The Impact of Health Care Spending On United States Industry

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Study Project on Health Care Reform and American Competitiveness

Wharton

The Wharton School of the University of Pennsylvania

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Introduction

U.S. employers are very concerned about the cost of health care. Former Colorado Governor Dick Lamm succinctly stated their concern when he called health care "...American industry's burden". However, the high level of costs and rate of growth in health benefit spending are not the only reason why employers are concerned; other aspects of health care costs suggest a clear distinction between these costs and other labor costs. First, health care costs in the U.S. are explicitly known by executives. Health care premiums are one of the few factor inputs for which employers receive a specific invoice each year, while most other costs are obscured through overhead distributions and other accounting complexities. Second, health care costs appear to be resistant to control, a fact which leaves many employers frustrated (Herzlinger, 1985). Indeed, the penetration of managed care and rate of innovation of cost-containment mechanisms demonstrate the level of concern in industry about health benefit cost growth. Third, and perhaps most important, many are concerned about the failure of the health care system to provide adequate access to effective care for all Americans. While the percentage of medical expenses covered by insurance is at an all-time high, the problem of access to care in the United States is now worse than at any time before Medicare was established; at least 14% of Americans have no health insurance. Employers' concerns about access may be economic as well as altruistic, since many health reform proposals will result in higher health care costs for many firms.

The cost of employer-paid health benefits is considered by some to be an important factor in the declining competitiveness of American firms. Firms assume that health benefit costs, although a small portion of production prices, increase output prices and harm their market share. This assertion assumes that rising employee benefit costs increase the total cost of production (by increasing total compensation) and further assumes that such cost increases either raise prices or reduce the amount of output which firms are willing to sell at world prices.

However, these connections do not necessarily occur. When facing higher health care costs, business can maintain prices and output if the cost is shifted backward onto labor, which means that wages, employment, or other benefits fall in order to accommodate more generous health benefits. If the value of additional health benefits to workers is not worth their cost (in terms of reduced wages), then their standard of living will fall. This relationship between domestic standard of living and the performance of firms in global markets is the type of competitiveness -- of the economy as a whole rather of an individual firm -- which this research addresses.

Background research

The incidence of rising labor costs can fall in three places. First, firms could pass costs on to consumers in the form of higher prices. The extent of this forward shift depends on the conditions of the market in which firms compete, such as the degree of the firm's market power or the elasticity of demand for the firm's output. Second, firms could absorb the expenses themselves in the form of decreased profit margins. This, of course, would make it difficult for firms to compete for capital, and in the long run would cause a reduction in the number of firms. Third, higher benefits costs could affect employees in the form of lower wages, or decreased employment in noncompetitive labor markets.

Economic theory asserts that, in the long run, the competitive market clearing price which brings the supply of and demand for labor into equilibrium is the total compensation package. The distribution of total compensation into wages and fringes is determined by workers' preferences. As a result, in a competitive labor market with a fixed (perfectly unresponsive) labor supply, rising fringe benefit costs should result in a decline in the market level of real money wages (Reinhardt, 1989; Pauly, 1987).

Empirical studies, however, have generally failed to find the expected inverse correlation between benefit costs and money wages. This may reflect the heterogeneity of the labor market which is composed of many different submarkets of specific sets of skills. Within a homogeneous submarket, there may still exist a tradeoff between fringe benefits and wages, but between submarkets, higher quality labor is associated with both higher benefits and higher money wages. It may also reflect the fact that both wages and fringe benefits are endogenous because they are chosen by the firm. Those firms with an unusually strong demand for labor would be expected to offer both higher money wages and more generous fringe benefits. As a result of these analytical problems, economists who have attempted to measure the substitutability of fringe benefits for wages have been unable to find perfect substitution (Smith and Ehrenberg, 1983). Other authors have found some, but imperfect, substitution between wages or benefits by analyzing models based on worker preferences (Woodbury, 1983).

Although past research which points to substitution has tended to stress the tradeoff between wages and pension benefits, pension benefits differ from health care benefits in a number of important ways. First, in gross terms, the actuarial value of pension benefits tends to dwarf health benefits. Second, the tradeoff between wages and pensions involves an inter-temporal choice in consumption. Health care insurance, on the other hand, is a smaller part of compensation than pensions, and is a form of current consumption. Third, workers tend to expect specified levels of health benefit coverage, independent of the cost to the firm for that bundle. This makes it difficult for employees to trade health care benefits costs for other forms of compensation.

Additional observations hint that health care costs may be less substitutable for cash wages than are other fringe benefits. In a study using Hay group data about total compensation packages both between and within firms, Smith and Ehrenberg (1983) determined that health care costs appeared to be held constant within the firm, implying that for the time period under investigation (late 1970's through early 1980's), companies chose health plans and made them equally available to all levels of workers (prior to ERISA), without regard to wages.

Health benefit costs can aggravate or relieve existing problems within some industries. For example, there are clearly documented regional variations in health care costs which can affect industries differentially, depending on where that industry is centered and whether local labor markets adjust to higher health benefit costs by supporting lower money wages. Long established firms in the northern United States have strong labor unions, an older work force, many retirees, and older factories. Hence they face lower productivity and, at the same time, higher than average health care costs and inflexible money wages. Many of these firms are also in industries which face intense foreign competition in domestic or world markets. If they continue to pay the same money wages and higher health benefit costs, they will be at a competitive disadvantage.

Most labor contracts in the U.S. (among the 16% of workers who are unionized) are fixed for a two- to three-year period after settlement, committing management to defined health care benefits which may require larger than expected payments if health care inflation is underestimated. Short-run rigidities such as unionization, contracts, market structures, and investment horizons could cause the firm to absorb some increased labor costs in the form of lower profits or a weakened market position. This may lead to permanent changes, such as plant closings, layoffs, or relocations, especially if money wages are "sticky" downward (Pauly, 1987). Therefore, it is conceivable that such rigidities between health care benefits and wages could affect the degree of short run substitution between health care costs and wages. The long run substitution, however, should not be affected.

Theory

A fully competitive model

A fully competitive model would assume that both product and input markets are competitive. In this model, depending on the elasticity of supply of labor and capital, much of the incidence of exogenous fringe benefit cost increases would be expected to fall on labor. Changes in premiums due to increases in coverage or shifts of employee shares have more complex effects, depending on reasons why coverage is increased or premiums shifted. For instance, suppose firms shift more of the dependent premiums to workers because of increasing work force heterogeneity; not all workers have high value for dependent coverage. Such a shift should lead to some offsetting decrease in money wages, but it need not equal the average amount of premium shifted; it could be either larger or smaller. If demand for health care is inelastic, increases in health care prices should lead to increases in total health expenditures. If labor supply is perfectly inelastic with respect to this change, there should be a perfect offset in money wages. If labor supply is different at lower real wages for a given level of total compensation, then some of the health benefit cost may fall onto capital or be shifted forward, but at least some of the cost should fall on labor's money wages[1].

In a competitive labor market, any employment effects of (exogenous) health care costs per worker are likely to be short run. Forecasted health benefit cost increases may not cause substantial layoffs, unless product prices rise. Real money wage growth may slow simultaneously with a foreseen rise in health benefit costs. Unforecasted changes in benefits costs should have their initial impact on profits, but then on employment in fairly short order. Restrictions on competition such as minimum wage laws, or a sluggishness in adjusting money wages, can cause substantial and possibly permanent reductions in employment. If rising health care costs do affect compensation per worker under such non-competitive conditions, there will be an effect on employment. If this is viewed in terms of labor demand, increases in money wages should have the same effect on employment as increases in health benefit costs because, from the employer's point of view, there is no difference in costs paid as money wages or as health benefits. Growth of either should lead to a decline in the quantity of labor demanded. If the supply of labor is perfectly inelastic, this translates into lower money wages.

If there are no artificial restrictions, the fully competitive model has a very strong implication. In this, model, exogenous increases in medical costs do not affect total compensation in the long run. This implies that such increases do not affect export prices, trade volumes, or firm profits. Conversely, a finding that medical costs do appreciably affect compensation implies that the labor market is not very competitive, and a finding that higher U.S. total compensation affects prices received by U.S. firms for goods traded in the world implies that product markets are not very competitive.

Non-competitive labor, competitive product model

One way to relax the fully competitive model is to consider labor markets as non-competitive. Suppose that unions prevent rising health care costs from being offset in the form of lower wages, that somehow they can bargain for a higher level of total

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[1]To test this theory, exogenous sources of variation in the relative price of quality-constant fringe benefits are needed, which are not easy to find for health care premiums. Most increases in medical spending over time come from changes in technology, which may increase value but surely increase cost. If the technology is valuable enough, increased health benefit spending may actually lead to an increase in total compensation and a decrease in the quality-constant price, so that money wages may fall by more than the increase in medical cost. Finding exogenous sources of technology at the level of the market as a whole is difficult. Exogeneity may be easier to assume at an industry level, since it is unlikely that the demand for health benefits by firms within an industry in itself will affect technology and cost. However, if the benefit is viewed as protection against variability in expenditures rather than as the purchase price of medical care, then the price of a quality-constant fringe benefit rises whenever health care costs increase.

compensation when health care costs rise than when they do not[2]. If products are sold in competitive global markets with a small U.S. presence, there still cannot be any forward shifting. Either capital will bear the cost (lower profits) or the number of workers will be cut until the marginal product of labor rises. In both of these cases there is, by definition, no relationship between health care costs and money wages. However, both health care cost-driven and money wage-driven increases in total compensation should have the same effect: workers laid off, reduced output, and no change in product prices.

If U.S. firms make up a substantial part of the product market, then higher compensation costs in the U.S. will cause world prices to increase. Demand for U.S.-produced output should drop drastically in response to the price increase unless U.S. firms have some special advantage. This results from the assumption that the rest-of-the-world supply curve is not perfectly elastic, so that some of the lost U.S. output cannot be replaced. The more competitive the international market, the lower the price increase and the larger the reduction in volume and employment for U.S. firms.

Non-competitive labor and product model

Further relaxing the model, suppose that U.S. firms could engage in administered pricing, and could explicitly shift forward any labor cost increase which is forced on them. Further suppose that (because of non-competitive labor market conditions) rising medical costs do raise total compensation. The main effects of rising health benefit costs in this model is a rise in the price of exports and a decline in export volume. It is even possible in this scenario that total firm profits will be increased if health care costs rise, since such a rise may trigger an oligopolistically-coordinated increase in price along an inelastic market demand curve. In this simple administered-price model, both health benefit costs and money wages should be passed through equally.

Magnitudes are also relevant to the understanding of this model. The average share of employer-paid health benefits in total compensation over the period of this research was about 4% (it is about 8% now). This means that a substantial increase in health care benefit costs would only have a small impact on total compensation cost per worker. For instance, a 20 percent increase in employer-paid health premiums at the average would increase total compensation by 0.8 percent. Even an increase from a 4 percent share to an 8 percent share of health benefits in total compensation would only increase labor costs, under full forward shifting, by 4 percent over a long period.

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[2]Alternatively, suppose that workers' preferences regarding the trade-off between wages and health benefits may be more complex than envisioned in the simple competitive model. For example, consider that rising health benefit costs imply rising variability of health expenditures for the worker. Thus, in order to maintain constant worker welfare over time, employer-paid health benefit costs may be required to increase <u>even at a constant money wage</u>.

A variation of this model is a non-competitive market model in which health benefit costs are a signal. In this model, health care costs and money wages could have different impacts on prices. The basic notion here is that rises in health benefit costs provide a signal to oligopolistic price setters that is, for some reason, stronger than the signal conveyed by rising money wages. Perhaps firms, hearing of double digit health care cost increases, are better able to anticipate increases in total compensation since the determinants of money wages in unionized firms are more speculative. The impact of a health benefit cost increase should be similar to that of an increase in the cost of living, and this phenomenon might be more common across firms than the circumstances which prompt increases in money wages.

Model specification

The question addressed by this research is whether increases in health benefit costs are shifted to workers in the form of lower wages or other fringes, or forward onto prices of domestic goods or services or exported goods. This research attempts to control for observable factors which affect total labor costs, such as the skill level and demographic makeup of workers; which have a direct effect on wages and benefits, geographic location and degree of unionization; which describe the labor market where the firm operates; and other factors which may affect industry labor costs. The control variables which may impact industry-wide health benefit costs include the growth of medical delivery capacity, and geographic location of industry, and factors which affect demand for benefits such as the degree of work force unionization, average worker age, sex mix of workers, firm size, and degree of risk of the industry (Pauly and Goldstein, 1976). This research will not examine whether health benefit cost growth affects demand for labor, the impact of health spending on firm profits[3], or the relationship between health benefit spending and health status of workers.

The following section describes the specification of a conjoint compensation model and price/trade flow model which can empirically examine this theory. For clarity, it is divided into those two components. Within the compensation model, separate time series and cross-sectional specifications are presented. The price/trade flow model is presented in aggregate time series only. In the specifications, all values are

[3]This model does not consider profits, although there is at least one channel by which health care costs can be expected to have an impact on industry profit levels. The estimates of health care costs used in the time series and cross-sectional analyses do not allow retiree and current work force health costs to be distinguished. Since retiree health care costs are independent of current operations, production decisions should not be influenced by these costs. Instead, retiree costs should affect the company like pension plan costs. If retiree health care costs take the form of defined future contributions, the equity market will quickly respond by adjusting stock prices until expected profit rates return to the market level. Thus, shareholders take a one-time loss, but there is no continuing impact on firm operations. If, on the other hand, retiree heath care costs take the form of defined benefits, a similar effect occurs as soon as the market recognizes the magnitude of future liabilities. In either case, profit levels decline but profit rates are unaffected. There are relatively few circumstances in which the incidence of retiree health costs would not be expected to fall entirely on capital.

expressed in nominal dollars[4] and all variables are in differenced natural logarithm form. General specification is presented here; in the results section the functional form and lag structure of the right hand side variables are shown. Variable names and sources are summarized in Appendix 1, and compensation data and price/trade flow data are shown in Appendices 2 and 3, respectively.

Compensation model

In general, conditions which bring the demand of and supply for labor into equilibrium at any wage can be expressed by

$$W^i = TC^i(N^i, X^i)$$
$$N^i = N^i(W^i, Y^i),$$

in which W is the unit cost (rent) for labor, N is the supply of labor, and X and Y are exogenous determinants, respectively, of demand for and supply of labor. This structural model does not allow for components of W (e.g., health benefit costs) to exert unique effects. The reduced form version of this model would specify total compensation per worker as exogenous factors in the labor market, such as inflation, work force quality, and demographic changes. Thus, the estimate of annual total compensation growth per worker can be expressed as

$$TC = f(UNION, SEX, LPROD, POP16, POP55, CPI, T) \qquad [1.0],$$

in which TC is total compensation per full time equivalent worker (FTE), UNION is the percent of workers unionized, SEX is the female labor force participation, LPROD is the value added per FTE, POP16 is the size of the population between 16 and 64, POP55 is the percent of POP16 which is between 55 and 64, CPI is the Consumer Price Index, and T is a linear time trend.

In this model, the partial effect on total compensation attributable to a component of compensation (such as health benefit costs) should be negligible. To determine if this is true, the health care benefit cost component of total compensation could be added to equation 1.0. However, employer-paid health insurance costs are endogenously determined, so exogenous identifiers of health benefit costs are needed to predict this value. Consider then the general specification

$$HC = f(FAM, SEX, RES, ST, CPI, ESP, DRG, T) \qquad [1.1],$$

in which HC is the total health benefit cost per FTE, FAM is the mean family size, SEX is the female labor force participation rate, RES is the annual federal and private sector expenditure on medical research, ST is the moving average of the number of U.S.

[4]The usual model of the labor market examines real compensation over time. However, nominal compensation, which is deflated by prices into real wages, are used in this research because they relate to price changes. Because the CPI is included as an explanatory variable, the elasticities can be interpreted as their effects on real compensation.

medical student slots, CPI is the Consumer Price Index, ESP is a dummy variable for the years of the Economic Stabilization Program (1973-1977=1), and DRG is a dummy variable for the DRG years (1982-1989=1). The right hand side of equation 1.1 specifies exogenous determinants of the health care premium costs per FTE.

The predicted values of health plan costs per FTE (HCHAT) allow the hypothesis of the competitive model (that exogenous shocks to health care costs are offset by wage reductions) to be tested by measuring the partial effect of HCHAT among the exogenous determinants of total compensation, as specified in equation 1.2.

TC = f(HCHAT, UNION, SEX, LPROD, POP16, POP55, CPI) [1.2],

The relationship between other forms of compensation (other than health plan costs per FTE) and total compensation can be similarly examined in order to determine if any relationship observed between HCHAT and TC is spurious, or if it is different from that seen for other forms of compensation. To test this, models for wages (WAGE), Medicare and Workman's compensation payments (MCWC), and other labor income (OLI; this is comprised of pensions, social security payments, and other supplements to income) per FTE can be estimated as follows.

TC = f(WAGE, UNION, SEX, LPROD, POP16, POP55, CPI) [1.3]
TC = f(MCWC, UNION, SEX, LPROD, POP16, POP55, CPI) [1.4]
TC = f(OLI, UNION, SEX, LPROD, POP16, POP55, CPI) [1.5]

Equations 1.3 to 1.5 use models which are identical to equation 1.2 except that HCHAT is replaced by the variable in question. The observed values for these variables are taken as exogenous at the aggregate level.

Because predicted health plan costs and other components of compensation can be correlated with determinants of total compensation, adding those variables to equation 1.0 could make equations 1.2 to 1.5 difficult to interpret. Therefore, the correlation between the compensation components and residuals from equation 1.0 will also be examined. This is identical to restricting the coefficients of all variables from equation 1.0 to their prior values in that equation and adding the component to the right-hand side. The hypothesis tested here is that if there is perfect substitution, then the elasticity of an increase in predicted health care costs or other components on inflation- and productivity-adjusted total compensation should be negligible.

In addition to the aggregate time series labor model, a cross-sectional labor model can be estimated for all private industry at the division level (one digit SIC) and for manufacturing at the sector level (two digit SIC) for 1988-1989. This model is specified as a direct correlate of equations 1.0 to 1.2, except that the exogenous predictors of aggregate health care costs have been replaced by industry-specific predictors of cost (see Pauly and Goldstein, 1976) or by regional employment-weighted variables.

The equations are estimated in a manner similar to that used for the time series. First, total compensation is estimated as a function of exogenous determinants (equation

2.0). Next, predicted health benefit costs are estimated from exogenous determinants (equation 2.1). Then, the relationship between predicted health benefit costs and the residuals of the exogenous determinants of total compensation is analyzed. All values are estimated by log differences under the following specification

TC= g(UNION, SEX, LPROD, POP55, EDUC) [2.0]
HC = g(FAM, SEX, MPI, DAYS, POP55) [2.1]
TC= g(HCHAT, UNION, SEX, POP55, LPROD, EDUC) [2.2],

where, for each industry, HC is the total health benefit cost per FTE, DAYS is the number of days lost to occupational disease, and EDUC is the mean highest grade of education achieved. FAM, SEX, and MPI (Medical Price Index) are not industry specific, but are weighted by the regional distribution of work force for each industry. All other variables are the industry-specific correlates of the similarly named time series variables.

Price and trade flow model

Standard trade flow models seldom include factor prices, relying instead on relative product prices, incomes, and currency exchange rates (Goldstein and Kahn, 1985). They focus on the demand for U.S. exports and imports expressed by

$$X^d = X^d(YF, PX/PF, T)$$
$$M^d = M^d(Y, PM/P, T)$$

where X^d is the demand for U.S. exports, M^d is the U.S. demand for imports, Y is real U.S. income, YF is real foreign income, PX is the price for U.S. exports, PM is the price level for U.S. imports, P is the index of U.S. domestic producer prices, PF is the index of foreign producer prices, and T is a time trend.

Although these two equations explicitly refer to the demand side, separate supply equations are generally not estimated because of the difficulty in formulating specifications that allow demand and supply to be identified separately[5]. Instead, some of the more ambitious models add supply-side factors, such as the size of the capital stock in the U.S. relative to its trading partners (along with the proportion of capital that is foreign owned which can affect demand as well), suppliers export prices relative to domestic market prices, and import prices relative to foreign producer prices.

These considerations lead to a "semi-reduced form" expanded trade model which incorporates both demand and supply for exports and imports in four simultaneously estimated equations. In this system, the effects of predicted total compensation on domestic and export prices, and of these prices on import flow and export flow, respectively, can be investigated. Note that in a fully competitive product market,

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[5]It is generally assumed that the supply of goods is either infinitely elastic or that the estimated trade regressions are reduced form equations derived from structural demand and supply relationships.

health benefit costs would not exert a separate influence on these factors. This system would be represented as

$$P = f(PM, TCHAT, Q) \quad [1.6]$$
$$PX = f(PF, TCHAT, QF, XNAG) \quad [1.7]$$
$$XNAG = f(YF, KFD, PX, PF, K, LPROD, N) \quad [1.8]$$
$$MMNP = f(Y, KFDF, P, PM, LPROD, N) \quad [1.9],$$

where P is the Producer Price Index, PM is the U.S. Import Price Index, Q is U.S. domestic private output, QF is foreign domestic private output, K is U.S. domestic capital investment, N is U.S. employment, PX is the U.S. Export Price Index, PF is a trade-weighted foreign price index (described in previous manuscript), XNAG is the volume of non-agricultural exports, MMNP is the volume of non-petroleum imports, YF is a trade-weighted foreign income, KFD is U.S. foreign direct investment abroad, Y is U.S. domestic income, KFDF is foreign direct investment in the U.S., and TCHAT is the predicted values of TC from equation 1.2 (estimated using HCHAT).

Foreign prices (PM or PF) are included because they will affect the prices of goods with which they must compete, but they can be taken as exogenous. However, the volumes cannot be taken as exogenous in this model. The simultaneity bias and possibly spurious correlations that would normally occur in this specification disappear under simultaneous estimation. Note that all indices account for exchange rate fluctuation.

Results and discussion

Equations 1.0 through 2.2 formalize a set of mechanisms by which the hypothesis that health benefit costs affect the competitiveness of U.S. industry can be tested. Equations 1.0 through 1.5 and 2.0 through 2.2 reflect the impact of health benefit costs on the labor market, namely total compensation; equations 1.6 through 1.9 show how total compensation relates to the prices and flows of international trade. The fully competitive model does not suggest any rationale by which domestic factor prices (e.g., employer-paid health benefit costs) can have a direct influence on prices or trade volumes. Thus, this model only allows health benefit cost growth to translate into prices through its effect on total compensation.

The time series model was estimated in aggregate for the years 1952-1989. The mean values and shares of each component of compensation across the years of this study are shown in Table 1. These variables are graphically depicted in Appendix 2.

Table 1. Means and shares of compensation components over time

	TC	HC	OLI	WAGE	MCWC
Mean	$12106.87	$418.75	$1010.02	$10475.19	$202.92
Share	1.00	0.03	0.08	0.87	0.02

During the period of analysis, nominal wages and employer-paid health benefit costs rose together, largely because of workers' preferences, labor productivity growth, and general inflation. However, during this period, the share of total compensation paid as money wages decreased from nearly 100 percent to about 73 percent. Notably, real wages declined over this period, particularly during the 1970's and 1980's. Conversely, the share of total compensation paid as pensions and health care benefits increased from less than 1 percent for both in 1952 to 13 and 8 percent, respectively, in 1989. Medicare and Workman's Compensation payments rose from negligible to about 6 percent of compensation (combined) over this period.

Time series compensation estimates

Exogenous determinants of total compensation per full time equivalent worker (TC) were estimated on annual aggregate data by ordinary least squares (OLS) regression. Table 2 shows the results of this estimation. T statistics are shown in parentheses. Because the estimation is expressed in differences of natural logarithms, the parameters here and throughout can be interpreted as elasticities.

Table 2. Parameter estimates for total compensation

Variables	Parameter est. (T)
INTERCEPT	0.024 (4.80)
UNION	0.200 (3.05)
SEX	-0.047 (0.24)
LPROD	0.197 (3.45)
POP16	0.381 (2.31)
POP55	0.210 (1.94)
CPI	0.607 (9.64)
T	-0.0001 (0.41)
R^2	0.8968
D-W	1.874

Table 2 shows that increases in unionization, labor productivity, and the underlying general inflation rate are related to total compensation growth. Total compensation also grows with the expansion of the working age population, and with the aging of the work force. Controlling for these factors, there is no significant time trend for total compensation growth. These results provide an expected picture of what has driven per worker total compensation over time. These variables can then be seen as instruments of the underlying growth of total compensation from year to year.

Because unionization has a significant positive impact on total compensation growth, the assumption that the marketplace is fully competitive is not supported. In this case, the noncompetitive labor market conditions described in the "unionized labor, competitive product model", where rising health care costs may affect demand for labor[6] or the level of other compensation, could be important.

Table 2 shows how exogenous determinants have affected total compensation growth over time. The question asked by this research, however, is whether rising health benefit costs have, *ceteris paribus*, affected the growth of total compensation. Because health benefits are endogenous to total compensation, exogenous determinants of total health benefit cost per FTE (HC) were first examined. The results of this estimation, using aggregate U.S. private non-farm industry data, are shown in Table 3.

Table 3. Parameter estimates for exogenous predictors of health plan costs

Variables	Parameter est. (T)
INTERCEPT	0.869 (1.43)
FAM	-0.818 (0.78)
SEX	-0.342 (2.25)
RESL2	0.213 (1.98)
STL2	0.220 (2.40)
CPI	0.480 (1.49)
T	0.001 (0.03)
ESP	-0.010 (1.38)
DRG	-0.059 (1.84)
R^2	0.4987
D-W	1.819

Table 3 shows that the growth of employer-paid health benefit costs is positively influenced by the average supply of medical student slots in previous years, which is a determinant of the current supply of physicians, and by medical research expenditures in preceding years[7]. Per worker health benefit cost growth is negatively influenced by the growth of female labor force participation, which approximates the growth over time of double health benefit coverage in families. Health benefit cost growth was slowed during the years of the Economic Stabilization Program and during the years after DRG implementation with respect to other periods. Family size, which has declined during the same period when health benefit costs have increased, the CPI, which has increased during the years in question, and the time trend do not have significant relationships to employer-paid health benefit costs.

The exogenous determinants of health benefit cost growth exerted effects which are consistent with prior expectations. The results of equation 1.1 indicate that this specification doesn't perfectly predict the historical (and endogenously selected)

[6]Note here that it is the noncompetitive labor market conditions, not unionization per se, which could lead to a relationship between rising health benefit costs and diminished labor demand. This aspect of rising health benefit costs was not examined by this phase of research.

[7]These variables are considered exogenous because they are to a large extent under government control.

growth of benefit costs but does explain substantial variation in cost growth. Thus, the predicted value, HCHAT, will perform acceptably as an exogenous instrument of employer-paid health benefit costs. This instrument can be used to examine whether health benefit cost growth affects total compensation.

To assess the effect of health benefit costs on total compensation, the predicted value of this variable (HCHAT) was added to the total compensation model shown in Table 2 (equation 1.0). A similar procedure was followed for each compensation component so that the effects of predicted health benefit costs could be interpreted in the context of the entire compensation package. In this manner, the partial effects on total compensation of Medicare and Workman's Compensation taxes, and pensions and other labor income were determined by independent estimations for each component[8]. Wages are not considered here because during the 1950's and 1960's, total compensation was closely approximated by wages. Recall that the hypothesis under examination here is that if compensating differentials exist, then the coefficients of these variables will be negligible when estimated in concert with the exogenous determinants of total compensation. Table 4 shows the results of these estimations.

Table 4. Parameter estimates for components of compensation

	d.v. TC	d.v. TC	d.v. TC
Variables	Par. est. (T)	Par. est. (T)	Par. est. (T)
INTERCEPT	0.003 (0.35)	0.022 (3.80)	0.012 (2.32)
HCHAT	0.161 (2.70)		
HCHATL1	-0.011 (2.16)		
HCHATL2	-0.022 (0.03)		
MCWC		0.007 (0.33)	
MCWCL1		0.010 (0.48)	
MCWCL2		0.022 (1.12)	
OLI			0.095 (4.03)
OLIL1			0.040 (1.16)
OLIL2			0.051 (1.39)
UNION	0.160 (2.02)	0.192 (2.33)	0.186 (3.10)
SEX	0.099 (0.35)	0.132 (0.41)	0.386 (1.73)
LPROD	0.143 (1.71)	0.244 (1.89)	0.140 (2.26)
POP16	0.190 (1.02)	0.268 (1.43)	0.226 (1.72)
POP55	0.114 (1.01)	0.212 (1.77)	0.232 (2.77)
CPI	0.345 (2.51)	0.584 (8.74)	0.431 (5.90)
T	0.0004 (1.32)	-0.0001 (0.44)	0.0004 (1.75)
R^2	0.9243	0.9094	0.9493
D-W	2.195	1.800	1.695

[8]In equations 1.1 through 1.4, Goldfield-Quandt tests for heteroskedasticity were performed on the predicted total compensation for each component. Because all had significant parameters for heteroskedasticity (F tests on the coefficient of TC for 1956-1964 compared to 1981-1989), all variables in equations 1.1 through 1.4 were specified as $<v>/(CPI)^{0.5}$. This specification did not change the general magnitude or significance of the uncorrected results (not reported).

Table 4 shows that contemporaneous health care expenditures increase total compensation and are offset by long run corrections which result in a net elasticity of 0.13. The growth of Medicare and Workman's Compensation payments is not related to total compensation growth. Other labor income has a contemporaneous effect and reinforcing lags which yield a long run elasticity on total compensation of 0.18.

The exogenous variables which were used to explain total compensation growth in equation 1.0 (Table 2) have effects in each of equations 1.2 to 1.5 (Table 4) which differ by equation and which are different from the base estimation shown in Table 2, suggesting multicollinearity. Therefore, in order to eliminate confounding effects of potential multicollinearity, the components of compensation were estimated on the residual variation of total compensation (TC - TCHAT)[9] which isn't predicted by the underlying instruments of total compensation growth. Table 5 shows the results of this estimation for each compensation component on the total compensation residuals[10].

Table 5. Parameter estimates for components of compensation on residuals of total compensation (TC - TCHAT)

	d.v. TC -TCHAT	d.v. TC -TCHAT	d.v. TC -TCHAT
Variables	Par. est. (T)	Par. est. (T)	Par. est. (T)
INTERCEPT	0.018 (4.16)	0.022 (9.25)	0.021 (7.50)
HCHAT	0.134 (2.13)		
HCHATL1	-0.035 (1.63)		
HCHATL2	0.016 (1.01)		
MCWC		0.004 (0.26)	
MCWCL1		-0.0002 (0.01)	
MCWCL2		0.018 (0.33)	
OLI			0.049 (2.32)
OLIL1			0.0003 (1.10)
OLIL2			0.010 (0.31)

Table 5 shows that the growth of total compensation which is not accounted for by the underlying factors of the labor market are significantly correlated with employer-paid health benefit cost growth. Parameters for contemporaneous health costs and the first

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[9]Statistically, HCHAT (or any other component of compensation) can be seen as consisting of two components, one correlated with and one independent of the set of exogenous predictors of total compensation. This specification assigns all of the explanatory power to to the exogenous predictors of total compensation, which allows the compensating differentials hypothesis to be clearly tested.

[10]Another potential problem with the results shown in Table 4 is that the log-linear specification of equations 1.2 to 1.5 imposes constant elasticities. Therefore, an alternative specification using a transcendental logarithmic form was also estimated for total compensation residuals. This specification yielded non-significant quadratic terms and a trivially small interaction term (results not shown), such that the elasticities and slopes are equivalent to that determined for the constant elasticities form, which is shown in Table 5. Thus, the restriction of constant elasticities was not rejected.

lag are significant, such that the long run elasticity of health benefit costs on total compensation is about 0.10[11]. The negative coefficient on the health benefit cost lag term can be interpreted as a long run correction of the short run effect. Other labor income growth exhibits a significant contemporaneous elasticity on total compensation of about 0.05, without error correction effects. Medicare and Workman's Compensation payments remain non-significant.

The long run elasticity of predicted health benefit costs on total compensation residuals could be interpreted as follows. From 1979 to 1989, predicted total compensation rose from $17,317 to $27,361, with a mean of $22,623[12], and annual total compensation residuals[13] ranged between $1,463 and $2,639 with a mean level of $2,175. Predicted health benefit costs per worker rose from $623 to $1,342[14], a 115 percent increase across the 1980's. Because health benefit costs exert a long run elasticity of 0.10, 11.5 percent of the total compensation residual level across all years can be explained by health benefit cost growth during this period. This implies that during the 1980's, the growth of real compensation explained by health benefit costs was $251 per worker, or 1.1 percent of mean compensation. On average, then, real annual worker compensation rose by $25 per worker in the 1980's because of health benefit cost growth compared to the amount if health costs had not risen at all.

The dependent variable for each model shown in Tables 4 and 5 is the growth of total compensation (TC). Recall that under conditions of perfect substitutability in the fully competitive model, total compensation in any year should be reflect its level in the the previous year plus growth attributable to labor productivity improvements and general inflation. This table shows that, for the 1980's, when predicted health benefit costs rose by $78 per worker per year on average, $25 of this growth was passed on as increased total compensation and $53 per worker, or about two-thirds of the total increase, was shifted back to labor. Thus, perfect substitution between health benefit costs and other forms of compensation was not found, although most health benefit cost increases were substituted within compensation. Likewise, in this research, other labor income also demonstrates imperfect substitution. This result is similar to that found for fringes in cross-section (Smith and Ehrenberg, 1983; Woodbury, 1983).

The significant negative elasticity of the first lag of health benefit costs (HCHATL1) in Table 5 has an important implication. Unlike that of the other components of compensation, this suggests that a long term correction of the short term effect in

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[11]Elasticities and dollar estimates shown throughout this paper represent the best estimate of the magnitude of relationships between the variables. While statistically significant, the confidence intervals are not shown, and thus any estimate should be interpreted with caution.

[12]During this period, total compensation rose in real terms from $22,037 to $23,569 per worker, with a mean of $22,803, and in nominal terms from $16,638 to $28,991 per worker, with a mean of $22,814.

[13]Total compensation residuals are independent of the explanatory variables and have a mean of zero. In this case, in which the estimation was performed in log-differences, the level values shown will not necessarily have a mean value of zero.

[14]Real health benefit costs during this period rose from $817 to 1,091 per worker, and nominal costs rose from $607 to $1,432 per worker.

allocating health plan costs into total compensation has occurred. Without this correction, the high contemporaneous elasticity would assign rising health benefits costs an inordinately important role in the growth of total compensation. The negative long term effect tends to offset this error. To examine this further, compare health benefit costs to Medicare and Workman's Compensation payments. Although Medicare and Workman's Compensation payments are driven by factors similar to health benefit costs, their payments are set legislatively and are usually predictable several years in advance (i.e., although they increase from year to year, they can be predicted accurately)[15]. The absence of long run correction in Medicare and by Workman's Compensation payments and the nonsignificant role they play in total compensation growth supports the assertion that some of the perceived adverse effects of employer-paid health benefit costs may be driven solely by their high and unpredictable rates of cost growth.

Cross-sectional compensation estimates

Turning to the cross-sectional model, the relationship between health benefit costs and total compensation shown previously can be studied in a different manner, and the question of whether there are inter-industrial differences in this relationship can be examined. Equations 2.0, 2.1, and 2.2 estimate health benefit costs per FTE (HC) and total compensation per FTE (TC), in a manner similar to equations 1.0, 1.1, and 1.2 (with the exception that industry-specific or regionally weighted factors are used in the instrumentation of health benefit costs and total compensation costs). Table 6 shows the parameter estimates for this cross-sectional labor model estimated by ordinary least squares on differences of logarithms for all private industry at the division level (one digit SIC) and for manufacturing at the sector level (two digit SIC) for 1988-1989.

Table 6. Parameter estimates for cross-sectional total compensation

Variables	Parameter est. (T)
INTERCEPT	0.165 (1.26)
UNION	0.265 (2.10)
SEX	-0.103 (1.98)
LPROD	1.124 (4.32)
POP55	0.114 (1.65)
EDUC	1.594 (3.99)
R^2	0.7456

Table 6 shows results similar to those in Table 2, where exogenous determinants perform in accordance with a priori expectation. Labor productivity has a stronger influence on total compensation in cross-section than in time series. As with the time series, a significant coefficient on unionization suggests that the labor market is non-

[15]Notably, Workman's Compensation payments have increased rapidly since 1985. These few years exert little weight because these costs rose slowly in many of the preceding years, making the overall rate of growth across many years quite small.

competitive. Higher mean work force education levels and more pre-retirement workers is associated with higher compensation.

Table 7 shows the estimation of predicted health benefit costs on the residuals of total compensation (TC-TCHAT).

Table 7. Parameter estimates of cross-sectional health care costs and total compensation

	d.v. HC	d.v. TC-TCHAT
Variables	Par. est. (T)	Par. est. (T)
INTERCEPT	2.435 (3.29)	-0.023 (0.32)
FAM	-0.647 (1.08)	
SEX	-0.324 (2.86)	
MPI	0.182 (2.79)	
DAYS	0.075 (2.96)	
POP55	0.203 (3.21)	
HCHAT		0.04 (1.97)
R^2	0.5747	0.8357

Table 7 shows that industry-specific health benefit costs (equation 2.1) increase with the regionally-weighted CPI, the size of the pre-retirement work force, and the number of work days lost due to occupational injury or illness. Health benefit costs decrease with the rising percentage of females in the industrial work force. Contemporaneous predicted health benefit costs exhibit an elasticity on total compensation residuals (TC - TCHAT) of 0.04, a smaller estimate than that obtained by the time series estimation.

The cross-sectional model allows examination of variations in the effect of health care cost growth on total compensation which may be obscured by the central tendency of aggregate data. Examination of subgroups within the cross-sectional data set could reveal if further analysis about specific industries is warranted, and provides interesting insights into the heterogeneity of this phenomenon. Table 8 shows the elasticity of health benefit costs on total compensation residuals (TC - TCHAT) for several subgroups, including globally competitive industries[16], service firms, and medical industry firms, as well as a T test to reject the hypothesis that the parameter is different from the mean (0.04).

[16]A globally competitive industry is one in which the free flow of goods occurs bilaterally across borders. The subgroup of industries analyzed here are those in which the sum of the import-held domestic market share and the domestic-held world trade share exceeds 0.5.

Table 8. Parameter estimates for selected industrial sub-groups

Subgroup	HCHAT on (TC-TCHAT) Par. est. (T)	Prob <> |T| Ho: $\beta_{mean} = \beta_{subgroup}$
Global	0.009 (1.03)	0.0013
Service	0.067 (2.48)	0.8730
Medical	0.245 (3.49)	0.0008

Table 8 shows substantial variation in the effect of health benefit cost growth on total compensation residuals for selected industry subgroups. Globally competitive industries demonstrate a non-significant relationship between health benefit cost growth and total compensation residuals, suggesting that all health benefit cost growth is offset by other wage reductions. Service industries exhibit a strong positive relationship between health benefit costs and total compensation residuals which is no different than the mean effects across all industries. The elasticity of growth of health benefit costs on the residual of medical industry total compensation is much larger than the mean. This could arise from the correlation between medical industry-paid health benefit costs (paid for their workers) and aggregate health costs (paid by all other employers), and could then reflect an income transfer through health care spending into this industry. While not proving specific conclusions, the results shown in this table suggests that there are industry-specific effects which are obscured by the aggregate model which should be examined in more detail in subsequent research.

Time series price and trade flow estimates

In order to assert that the growth of health benefit costs, or of any other component of compensation, affects the competitiveness of U.S. industry, it must be shown that total compensation growth does indeed get passed through to output prices. This part of the study examines U.S. export prices and volumes and domestic prices and import volumes in comparison to the top fifteen U.S. bilateral trade partners[17]. During the period of this study, U.S. domestic prices and U.S. export prices increased. Export prices exhibited strong growth in the 1970's and 1980's after the termination of the Bretton Woods Agreement, which had fixed exchange rates among Western trading partners. The times series of these variables is shown in Appendix 3. Table 9 shows the results of two stage least squares estimations of the price and trade flow model[18] using predicted total compensation growth (estimated using HCHAT and exogenous determinants).

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[17]85% of U.S. bilateral trade. Australia, Brazil, Venezuela, and Saudi Arabia are excluded.

[18]This is not an attempt to fully specify a trade model but to illustrate the relationship between total compensation and prices. Fully specified co-integrated and simultaneous models of trade flows and prices have been analyzed in this research, and have been presented in related working papers.

Table 9. Parameter estimates for prices and trade flows

	d.v. MMNP	d.v. XNAG	d.v. PX	d.v. P
Variables	Par. est. (T)	Par. est. (T)	Par. est. (T)	Par. est. (T)
INTERCEPT	-0.030 (0.89)	0.053 (1.09)	-0.030 (1.113)	-0.033 (2.78)
Y	0.630 (2.52)			
YF		0.194 (2.11)		
PM				0.007 (0.12)
PF			0.383 (2.08)	
P	0.212 (2.05)			
PX		-0.268 (2.63)		
K		0.940 (1.30)		
KFD		0.084 (0.21)		
KFDF	0.068 (0.55)			
TCHAT			0.532 (2.48)	0.394 (6.06)
TCHATL1			0.095 (2.19)	0.153 (3.52)
LPROD	0.263 (0.43)	0.681 (1.26)		
XNAG			0.611 (4.90)	
Q				-0.265 (4.53)
QF			0.616 (3.48)	
N	3.474 (1.75)	3.167 (2.71)		
R^2	0.7009	0.7296	0.7492	0.7732

Table 9 shows, as expected, that total compensation growth positively affects the growth of U.S. domestic producer prices (P) and export prices (PX), exhibiting contemporaneous elasticities of 0.532 and 0.394, respectively, with reinforcing lags yielding long run elasticities of 0.627 and 0.547, respectively. These prices, in turn, affect trade flows in the expected manner. The implications of these results are discussed in the conclusions.

Conclusions

This research has attempted to address the question of whether and how employer-paid health benefit costs affect the competitiveness of U.S. industry. To accomplish this, it has examined the underlying questions of (1) how health benefit cost growth affects the growth of total compensation, (2) how total compensation growth affects domestic and export prices, and, (3) how these prices affect the flow of imports into and exports out of the United States. As such, the central issue here is whether rising employer-paid health benefit costs are offset by reductions in the remaining compensation bundle. This research has been constrained by a lack of detailed data, particularly about health costs in specific industries over time, with which to address these questions.

Given the objective of this research and its limitations, several preliminary conclusions can be drawn which are based on the findings of this study. Because this research is ongoing in its attempts to improve these models, these conclusions should be interpreted within the existing body of knowledge about health care benefits, labor markets and compensation, and prices and trade flows.

1. For aggregate U.S. private, non-farm industry since 1952, rising health benefit costs have increased total compensation beyond that predicted by labor market factors, with an elasticity of about 0.10[19]. Thus, during the 1980's, an average of about $251 per worker of real compensation growth was explained by health benefit cost increases. Since exogenously determined health benefit costs rose with a per worker annual average of $78 during this period, this means that about $53 per worker-year has been offset elsewhere, presumably by backward shifting to labor in the form of decreased wages or other fringes. This implies that there is some, but imperfect, substitution between employer-paid health benefits and other forms of compensation, which is consistent with previous empirical estimates of compensating differentials between wages and fringes. By contrast, changes in Medicare and Workman's Compensation payments appears to be offset entirely by declines in other components of total compensation.

2. Total compensation paid to workers by private non-farm industry, in aggregate, has been associated with increased domestic and export prices, with respective elasticities of 0.627 (domestic producer prices) and 0.547 (export prices). In turn, rising export prices decrease export volumes, and rising domestic prices increase import volumes, as expected. Because unexplained (residual) total compensation was about 9.5 percent of total compensation during the 1980's, the elasticity of growth of health benefits of 0.1 could be seen as having an elasticity on total compensation of about 0.0095. Thus, the increase in health benefit costs from 1979 to 1989, through its effect on total compensation, increased domestic prices by about 0.68 percent and export prices by about 0.59 percent. In turn, this would have been expected to increase import volume by about 0.14 percent and decrease export volume by about 0.16 percent during the 1980's.

3. The effect of rising health benefit costs on total compensation, and thus on prices and trade flows, is positive and significant but quite small in magnitude. For example, U.S. import volume during the 1980's increased by 125 percent, but only 0.14 percent could be explained by health benefit cost growth. Likewise, during this period, U.S. export volume increased by 75 percent, although health benefit cost growth exerted a negative influence of 0.16 percent. It is therefore not clear from this research that employer-paid health benefit costs, by themselves, have materially harmed the competitiveness of U.S. industry in aggregate.

4. There is substantial industrial variation in the relationship between health benefit cost growth and total compensation growth. In particular, there is a significant difference between globally competitive industries and service industries in the

[19]Elasticities and dollar estimates shown throughout this paper represent the best estimate of the magnitude of relationships between the variables. While statistically significant, the confidence intervals are not shown, and thus any estimate should be interpreted with caution.

contribution of rising health benefit costs to higher total compensation. Paradoxically, health benefit cost growth has almost no effect on total compensation paid by firms in globally competitive industries despite their high burden of health benefit payments. Also, the growth of total compensation in medical industry firms exceeds that predicted by their health benefit costs. These variations suggest that, although each industry produces in very different labor and product markets, further examination may likely reveal variation in the terminal effects of health benefit cost growth on prices across industries. Further research should be directed at characterizing these variations.

5. The unpredictable growth of health benefit costs may exacerbate the effect of these costs on total compensation growth. Long term correction of the short run effect suggests that unforecasted or unanticipated increases in health benefit costs may result in reduced substitution between health costs and other compensation which may, in turn, increase total compensation growth. Moreover, the nonsignificant effect of Medicare and Workman's Compensation payments on total compensation suggest that predictable heath benefit cost growth may reduce the observed total compensation growth attributed to rising health care costs. Thus, the form of payment for health care services may influence the degree of downstream economic effects arising from it.

6. This research is ongoing, so results and conclusions should be interpreted cautiously. More research should be conducted to confirm and refine these findings. Future research should address several weaknesses of this research, including:

a) A channel should be included by which firm profits can be affected by rising health benefit costs. It is known that the ratio of health care costs to corporate profits has increased dramatically (Levitt, 1991), but no behavioral model has implicated health care costs in actually reducing corporate profits.

b) The demand for and supply of labor was not considered in this research, but should be included in future efforts. The suggestion in this research that the labor market is noncompetitive raises the possibility that employment may be affected by rising health benefit costs.

c) Better data at the industry level across time should be identified so that more detailed analysis of effects within industries can be performed. Moreover, some of the instruments used to predict health benefit costs in the time series data may not really be exogenous. Using a combination of time series and cross section data might better fit the requirement that only exogenous benefit cost increases be examined.

d) Future research should address the value of health status improvements obtained through investment in health benefits. It may be that the value of worker productivity and well-being gained by health benefit spending more than offsets the costs of that spending.

e) Intra-firm effects of rising health benefit costs should be addressed by future research. These effects could include changes in the production supply chain, reductions of work force training or research and development spending, or decisions to relocate facilities in the U.S. or offshore. Such intra-firm trade-offs could give rise to a mechanism by which industrial core competence (Prahalad, C.K. and G. Hamel, 1990), a factor in sustainable competitive advantage, could be diminished by rising health benefit costs.

f) This research does not address specific options for reform of the U.S. health care system, but future efforts should attempt to project how different mechanisms of financing health delivery will affect the relationship between health costs and the competitiveness of the U.S. economy. Such research will add a new dimension to the analysis of reform options currently being conducted by supplementing actuarial cost projections with estimations of wage, employment, profit, price, and trade flow changes, as well as inter-industrial transfers and subsidies, which would arise from proposed reforms.

The principal focus of this research is whether health benefit costs affect the competitiveness of U.S. industry. This research finds that there is, indeed, an aggregate relationship between rising employer-paid health benefit costs and competitive dimensions of industry such as prices and trade flows, but that it is quantitatively negligible relative to other influences on compensation growth or trade patterns. Moreover, the question of causality remains unanswered. Rising health care costs do not affect prices in globalized industries, but other industries appear to pass rising health benefit costs onto prices. This suggests that the relationship between rising health benefit costs and competitiveness is governed by the underlying characteristics of the market in which the industry operates, rather than the nature of the health benefit itself.

Bibliography

A. Foster Higgins Co., Inc. *Health Care Benefits Survey 1989.* Princeton, NJ.

American Medical Association. *Socioeconomic Monitoring System 1987 Core Survey.*

Baldwin, R. "Hysteresis in Import Prices: The Beachhead Effect." *American Economic Review.* September , 1988.

Chrysler Corporation, *Rising Health Care Costs: Are They Really Making It Harder for U.S. Firms to Compete?* Statement before the joint economic committee. Presented by W. B. Maher. May 23, 1990.

Freudenheim, Milt. The Turnaround of the HMO's. *New York Times.* October 24, 1989.

Garland, S.B. The Retiring Kind Are Getting Militant About Benefits. *Business Week.* May 28, 1990.

Goldstein, M. and M. Kahn. "Income and Price Effects in Foreign Trade." *The Handbook of International Economics.* 11: 1041-1105. 1985.

Granger and Newbold. "Spurious Regression in Econometrics." *Journal of Econometrics.* 2: 11-20.

Granger. "Some Properties of Time Series Data and Their Use in Econometric Model Specification." *Journal of Econometrics.*16: 121-130.

Health Care Financing Administration. *Health Care Financing Review, Annual Supplement.* 1989.

Herzlinger, R. Corporate America's "Mission Impossible": Containing Health-Care Costs. *Technology Review.* November/December, 1985.

Hewitt Associates. As quoted by J. Stacey. *USA Today.* January 25, 1989.

Ikegami, N. *The Japanese Health Care Financing and Delivery System: Its Experiences and Lessons for Other Nations.* Presented at the International Symposium on Health Care Systems. Taiwan. December 18-20, 1989.

Leibowitz, A. Fringe Benefits in Employee Compensation. *The Measurement of Labor Costs.* ed. Jack Triplett. Chicago. University of Chicago Press. 1983.

MHW. *1986 Survey of Physicians, Dentists and Pharmacists.* Tokyo. Kousei Tokei Kyoukai. 1988.

Monheit, A.C. and P.F. Short. Mandating Health Care Coverage for Working Americans. *Health Affairs.* Winter, 1989.

National Center for Health Statistics. *Health, United States, 1989.* Washington, D.C. 1990.

Pauly, M.V. The Incidence of Health Insurance Costs: Is Everyone Out of Step But Economists? *IRRA 41st Annual Proceedings.*

Pauly, M.V. and Goldstein, G.S. Group Health Insurance as a Local Public Good. *The Role of Health Insurance in the Health Services Sector.* ed. R. Rosett. 1976.

Prahalad, C.K. and G. Hamel. The Core Competence of the Corporation. *Harvard Business Review.* May-June, 1990.

President's Commission on Industrial Competitiveness, *Global Competition: The New Reality.* Vol. I (6),1985.

Reinhardt, U.E. Health Care Spending and American Competitiveness. *Health Affairs*. Winter, 1989.

Siu, A.L. et al. Inappropriate Use of Hospitals in a Randomized Trial of Health Insurance Plans. *New England Journal of Medicine*. November 13, 1986.

Smith, J. and R. Ehrenberg. Estimating Wage-Fringe Trade-offs: Some Data Problems. *The Measurement of Labor Costs*. ed. Jack Triplett. Chicago. University of Chicago Press. 1983.

Solomon, J. Retirees, Companies Head for Showdown Over Moves to Reduce Health Coverage. *Wall Street Journal*. May 17, 1990.

Sullivan, C.B. and T. Rice. The Health Insurance Picture in 1990. *Health Affairs*. Summer, 1991.

United Nations. *Global Estimates and Projections of Population by Age and Sex: The 1988 Edition*. 1989.

U.S. Bureau of the Census. *Statistical Abstracts of the United States: 1988*. Washington, DC.

Waldo, D.R. et al. Health Expenditures by Age Group, 1977 and 1987. *Health Care Financing Review*. 10, no. 4. Summer 1989.

Winslow, C.M. et al. The Appropriateness of Carotid Endarterectomy. *New England Journal of Medicine*. March 24, 1988.

Woodbury, S.A. Substitution Between Wage and Non-wage Benefits. *American Economic Review*. 73. March, 1983.

Woolhandler, S. and Himmelstein. Deteriorating administrative efficiency of the U.S. Health Care System. 324(18). 1991.

World Health Organization. *World Health Statistics Annual*. Geneva, Switzerland.

Appendix 1: Variable summary

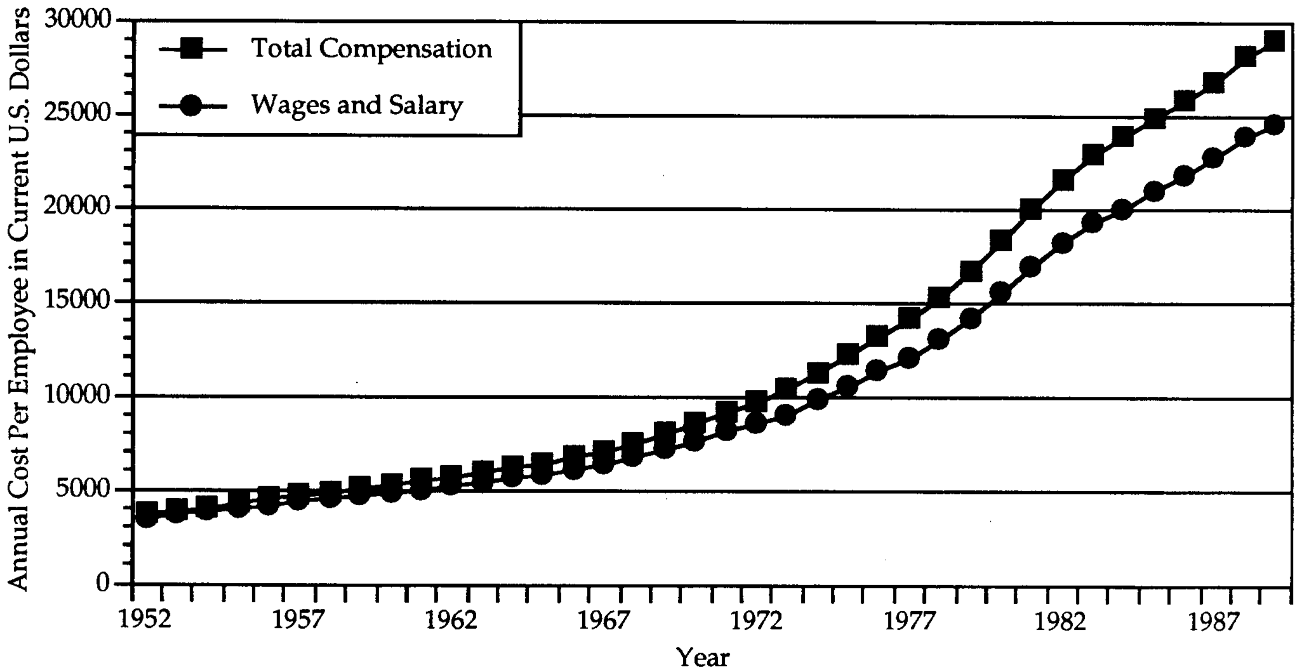
General notes:

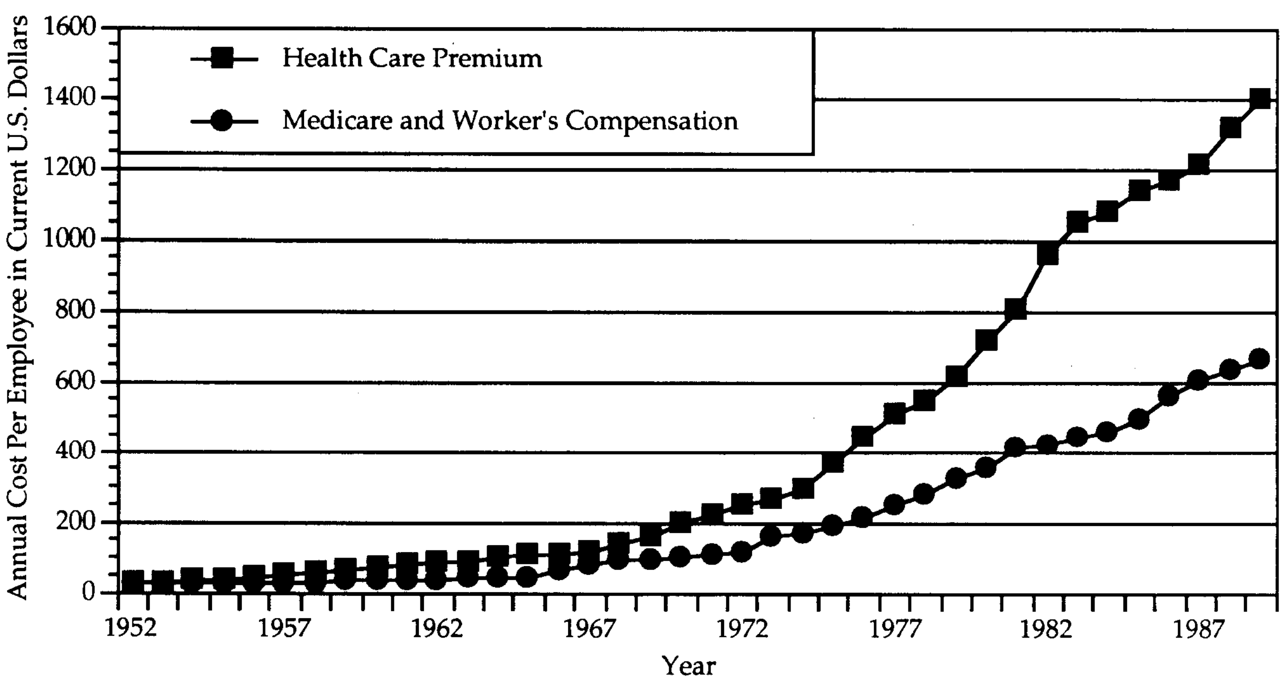
(1) All variables are natural logs, except T, the time dummy.
(2) Years of analysis are 1952-1989, inclusive for time series estimation and 1988-1989 for cross-sectional estimation.
(3) All compensation values are expressed as per full-time equivalent employee (FTE).
(4) "Foreign" refers to top fifteen U.S. bilateral trading partners, except Australia, Brazil, Venezuela, and Saudi Arabia. Total multilateral trade flux in 1985 were used to construct trade weights for aggregate foreign values.
(5) All values are nominal.
(6) "<v>", "<v>L1", and "<v>L2" refer respectively to the contemporaneous difference, and the first and second lagged differences of the variable.
(7) "<v>HAT" refers to the predicted value of the variable.

VARIABLE	DESCRIPTION/SOURCE
CPI	Consumer Price Index
	Source: U.S. Department of Commerce
DRG	Time dummy for Diagnosis Related Group implementation (1982-1989 = 1)
EDUC	Mean highest grade of education achieved
	Source: U.S. Bureau of Labor Statistics
ESP	Time dummy for Economic Stabilization Program (1973-1977 = 1)
FAM	Average size of U.S. families
	Source: U.S. Bureau of the Census
HC	Employer health plan cost per FTE
	Source: time series: U.S. Bureau of Economic Analysis;
	cross-section: A. Foster Higgins Co., Health Insurance Assoc. of America
K	U.S. net stock of fixed private, nonresidential capital
	Source: U.S. Bureau of Economic Analysis
KFD	U.S. direct investment position abroad
	Source: U.S. Bureau of Economic Analysis
KFDF	Foreign direct investment position in the U.S. manufacturing sector
	Source: U.S. Bureau of Economic Analysis
LPROD	Value-added output per FTE
	Source: U.S. Bureau of Labor Statistics
MCWC	Medicare and Workman's Compensation payments per FTE
	Source: Bureau of Labor Statistics
MMNP	Index of the volume of non petroleum imports into the U.S.
	Source: U.S. Bureau of Economic Analysis
N	Number of civilian non-agricultural employees
	Source: U.S. Bureau of Labor Statistics
OLI	Pensions and non-wage, non-health income per FTE
	Source: U.S. Bureau of Labor Statistics

POP55	Percentage of population age 16-61 which are 55-64 Source: U.S. Bureau of the Census
POP16	Size of population age 16-64 Source: U.S. Bureau of the Census
P	Index of U.S. producer prices Source: International Monetary Fund
PX	Index of U.S. non agricultural export prices Source: Constructed using data from the U.S. Bureau of Economic Analysis
PM	Index of U.S. non petroleum import prices Source: Constructed using data from the U.S. Bureau of Economic Analysis
PF	Index of foreign producer prices Source: Constructed using data from the International Monetary Fund
Q	U.S. industrial production Source: International Monetary Fund
QF	Foreign industrial production Source: Constructed using data from the International Monetary Fund
RES	Total federal and private expenditures for medical research Source: National Institutes of Health
SEX	Female labor force participation Source: U.S. Bureau of Labor Statistics
STUD	Five-year weighted average number of medical school students Source: American Academy of Medical Colleges
UNION	Percentage union members in labor force Source: U.S. Bureau of Labor Statistics
WAGE	Average wages and salaries per FTE Source: time series: U.S. Bureau of Labor Statistics; cross-section: U.S. Bureau of Labor Statistics and A. Foster Higgins Co.
XNAG	Index of the volume of non agricultural exports from the U.S. Source: U.S. Bureau of Economic Analysis
Y	U.S. GNP Source: U.S. Bureau of Economic Analysis
YF	Foreign GNP Source: Constructed using data from the International Monetary Fund

Appendix 2: Compensation data

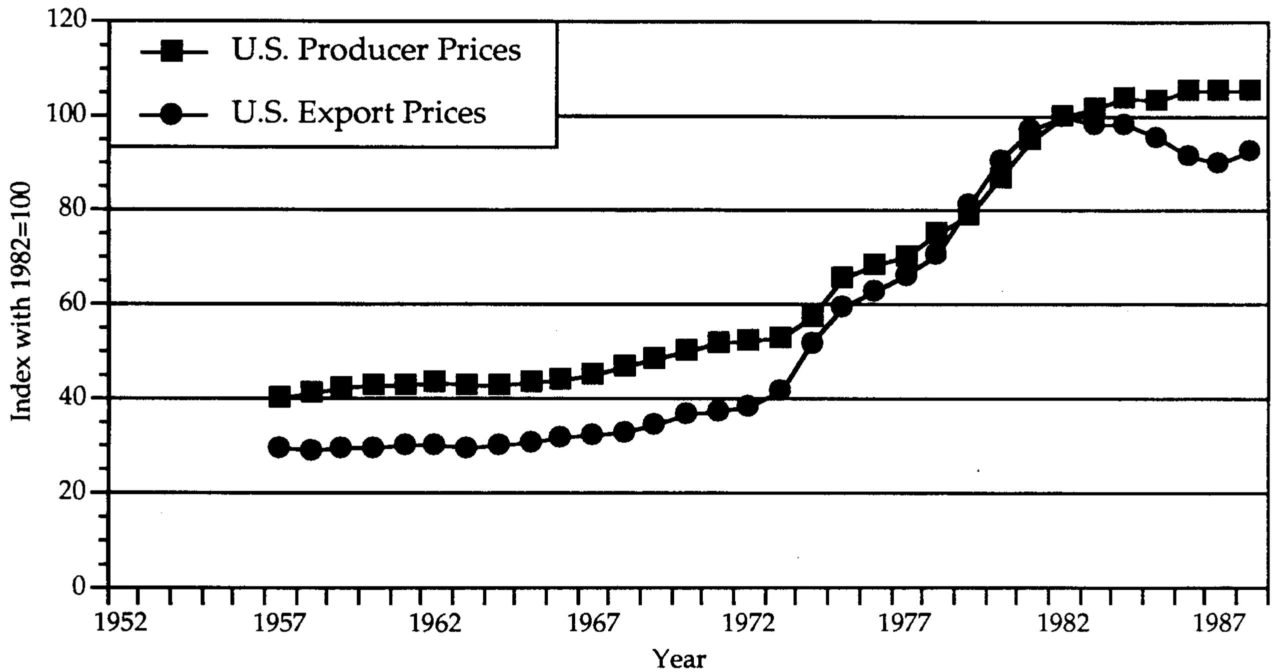


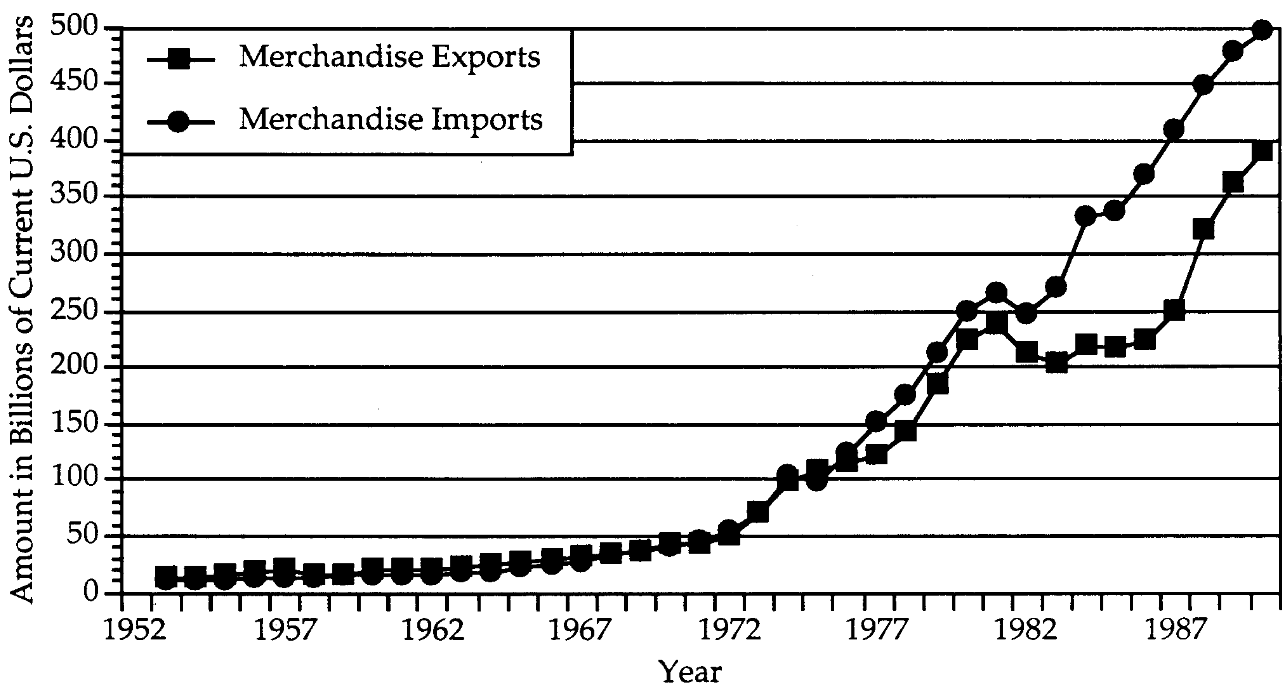


U.S. civilian, non-farm workers

Source: *Survey of Current Business*, U.S. Bureau of Labor Statistics

Appendix 3: Price and trade data





Non-petroleum, non-agricultural commodities
Source: International Monetary Fund and Federal Reserve Bank