and demand sensitive to the relative price of home

and foreign goods and the relevant income variable. A log-linear model of demand and supply of exportables is described below, with analogous results for import-competing goods and non-tradables.

9.2.1 Exportables

The demand for exportables is written in log-linear form as:

$$(1) \qquad \ln Q_x = \ln c_1 + d_x \ln (EP^*/P_x) + g_{x1} \ln Y + g_{x2} \ln Y^*.$$

Here Q_x is the quantity demanded, EP^*/P_x is the relative price of exportables and foreign goods, and Y (Y^*) is home (foreign) real income. The parameter d_x is the positive price elasticity of demand, and the g's are the income elasticities. The supply of exportables is assumed to be an inverse function of the product wage:

$$(2) \qquad \ln Q_x = \ln c_2 + s_x \ln (P_x/W).$$

Here W is the nominal wage rate and s_x is the price elasticity of supply. As P_x/W increases, Q_x supplied increases.

The demand and supply equations (1) and (2) can be solved to obtain the "reduced form" expressions for Q_x and P_x, given E, P^*, W, Y, and Y^*. The solution for Q_x, the output of exportables, is given by:

$$(3) \quad \ln Q_x = A_{1x} + \frac{s_x d_x}{s_x + d_x} \ln \frac{EP^*}{W} + \frac{s_x}{s_x + d_x} [g_{x1} \ln Y + g_{x2} \ln Y^*],$$

where $A_{1x} = \dfrac{s_x c_1 - d_x c_1}{s_x + d_x}$ is the constant term.

Both coefficients in the reduced form are positive, given the way d_x was defined in equation (1). An appreciation of the dollar, expressed as the fall in the exchange rate E, reduces competitive prices EP^* relative to domestic costs W, reducing Q_x. Growth in Y or Y^* increases demand and production.

The estimating equations in section 9.3 below follow equation (3). The real exchange rate EP^*/W is inverted in those equations, since the data use the inverse IMF definition of the exchange rate. This makes the estimated coefficients for the real exchange rate negative. The domestic income variable is broken into trend and cyclical components, and Y^* is dropped due to colinearity with Y.

The equation for employment N_x in the exportable sectors takes the same form as the output equation, with the two tied by a production function. If the production function is $Q = Q(N,K)$, with the capital stock K fixed in the short run, variations in output are given by $dQ = Q_n dN$, where Q_n is the marginal product of labor. Then the employment equation in variation terms would be the output equation (3) divided by Q_n, which is positive. Since all the estimated equations

below have a separate trend term, differential productivity growth trends across sectors are included in the controlled variable set. The employment equations are the same as the output equations with $\ln N_x$ replacing $\ln Q_x$ on the left-hand side of equation (3).

In a later phase of research, we will estimate the effects of movements in the real exchange rate on real wages and profits in the manufacturing sectors. It will be useful then to have the solution for P_x from (1) and (2):

$$(4) \quad \ln P_x = A_{2x} + \frac{1}{s_x + d_x}[g_{x1}\ln Y + g_{x2}\ln Y^* + d_x \ln (EP^*) + s_x \ln W],$$

where $A_{2x} = \dfrac{\ln c_1 + \ln c_2}{s_x + d_x}$ is the constant term.

The usual small-country results can be obtained from equations (3) and (4) by setting the price elasticity of demand d_x at infinity. In (3), this eliminates income effects and sets the relative price coefficient equal to s_x. The output of exportables reacts along the supply function as the real exchange rate moves exogenously. In the price equation (4), setting d_x at infinity sets the coefficients of Y, Y^*, and W at zero and the coefficient of EP^* at unity. Exportable prices are fixed by the world market in the small-country case. The assumption maintained in the empirical work is that the United States is not a small country, in the sense of being a price taker on world markets.

9.2.2 Import-Competing and Nontraded Goods

The basic demand and supply equations for import-competing and nontraded goods will have exactly the same form as (1) and (2) for exportables, so the quantity and price solutions will have the same form as (3) and (4). For both sectors we will eliminate the foreign output variable from the demand function, although in principle it (and many others) should be included. In both sectors supply is again an inverse function of the product wage, and demand depends on the price of own output relative to competing foreign goods, represented in general by EP^*. As EP^* rises, we expect substitution towards both domestic production of import-competing goods and nontraded output, and vice versa as EP^* falls and the dollar appreciates.

Again, in principle we should include all product wages in each supply function, to catch supply-side substitution as any relative price changes. And we should include all relative prices in each demand function for a similar reason. In the empirical work, we focus on the exogenous event of a major swing in E, producing a swing in the real exchange rate. The maintained hypothesis expressed in the exclusion

of the other relative prices is that there was no significant exogenous shift amongst them during the sample period, or that shifts over time are captured by a trend variable. The obvious exception is the energy price, which is included explicitly in the empirical work.

With Y^* excluded from the demand functions, and m and n subscripts denoting import-competing and nontraded output and price, respectively, the reduced-form solutions for Q_m, P_m, Q_n, P_n are equations (3) and (4) with no term in Y^* and with the subscripts on the elasticities altered appropriately. The employment equations, again, are similar to the output equations via a production function. Trend terms will adjust for differences in productivity growth across sectors. The presumed difference in demand substitution against foreign goods among exportable, import-competing, and nontraded goods should come out in the estimated values of the demand elasticities, d_x, d_m, and d_n.

9.3 The Model to be Estimated

In the next section we report the empirical estimates of the relationship between movements in the real exchange rate and employment in manufacturing. We take the manufacturing sector to represent both import-competing and exportable goods. Initial estimates for nontraded goods are reported in Branson and Love (1986, table 2). Employment within the manufacturing sector is disaggregated by the 20 industries defined by the Standard Industrial Classification (SIC) system. We have not modeled each industry within the manufacturing sector individually, taking into account the special sectoral demand shocks and cost effects that may be important. A general reduced-form model is applied to all industries sectors, disaggregated again by type of worker.

The left-hand dependent variable is the natural logarithm of employment. The right-hand independent variables include a constant, three variables to capture secular, cyclical, and structural changes in demand, and the real exchange rate. The secular and cyclical variables are time (*TREND*) and the natural logarithm of the national unemployment rate (*LURT*). Inclusion of the national unemployment rate in the estimating equation catches the effect of fluctuations in aggregate demand. The coefficients of the real exchange rate therefore give the distributive effects of exchange-rate movements adjusted for cyclical movements in total demand. These coefficients are the effects of relative price changes of traded and nontraded goods, compensated for income effects.

The structural variable is the natural logarithm of an index to measure the real price of energy (*LRENGY*). This is the ratio of the energy component of the CPI to the total CPI. This variable catches the effects of shifts of energy costs on employment by sector. The net effect of a

given change in the real exchange rate is therefore the coefficient of the exchange rate plus the coefficient of the relative energy price times the effect of the movement of the exchange rate on the energy price. The exchange rate variable is the natural logarithm of an index that measures the real U.S. trade-weighted exchange rate (*LREX*).[1] The exchange rate used here is the IMF index of relative unit labor costs. We considered the inclusion of a foreign demand variable, but found that deviations from trend growth in foreign demand were so highly correlated with changes in domestic demand that no additional explanatory power came from foreign demand.[2] The form of the estimating equation is

$$y_{it} = \beta_0 + \beta_1 t + \sum_{j=0}^{4} \beta_{2j} LURT_{t-j} + \sum_{k=0}^{4} \beta_{3k} LRENGY_{t-k} + \sum_{l=0}^{6} \beta_{4l} LREX_{t-1} + \epsilon_t, \tag{5}$$

where:

y_{it} = the log of employment or output in sector i,
t = the *TREND* variable time,
LURT = the log of the unemployment rate,
LRENGY = the log of the relative price of energy,
LREX = the log of the IMF real exchange rate index, adjusted for changes in relative unit labor costs,
ϵ_t = the stochastic error term,
and the β's are the parameters to be estimated.

The data used to estimate equation (5) are quarterly. The equations are estimated over a period that ends in first quarter 1986.[3] In most cases the equations were estimated over the periods beginning at first quarter 1970, although longer and shorter time periods were tested and are reported. The 1970:I to 1986:I estimates have 65 observations and 46 degrees of freedom.

The exchange rate variable *LREX* includes the current observation plus six quarters of lagged observations. The real energy price *LRENGY* and the unemployment rate *LURT* variables both include the current value plus four quarters of lags. Because the model is in log-linear form, the estimated coefficients have simple economic interpretations. The numbers we report are the sums of the coefficients on these log distributions and the test statistics on these sums.

The coefficient for the *TREND* variable (t) is the estimated exponential rate of growth or decline in employment that occurs due to secular changes in income, tastes, comparative advantage, or tech-

nology. A coefficient for *TREND* of −.001 means that, holding everything else constant, employment will decline at the percentage rate of 0.1% each quarter.

The coefficients for the real exchange rate, the real price of energy, and the unemployment rate variables can be interpreted as elasticities. For example, a coefficient of −.3 for the real exchange variable *LREX* means that a 10% increase in the exchange rate will lead to a 3% decrease in the number of workers employed. When coefficients are interpreted as elasticities it is not necessary to know the units which were used to measure the variables, and it is also easier to compare the coefficients across different industries. Because the estimated elasticities describe the percentage changes in the employment variable, it is necessary to make separate calculations of the number of jobs that will be affected by movements in the exchange rate. These calculations are described in greater detail below.

The source of the data on employment is the Bureau of Labor Statistics' (BLS) *Employment and Earnings*. The dependent variable is the natural logarithm of the number of employed workers. In most cases the employment variable includes all workers, although the results for production versus non–production workers are also reported for the 2-digit SIC manufacturing sectors.

The real exchange rate index is the IMF index of relative unit labor costs.[4] The real energy index is the CPI-Urban index for energy divided by the CPI-Urban index for all consumer goods. The unemployment rate is for all workers.[5]

9.4 Basic Results at the 2-Digit Level

Tables 9.1 through 9.4 report the results of the econometric estimates for the twenty 2-digit SIC manufacturing sectors. Table 9.1 provides the results from the equations that used all workers as the dependent variable, estimated over the period 1970:I to 1986:I. The table reports the first-order autocorrelation coefficient *RHO*, the coefficients for each of the independent variables, and a significance statistic. When independent variables are lagged, the coefficient represents the sum of all lagged coefficients. The significance measure (*SIG*) is the probability that the true value of the sum of the coefficients is zero, using a two-tailed *t*-test. The standard error (*SE*) for the sum of the exchange-rate coefficients is also reported.

The *RHO* is positive and large for most of the industries, indicating a high degree of serial correlation in employment. The variable *TREND* is positive for 12 of the industries and statistically significant at the .05 level in 16 of the regressions. The cyclical variable *LURT* measures the impact of cyclical movements in the national economy; the predicted

Table 9.1 **Employment for All Workers, 1970:I–1986:I**

	SIC	RHO	TREND	SIG	LREX	SE	SIG	LURT	SIG	LRENGY	SIG
						Nondurable Goods					
Food and kindred products	20	0.92	−0.001	0.03	−0.00	0.04	0.92	−0.05	0.01	0.01	0.87
Tobacco manufactures	21	0.70	−0.004	0.00	−0.07	0.06	0.27	−0.03	0.59	−0.03	0.86
Textile mill products	22	0.73	−0.006	0.00	−0.16	0.03	0.00	−0.09	0.00	0.01	0.84
Apparel and other textile prod	23	0.74	−0.004	0.00	−0.11	0.03	0.00	−0.09	0.00	0.05	0.48
Paper and allied products	26	0.84	0.001	0.19	0.00	0.03	0.91	−0.13	0.00	−0.00	0.98
Print and publishing	27	0.94	0.006	0.00	0.12	0.02	0.00	−0.13	0.00	0.02	0.52
Chemicals and allied products	28	0.93	0.000	0.90	−0.10	0.03	0.00	−0.11	0.00	0.10	0.02
Petroleum and coal products	29	0.47	−0.004	0.00	−0.25	0.06	0.00	−0.07	0.18	0.37	0.01
Rubber and misc plastics prod	30	0.73	0.007	0.00	−0.19	0.05	0.00	−0.27	0.00	−0.23	0.06
Leather and leather goods	31	0.93	−0.013	0.00	−0.14	0.11	0.21	−0.04	0.43	0.34	0.02
						Durable Goods					
Lumber and wood products	24	0.72	0.003	0.00	−0.13	0.05	0.01	−0.20	0.00	−0.28	0.01
Furniture and fixtures	25	0.88	0.004	0.00	−0.05	0.05	0.31	−0.21	0.00	−0.23	0.01
Stone, clay, and glass prod	32	0.88	0.000	0.74	−0.28	0.04	0.00	−0.19	0.00	−0.20	0.01
Primary metal industries	33	0.70	−0.007	0.00	−0.57	0.06	0.00	−0.35	0.00	0.14	0.28
Fabricated metal products	34	0.75	0.000	0.37	−0.29	0.03	0.00	−0.32	0.00	−0.03	0.63
Machinery, except electrical	35	0.69	0.002	0.00	−0.41	0.03	0.00	−0.37	0.00	0.32	0.00
Electrical and electronic equip	36	0.92	0.005	0.00	−0.03	0.05	0.53	−0.33	0.00	0.05	0.51
Transportation equipment	37	0.36	0.003	0.00	−0.19	0.04	0.00	−0.39	0.00	−0.09	0.32
Instruments and related prod	38	0.93	0.006	0.00	−0.15	0.04	0.00	−0.25	0.00	0.24	0.00
Misc manufacturing industries	39	0.77	−0.001	0.02	−0.28	0.03	0.00	−0.16	0.00	−0.12	0.10

Notes: Dependent variable is log of employment (all workers). Data are seasonally adjusted. Model: AR1(METHOD-MAXL) 70,1 86.1 DOF: 46. CONSTANT TREND LREX(0,6) LURT(0,4) LRENGY(0,4).

sign for this variable is negative, as high sectoral employment is associated with lower national unemployment rates. In the regressions, *LURT* is negative in all 20 industries and is significant at the .05 level 17 times.

The real price of energy variable *LRENGY* is positive 11 times and significant 8 times. The predicted sign of this variable is ambiguous. An increase in the relative energy price increases cost in all sectors, reducing employment. But some sectors produce outputs that substitute for energy or are inputs to energy-substitute products. In five of the eight cases where this variable is statistically significant, the sign is positive (*SIC* 28, 29, 31, 35 and 38).

The real exchange rate variable *LREX* is negative for 18 of the 20 industries and statistically significant at the .05 level 14 times. In 13 of the 14 industries where the exchange-rate coefficient is statistically significant, the sign of the coefficient is negative, the sole exception being print and publishing (*SIC* 27). The exchange rate has its greatest impact on primary metal industries (*SIC* 33), with an elasticity of $-.57$, and nonelectrical machinery (*SIC* 35), with an elasticity of $-.41$. Fabricated metal industries (*SIC* 34), petroleum and coal products (*SIC* 29), stone, clay, and glass products (*SIC* 32), and miscellaneous manufacturing (*SIC* 39) all have elasticities grouped between $-.25$ and $-.30$. We observe somewhat smaller, but important, effects on textiles and apparel (*SIC* 22 and 23), chemicals and allied products (*SIC* 28), rubber and miscellaneous products (*SIC* 30), lumber and wood products (*SIC* 24), transportation equipment (*SIC* 37), and instruments and related products (*SIC* 38).

The *LREX* coefficients for food and kindred products (*SIC* 20), tobacco manufactures (*SIC* 21), leather and leather goods (*SIC* 31), furniture and fixtures (*SIC* 25), and electrical and electronic equipment (*SIC* 36) are negative, but not statistically different from zero. Only paper and allied products (*SIC* 26) and print and publishing (*SIC* 27) have positive signs, and only the latter is statistically significant.

The model used in the basic estimates is, as noted above, a rather simple one, and it is certainly possible that the effect that is attributed to the exchange rate may an artifact of, among other things, the period used for estimation. The exchange-rate movements may be catching the effects of other structural changes in the economy or other omitted variables. One test of the robustness of these results is presented in tables 9.2 through 9.4. In tables 9.2 and 9.3, the regression results are reported for the same twenty industries, when the period of estimation is longer (beginning in first quarter 1963) and shorter (beginning in first quarter 1975) than was used in table 9.1 (beginning in first quarter 1970). In table 9.4 the three sets of estimated coefficients for *LREX*—those estimated from 1963, 1970, and 1975—are compared to each other.

Table 9.2 **Employment for All Workers, 1963:I–1986:I**

	SIC	RHO	TREND	SIG	LREX	SE	SIG	LURT	SIG	LRENGY	SIG
						Nondurable Goods					
Food and kindred products	20	0.92	−0.001	0.03	−0.01	0.03	0.75	−0.04	0.01	−0.04	0.40
Tobacco manufactures	21	0.60	−0.004	0.00	−0.06	0.05	0.18	−0.01	0.83	−0.03	0.71
Textile mill products	22	0.98	−0.002	0.06	−0.14	0.08	0.07	−0.10	0.00	−0.15	0.11
Apparel and other textile prod	23	0.97	−0.001	0.15	−0.13	0.07	0.05	−0.09	0.00	−0.11	0.24
Paper and allied products	26	0.97	0.002	0.00	0.02	0.04	0.59	−0.13	0.00	−0.09	0.08
Print and publishing	27	0.95	0.006	0.00	0.11	0.03	0.00	−0.12	0.00	0.02	0.55
Chemicals and allied products	28	0.99	0.002	0.01	−0.08	0.04	0.07	−0.13	0.00	0.02	0.71
Petroleum and coal products	29	0.59	−0.001	0.29	−0.28	0.07	0.00	0.02	0.74	−0.03	0.78
Rubber and misc plastics prod	30	0.78	0.009	0.00	−0.21	0.06	0.00	−0.21	0.00	−0.41	0.00
Leather and leather goods	31	0.98	−0.009	0.00	−0.14	0.10	0.18	−0.07	0.13	0.15	0.25
						Durable Goods					
Lumber and wood products	24	0.87	0.002	0.00	−0.08	0.06	0.18	−0.12	0.00	−0.26	0.02
Furniture and fixtures	25	0.87	0.005	0.00	−0.06	0.04	0.14	−0.20	0.00	−0.29	0.00
Stone, clay, and glass prod	32	0.91	0.001	0.08	−0.27	0.06	0.00	−0.17	0.00	−0.25	0.00
Primary metal industries	33	0.91	−0.004	0.00	−0.65	0.10	0.00	−0.31	0.00	−0.22	0.19
Fabricated metal products	34	0.98	0.002	0.00	−0.24	0.07	0.00	−0.31	0.00	−0.11	0.13
Machinery, except electrical	35	0.95	0.004	0.00	−0.45	0.06	0.00	−0.36	0.00	0.17	0.06
Electrical and electronic equip	36	0.90	0.005	0.00	−0.03	0.06	0.62	−0.32	0.00	0.06	0.45
Transportation equipment	37	0.57	0.002	0.00	−0.12	0.04	0.00	−0.37	0.00	0.12	0.06
Instruments and related prod	38	0.95	0.006	0.00	−0.13	0.05	0.01	−0.25	0.00	0.24	0.00
Misc manufacturing industries	39	0.88	0.000	0.67	−0.29	0.04	0.00	−0.15	0.00	−0.25	0.00

Notes: Dependent variable is log of employment (all workers). Data are seasonally adjusted. Model: AR1(METHOD-MAXL) 63,1 86.1 DOF: 74. CONSTANT TREND LREX(0,6) LURT(0,4) LRENGY(0,4).

Table 9.3 **Employment for All Workers, 1975:I–1986:I**

	SIC	RHO	TREND	SIG	LREX	SE	SIG	LURT	SIG	LRENGY	SIG
						Nondurable Goods					
Food and kindred products	20	0.14	0.001	0.05	−0.25	0.02	0.00	−0.03	0.05	−0.10	0.00
Tobacco manufactures	21	0.61	−0.002	0.41	−0.27	0.15	0.08	0.14	0.10	−0.21	0.26
Textile mill products	22	0.69	−0.004	0.00	−0.36	0.07	0.00	−0.01	0.86	−0.07	0.38
Apparel and other textile prod	23	0.31	−0.002	0.00	−0.27	0.05	0.00	−0.03	0.19	−0.01	0.87
Paper and allied products	26	0.69	0.001	0.06	−0.11	0.04	0.00	−0.11	0.00	−0.01	0.75
Print and publishing	27	−0.25	0.007	0.00	0.08	0.01	0.00	−0.14	0.00	0.02	0.07
Chemicals and allied products	28	0.92	0.001	0.33	−0.18	0.05	0.00	−0.09	0.00	0.09	0.08
Petroleum and coal products	29	0.04	−0.001	0.50	−0.55	0.14	0.00	−0.01	0.87	0.30	0.13
Rubber and misc plastics prod	30	0.64	0.007	0.00	−0.18	0.14	0.23	−0.28	0.00	−0.11	0.53
Leather and leather goods	31	0.84	−0.009	0.00	−0.58	0.15	0.00	0.10	0.26	0.24	0.17
						Durable Goods					
Lumber and wood products	24	0.59	0.004	0.02	−0.27	0.12	0.03	−0.20	0.01	−0.29	0.06
Furniture and fixtures	25	0.63	0.003	0.00	−0.06	0.06	0.37	−0.25	0.00	−0.10	0.17
Stone, clay, and glass prod	32	0.59	−0.001	0.07	−0.25	0.05	0.00	−0.27	0.00	−0.01	0.89
Primary metal industries	33	0.56	−0.010	0.00	−0.44	0.12	0.00	−0.48	0.00	0.44	0.01
Fabricated metal products	34	0.55	−0.000	0.71	−0.29	0.05	0.00	−0.37	0.00	0.08	0.22
Machinery, except electrical	35	0.62	0.000	0.83	−0.33	0.07	0.00	−0.43	0.00	0.45	0.00
Electrical and electronic equip	36	0.92	0.005	0.00	−0.11	0.07	0.14	−0.27	0.00	0.09	0.20
Transportation equipment	37	0.31	0.004	0.00	−0.20	0.06	0.00	−0.35	0.00	−0.14	0.07
Instruments and related prod	38	0.94	0.006	0.00	−0.25	0.07	0.00	−0.18	0.00	0.20	0.01
Misc manufacturing industries	39	0.69	−0.001	0.36	−0.38	0.08	0.00	−0.12	0.01	−0.14	0.14

Notes: Dependent variable is log of employment (all workers). Data are seasonally adjusted. Model: AR1(METHOD-MAXL) 75,1 86.1 DOF: 26. CONSTANT TREND LREX(0,6) LURT(0,4) LRENGY(0,4).

Table 9.4 **Employment for All Workers, 1980–85**

	SIC	1963			1970			1975		
		LREX	SE	SIG	LREX	SE	SIG	LREX	SE	SIG
					Nondurable Goods					
Food and kindred products	20	−0.01	0.03	0.75	−0.00	0.04	0.92	−0.25	0.02	0.00
Tobacco manufactures	21	−0.06	0.05	0.18	−0.07	0.06	0.27	−0.27	0.15	0.08
Textile mill products	22	−0.14	0.08	0.07	−0.16	0.03	0.00	−0.36	0.07	0.00
Apparel and other textile prod	23	−0.13	0.07	0.05	−0.11	0.03	0.00	−0.27	0.05	0.00
Paper and allied products	26	0.02	0.04	0.59	0.00	0.03	0.91	−0.11	0.04	0.00
Print and publishing	27	0.11	0.03	0.00	0.12	0.02	0.00	0.08	0.01	0.00
Chemicals and allied products	28	−0.08	0.04	0.07	−0.10	0.03	0.00	−0.18	0.05	0.00
Petroleum and coal products	29	−0.28	0.07	0.00	−0.25	0.06	0.00	−0.55	0.14	0.00
Rubber and misc plastics prod	30	−0.21	0.06	0.00	−0.19	0.05	0.00	−0.18	0.14	0.23
Leather and leather goods	31	−0.14	0.10	0.18	−0.14	0.11	0.21	−0.58	0.15	0.00
					Durable Goods					
Lumber and wood products	24	−0.08	0.06	0.18	−0.13	0.05	0.01	−0.27	0.12	0.03
Furniture and fixtures	25	−0.06	0.04	0.14	−0.05	0.05	0.31	−0.06	0.06	0.37
Stone, clay, and glass prod	32	−0.27	0.06	0.00	−0.28	0.04	0.00	−0.25	0.05	0.00
Primary metal industries	33	−0.65	0.10	0.00	−0.57	0.06	0.00	−0.44	0.12	0.00
Fabricated metal products	34	−0.24	0.07	0.00	−0.29	0.03	0.00	−0.29	0.05	0.00
Machinery, except electrical	35	−0.45	0.06	0.00	−0.41	0.03	0.00	−0.33	0.07	0.00
Electrical and electronic equip	36	−0.03	0.06	0.62	−0.03	0.05	0.53	−0.11	0.07	0.14
Transportation equipment	37	−0.12	0.04	0.00	−0.19	0.04	0.00	−0.20	0.06	0.00
Instruments and related prod	38	−0.13	0.05	0.01	−0.15	0.04	0.00	−0.25	0.07	0.00
Misc manufacturing industries	39	−0.29	0.04	0.00	−0.28	0.03	0.00	−0.38	0.08	0.00

Notes: Dependent variable is log of employment (all workers). Data are seasonally adjusted. Model: AR1(METHOD-MAXL). CONSTANT TREND LREX(0,6) LURT(0,4) LRENGY(0,4).

In each of the three sets of estimates, the signs of the *LREX* coefficients are overwhelmingly negative, in 18 of 20 industries in the 1963 and 1970 estimates and in 19 of 20 industries in the 1975 estimates. The 1963 and 1970 *LREX* coefficients are very similar. In the 1963 estimates the *LREX* coefficient is statistically significant at the .05 level for 11 industries. The 9 industries with insignificant coefficients include all 6 that were not significant in the 1970 regressions, plus 2 that would be significant at the .07 level. The sizes of the coefficients are also very similar. In all 20 of the industries the differences between the 1963 and the 1970 estimated *LREX* coefficients are less than twice the standard error (*SE*) from the 1970 regressions, and one cannot reject the hypothesis that the 2 coefficients are the same. In 16 of 20 industries the differences are less than one standard error. In most cases the coefficients are so similar that they are nearly identical.

The 1975 regressions are less similar to the 1970 estimates than the 1963 estimates, although for several industries there is little difference. Overall, 16 of the 20 industries have statistically significant coefficients, compared to 14 for the 1970 regressions. Three industries with insignificant coefficients in the 1970 regressions are significant over the shorter time period, including food and kindred products (*SIC* 20), paper and allied products (*SIC* 26), and leather and leather goods (*SIC* 31). One industry, rubber and miscellaneous plastics products (*SIC* 30), that has a significant coefficient in the 1963 and 1970 estimates is no longer significant for the 1975 regressions. Most of the industries that had the largest *LREX* coefficients in the 1970 estimates have roughly similar coefficients in the 1975 regressions. The estimated coefficients for a number of industries are quite different, however. Overall, for 14 of the 20 coefficients, the difference between the 1970 and the 1975 regressions is more than twice the 1970 standard error.

In most cases where there is a large difference between the 1963–70 regressions and the 1975 estimates, the *LREX* coefficient is larger in absolute value (more negative) for the 1975 regressions than for the 1963–70 estimates. The 1975 regressions place a much larger weight on the period 1978 through 1985, which experienced the greatest movement in the real exchange rate. The more recent period is also one in which the U.S. economy may have become more open and sensitive to international trade. On the other hand, the shorter period has fewer degrees of freedom and may overfit the data or place too much weight on periods that are unrepresentative because of shocks to the economy, such as the deep 1982 recession or the 1979 increase in oil prices.

For 16 of the 20 2-digit SIC industries, the 1970 regressions have the smallest estimated standard error for the *LREX* coefficient. For this reason, and also because it seems to be a good compromise between

a longer history and the most recent experience, this time period is used hereafter as our base case. The choice of the time period, however, as well as many of the features of this or other models, remains inherently arbitrary, and caution should be used before too much reliance is placed on the individual industry estimates provided here.

9.5 Effects on Employment

The estimated coefficients presented in tables 9.1 through 9.4 provide one measure of the importance of the exchange rate to the manufacturing sector. These estimated elasticities give the percentage changes in employment that are the predicted percentage change in the exchange rate. As noted above, however, it is often helpful to have estimates of the number of jobs that will be affected by exchange rate movements. Table 9.5 provides these estimates.

Columns (3) and (4) in table 9.5 report the number of workers, in thousands, employed in each of 20 2-digit manufacturing industries in 1980 and 1985, respectively. For the manufacturing sector as a whole, employment declined from 20.29 million to 19.32 million, a loss of some 970,000 jobs. To decompose this employment change into the components attributed to the real exchange rate and other factors, the estimated model is used to predict the 1985 employment, given historical values for the four independent variables, *TREND, LRENGY, LURT,* and *LREX*. These numbers are reported in column (6).

Next, the predicted 1985 employment is recalculated four times, each time using the historical data for three of the series, but substituting the average 1980 values for the fourth independent variable. These new calculations represent the predicted value for employment, given the counterfactual case where the values for one of the independent variables remained at its 1980 level. The differences between the predictions based on the actual and the counterfactual values for the independent variables are the changes in employment that are attributed to the independent variables. These components of the change in employment are reported in columns (8), (9), (10), and (11), for each of the four independent variables. Column (12), which is labeled *RESID,* for the unexplained residual change, is the difference between the actual change and the change attributed to the four independent variables.[6]

According to these estimates, the appreciation of the dollar from 1980 to 1985 resulted in the loss of more than 1 million jobs for the manufacturing sector as a whole, or 5.3% of the work force employed in manufacturing in 1985. The *TREND* variable was associated with an increase of more than 400,000 jobs. The energy and unemployment

Table 9.5 **Change in Employment for All Workers, 1980–85 (Employment in Thousands)**

		Employment					1980–85 Employment Change[a]					Employment Change (%)[b]
(1)	SIC CODE (2)	1980 (3)	1985 (4)	Change (5)	Pred 1985 (6)	1985 Pred-Actual (7)	TREND (8)	ENERGY (9)	URATE (10)	EXCH (11)	RESID[c] (12)	(13)
					Nondurable Goods							
Food and kindred products	20	1,708	1,608	−100	1,623	15	−37.0	−3.0	−1.3	−8.6	−50.1	−0.5
Tobacco manufactures	21	69	65	−5	65	0	−5.2	0.4	−0.1	−0.4	0.8	−0.6
Textile mill products	22	848	704	−144	710	6	−83.9	−3.1	1.7	−42.6	−15.9	−6.1
Apparel and other textile prod	23	1,263	1,126	−138	1,134	9	−82.6	−6.6	3.4	−47.3	−4.7	−4.2
Paper and allied products	26	693	682	−11	689	6	7.2	−1.8	0.0	0.7	−16.6	0.1
Print and publishing	27	1,252	1,435	183	1,434	−1	158.6	−2.8	−2.6	52.9	−22.8	3.7
Chemicals and allied products	28	1,108	1,046	−62	1,054	8	1.1	−9.9	−1.5	−30.5	−20.9	−2.9
Petroleum and coal products	29	198	178	−21	179	2	−14.2	−4.1	−0.4	−16.6	14.8	−9.4
Rubber and misc plastics prod	30	727	790	63	799	10	109.9	12.3	0.2	−44.8	−15.1	−5.7
Leather and leather goods	31	233	166	−67	171	5	−50.3	−5.3	0.7	−9.6	−2.0	−5.8

	Durable Goods										
Lumber and wood products	24	691	701	10	704	3	41.8	13.7	3.3	−31.0	−18.3	−4.4
Furniture and fixtures	25	466	493	27	493	−0	37.7	8.2	0.8	−10.3	−9.2	−2.1
Stone, clay, and glass prod	32	663	591	−72	593	2	2.2	8.4	−0.3	−56.5	−25.6	−9.6
Primary metal industries	33	1,142	813	−330	816	3	−128.5	−9.7	−2.3	−158.2	−30.8	−19.5
Fabricated metal products	34	1,613	1,468	−146	1,470	3	11.6	3.8	−3.2	−133.9	−24.1	−9.1
Machinery, except electrical	35	2,494	2,182	−312	2,179	−3	64.8	−58.1	−12.1	−300.6	−6.3	−13.8
Electrical and electronic equip	36	2,091	2,207	117	2,212	5	205.4	−12.9	−5.4	−21.8	−48.8	−1.0
Transportation equipment	37	1,900	1,971	72	1,966	−5	131.0	22.4	−5.3	−101.0	24.4	−5.1
Instruments and related prod	38	711	724	12	735	12	79.1	−15.7	−2.8	−34.3	−14.1	−4.7
Misc manufacturing industries	39	419	369	−50	374	6	−10.7	3.5	0.1	−33.3	−9.3	−9.0
Total		20,287	19,316	−972	19,399	84	438	−60	−27	−1,028	−295	−5.3

[a]Change in 1985 predicted value when 1980 values are used.

[b]Due to exchange rate as percentage of 1985 employment.

[c]Employment change 1980–85 not attributed to the four variables.

variables together predicted an employment decline of less than 90,000, less than 0.5% of the work force employed in the manufacturing sector.

The unexplained decline in employment (*RESID*) is 295,000 jobs. This can be contrasted to the 84,000 difference between the predicted and actual employment for 1985. The apparent inconsistency between these figures is due to the lag structure of the model and the fact that the counterfactual assumptions use average values for 1980 rather than the particular history of values for the independent variables, including lagged quarters from 1979 and 1978.[7]

Among the individual sectors, two-thirds of the jobs lost because of the appreciation of the dollar are in four durable-goods industries: primary metals (−158,000), fabricated metal products (−134,000), nonelectrical machinery (−301,000), and transportation equipment (−101,000). Other durable-goods industries that experienced large job losses include lumber and wood products (−31,000), stone, clay, and glass products (−57,000), and instruments and related products (−34,000). Big losers among the nondurable goods industries include food and kindred products (−50,000), textile mill products and apparel and other textile products (−90,000), chemicals and allied products (−31,000), and rubber and miscellaneous plastics products (−45,000).

On a percentage basis, the big losers are primary metals, where the job losses represented nearly 20% of the 1985 work force, nonelectrical machinery (−13.8%), stone, clay, and glass products (−9.6%), fabricated metal products (−9.1%), petroleum and coal products (−9.4%), and miscellaneous manufacturing (−9.0%).

The industries that experienced the largest job losses are divided fairly evenly among industries that were experiencing secular decline and secular growth. Among the durable goods, three of the four largest losers in terms of the exchange rate show employment gains due to the *TREND* variable, but the largest percentage loser, primary metals, shows employment declines due to *TREND*. Among the nondurable goods sectors, six industries show employment declines due to *TREND*, and four of these show exchange-rate job losses that represent more than 5% of 1985 employment. Of the four nondurable goods industries that have positive growth in employment due to *TREND*, two have employment gains from the exchange-rate movement and two have declines. Overall, the two industries with the greatest *TREND* rate of growth are rubber and miscellaneous products and instruments and related products, and they experienced exchange-rate employment declines equal to 5.7% and 4.7%, respectively. The two industries with the most negative *TREND* growth rates are leather and leather goods and primary metal industries, and they experienced exchange-rate employment declines equal to 5.8% and 19.5%, respectively.

9.6 Production Workers and Non–Production Workers

The empirical results presented above relate to total employment. The Bureau of Labor Statistics also provides a series for the employment of production workers. The complement of this series, all workers minus the production workers, will be referred to here as "non–production workers." Production workers include employees who are directly engaged in the physical processes of production of manufactured goods—workers on assembly lines. The non-production series includes workers who are involved in research and development, marketing, transportation, secretarial and clerical tasks, and management activities.

If the market structure is such that the industry has a fixed ratio of production to non–production workers, and if production and non–production workers are both domiciled in the United States, then a movement in the real exchange rate would have the same percentage impact on production and non–production workers. If, on the other hand, the industry was characterized by increasing returns to scale, or if the results of the production workers' activities are more tradable than is the case for non–production workers, then exchange rate movements may have very different impacts on the production and non–production workers.

In tables 9.6 through 9.11, the two time series are compared, first to the combined series for all workers and then to each other. In table 9.6 the estimated coefficients for production workers are presented. Table 9.7 presents the results from the simulated decomposition of employment change, using the methodology described above. Table 9.8 compares results for production workers with those for all workers. Table 9.9 presents the results for non–production workers, and table 9.10 presents the results of the decomposition of change for this series.

A comparison between the production and non–production worker results is presented in table 9.11. In 15 of the 20 industries, the difference between the *LREX* coefficients is greater than two standard errors for the production worker series. Moreover, the signs of the coefficients are different for 8 of the 20 industries.

Within the nondurable goods industries the results are mixed. For half of the industries, the exchange-rate elasticities are more negative for production workers than is the case for non–production workers. Within the durable goods industries, the *LREX* coefficients are more negative in nine out of ten sectors, suggesting that production workers provide services that are more tradable than the services provided by non–production workers. Indeed, for three durable goods industries—electrical and electronic equipment, transportation equipment, and

Table 9.6 **Employment for Production Workers, 1970:I–1986:I**

	SIC	RHO	TREND	SIG	LREX	SE	SIG	LURT	SIG	LRENGY	SIG
						Nondurable Goods					
Food and kindred products	20	0.88	−0.000	0.54	0.01	0.04	0.78	−0.06	0.01	0.00	0.96
Tobacco manufactures	21	0.74	−0.005	0.00	−0.14	0.08	0.10	−0.01	0.92	−0.17	0.36
Textile mill products	22	0.72	−0.006	0.00	−0.15	0.03	0.00	−0.10	0.00	0.02	0.80
Apparel and other textile prod	23	0.72	−0.004	0.00	−0.09	0.03	0.01	−0.10	0.00	0.07	0.38
Paper and allied products	26	0.80	0.001	0.29	0.03	0.03	0.26	−0.16	0.00	−0.00	0.94
Print and publishing	27	0.92	0.005	0.00	0.17	0.02	0.00	−0.17	0.00	−0.02	0.66
Chemicals and allied products	28	0.87	−0.001	0.09	−0.13	0.03	0.00	−0.12	0.00	0.09	0.08
Petroleum and coal products	29	0.39	−0.004	0.01	−0.40	0.07	0.00	−0.11	0.11	0.29	0.15
Rubber and misc plastics prod	30	0.74	0.008	0.00	−0.20	0.06	0.00	−0.29	0.00	−0.27	0.07
Leather and leather goods	31	0.92	−0.014	0.00	−0.17	0.11	0.11	−0.03	0.60	0.35	0.03
						Durable Goods					
Lumber and wood products	24	0.76	0.003	0.00	−0.12	0.05	0.03	−0.21	0.00	−0.33	0.01
Furniture and fixtures	25	0.85	0.004	0.00	−0.07	0.05	0.18	−0.23	0.00	−0.26	0.01
Stone, clay, and glass prod	32	0.79	−0.000	0.73	−0.31	0.04	0.00	−0.20	0.00	−0.27	0.00
Primary metal industries	33	0.68	−0.008	0.00	−0.62	0.06	0.00	−0.40	0.00	0.09	0.57
Fabricated metal products	34	0.71	0.000	0.46	−0.31	0.03	0.00	−0.35	0.00	−0.12	0.08
Machinery, except electrical	35	0.72	0.000	0.73	−0.55	0.04	0.00	−0.47	0.00	0.28	0.00
Electrical and electronic equip	36	0.93	0.003	0.01	−0.16	0.07	0.04	−0.35	0.00	−0.06	0.60
Transportation equipment	37	0.37	0.003	0.01	−0.32	0.05	0.00	−0.43	0.00	−0.30	0.04
Instruments and related prod	38	0.90	0.004	0.00	−0.34	0.06	0.00	−0.30	0.00	0.22	0.02
Misc manufacturing industries	39	0.67	−0.002	0.00	−0.33	0.03	0.00	−0.18	0.00	−0.17	0.03

Notes: Dependent variable is log of employment (production workers). Data are seasonally adjusted. Model: AR1 (METHOD-MAXL) 70,1 86,1 DOF: 46. CONSTANT TREND LREX (0,6) LURT (0,4) LRENGY (0,4).

Table 9.7 **Change in Employment for Production Workers, 1980–85 (Employment in Thousands)**

(1)	SIC CODE (2)	Employment 1980 (3)	1985 (4)	Change (5)	Pred 1985 (6)	1985 Pred-Actual (7)	1980–85 Employment Change[a] TREND (8)	ENERGY (9)	URATE (10)	EXCH (11)	RESID[c] (12)	Employment Change (%)[b] (13)
					Nondurable Goods							
Food and kindred products	20	1,175	1,122	−52	1,133	11.0	−8.6	−1.9	−1.2	−2.1	−38.4	−0.2
Tobacco manufactures	21	54	49	−5	49	0.5	−4.9	1.0	−0.1	−1.5	0.5	−3.1
Textile mill products	22	737	608	−129	612	4.4	−76.1	−3.3	1.7	−35.9	−15.2	−5.9
Apparel and other textile prod	23	1,080	949	−131	956	7.4	−84.3	−7.1	3.1	−36.5	−6.0	−3.8
Paper and allied products	26	523	516	−7	520	4.1	5.0	−1.9	0.0	4.5	−14.6	0.9
Print and publishing	27	699	793	95	794	0.3	72.0	0.5	−1.8	41.9	−18.1	5.3
Chemicals and allied products	28	626	579	−47	584	4.6.	−8.2	−5.5	−0.3	−23.3	−9.2	−4.0
Petroleum and coal products	29	125	108	−18	107	−0.1	−9.0	−1.6	−0.4	−16.2	9.7	−15.1
Rubber and misc plastics prod	30	559	610	51	621	10.2	88.3	11.0	0.9	−36.1	−13.1	−5.9
Leather and leather goods	31	197	138	−59	142	4.2	−44.5	−4.4	0.6	−9.9	−1.1	−7.2

(*continued*)

Table 9.7 (continued)

(1)	SIC CODE (2)	Employment 1980 (3)	Employment 1985 (4)	Employment Change (5)	Pred 1985 (6)	1985 Pred-Actual (7)	1980–85 Employment Change[a] TREND (8)	ENERGY (9)	URATE (10)	EXCH (11)	RESID[c] (12)	Employment Change (%)[b] (13)
				Durable Goods								
Lumber and wood products	24	578	587	9	589	2.0	34.1	14.0	3.2	−25.2	−17.6	−4.3
Furniture and fixtures	25	376	394	18	393	−0.9	27.0	7.4	0.8	−10.6	−6.4	−2.7
Stone, clay, and glass prod	32	514	453	−61	452	−0.4	−1.9	8.7	0.1	−49.4	−18.5	−10.9
Primary metal industries	33	878	615	−263	616	0.4	−101.5	−4.5	−1.7	−131.3	−23.5	−21.3
Fabricated metal products	34	1,195	1,085	−110	1,084	−1.6	8.2	10.7	−1.8	−107.4	−19.7	−9.9
Machinery, except electrical	35	1,602	1,311	−291	1,303	−8.0	6.3	−29.8	−8.4	−243.0	−16.1	−18.5
Electrical and electronic equip	36	1,329	1,305	−24	1,305	−0.2	80.8	3.9	−1.3	−63.9	−43.0	−4.9
Transportation equipment	37	1,233	1,251	18	1,243	−8.3	73.3	36.1	−1.2	−111.5	21.3	−8.9
Instruments and related prod	38	425	393	−32	402	8.9	30.5	−7.6	−1.5	−44.4	−9.1	−11.3
Misc manufacturing industries	39	313	266	−48	269	3.5	−13.4	3.5	0.2	−29.7	−8.1	−11.2
Total		14,217	13,132	−1,085	13,174	42	73	29	−9	−932.0	−246	−7.1

[a]Change in 1985 predicted value when 1980 values are used.

[b]Due to exchange rate as percentage of 1985 employment.

[c]Employment change from 1980 to 1985 that is not attributed to the change in the four variables.

Table 9.8 **Production Workers and All Workers, 1970:I–1986:I**

	SIC CODE	Exchange Rate Elasticities: Production Workers LREX	SE	SIG	All Workers LREX	SE	SIG	Employment Change(%)[a]: Production Workers	All Workers
				Nondurable Goods					
Food and kindred products	20	0.01	0.04	0.78	−0.00	0.04	0.92	−0.2	−0.5
Tobacco manufactures	21	−0.14	0.08	0.10	−0.07	0.06	0.27	−3.1	−0.6
Textile mill products	22	−0.15	0.03	0.00	−0.16	0.03	0.00	−5.9	−6.1
Apparel and other textile prod	23	−0.09	0.03	0.01	−0.11	0.03	0.00	−3.8	−4.2
Paper and allied products	26	0.03	0.03	0.26	0.00	0.03	0.91	0.9	0.1
Print and publishing	27	0.17	0.02	0.00	0.12	0.02	0.00	5.3	3.7
Chemicals and allied products	28	−0.13	0.03	0.00	−0.10	0.03	0.00	−4.0	−2.9
Petroleum and coal products	29	−0.40	0.07	0.00	−0.25	0.06	0.00	−15.1	−9.4
Rubber and misc plastics prod	30	−0.20	0.06	0.00	−0.19	0.05	0.00	−5.9	−5.7
Leather and leather goods	31	−0.17	0.11	0.11	−0.14	0.11	0.21	−7.2	−5.8
				Durable Goods					
Lumber and wood products	24	−0.12	0.05	0.03	−0.13	0.05	0.01	−4.3	−4.4
Furniture and fixtures	25	−0.07	0.05	0.18	−0.05	0.05	0.31	−2.7	−2.1
Stone, clay, and glass prod	32	−0.31	0.04	0.00	−0.28	0.04	0.00	−10.9	−9.6
Primary metal industries	33	−0.62	0.06	0.00	−0.57	0.06	0.00	−21.3	−19.5
Fabricated metal products	34	−0.31	0.03	0.00	−0.29	0.03	0.00	−9.9	−9.1
Machinery, except electrical	35	−0.55	0.04	0.00	−0.41	0.03	0.00	−18.5	−13.8
Electrical and electronic equip	36	−0.16	0.07	0.04	−0.03	0.05	0.53	−4.9	−1.0
Transportation equipment	37	−0.32	0.05	0.00	−0.19	0.04	0.00	−8.9	−5.1
Instruments and related prod	38	−0.34	0.06	0.00	−0.15	0.04	0.00	−11.3	−4.7
Misc manufacturing industries	39	−0.33	0.03	0.00	−0.28	0.03	0.00	−11.2	−9.0

Notes: Model: AR1 (METHOD-MAXL) 70,1 86,1 DOF:46. CONSTANT TREND LRENGY (0,4) LURT(0,4) LREX(0,6).

[a]Due to exchange rate as percentage of 1980 employment.

Table 9.9 Employment for Non-Production Workers

	SIC	RHO	TREND	SIG	LREX	SE	SIG	LURT	SIG	LRENGY	SIG
						Nondurable Goods					
Food and kindred products	20	0.97	−0.003	0.00	−0.03	0.03	0.34	−0.03	0.02	0.04	0.28
Tobacco manufactures	21	0.20	0.000	0.81	0.20	0.06	0.00	−0.14	0.02	0.59	0.00
Textile mill products	22	0.78	−0.004	0.00	−0.20	0.04	0.00	−0.04	0.16	0.01	0.94
Apparel and other textile prod	23	0.88	0.001	0.30	−0.21	0.05	0.00	−0.07	0.02	−0.02	0.81
Paper and allied products	26	0.89	0.000	0.49	−0.07	0.05	0.12	−0.04	0.17	0.03	0.66
Print and publishing	27	0.95	0.007	0.00	0.04	0.03	0.15	−0.07	0.00	0.06	0.14
Chemicals and allied products	28	0.96	0.001	0.10	−0.08	0.04	0.08	−0.10	0.00	0.12	0.02
Petroleum and coal products	29	0.78	−0.004	0.01	−0.06	0.08	0.47	−0.03	0.60	0.49	0.00
Rubber and misc plastics prod	30	0.57	0.007	0.00	−0.16	0.02	0.00	−0.21	0.00	−0.08	0.13
Leather and leather goods	31	0.89	−0.009	0.00	0.05	0.12	0.68	−0.13	0.06	0.49	0.01
						Durable Goods					
Lumber and wood products	24	0.75	0.004	0.00	−0.17	0.05	0.00	−0.14	0.00	−0.00	0.96
Furniture and fixtures	25	0.87	0.006	0.00	0.02	0.05	0.71	−0.12	0.00	−0.12	0.25
Stone, clay, and glass prod	32	0.94	0.002	0.05	−0.19	0.06	0.00	−0.15	0.00	−0.01	0.89
Primary metal industries	33	0.89	−0.006	0.00	−0.40	0.05	0.00	−0.14	0.00	0.29	0.00
Fabricated metal products	34	0.92	0.001	0.14	−0.21	0.03	0.00	−0.20	0.00	0.20	0.00
Machinery, except electrical	35	0.79	0.004	0.00	−0.20	0.03	0.00	−0.20	0.00	0.37	0.00
Electrical and electronic equip	36	0.80	0.007	0.00	0.19	0.02	0.00	−0.28	0.00	0.31	0.00
Transportation equipment	37	0.79	0.004	0.00	0.09	0.04	0.02	−0.34	0.00	0.33	0.00
Instruments and related prod	38	0.91	0.008	0.00	0.11	0.04	0.01	−0.18	0.00	0.32	0.00
Misc manufacturing industries	39	0.79	0.001	0.09	−0.14	0.04	0.00	−0.07	0.02	0.04	0.68

Notes: Dependent variable is log of employment. Data are seasonally adjusted. Model: AR1 (METHOD-MAXL) 70,1 86,1 DOF: 46. CONSTANT TREND LREX(0,6) LURT(0,4) LRENGY(0,4).

Table 9.10 **Change in Employment for Non-Production Workers (Employment in Thousands)**

(1)	SIC Code (2)	Employment 1980 (3)	1985 (4)	Change (5)	Pred 1985 (6)	1985 Pred-Actual (7)	1980–85 Employment Change[a] TREND (8)	ENERGY (9)	URATE (10)	EXCH (11)	RESID[c] (12)	Employment Change (%)[b] (13)
		Nondurable Goods										
Food and kindred products	20	534	486	−48	489	3	−29.4	−2.0	−0.1	−5.2	−11.0	−1.1
Tobacco manufactures	21	16	16	1	16	−0	0.1	−0.9	0.0	1.0	0.3	6.3
Textile mill products	22	111	96	−15	98	2	−8.0	0.0	0.1	−6.7	−0.4	−7.0
Apparel and other textile prod	23	184	177	−7	178	1	2.6	0.4	0.2	−13.0	2.7	−7.4
Paper and allied products	26	170	167	−4	169	2	1.5	−0.3	0.0	−3.0	−1.7	−1.8
Print and publishing	27	553	642	89	640	−2	88.6	−3.1	−0.8	8.5	−4.5	1.3
Chemicals and allied products	28	482	467	−15	468	1	7.9	−4.6	−1.2	−8.3	−9.0	−1.8
Petroleum and coal products	29	73	70	−3	71	1	−5.3	−2.5	0.0	−0.5	5.3	−0.7
Rubber and misc plastics prod	30	168	179	12	179	−0	21.7	1.4	−0.6	−8.7	−2.3	−4.9
Leather and leather goods	31	36	29	−7	30	1	−6.0	−1.4	0.0	0.5	−0.4	1.8

(*continued*)

Table 9.10 (continued)

(1)	SIC Code (2)	Employment 1980 (3)	Employment 1985 (4)	Change (5)	Pred 1985 (6)	1985 Pred-Actual (7)	1980–85 Employment Change[a] TREND (8)	ENERGY (9)	URATE (10)	EXCH (11)	RESID[c] (12)	Employment Change (%)[b] (13)
				Durable Goods								
Lumber and wood products	24	113	114	1	115	1	8.6	0.0	0.0	−6.5	−1.1	−5.7
Furniture and fixtures	25	90	99	9	99	0	10.6	0.7	0.0	0.2	−2.5	0.2
Stone, clay, and glass prod	32	149	138	−11	139	1	4.3	0.1	−0.3	−8.1	−6.8	−5.9
Primary metal industries	33	265	198	−67	200	3	−25.2	−4.9	−0.6	−26.0	−10.3	−13.2
Fabricated metal products	34	418	382	−36	385	3	4.8	−6.2	−1.4	−26.6	−6.3	−7.0
Machinery, except electrical	35	892	870	−21	873	3	62.7	−27.5	−3.4	−57.6	4.6	−6.6
Electrical and electronic equip	36	762	902	140	907	5	122.4	−24.5	−4.5	50.1	−3.6	5.6
Transportation equipment	37	667	720	54	722	2	57.9	−19.6	−4.2	15.2	4.2	2.1
Instruments and related prod	38	286	330	44	333	3	48.1	−9.6	−1.2	11.7	−4.7	3.5
Misc manufacturing industries	39	105	103	−2	105	2	2.5	−0.1	0.0	−3.5	−1.2	−3.4
Total		6,071	6,184	113	6,215	31	370.0	−105	−18	−87	−48.7	−1.4

[a]Change in 1985 predicted value when 1980 values are used.

[b]Due to exchange rate as percentage of 1985 employment.

[c]Employment change 1980–85 not attributed to the four variables.

Table 9.11 **Production Workers and Non-Production Workers, 1970:I–1986:I**

	SIC CODE	Exchange Rate Elasticities: Production Workers LREX	SE	SIG	Non-Production Workers LREX	SE	SIG	Employment Change(%)[a]: Production Workers	Non-Production Workers
		Nondurable Goods							
Food and kindred products	20	0.01	0.04	0.78	−0.03	0.03	0.34	−0.2	−1.1
Tobacco manufactures	21	−0.14	0.08	0.10	0.20	0.06	0.00	−3.1	6.3
Textile mill products	22	−0.15	0.03	0.00	−0.20	0.04	0.00	−5.9	−7.0
Apparel and other textile prod	23	−0.09	0.03	0.01	−0.21	0.05	0.00	−3.8	−7.4
Paper and allied products	26	0.03	0.03	0.26	−0.07	0.05	0.12	0.9	−1.8
Print and publishing	27	0.17	0.02	0.00	0.04	0.03	0.15	5.3	1.3
Chemicals and allied products	28	−0.13	0.03	0.00	−0.08	0.04	0.08	−4.0	−1.8
Petroleum and coal products	29	−0.40	0.07	0.00	−0.06	0.08	0.47	−15.1	−0.7
Rubber and misc plastics prod	30	−0.20	0.06	0.00	−0.16	0.02	0.00	−5.9	−4.9
Leather and leather goods	31	−0.17	0.11	0.11	0.05	0.12	0.68	−7.2	1.8

(continued)

Table 9.11 (continued)

	SIC CODE	Exchange Rate Elasticities: Production Workers LREX	SE	SIG	Non-Production Workers LREX	SE	SIG	Employment Change(%)[a]: Production Workers	Non-Production Workers
					Durable Goods				
Lumber and wood products	24	−0.12	0.05	0.03	−0.17	0.05	0.00	−4.3	−5.7
Furniture and fixtures	25	−0.07	0.05	0.18	0.02	0.05	0.71	−2.7	0.2
Stone, clay, and glass prod	32	−0.31	0.04	0.00	−0.19	0.06	0.00	−10.9	−5.9
Primary metal industries	33	−0.62	0.06	0.00	−0.40	0.05	0.00	−21.3	−13.2
Fabricated metal products	34	−0.31	0.03	0.00	−0.21	0.03	0.00	−9.9	−7.0
Machinery, except electrical	35	−0.55	0.04	0.00	−0.20	0.03	0.00	−18.5	−6.6
Electrical and electronic equip	36	−0.16	0.07	0.04	0.19	0.02	0.00	−4.9	5.6
Transportation equipment	37	−0.32	0.05	0.00	0.09	0.04	0.02	−8.9	2.1
Instruments and related prod	38	−0.34	0.06	0.00	0.11	0.04	0.01	−11.3	3.5
Misc manufacturing industries	39	−0.33	0.03	0.00	−0.14	0.04	0.00	−11.2	−3.4
Total								−7.1	−1.4

Note: Model: AR1 (METHOD-MAXL) 70,1 86,1 DOF: 46. CONSTANT TREND LRENGY(0,4) LURT(0,4) LREX(0,6).

[a]Due to exchange rate as percentage of 1980 employment.

instruments and related products—the coefficients are negative and statistically significant for production workers, and positive and statistically significant for non–production workers. Thus for the instruments and related products industry, for example, the dollar appreciation from 1980 to 1985 is estimated to have caused a decrease of 11.3% for production workers, but an increase of 3.5% for non–production workers. Since the level of overall unemployment is controlled for in the estimates, the relative increase in non–production workers is not surprising.

These results suggest that a dollar appreciation may cause U.S. firms to move production facilities out of the United States, thus leading to a larger proportional reduction in production workers. This may mean that the jobs will not return to the United States now that the real value of the dollar has declined relative to foreign currencies. This may also imply that to some extent our model may be mis-specified, because of hysteresis effects.

Hysteresis reflects the dependence of present employment not only on the levels of the independent variables, but also on the path of those variables over the past. Industries or sectors where hysteresis effects may be important include industries where economies of scale or learning by doing are important, and where there are "sunk" costs for research and development (R&D), relocation, marketing efforts, capital investments, or other items that could represent a strategic barrier to entry in a market. It may be that once the initial costs of relocating production workers in foreign countries have been incurred, it will not be cost-effective to relocate the workers back in the United States after the dollar depreciates. Thus, while our model is useful in decomposing the causes of the changes in employment from 1980 to 1985, for some industries it may not be a good predictor of the employment changes that will occur in the more recent period of dollar depreciation.

Notes

1. The IMF defines the exchange rate as the inverse of EP^*/W from section 9.2. An increase of the index is an appreciation of the dollar.

2. We further considered the inclusion of a real interest rate variable, but found, surprisingly, that it had little explanatory power and did not significantly change the estimated exchange rate elasticities. The lack of explanatory power may be due to multicolinarity between the interest rate variable and the three variables *TREND, LURT,* and *LRENGY.*

3. The Beach-MacKinnon (1978) maximum likelihood procedure for correcting first order autocorrelation was used.

4. In an early version of this paper (Branson and Love 1986) we used a six-country index of exchange rates deflated by consumer prices. We have also experimented with an index based on wholesale prices, and we have used different weighing methods for the countries in the index. In general, changes

in the country weights or the price deflators have changed the metric of the estimates but not the ranking of the coefficients. The index based on unit labor costs tends to fit the data better than indexes based on wholesale or consumer prices.

5. Detrending of the unemployment rate to account for secular changes in labor force participation rates (a higher "natural rate") changes the estimated coefficient for the *LURT* variable and the *TREND* variable, but does not change the other coefficients.

6. The calculations reported in table 9.5 are the average of quarterly values, simulated as described in the text. The predicted values for 1985 are based on lagged values for the independent variables, and calculations based on the summed lagged coefficients reported in table 9.1 will lead to somewhat different answers from those in table 9.5, which are based on the particular lag structure estimated by the model.

7. If the model is true, then the first-quarter 1980 employment is a function of third-quarter 1978 real exchange rate and the first-quarter 1979 unemployment rate and price of energy, and not simply the average values for 1980 that are used in the counterfactual simulations. The values for the exchange rate, the unemployment rate, and the relative price of energy all underwent substantial changes between 1979 and 1980. The relative price of energy index rose from 114 in 1979:I to 144 in 1980:I, the civilian unemployment rate averaged 5.8% in 1979 and 7.1% for 1980, and the IMF relative unit labor cost index increased about 7% in 1980 over the value for 1979:I. The increase in the real exchange rate and the unemployment rate would suggest that the use of average 1980 values would understate the employment decline in the simulations, which explains both the additional 200-job loss in the residual category and the fact that the *RESID* column is negative for 18 of the 20 sectors. The use of the appropriately lagged series from 1978 to 1980 in the counterfactual simulations would result in a larger job loss associated with both the unemployment and the real exchange rate variables and a smaller job loss for the residual category.

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Comment Robert M. Stern

Theoretical Considerations

Branson and Love begin with a theoretical framework in which three sectors are distinguished: exportables, import-competing goods, and

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nontradables. In the short run, with nominal wages and/or aggregate expenditure fixed, an exchange rate change will alter the value of the nominal variables relative to those abroad and thus bring about changes in output and employment. In terms of comparative statics, these changes in output and employment will depend on the magnitude of the change in the exchange rate and on the economic characteristics of the individual sectors, in particular the elasticity of supply of exports, the elasticity of substitution between imported and home-produced goods, and the input-output structure that will govern how individual sectors will respond to changes in the costs of intermediate inputs due to the exchange rate change itself and the secondary effects of the changes in outputs.

Since in their theoretical discussion Branson and Love rely on a partial equilibrium model, they can only provide a start toward understanding what the sectoral effects of exchange-rate changes may be. The full effects must include a variety of general-equilibrium interactions. Thus, for example, in their analysis of the sectoral impact of exchange-rate changes based on the Michigan Model of World Production and Trade, Deardorff and Stern (1986, esp. pp. 139–51), distinguish the following effects:

1. Export effect, which will depend on the elasticity of supply of the industry and the share of exports in total production
2. Import substitution effect, which will depend on the elasticity of substitution between imported and home-produced goods and the share of imports in total demand
3. World price effect, which will depend on the country's exports and imports as shares of the corresponding world supply and demand
4. Interindustry sales effect, which will depend on the share of final demand in total demand for an industry
5. Interindustry purchases effect, which will depend on the labor share of value added in an industry
6. Expenditure effect, which will depend on the size and direction of the change in consumer expenditure resulting from the change in the exchange rate

Branson and Love focus their presentation on the export and import substitution effects and also note that the United States is to be considered a large country in world trade. But they do not take into account the interindustry effects noted, and they do not explain if and how expenditure may be affected by the change in the exchange rate. Finally, they assume a common nomimal wage across all sectors, thus abstracting from differences and adjustments to changes in intersectoral wages.

The determinants of employment in each sector are assumed to be the same as the determinants of output, with employment and output being tied together by a production function. What form the production

function takes is not stated explicitly in the paper, however. Presumably some allowance should be made in the production function for capital-labor substitution, as in the Michigan Model, but Branson and Love apparently abstract from such substitution.

Since there is reason to believe that sectors may differ substantially in their output and employment responses because of direct and indirect changes in relative prices as a consequence of a variety of general equilibrium interactions, it would thus be useful if Branson and Love were to be more explicit on what they were leaving out of their partial framework and how the omissions might affect the subsequent estimating equation and interpretation of results.

Estimating Equation

Branson and Love work with an estimating equation in which the log of employment in sector i over a given period of time is to be explained by lagged values of the log of the real exchange rate and domestic real income. The real exchange rate is supposed to capture changes in the relative prices of traded and nontraded goods. Changes in demand are presumed to reflect secular, cyclical, and structural influences, and the authors use a time trend, the log of the unemployment rate, and the log of the relative price of energy to capture these influences.

While the estimating equation bears a broad resemblance to the equations and discussion in the theoretical section of the paper, some of the links involved are not made clear. For example, in 9.2, the "real" exchange rate is $e = EP^*/P$, where P (P^*) is the relevant home (foreign) price. The key word here is "relevant." The authors apparently experimented with three different versions of the exchange rate based on relative movements in consumer prices, wholesale prices, and unit labor costs. They chose the latter measure on the basis of fit, although it is not clear if this particular measure is an accurate reflection of the relative price changes in tradables and nontradables. They assume that sectoral supply responds to the product wage (P/W), but as noted above, the wage is taken to be identical across industries, and no allowance is made for intersectoral wage differences which may in fact be fairly important.

An alternative procedure for decomposing the real income measure would be to fit a time trend and to measure the cyclical component of income in terms of deviation from trend. Presumably this would reflect the different elements of real income. Since they use a time trend and the unemployment rate, it is not clear that the two components of real income are being measured precisely. Further, the authors interpret the trend variable as measuring (9.4) "secular changes in income, tastes, comparative advantage, or technology." Since there are so many dif-

ferent influences included, it is not obvious what the trend variable is supposed to represent. Moreover, there is no allowance made for secular changes that could be important at the industry level.

Branson and Love use a four-quarter lag for the unemployment rate and the relative price of energy and a six-quarter lag for the real exchange rate index. They do not state how they selected these lag lengths. I imagine that it may have been after some previous experimentation with lags of different length.

Results

Even though the authors set up their theoretical analysis in terms of exportables, import-competing goods, and nontradables, they estimated single equations for 20 2-digit manufacturing industries without distinguishing the tradable characteristics of the different industries. It is not stated why they did not estimate equations as well for the agricultural sector and for the nontradables in order to provide a comprehensive set of estimates for all the major sectors in the economy. Not only would this be interesting in its own right, but it would call attention to the effects that the real appreciation of the dollar may have had in redistributing employment, especially between tradable and nontradable sectors. As it is, Branson and Love talk about "job losses" in manufacturing without considering whether the displaced workers may have been absorbed elsewhere in the economy.

Branson and Love ran their regressions for three different periods (1963:I–1986:I, 1970:I–1986:I, and 1975:I–1986:I) in order to "test the robustness" of the results. The best fits were for the period 1970:I–1986:I, and these were preferred over the longer and shorter time periods. It is not obvious why one would want to experiment with these different time periods, except that it may be worthwhile knowing how the coefficients may have been affected by the different events that took place. But distinguishing the results according to time period is not, despite what the authors suggest, a convincing test of the robustness of the results in terms of other structural changes that may have occurred or of omitted variables.

The ordinary-least-squares method is used for each of the 20 industries, with a correction for first-order autocorrelation. This assumes that the error terms are independent across equations. However, this may well not be true and, if not, the coefficient estimates may not be efficient. The equations should then be reestimated using generalized least squares to determine if the results may change.

For reasons that are not made clear, the industries are classified in the tables of results according to whether they represent nondurable or durable goods. However, there is only limited discussion of how the results differ. For example, it is evident that the durable goods sectors

are more cyclically sensitive than the nondurable sectors in terms of the unemployment rate and relative energy price variables. The nondurable goods sectors especially show evidence of negative employment trends, which we would expect, and primary metals has a negative employment trend as well. The real exchange rate results appear on the whole to be larger for the durable goods sectors, especially primary and fabricated metals, nonelectrical machinery, stone, clay, and glass products, and miscellaneous manufactures. This may reflect in part the relatively homogeneous products involved, but there could be interindustry effects at work as well. In any event, some further interpretation of the results in terms of the economic factors at work would be useful.

Effects on Employment

Branson and Love use their empirical results to calculate the components of the sectoral changes in employment between 1980 and 1985. They conclude (9.6) that more than 1 million jobs were lost in the manufacturing sector as a whole because of the appreciation of the dollar. But, as mentioned above, since they do not include the agricultural and nontradable sectors, it is not clear how to interpret this calculation. Presumably the workers either became unemployed or they were absorbed in the nontradables sectors. To say that manufacturing jobs were "lost" may therefore be misleading. There were of course sizable impacts on employment in the tradables sectors due to the dollar appreciation. In this respect, the largest actual employment declines between 1980 and 1985 were in primary metals, nonelectrical machinery, fabricated metals, textiles, and apparel. The impact of the exchange rate was most pronounced in nonelectrical machinery and primary and fabricated metals. Primary metals also had a substantially negative trend effect, as did textiles and apparel. Printing and publishing, electrical machinery, and transport equipment had sizable positive employment trend effects, while transport equipment had a noteworthy decline in employment associated with the dollar appreciation.

Worker Characteristics

Branson and Love repeat the foregoing estimation for production and non–production workers in each of the 20 manufacturing industries. They show that the exchange-rate effects are much larger with respect to the employment of production workers, suggesting that the services of these workers are more tradable than the services of non–production workers. It would be interesting if they had made an effort to relate the employment results to the export and import-competing characteristics of the different industries and to a more detailed breakdown of the workers involved. Thus, for example, as Katz (1987, p. 7) and

others have shown using cross-section data, import-competing industries "tend to have low wages, low value added per worker, and large concentrations of women, immigrants, and production workers relative to the typical manufacturing industries. . . . the opposite is true for . . . export . . . industries . . . [which] also tend to be more R&D intensive and to have more educated labor forces." The industry categories used by Branson and Love are perhaps too highly aggregated to identify clearly the major U.S. import-competing and export industries, and the industry labor force characteristics are not available on a continuous basis for all years. It would appear, nonetheless, that a richer and more complete portrayal of the employment impact of changes in the real exchange rate is possible than the one presented by the authors.

In their conclusion, Branson and Love note that their results suggest that dollar appreciation may cause U.S. firms to move production facilities abroad, to the detriment of U.S. production workers, and further, that because of hysteresis effects it may be difficult to reverse this process after the dollar depreciates. They view hysteresis as a possible source of misspecification of their model, which may possibly be the case. But one should not overemphasize hysteresis effects, especially in import-competing industries that are undergoing structural change because of relatively more abundant, and greater efficiency in the use of, factor endowments abroad. Thus, many U.S. industries would in any event be seeking out lower-cost sources of foreign supply. Dollar appreciation may have hastened this process, although to the extent that foreign investment in the United States was encouraged, there could be some offset to the employment declines associated with U.S. firms relocating abroad. Finally, the authors do not mention the difficulties that U.S. export industries may have in regaining markets. As implied above, this could work to the detriment of the relatively more skilled workers in the export industries.

References

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