MARCH/APRIL 1989

ECONOMIC PERSPECTIVES

A review from the
Federal Reserve Bank
of Chicago

Unemployment insurance and regional economic development

Competitive pricing behavior in the U.S. steel industry

FEDERAL RESERVE BANK
OF CHICAGO

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Unemployment insurance and regional economic development

High payroll taxes can be a disadvantage in attracting and holding business, but states have only modest control over the economic conditions that may force higher unemployment insurance costs

William A. Testa and Natalie A. Davila

Two questions arise concerning unemployment insurance (UI) in the context of economic development. Do state differences in UI system costs affect regional growth and development? If not, economic development policies undertaken by states to modify their UI tax rates will be misdirected. Previous statistical studies offer little guidance in assessing the importance of UI to regional growth. We have conducted an empirical study covering 75 metro areas over the 1976–1985 period which examines the relation between UI costs and regional growth for major industrial categories. Our results suggest that high UI tax rates do tend to retard state employment growth in the manufacturing sector.

The second question concerns the latitude that states have to adjust UI tax rates by means of legislative changes in the liberality of their UI systems. To the extent that larger forces beyond the influence of state policy, particularly lagging regional growth itself, are responsible for high UI costs to employers, state action to lower benefits may result in higher social costs without countervailing economic benefits.

We find that the state's economic condition, particularly the unemployment rate itself, is an important influence on the geographical variation in UI tax rates.

The UI system and its features

In 1935 the Social Security Act was signed by President Franklin Roosevelt. The Act provided for a federal-state unemployment insurance system along with national old-age pensions, old-age assistance, and federal grants for dependent children, the handicapped, and the disabled.[1] The UI system was designed to provide weekly cash benefits to unemployed workers who lose their jobs through cyclical or structural changes in the economy, the so-called ''involuntarily'' unemployed workers. UI benefit payments are usually reserved for those workers who have at least moderate work experience in the year prior to losing their jobs. Accordingly, new job market entrants and re-entrants are usually ineligible to receive benefits.

The unemployment insurance system has several intended functions:

- To provide a type of insurance to workers subject to cyclical swings in income (i.e., a budgeting aid to workers).
- To provide jobless workers with the income to search for new jobs.
- To stabilize the overall level of economic activity as a countercyclical program.

The cost at which the program succeeds in achieving these goals remains open to question. Some analysts believe that the system

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significantly increases the frequency and duration of unemployment by lowering the cost to workers of becoming or remaining jobless.[2] Because UI payments are available, workers may be less concerned with losing their jobs and, once unemployed, less motivated to regain employment. Several proposals have been offered to improve the functioning of the UI system in re-employing workers.[3]

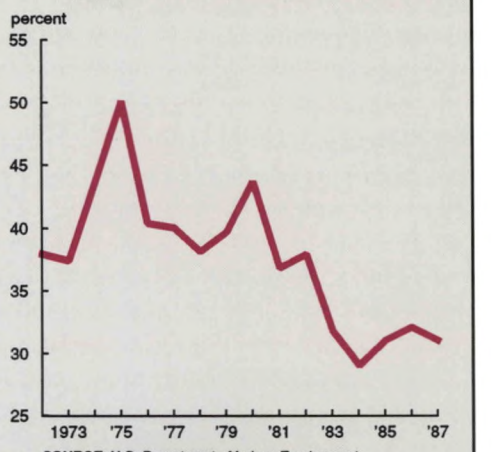
The UI system's design has also been implicated in impairing the efficient functioning of regional growth and development.[4] The UI system remains decentralized; each state (for the most part) determines the terms and size of benefits paid to workers within its own borders. Consequently, regional costs of doing business for firms may vary, because the firm must bear the costs of UI insurance.[5] Accordingly, variation in UI costs may affect regional income and employment.

The UI system in the United States currently covers approximately 86 percent of the total employed civilian population (and 97 percent of wage and salary workers). The proportion of covered workers has been relatively constant over the past decade. Prior to 1978, the covered share of all workers (including the self-employed) stood at 77 percent because state and local government employees were excluded from coverage.

The vast majority of those who receive benefits become eligible through involuntary job loss. The term of regular benefits usually expires within 26 weeks, providing only transitory income to many of the unemployed. In 1987, approximately 31 percent of all unemployed persons were receiving UI benefits. This figure has fallen by about one-fourth since 1980 and the reasons behind the drop are not completely understood (Figure 1).[6] From a labor market perspective, the length and depth of the 1981–82 recession, and the fact that it occurred so soon after the 1980 recession, undoubtedly left many laborers out of work for extended periods of time. As a result, the proportion of the unemployed who exhausted their benefits increased as economic recession and regional upheaval dragged on. Several contributing factors have also been suggested. One is that a series of relatively small legislative and administrative changes at both state and federal levels have combined, by tightening eligibility, to reduce the number of UI recipients.[7] And it may be that, owing to increased regional and world competition, employers became more aggressive in contesting benefit claims by asserting that quits or misconduct (rather than layoffs) were involved in job terminations.

FIGURE 1

The insured share of total unemployment



SOURCE: U.S. Department of Labor, Employment and Training Administration.

Eligibility

Under state statutes, unemployed individuals covered by UI must file a claim in order to receive benefits. Eligibility rules can be categorized into two types, nonmonetary and monetary conditions.

Nonmonetary rules generally apply to conditions of separation from work and also a worker's continuing willingness and availability for work (Table 1).[8] An individual receiving benefits must typically be able to work, be seeking work, be otherwise free from disqualification, and not have quit his previous job without a good cause. Particular rules and the degree to which they are enforced vary among states.

Monetary eligibility rules attempt to measure a worker's previous ties to the labor force. Eligible status is partly determined by a worker's recent experience in covered employment, typically during the past one-year "base" period. A claimant must have earned a specified amount of wages, have worked a certain number of weeks in covered employment in the base period, or meet some combination of wage and employment criteria (Table

TABLE 1

Nonmonetary denial rates by state–1987

State	For separation issues[1]	For nonseparation issues[2]
Illinois	95.9	1.2
Indiana	119.7	17.8
Iowa	84.5	11.0
Michigan	93.4	9.5
Ohio	65.0	11.2
Wisconsin	60.2	15.0
U.S. average[3]	104.1	19.4

[1]Separation issue denial rates are reported per 1,000 new spells of insured unemployment.

[2]Nonseparation issue denial rates are reported per 1,000 claimant contacts.

[3]Unweighted average of 50 states plus the District of Columbia.

SOURCE: Unemployment Insurance Service Employment and Training Administration, (unpublished data).

2). In January of 1988, the amount of wages needed to obtain minimum payment offered within a state varied from $150 in Hawaii to $3,640 in Oklahoma.

Benefit amounts and duration vary widely among states. Benefits are commonly available for up to a maximum of 26 weeks but the duration is shorter in some states for workers with lesser work experience in the base period. Average weekly benefits that were actually received in 1987 ranged from $98 in Tennessee to $177 in Minnesota (Table 3). Illinois averaged $141 which, along with all other Seventh District states except Indiana, lies above the U.S. average of $136. Michigan had the highest average benefit level in the District in 1987, 13 percent above the national average, while Indiana maintained a level of weekly benefit 26 percent below the national average.

Interstate differences in average benefits can be partly accounted for by wage differences across regions. Average wage levels and average UI benefit levels of U.S. states display a strong tendency to vary in the same direction.[9] To the extent that high wages compensate for higher living costs in a state, the state may desire to replace a proportionate share of a worker's wages during spells of unemployment.

Regional preferences and opinions concerning the efficacy of UI benefits may also affect state differences in average benefits. Even after holding the effects of average weekly wage constant through the use of multiple regression analysis, we find much variation in average weekly benefits across regions.[10] In general, states in the East South Central and South Atlantic regions tend to pay out lower average benefits; the West, South Central, and Mountain regions display higher weekly payments to unemployed workers.

Joint federal-state responsibility

The UI system is funded by both a state and a federal tax on payrolls of workers who are covered by the system. The bulk of system benefits are provided by state-funded benefit payouts which are administered through state programs. Accordingly, the state tax rates greatly exceed the federal tax. In 1987, state tax revenue under the UI system exceeded federal revenues fourfold.

Nonetheless, the functions of the federal government in the UI system are significant. The federal tax rate system is structured to penalize severely any state that chooses to shirk its UI mandate or ignore federal guidelines. In addition, revenues from the federal tax component fund the system's administration, provide short-term loans to states, and help provide extended benefits to workers during periods of extended recessions.

Federal role

All UI system funds—both state and federal—are deposited into and withdrawn from trust accounts which are held by the federal government. Thus, both federal and state tax receipts and benefits appear as revenue and outlays in the unified federal budget and all UI activities affect the federal deficit accordingly.

A basic federal tax rate is now levied at a uniform rate of 0.8 percent across all covered employers in the U.S. It is levied on a uniform taxable wage base which consists of the first $7000 of each employee's wages. Revenue accruing from the federal tax is directed into one of three accounts (Figure 2). These

TABLE 2

Unemployment insurance: minimum and maximum wage requirements and benefits by state, January 1, 1988

District states	Wages required for minimum benefits*		Minimum benefits[1]		Wages required for maximum benefits*		Maximum benefits[1]	
	Base period	High quarter[2]	Weekly benefit amount	Number of weeks	Base period	High quarter[2]	Weekly benefit amount	Number of weeks
Illinois	1600.00	_	51.00	26	9321.00	4660.50	176-230	26
Indiana	2500.00	750.00[3]	40.00	9+	3348.82	2232.55	96-161	26
Iowa	870.00	580.00	25-30.00	11+	5761.50	3841.00	167-205	26
Michigan	3195.00	_	58.00	15	8678.20	_	229	26
Wisconsin	1702.00	_	38.00	1-14+	6766.17	_	200	26

*Figures reported in dollars.

[1]Higher of two amounts shown indicates allowance for family dependents.

[2]Some states require a minimum amount of earnings in any single quarter of the base period as a qualification for benefits.

[3]$1500 over two quarters.

SOURCE: U.S. Dept. of Labor, Employment and Training Administration, *Comparison of State Unemployment Insurance Laws*, January 3, 1988.

accounts are: the Federal Employment Security Administration Account (FESAA), used to cover administration expenses; the Federal Extended Unemployment Compensation Account (FEUCA), used to finance the federal share of extended benefits (EBs); and the Federal Unemployment Account (FUA), which provides loans to states for the payment of benefits. Advances to states from the FUA made prior to April 1, 1982, are interest-free; loans made after this date can bear interest.

During periods of state economic hardship, extended benefits (EBs) are available after state UI expires, up to a combined total (including regular state benefits) of 39 weeks. The payment of EBs is financed equally through federal and state tax revenues.

In addition to extended benefits a third tier of benefits, Federal Supplemental Compensation (FSC), authorized only at the discretion of Congress, can be paid to claimants either after EBs expire or when a state has not triggered into EBs. In contrast to the other two benefit programs, its revenues have, on occasion, come from general federal revenues. The most recent FSC payments period was enacted in response to the 1981–82 recession.

An important federal role is that of maintaining guidelines for state UI programs. The federal tax rate scheme enables the federal government to control the *basic* tax and benefit structure of state UI programs. Compliance

TABLE 3

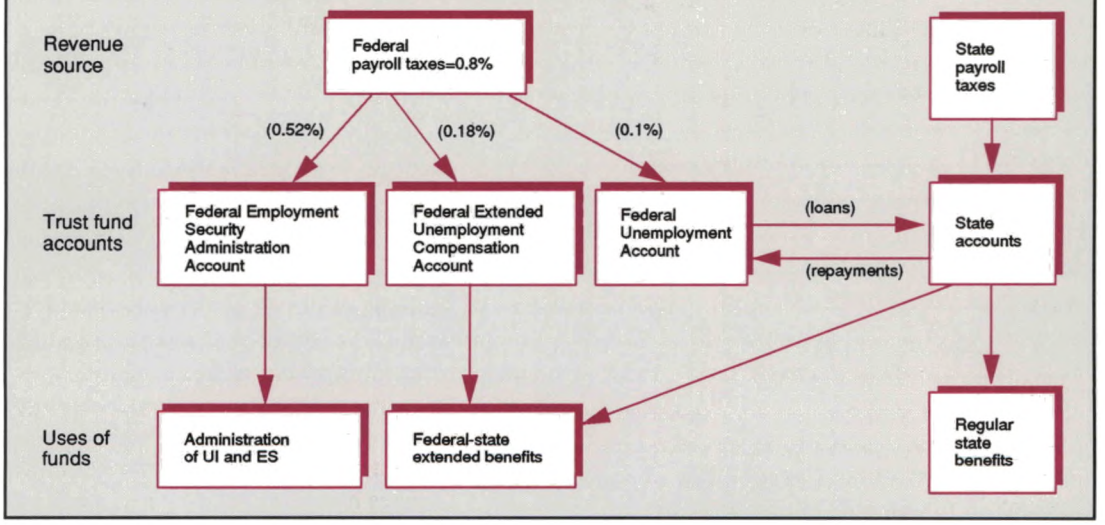
Ratio of average weekly benefit amount to average weekly wage, 1987

State	Average weekly benefit (dollars)	Average weekly wage (dollars)	Benefit-to-wage ratio
Minnesota (highest avg. of 50 states)	177	375	.45
Illinois	147	429	.35
Indiana	104	381	.28
Iowa	143	330	.43
Michigan	158	452	.36
Wisconsin	144	360	.40
Tennessee (lowest avg. of 50 states)	98	349	.28
National average	140	397	.35

SOURCE: U.S. Department of Labor, Employment and Training Administration, *ET Handbook No. 394.*

FIGURE 2

The flow of unemployment insurance funds



by state programs with federal rules is virtually assured because the federal government drastically reduces the federal UI tax for employers in states with federally-approved UI programs. The nominal or gross federal tax rate now stands at 6.2 percent. However, firms are allowed a 5.4 percent credit allowance against the full federal tax provided they are in states with approved UI laws. All states currently maintain approved programs.

Original federal requirements, which covered only areas where uniformity was considered essential, largely remain in effect today: that all state-collected unemployment insurance taxes be immediately deposited in the U.S. Treasury; that money be withdrawn only for the purpose of paying UI benefits; and that states permit reduced rates to employers on the basis of the firm's past experience with unemployment. Subsequent federal legislation also covers some claimant eligibility conditions, administrative practices, and the industry sectors that states must cover under UI.

State role

Unlike social welfare programs such as Aid to Families with Dependent Children (AFDC) which are assessed on a needs basis, UI is an insurance program and therefore is provided without regard to the economic condition of the recipient.[11] States are responsible for: developing UI benefit structure; establishing eligibility requirements (within federal guidelines); fixing length and size of benefit; and specifying state payroll tax structure.

At present each state remains responsible for funding its own *regular* UI benefit costs, regardless of how severe unemployment becomes or how it has been caused. No federal standards exist that cover the amount and duration of benefits payable—this is decided at state level. Each state uses at least the first $7,000 in wages (as federally required) as a base for its state UI tax (Table 4). These taxes are collected quarterly and deposited in the Unemployment Insurance Trust Fund in the U.S. Treasury.

State tax receipts not immediately paid out in benefits are used to build up a state's UI reserves. Thus do states build up their funds during good times and run them down during hard times. However, many state systems also contain elements of ''pay-as-you-go'' UI financing with the schedule of employer tax rates shifting up or down according to the soundness of the state's reserve funds.

Regardless of the state philosophy on financing, however, a long period of higher-than-expected unemployment can break a state fund and force borrowing from the federal government. Due to rapidly changing regional fortunes, some 37 states have, at one time or another, depleted their reserves and have borrowed federal funds over the last decade. In

TABLE 4

Taxable wage base

State	State tax base (dollars)	Federal tax base (dollars)
Illinois	9,000	7,000
Indiana	7,000	7,000
Iowa	11,000	7,000
Michigan	9,500	7,000
Wisconsin	10,500	7,000
U.S. average (50 states and D.C.)	9,300[1]	7,000

[1]Figure (an unweighted average) rounded to nearest 100. Median state tax base equals $8,000.

SOURCE: U.S. Department of Labor, Employment and Training Administration, *Comparisons of State Unemployment Insurance Laws*, January 1988.

the 1970s and early 1980s the older manufacturing belt states suffered severe and prolonged unemployment. More recently, oil patch states and other energy states, such as West Virginia, Louisiana, Texas, and North Dakota, have experienced similar problems.

Prior to April 1982, a period when interest payments were not imposed on advances from the federal government, only three of the five Seventh District states, Michigan, Illinois, and Wisconsin, borrowed money from the FUA. These three states alone, however, accounted for almost 40 percent of total loans made before 1982. Michigan and Pennsylvania still owe money borrowed during this time.

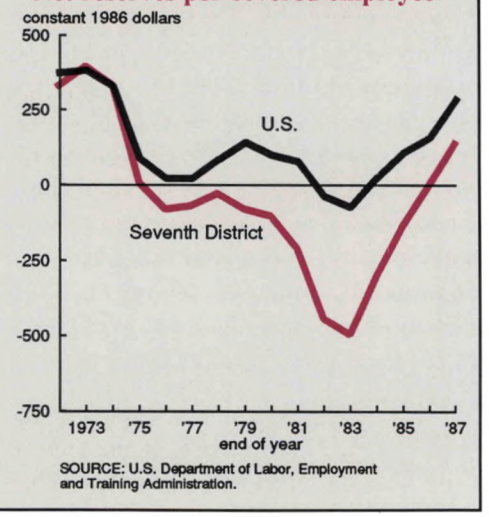
Since April 1982 all five District states have, at one time or another, borrowed from the federal fund. Total advances made to the Seventh District states stand at some 32 percent of all loans made during the latter period, with Illinois and Michigan each borrowing over $2 billion.

One indicator of the solvency of state UI trust funds is the end-of-year reserves which are available for payout of benefits to claimants. In Figure 3, this measure is standardized on a per-employee basis and deflated by the GNP implicit price deflator. The five Seventh District states have had differing reserve experiences in recent years (Figure 4). Both Michigan and Illinois had a negative balance through 1986 (with the exception of Michigan in 1979.) Iowa's and Wisconsin's net reserves fell into the red during the early 1980s before recovering.[12] In contrast to other District states, Indiana's fund remained solvent throughout the dramatic economic events of the last 15 years. The state was forced to borrow in only one year, 1983, but repaid the principal within the same calendar year.

In comparing the Seventh District with the U.S. as a whole, reserve fund trends differ

FIGURE 3

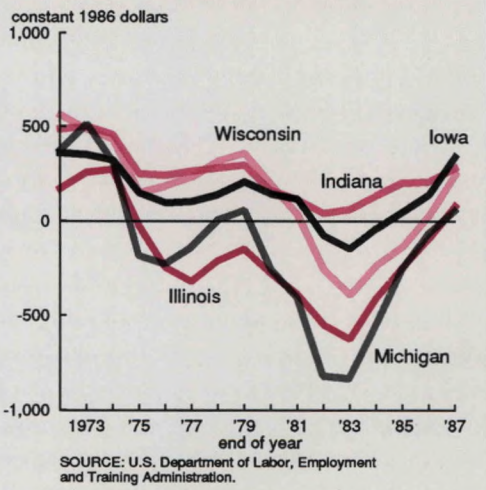
Net reserves per covered employee



SOURCE: U.S. Department of Labor, Employment and Training Administration.

FIGURE 4

Net reserves by state: Seventh District



SOURCE: U.S. Department of Labor, Employment and Training Administration.

markedly. While total District net reserves were negative from 1976 to 1986 with the exception of 1979, U.S. net reserves have only been negative in two years, 1982 and 1983.

State experience rating

Federal guidelines induce states to impose differential tax rates on employers based on "experience rating." Under experience-rating schemes, states are required, albeit with broad latitude, to adjust each employer's tax rate on the basis of the employer's actual experience with unemployment. This allows the cost of unemployment compensation to be more "fairly" allocated among employers, by making firms more accountable for the joblessness they create. The design is also intended to discourage firms which may be contemplating excessive layoffs, thereby serving the national macroeconomic goal of stabilization.

The degree to which employers are experience-rated varies widely from state to state. Within any given state, the range between minimum and maximum employee costs crudely reflects the degree to which a state has adopted the experience-rating concept (Table 5). Very low minimum rates can reflect that a system rewards stable-employment firms with low UI rates. Very high maximum rates can indicate a state system designed to penalize firms with significant layoff histories. Using the range as a proxy for the sensitivity to firm experience rating in a state, it appears that Iowa and Michigan, for example, have experience-sensitive systems.

The lack of experience rating within a state indicates that firms with stable employment behavior are subsidizing volatile firms through the UI system.

An employee's benefit payments are *not* disbursed from his employer's individual account. Rather, benefit payments are drawn from the pooled funds deposited by all employers into the state's general trust fund account. Thus even within a state which has implemented a strong experience-rating system, there are employers whose taxes never fully reflect their benefit charges. Factors which contribute to the incompleteness of experience rating include: high minimum tax rates; low maximum tax rates and low taxable wage base; and the inability to collect taxes from bankrupt firms. Insofar as a state's experience-rating scheme seldom mirrors every firm's employment experiences, a varying degree of industry cross-subsidization occurs from state to state.

State differences in UI tax rates

Overall UI tax rates, expressed as taxes paid per dollar of payroll for all industries, varied considerably across Seventh District states in 1987 (Table 6). These raw measures of overall UI tax rate display a wide geographic variation for several reasons. To some extent, tax-rate differences reflect differing industry compositions. For example, a state with a strong labor market concentration in cyclically-sensitive durable goods manufacturing industries will, other things being equal,

TABLE 5

Statutory state UI costs per employee,[1] 1988

District states	Tax rates (percent)			Yearly employee costs (dollars)		
	Minimum	Maximum	Range	Minimum	Maximum	Range
Illinois	0.8	7.3	6.5	68	621	553
Indiana	0.3	5.4	5.1	21	378	357
Iowa	0.0	9.0	9.0	0	1107	1107
Michigan	1.0	10.0	9.0	95	950	855
Wisconsin	0.4	6.7	6.3	42	704	662

[1]Costs for employers paying wages at or above the taxable wage base as of January 3, 1988.

SOURCE: U.S. Department of Labor, Employment and Training Administration, *Comparison of State Unemployment Insurance Laws,* January 3, 1988.

TABLE 6

State UI tax rates[1] by industry sector, 1986

	Construction	Manufacturing	Transport, communication, and public utilities	Wholesale	Retail	Finance, insurance, and real estate	Services	Total
Illinois	2.3	1.7	0.9	1.4	2.0	0.9	1.5	1.6
Indiana	1.3	0.6	0.3	0.3	0.5	0.2	0.5	0.5
Iowa	4.5	2.1	1.2	1.5	1.8	1.1	1.5	1.9
Michigan	3.8	2.3	1.4	1.7	2.3	1.2	1.8	2.1
Wisconsin	4.5	2.5	1.6	1.8	2.5	1.3	1.9	2.3
U.S. average[2]	2.0	1.2	0.8	0.9	1.3	0.7	1.1	1.2

[1] Tax rates express UI contributions as a percentage of total wages

[2] 50 states and U.S.

SOURCE: U.S. Department of Labor, Employment and Training Administration, *Reports and Analysis Letter No. 4-88,* July 28, 1988.

tend to carry a tax rate reflecting the higher likelihood of manufacturing workers being laid off over the course of a business cycle.

In addition, UI tax rates may reflect the relative performance of a state's overall economy; i.e., higher unemployment will require the payment of greater taxes on those workers who remain employed. Also, a tendency toward higher benefit levels paid out to laid-off workers and the state's liberality in qualifying requirements for unemployed workers also play a role.

Employer costs for hypothetical firms

Business interests and economic development officials are often concerned about geographical differences in the cost of doing business when evaluating alternative plant locations and making business expansion decisions. Cost differences arising from varying state UI programs are often mentioned in this context. However, accurate information concerning interstate UI cost comparisons for individual firms is not often available. The published average state tax rates do not accurately reflect any single firm's expected UI costs. A firm's UI liabilities will depend on the degree of experience-rating within a particular state and how the experience-rating scheme interacts with the overall employment conditions (i.e., UI system liabilities) within a state. For example, in a state with a very sensitive experience-rating scheme, a firm with a very strong record of maintaining its employment levels could expect to be rewarded with a low UI tax bill relative to many of its competitors even though average overall UI tax rates may be high.

Some ambitious attempts have been made at gauging hypothetical UI tax cost differences for similarly situated firms across states. Timothy L. Hunt estimates UI costs borne by hypothetical firms located in 28 industrial states by means of a simulation model which accounts for the states' statutory UI structures (Hunt, 1986, 1987). Specific values of wage rates and layoff rates of the hypothetical firm(s) are chosen and held constant from state to state. The values of wage and layoff rates are chosen from actual nationwide average figures. Along with each state's individual statutory UI structure, these values are used to generate hypothetical UI costs (there are 9 reported simulations—3 wage levels and 3 layoff records). The 1987 state and federal UI statutes in each state remain constant in each simulation so that cost differences arising from statutory differences are thereby captured by Hunt's methodology.[13]

Estimates from the Hunt study are reprinted in Table 7. The methodology is extensive and the reader is advised to examine the

TABLE 7

Simulated UI tax rates for individual firms, 1987

(28-state index, average=100)

State	Firm-insured unemployment rate[1] Low (rank)[2]	Average (rank)[2]	High (rank)[2]
Illinois	122 (7)	134 (6)	117 (8)
Indiana	54 (27)	56 (27)	70 (27)
Iowa	72 (20)	79 (20)	104 (12)
Michigan	120 (8)	121 (8)	144 (3)
Wisconsin	136 (5)	135 (4)	171 (1)

[1]Firm unemployment rates: Low = 1.7%; Average = 3.4%; High = 6.8%.

[2] The numbers in parenthesis are each state's rank (out of 28) from highest cost to lowest.

SOURCE: Timothy L. Hunt, *Employer Costs and Worker Benefits of Unemployment Insurance in Michigan: An Interstate Comparison for 1987,* The W. E. Upjohn Institute for Employment Research, December 1987, (Table A.6, p. 44).

study itself to gain a full understanding and appreciation of the results. A wide range of employer costs are estimated among Seventh District states. Generally, Illinois, Michigan, and Wisconsin lie significantly above the 28-state average for the 1987 statutes. Iowa and Indiana fall below average—especially the state of Indiana which ranks 27th across the range of hypothetical firm unemployment insurance costs. Hypothetical firm costs in the states of Iowa, Michigan, and Wisconsin tend to rise rapidly (relative to the other states) as a firm's hypothetical unemployment rises. A higher experience rating apparently pushes UI system costs onto volatile firms in those states.

UI tax rates and economic growth

Because UI payroll taxes vary significantly across states, a common concern is that states with high payroll taxes will be placed at a competitive disadvantage in attracting and holding jobs and industry. Higher payroll taxes are feared to contribute to a poor "business climate." For example, concern over unemployment insurance costs are expressed by manufacturers in the Grant-Thornton Annual Study of Manufacturing Climates. Input into this widely known business climate ranking is provided by 36 associations representing manufacturers around the country. In the 1988 edition of the study, UI system features account for 9.7 percent of the overall index.

More often than not, high UI payroll taxes are perceived to arise from overly liberal benefit levels, generous eligibility rules, lax enforcement of eligibility, and costly administration. In response, economic development efforts of the business community have often focused on restricting benefit costs in order to foster the region's economic growth.

There have been many studies of regional growth in the United States and the determinants of such growth. However, very few of them have explored UI taxes as a growth factor. Those that do mention UI taxes have almost universally found no significant relation between measures of UI tax rates and regional growth (Wasylenko 1983; Bartik 1985; Schmenner, Huber, and Cook 1987).

To some extent the lack of significant findings should not be surprising. Although there is significant variation across states in UI tax rates, UI taxes do not loom as a large percentage of total costs for most firms. Accordingly, given the difficult task of identifying regional growth determinants amid a continual sea of regional upheaval, a smaller cost item such as UI taxes (representing 1.05 percent of wages in 1987) could easily be overlooked or not considered for study.

UI and regional growth: New evidence

In our study, using multiple regression techniques over a cross-sectional sample of regions, variation in economic growth is explained by beginning-period values of cost-related factors and also by demand factors. For any metro area, explanatory factors are assumed to be mostly invariant over the ensuing growth period with regional adjustment in economic variables moving very gradually.

Specifically, percentage change in employment is chosen as a dependent variable covering a sample of the 75 largest metropolitan areas over the 1976–85 period. Growth in total employment, manufacturing employment, nonmanufacturing employment, and manufacturing output are all estimated separately. The econometric specification chosen is in linear form; percentage change in employment is a linear function of beginning period levels of input costs and other growth factors. Each metro area (and its growth from 1976–1985) accounts for one observation so that the data-

base can be thought of as cross-sectional rather than time-series.

Aside from UI cost, individual factor influences on growth will not be discussed at length here, but they are discussed elsewhere (Testa 1988). Retained explanatory variables include measures of labor costs, regional market growth, access to technology, defense spending, educational spending, tax growth, and export orientation (Table 8).

A variable for unemployment insurance cost is measured by state total tax payments as a percentage of total UI wages paid to workers who are covered by the UI system. This measure is specific to the industry sector—manufacturing, services, and a total UI tax rate covering all industries. A single year's tax rate does not always reflect the total state liability because benefit payment obligation can be deferred through borrowing. For this reason, the average of state UI tax rates for the years 1975 to 1977 was constructed.

Geographical differences in unemployment insurance tax rates are found to have significantly deterred growth in the manufacturing sector over the study period. However, the hypothesis that UI tax rate differences had *no* effect in the nonmanufacturing sector cannot be rejected. This result has intuitive appeal in the following sense: Insofar as UI tax rates bear heavily on manufacturing industries, one would most expect to find that UI rate differences are a growth deterrent for manufacturing industries.

State UI cost differences: Does benefit generosity matter?

Even if UI tax rates do affect a state's business climate, do state governments have any policy latitude to vary their own UI tax rates in order to spur development? This question recognizes that a state or region's economic condition may well be the primary determinant of a state's UI benefit obligations. Rather than liberal benefit provisions, slow regional growth may lie behind the bulk of interstate UI tax differences. For example, even a region with conservative benefit provisions for unemployed workers can find itself in the position of taxing its employers at a high rate due to an inordinately large number of claims recipients. If so, moderate downward adjustment of benefits may do little for economic growth even as social costs rapidly rise.

Previous study

In measuring the influence of state benefit generosity on UI tax rates, one approach is to incorporate the multitude of existing benefit and eligibility features (those which are reported for each state's UI system) as explanatory variables into a multiple regression equation.[14] In this fashion at least one study has already attempted to determine indirectly the extent to which variation in interstate UI taxes can be accounted for by benefit liberality (Saul J. Blaustein and Paul J. Kozlowski 1978).

For the 1973–1975 period, Blaustein and Kozlowski attempted to attribute state UI cost differences to 1) varying regional economic conditions and/or 2) benefit "generosity." The 1978 study used multiple regression to explain variation in UI benefit-to-payroll ratios by both economic condition factors (proxied by the insured unemployment rate) and by benefit liberality parameters. The latter included the state average weekly benefits paid to UI recipients as a percent of state weekly wage, the state's potential duration of benefits, the number of weeks of work needed to qualify for benefits, and whether the state disqualified a claimant completely for voluntarily quitting his previous job. The study concluded that economic conditions were solely responsible for differences in UI tax rates over the period from 1973 to 1975.

The authors chose to proxy statewide economic conditions by the insured unemployment rate. This rate measures those unemployed workers who are eligible to receive benefits as a proportion of employed workers covered by the UI system in a prior period. But surely this rate will vary across states, not only because of differing state economic conditions, but also because of varying eligibility and enforcement requirements in each state. This variable itself, then, partly reflects a state's UI benefit liberality so that it is not independent of the "benefit" measures in the study. Accordingly, the authors' claims to be able to disentangle the effects of regional economic condition from UI system liberality are highly suspect.

New evidence

The following empirical work tests the robustness of the Blaustein-Kozlowski findings and it offers several refinements in methodology. In place of using several state benefit

TABLE 8

OLS regression equations

EMPLOYMENT AND OUTPUT GROWTH IN MANUFACTURING

	Percent change in manufacturing employment (1976 to 1985)	Percent change in manufacturing output (1976 to 1982)
Intercept	1.04** (3.34)	0.95** (2.27)
Labor costs (WM76MFG)	–0.15** (–2.76)	–0.18** (–2.45)
Market maturity (MARKET)	–0.00013** (–3.72)	–0.00015** (–3.22)
Access to technology (TECH)	0.04 (1.13)	0.07 (1.36)
Defense spending per capita (DOD)	0.0001 (1.21)	–0.00002 (–0.14)
Educational expenditure per pupil (EDEXP)	0.0002* (1.78)	0.0001 (0.60)
Tax growth per capita (CHTX)	–0.003** (–2.06)	–0.0001 (–0.07)
Export orientation (EXPORT)	0.03** (2.27)	0.03* (1.71)
Unemployment insurance (UIMAN)	–0.22* (–1.84)	.03 (0.18)
$\bar{R}^2$	0.44	0.29

TOTAL AND NONMANUFACTURING EMPLOYMENT GROWTH

	Percent change in total employment (1976 to 1985)	Percent change in manufacturing employment (1976 to 1985)
Intercept	1.02** (5.69)	1.05** (6.30)
Labor costs (UPLTW)	–0.006** (–3.23)	–0.007** (–3.57)
Market maturity (MARKET)	–0.000097** (–3.84)	–0.000056** (–2.39)
Access to technology (TECH)	0.04 (1.59)	0.03 (1.39)
Defense spending per capita (DOD)	0.0002** (2.21)	0.0002** (2.34)
Educational expenditure per pupil (EDEXP)	0.0002* (1.98)	0.0001* (1.79)
Tax growth per capita (CHTX)	–0.002** (–2.47)	–0.002** (–2.21)
Unemployment insurance (UITOT/UISER)	–0.08 (–0.94)	–0.03 (–0.45)
$\bar{R}^2$	0.48	0.41

*t-statistic significant at the 10 percent level. **t-statistic significant at the 5 percent level.

Glossary of variables in regression equations

CHTX	Percent change in per capita state and local taxes from fiscal 1976-77 to fiscal1984-85.
EDEXP	Education expenditure per pupil in average daily attendance 1976-77.
DOD	Per capita procurement and payroll by the Department of Defense in 1977.
MARKET	Ratio of value added in manufacturing to population in the metro area.
TECH	Total number of scientists and engineers engaged in research and development per 1,000 of the population, 1974.
UPLTW	Index of average hourly earnings of unskilled plant workers, 1975-76.
WM76MFG	Average hourly wages, all manufacturing industries, 1976.
XMFGEMP	Percent of total manufacturing employment related to exports, 1976.
PCMFG	Percent change in manufacturing employment, 1976-1985.
PCTOT	Percent change in total employment, 1976-1985.
PCNM	Percent change in nonmanufacturing employment, 1976-1985.
PCVA	Percent change in value-added in manufacturing, 1976-1982.
UIMAN	Average statewide unemployment insurance rate (as a percent of total wages) for 1975, 1976, and 1977 in the manufacturing sector.
UISER	Average statewide unemployment insurance rate (as a percent of total wages) for 1975, 1976, and 1977 in the service sectors.
UITOT	Average statewide unemployment insurance rate (as a percent of total wages) for 1975, 1976, and 1977 for all covered sectors.

features to characterize UI system liberality, estimates constructed by John M. Barron and Wesley Mellow (1981) are used. Those estimates fully reflect expected benefit payouts for similarly situated individuals across states. In addition, we substitute total unemployment rate (from the Current Population Survey) for the Blaustein-Kozlowski insured unemployment rate. Some may take issue with our measure in that the CPS unemployment rate covers workers both inside and outside the UI system. But we believe it superior because it is largely independent of UI system eligibility claims (unlike the insured unemployment rate) in characterizing economic conditions.

Because the Barron-Mellow estimates (reporting expected UI benefit differences by state) are available for the 1976 period, the sample period is drawn for the period circa 1976 (Table 9). The dependent or explanatory variable was constructed as the simple average of the overall UI tax rates (i.e., all industries) for the years 1975, 1976, and 1977.

TABLE 9

OLS regression equations: average unemployment insurance tax rate
(Circa 1976)

	MODEL 1	MODEL 2	MODEL 2
Intercept	0.26 (1.18)	0.87** (7.31)	0.22 (0.65)
UR76 (unemployment rate, C.P.S.)	0.12** (4.06)		0.11** (3.76)
UIBARRON (expected UI benefits)		0.25** (2.39)	.019* (1.99)
$\bar{R}^2$	0.24	0.09	0.28

*t-statistic significant at the 10 percent level.
**t-statistic significant at the 5 percent level.

Glossary of variables in regression equations

TX76	Average statewide unemployment insurance tax rate (as a percentage of total wages) for 1975, 1976, and 1977.
UR76	Average unemployment rate of total labor force from the Current Population Survey (U.S. Bureau of Labor Statistics).
UIBARRON	State variable taken from J. Barron and W. Mellow study "Interstate Differences in Unemployment Insurance," *National Tax Journal*, March 1981, reflecting difference in expected benefits for unemployed workers across states.

The results of our statistical tests reveal that the findings of the 1978 Blaustein-Kozlowski study are only partly robust. Using our more refined and meaningful measures of benefit liberality and regional economic condition, measures of economic conditions (i.e., state unemployment rates) appear to account for much of the variation across states in UI tax rates (Table 9, Models 1 and 3). However, the Blaustein-Kozlowski result is overstated. State benefit liberality does, in fact, exert some influence on a state's relative position with respect to UI costs, as suggested by the statistical significance of the expected benefits variable, ('UIBARRON') in the regression equation (Table 9, Models 2 and 3). Nonetheless, it appears that the state's overall labor market condition, which may or may not be controllable by state policy, exerts a strong influence on UI cost variation (Model 1).

Conclusions

Preliminary new evidence for the manufacturing sector tends to support the often heard assertions by the business community that UI system costs influence the geography of business investment. Moreover, state government policy maintains some leverage in controlling UI tax rates. The differing "liberality" of states in providing an income floor under unemployed workers accounts for a small but statistically significant part of the observed regional differences in UI costs to employers. For this reason, efforts to tighten the benefit eligibility can possibly yield payoffs in terms of economic development. Of course, such payoffs must be weighed against any offsetting costs which may arise in diminishing the unemployment safety net.

In addition, our findings also suggest that states that are experiencing slow growth and high unemployment may find it difficult to bring their system costs into line with national norms by cutting benefit rates. High unemployment itself accounts for part of the geographical disparities in UI tax rates and states often have little control over such conditions—especially in the short term. Accordingly, a small tightening in benefit liberality toward workers may do little to bring a state with an aberrantly high UI tax rate back towards the national norm.

A finding that regional unemployment conditions account for part of the geographical

differences in UI tax costs while, at the same time, UI tax cost differences have affected regional growth, has implications for the overarching structure of the UI system. Those state economic problems that are related to long-term regional restructuring are compounded by the UI funding structure which places much of the benefit funding responsibility on individual states. Slow economic growth can result in high UI tax costs to a state's employers which, in turn, exerts an additional drag on the region's growth. For this reason, a larger federal role in the funding of UI benefit payments may be advisable. As with other income transfer programs, funding at the state or local level often conflicts with the functioning of the market economy. Firms and workers will relocate in response to local tax differences rather than in response to fundamental market prices and costs.[15] Accordingly, a dead weight loss can be imposed on national economic output.

FOOTNOTES

[1]For a history of the UI system and the developments preceding its inception, see James M. Rosbrow, "Unemployment Insurance System Marks Its 50th Anniversary," *Monthly Labor Review*, September 1985, pp. 21-28.

[2]Several studies have estimated significant impacts of the UI system on the insured unemployment rate of covered workers. See: Robert Moffit and Walter Nicholson, "The Effects of Unemployment Insurance on Unemployment: The Case of Federal Supplemental Benefits," *Review of Economics and Statistics*, Vol. 64 (February 1982), pp. 1-11; Stephen T. Marston, "The Impact of Unemployment Insurance on Job Search," *Brookings Papers on Economic Activity*, 1:75, pp. 13-60; Martin S. Feldstein, "Lowering the Permanent Rate of Unemployment," A Paper Prepared for the Use of the Joint Economic Committee, 93 Cong. 1 Sess. (1973); and Gene Chapin, "Unemployment Insurance, Job Search and the Demand for Leisure," *Western Economic Journal*, Vol. 9, (March 1971), pp. 102-107.

[3]For example, see Stephen A. Woodbury and Robert G. Spiegelman, "Bonuses to Workers and Employers to Reduce Unemployment: Randomized Trials in Illinois," *The American Economic Review*, Vol. 77, No. 4, Sept. 1987, pp. 513-530; Paul L. Burgess and Jerry L. Kingston, *An Incentives Approach to Improving the Unemployment Compensation System*, W. E. Upjohn Institute, 1987; and Congressional Budget Office, *Unemployment Insurance: Financial Condition and Options for Change*, June 1983.

[4]For example, A. James Heins, *Unemployment Insurance and the Illinois Economy*, The Illinois Alliance for Economic Initiatives, 1987.

[5]Of course, firms do not bear taxes, people do. The final incidence of the UI tax is uncertain between labor and capital owners. The point we are making here is much simpler: To a partial extent, differential UI taxation will raise the costs of capital investment in a state or region, ultimately affecting economic growth.

[6]For a more detailed discussion see Gary Burtless, "Why Is Insured Unemployment So Low?" *Brookings Papers on Economic Activity*, 1:83, pp. 225-249.

[7]Ibid.

[8]For a discussion, see Walter Corson, Alan Hershey, and Stuart Kerachsky, *Nonmonetary Eligibility in State Unemployment Insurance Programs: Law and Practice*, W. E. Upjohn Institute for Employment Research, Kalamazoo, 1986.

[9]See William A. Testa and Natalie A. Davila, *Unemployment Insurance: A State Economic Development Perspective, Regional Economic Issues*, Federal Reserve Bank of Chicago, 1988.

[10]Ibid.

[11]Generally UI benefits are not considered subject to means testing. However, by providing dependents' allowance, taxing benefits, and calculating benefits as a proportion of after-tax income (as is the case in Michigan), elements of an indirect means test procedure do exist in some states.

[12]Net reserves are the reserves as of the end of the year minus the balance of federal loans to state reserve funds. Reserves are the funds on deposit in a state's account in the Federal Unemployment Trust Fund plus the balances in the state's "clearing account" and "benefit payment account" that each state maintains plus the interest credited for the last quarter of the calendar year.

[13]State differences in qualifying requirements of claimants (and their enforcement) are not included in the model.

[14]For data on state UI system characteristics, see *Significant Provisions of State Unemployment Insurance Laws*, U.S. Department of Labor, Employment and Training Administration, Washington D.C., annual; and *Highlights of State Unemployment Compensation Laws*, National Foundation of Unemployment Compensation and Workers' Compensation, Washington D.C., annual.

[15]See Flatters, F., V. Henderson, and P. Miesztowski, "Public Good Efficiency and Regional Fiscal Equalization," *Journal of Public Economics*, 1974, pp. 99-112.

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Competitive pricing behavior in the U.S. steel industry

Distinguishing two steel markets—the spot market, where price varies with demand, and the contract market, where both price and lead time are negotiated—explains the seeming price rigidity of the big integrated steel producers

Christopher J. Erceg, Philip R. Israilevich and Robert H. Schnorbus

Few economic studies of pricing behavior have had results as predictable as those of the U.S. steel industry. Despite intense competition from mini-mills and foreign producers, the large integrated producers have consistently been accused of having inflexible prices.[1] This apparent lack of price competitiveness among integrated producers is often blamed for the decline of the domestic steel industry. Their prices have been viewed as higher and capacity larger than should exist in a competitive market. Integrated producers have been seen as either ignorant of or insensitive to structural changes sweeping their industry.

Equally inexplicable has been the willingness of some steel consumers to continue buying the high-priced steel of integrated producers. But, the inability of past studies to explain seemingly irrational behavior toward pricing signals may simply mean that relevant features of the interaction between integrated steel producers and their customers have been ignored.

One source of confusion can be easily traced to the pattern of two sets of observed prices in the steel industry. One price is the spot-market price, measured by the transactions price of steel sold on the Antwerp spot market. The other price is the contract price, measured by the transactions price of steel sold on forward contract. At face value, inflexible pricing behavior is consistent with the observed price pattern of contract prices, when compared to the spot market (see Figure 1). Past studies, as well as public perceptions, have erroneously treated the steel sold in the two markets as identical, however, and concluded that the divergence of the two price series is evidence of noncompetitive behavior in the contract market.

Theories developed to explain the seemingly inflexible contract prices have been taken from traditional industrial organization models that do not differentiate between the products that different producers sell. For example, a common model of price behavior would distinguish between two types of firms—the 'competitive' firm and 'corporate' firm—which have parallels in the steel industry.[2] The competitive firm, most closely identified with mini-mill producers and importers, is a price-taker and, therefore, very sensitive to demand conditions. However, the corporate firm, most closely associated with integrated steel producers, can influence the price of its product. The corporate firm is generally viewed as setting its price based on production costs that include the long-run cost of capital.

In the short run, changes in demand in the spot market will be met with changes in price in order to equilibrate supply and demand. The corporate firm, however, can continue to base its price on a markup over input costs. The price does not depend on demand directly,

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as it would if the producer's price were set in a competitive market. Instead, the price depends on demand only insofar as long-run projections of demand affect input costs (e.g., wage settlements may be affected by expected long-run profits). Since competitive firms' prices can drop more quickly than corporate firms' prices in the face of weakening demand, competitive firms might be able to gain market share at the corporate firms' expense. While this description of price and firm behavior is simplistic, it is in essence how economists have explained the effect of industrial organization on the steel industry's performance.

Treating the product of the two types of firms as identical may be a basic flaw in the description of the steel industry's pricing behavior. While the two firms do produce identical *physical* goods, they may be selling different *economic* goods with distinct nonphysical attributes. If so, the theories based on past empirical evidence of steel pricing behavior are erroneous, and the explanations of the price inflexibility of integrated producers are called into question. This article presents a more plausible explanation for many of the observed features of integrated steel producers' pricing behavior, including price rigidity, buyer loyalty, and excess capacity.

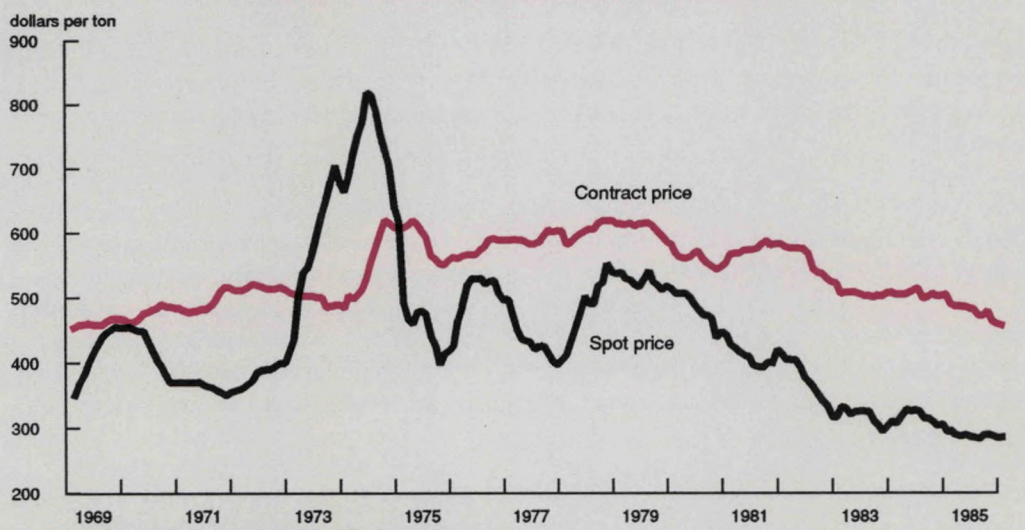
Product differentiation by lead time

Steel purchasers have long argued that three factors govern their decisions about choosing a supplier: quality, lead time, and price (usually in that order).[3] Quality for a specific firm's product is unlikely to change in the short run, however, although the relative quality of its steel may change over the long run. Thus, while quality may be important in explaining price trends, quality's importance in explaining short-term price variation is limited. However, lead times (or the amount of time between placing an order and receiving delivery at the plant) do vary considerably with price in the short run, so that the relative lead-time variation may be responsible for the observed variation in the relative prices of different producers.

In the spot market, i.e., the competitive sector of the steel industry, lead times are technically fixed by the amount of time necessary to load and ship the steel to the customer's plant. Since spot steel is purchased essentially out of inventory, production time and the possibility of delays are not included in the lead time. Of course, the customer must pay whatever price the market sets at the time of purchase, which will change quickly and dramatically with demand as customers in

FIGURE 1

Steel price trends: Contract vs. spot markets



NOTE: Both prices are converted to dollar values and appropriately deflated to remove the influence of inflation on steel price trends.
SOURCE: Paine Webber.

effect bid for the amount of steel available on the spot market.

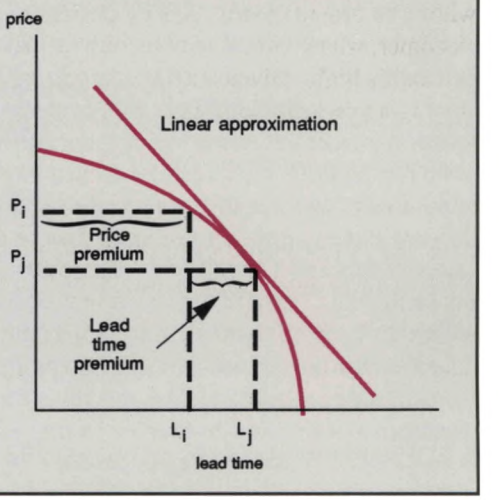
The spot market does not have a queue of customers per se; the market is cleared by the competitive price. However, an alternative view of the spot market would be that some customers, who are essentially priced out of the market by the current level of spot prices, are waiting for that price to drop to a fixed price that they are willing to pay. Their expected lead time for spot market steel in this sense will depend on the expectation of the level of demand for steel in the near future—higher demand will mean longer lead times.

Lead time in the contract market, however, is subject to negotiation between the customer and (integrated) producer. Steel consumers who require guaranteed deliveries at set prices for their production planning can reduce the risk of late deliveries through the terms of the contract, regardless of the level of demand. Given projected shortages that were expected to occur in the 1980s (especially after the steel shortage of 1973–74), steel consumers felt that they had good reason to cultivate domestic supply channels in order to insure an adequate supply of steel in the future, even if purchasing steel by long-term contract meant paying a premium over spot market prices.[4] If so, nonphysical attributes of steel (i.e., lead times) attained an overriding importance to those customers who required certainty for their production planning.

The transaction price of steel is itself a function of these nonphysical factors. For example, for a given level of demand, customers who contract for future delivery of steel are willing to trade higher transaction prices for shorter lead times. Indeed, the steel consumer can be depicted as having a hedonic price schedule relating differences in prices to differences in lead times (see Figure 2). The additional price the customer is willing to pay to reduce lead time by $L_i < L_j$ is simply $P_i > P_j$, where $L_i < L_j$ and $P_i > P_j$ (or, P_j is the price associated with the shorter lead time and P_i is the price associated with the longer lead time). While its exact shape is unknown, the hedonic price schedule must be monotonically decreasing, so that shorter lead-time steel commands higher prices than longer lead-time steel.

FIGURE 2

Hedonic price schedule



The role of capacity

The customers' demand for lead time is implicitly a demand for capacity—larger capacity means shorter lead time. The purchasing literature contains frequent references to implicit contracts between producers and consumers to reserve a producer's capacity on a regular basis. For example, in a recent *Purchasing Magazine* article, the relationship was described as following:

"The buyer, in effect, reserves production line capacity and holds off placing a specific order until he has a clean fix on his requirements. Then he tells the vender how he wants the capacity he has reserved to be used, so much of product X, so much of product Y."[5]

If steel producers can accurately forecast demand over the period that their capacity decision is binding, producers can predict the trade-off between prices and lead times that reveals the customer's willingness to pay for increments of capacity, and producers can make their supply decisions accordingly. The problem that the producers face is demand uncertainty. A customer's willingness to pay for a certain level of capacity will depend on the level of expected total demand for steel—access to extra capacity is not worth much when lead times are already low or expected to be low when delivery is needed.

Since the capacity decision of the producer is fixed before it is priced in the market,

producers are vulnerable to low returns to excess capacity if steel demand is low. If producers are risk averse, they would be unwilling to provide extra capacity desired by the customer, who is afraid of being cut off when demand is high. Given such a situation, risk-sharing agreements logically can emerge, where customers guarantee to pay a certain price for the producer's steel regardless of the current level of demand for steel. The producer will then be able to cover the cost of his capacity decision when demand is considerably weaker than expected. The contract guarantees the customer will have a place in the queue even when demand is high. In addition, the contract guarantees the producer that the customer will continue to purchase steel even though the customer could find lower prices on the spot market, when demand is relatively low.

Competition between spot and contract markets

Thus, rather than the two types of producers selling in the same market, they are actually selling in different markets, but the two markets are in competition with one another. In the spot market, only price varies. Alternatively, one can imagine price held constant and only lead time varying for the customers who wait for the spot market to drop to a desired level. In the contract market, both price and lead time are subject to negotiation and can vary in some inverse relationship. Expected increases in demand for steel in the contract market will allow the producer to negotiate either longer delivery times, higher prices, or both.

If the negotiated lead time in the contract market is very high for a given price, some steel customers may switch to the spot market—paying possibly higher prices but getting quicker delivery. For the customer, the decision to switch will be based on a trade-off between anticipated spot prices in the future versus the combination of delivery time and price that can be negotiated currently in the contract market. However, an additional cost to switching will also be the risk of not being able to return to the contract market as a loyal customer with a reserved spot in the queue when demand is high.

Prices of contract steel, therefore, are more stable than spot prices because contract prices are based on long-run expectations rather than short-term demand and supply factors. Contrary to past speculations, integrated producers can be shown to be pricing competitively, but they are competing in a different market than the spot market. In order to make a fair comparison, the price difference between the two markets must be analyzed with the same lead time in both markets. In the next two sections, it is shown that even under these conditions the contract price fluctuates less than the spot price. The remaining difference in fluctuation is due to the long-term agreement between producers and consumers, as will be explained in the latter section. This agreement constitutes an insurance that the producer will provide enough capacity to provide guaranteed delivery times.

Empirical evidence of two price mechanisms

The search for evidence of competitive pricing behavior in the steel industry centers around identifying the shape of the hedonic price schedule. Although its exact shape is unknown, it is possible to derive a linear approximation of the schedule and empirically test for it. Assume two types of steel, type C (contract steel) with lead time (w_C) and type S (spot steel) with lead time (w_S). Using a first-order Taylor expansion of the price of C (P_C) around the price of S (P_S), the formula for the linear approximation of the hedonic price schedule is:[6]

1) $P_c - P_s = \{dP/dw\}*(w_c - w_s)$

or 1') $P_c - P_s = -(dP/dw)w_s + (dP/dw)w_c$

where P_c = the c.i.f. transactions price of composite domestic sold on forward contract.

P_s = the c.i.f. transactions price of steel sold on the Antwerp spot market.

w_c = the lead time on domestic contract steel in months.

w_s = the lead time on spot steel in months.

The linear approximation is the derivative (dP/dw), determined at the point w_S, and should be negative. Equation 1' can now be used to test the following hypotheses:

H1) the observed gaps between contract prices and spot prices can largely be explained by the effect of underlying material character-

istics (including lead time) on the two markets.

H2) the observed gaps are attributable to differences in the nature of the buyer-seller relationship in the two markets.

With waiting time for spot steel (w_S) assumed constant, Equation 1' was tested over the period 1969–84, which was a period free of trade restraints in the steel industry. The results are:

2) $(P_c - P_s) - 415.1 - 132.7\ w_c$
(14.6) (–11.4) (t statistics)

DW = .210 FOA = .891 R^2 = .39
n = 203 DM = 97.1

(where *DW* are Durbin-Watson statistics, *FOA* is first-order autocorrelation in the residuals of the equation, R^2 is the coefficient of determination, *n* is sample size, and *DM* is the mean of the dependent variable).

These results show that the regression model has statistical power. Differences in lead times explain about 40 percent of the relative price differences. The coefficient of w_c is negative and significant, which is consistent with the negative slope of the hedonic price schedule, as depicted in Figure 2.

The interpretation of the estimated Equation 2 is that if expected lead time for the contract market decreases relative to lead time for the spot market, the contract price will increase relative to the spot price. However, in times of extreme shortage of capacity, the contract market may fall behind its normal lead time schedule and significantly exceed its average lead time when demand is normal.[7] In that case, the price difference may reverse itself, as it did in the 1973–74 period (see the negative values shown in Figure 3).

The evidence of Equation 2 does not make a strong statement about whether lead time largely accounts for relative price variation, in part because of high autocorrelation. Efforts to correct for autocorrelation reduce variation in the model.[8] Therefore, rather than employ such corrections, the regression results will be tentatively accepted as lending support to *H1*, that lead time variation has power to explain price changes, with the understanding that the statistical inference is biased in favor of accepting the hypothesis.

The 1973–74 period was particularly unusual, since steel was in severe short supply and contract lead times rose markedly. If the 1973–74 period is deleted, a large amount of the variation in the dependent variable is lost, and much poorer regression results are obtained. The range of the independent variable w_c is about 2.5 months over the entire sample period of 1973–74, while it drops to 1.5 if that period is omitted (i.e., a 40 percent reduction in the variation in the range). Running Equation 2, but excluding the 1973–74 period, yields the following results:

3) $(P_c - P_s) = 127.1 - 1.3\ w_c$
(4.6) (–0.1) (t statistics)

DW = .05 FOA = .968 R^2 = .0001
n = 167 DM = 124.0

As expected, regression 3 has no power to explain the effect of lead time on the price premium. The normal variation for the w_c range is within 1.5 months for lead time. In other words, lead times are being drawn for the same underlying distribution of aggregate demand, so that the spread largely represents random variation around a constant mean. This random variation would not be expected to explain the price premium. Only when the 'abnormal' variation of the 1973–74 period is included in the sample can the regression capture the price premium effect, because the switching between normal and abnormal demand situations is captured.

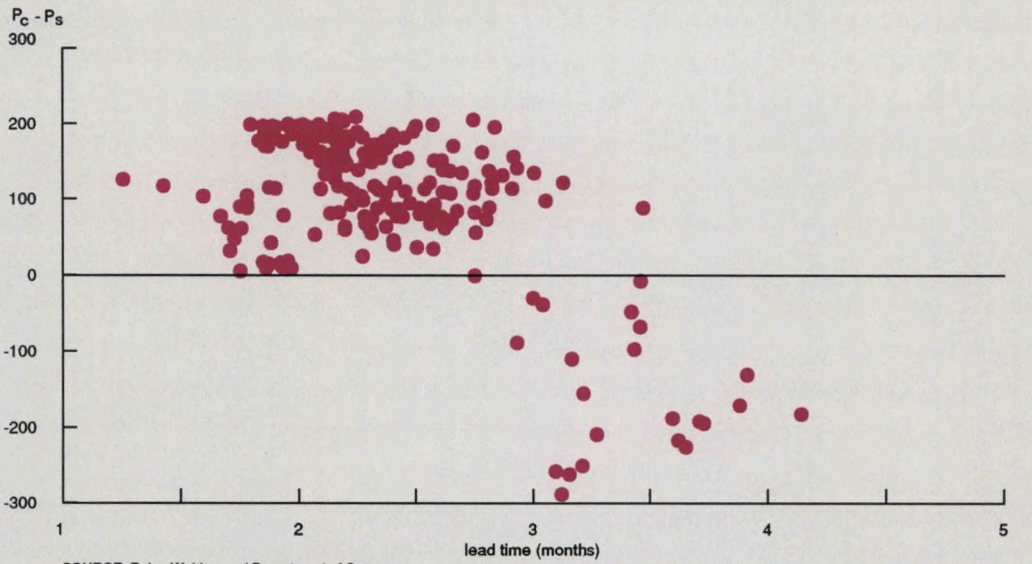
While the price premium is expected to change as the *ex ante* lead-time difference changes, the premium does not necessarily have to respond to changes in *ex post* realizations of lead-time differences. Thus, a contract producer may deliver a product at a price that is higher and a lead time that is on average shorter than the price and lead time that the consumer expected to obtain on the spot market. During normal times, the producer's actual lead time may vary considerably around this average value without affecting the previously contracted price for the steel (although one would expect that variance in lead time would affect the price that is set *ex ante*). This behavior leads to the results of Equation 3.

Empirical evidence of price premiums under normal demand

To be sure, even when the 1973–74 period is excluded, the price differential shows substantial variation. Over this subsample, the contract premium ranges from a low of six

FIGURE 3

Scatter plot of price premium vs. lead time: 1969–84



SOURCE: Paine Webber and Department of Commerce.

dollars to a high of two hundred and seven dollars per ton, or roughly between 1 percent and 35 percent of its average value over the entire sample. This is interesting because it gives some idea of the amount of the premium not explained by the lead-time differences.

While Equation 2 could not entirely explain the price premium, Equation 3 shows that there are large price swings that remain even after the effect of the variation in lead time is removed. This is supportive evidence for *H2*—there seems to be large variation in the price premium that cannot be rationalized by variation in a material characteristic.

The contract premium, $P_C - P_S$, exhibits substantial covariation with the business cycle even when the premium does not systematically vary with lead time. Figure 4 plots $P_C - P_S$ against capacity utilization for steel over the subsample (i.e., excluding 1973–74). When business activity is relatively strong (proxied by capacity utilization), the spot price rises relative to the contract price. When business activity is relatively weak, the spot price falls relative to the contract price. Contract price seems to be 'overpriced' when demand is low and 'underpriced' when demand is high.[9]

As observed in the introduction, rigid prices may be rationalized as the outcome of long-term arrangements between buyers and sellers, rather than reflecting anticompetitive practices. The basic model can be reformulated to show how the opportunities of some consumers appear to worsen as aggregate demand for steel increases, while other customers experience little or no increase in price and/or lead time. Specifically, in the range of low-to-moderate demand pressure (i.e., over the subsample excluding the 1973–74 period), neither the contract price nor the lead time rises with increasing capacity utilization (CAPU). In fact, both variables appear to be close to constant, as the regressions below indicate:

4) $P_c = 525.6 + 22.7\ \text{CAPU}$
(27.3) (.9) (t statistics)

DW = .04 FOA = .968 R^2 = .005
n = 167 DM = 558.6

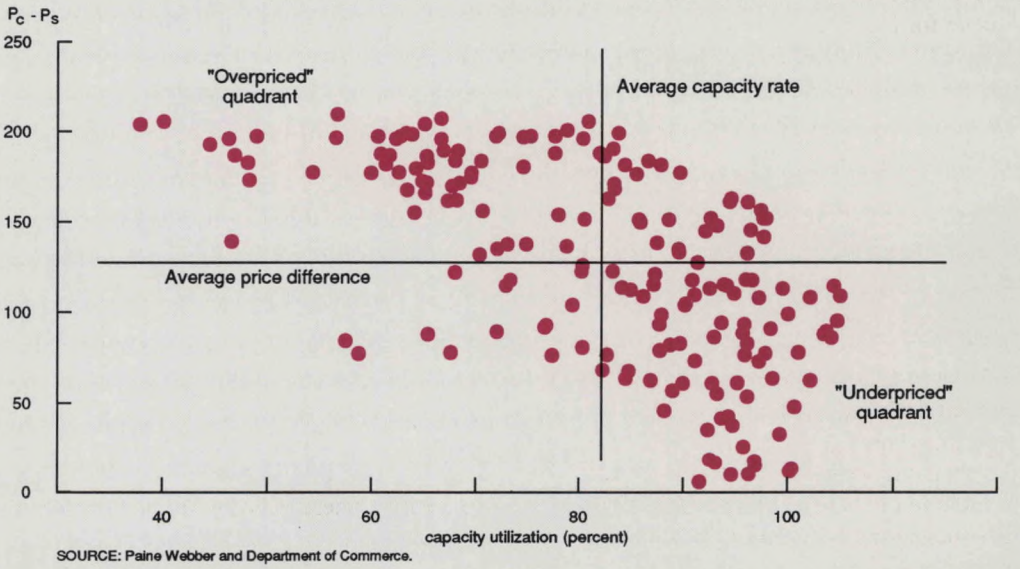
5) $w_c = 2.2 + .12\ \text{CAPU}$
(14.6) (.7) (t statistics)

DW = .582 FOA = .703 R^2 = .003
n = 167 DM = 2.3

The regression of P_S on capacity utilization, however, does yield significant correlation with capacity over the subsample, representing the short-run supply and demand characteristics of that market:

FIGURE 4

Scatter plot of premium vs. capacity utilization: 1969–84, excluding 1973–74



SOURCE: Paine Webber and Department of Commerce.

6) $P_s = 225.6 + 236.4\ CAPU$
(14.6) (8.0) (t statistics)

DW = .09 FOA = .943 R^2 = .279
n = 167 DM = 420.3

Equations 4 and 6 are obviously poor models for forecasting the levels of prices. However, these equations in combination afford further insight into the behavior of the contract price premium. Namely, one component of the premium, the spot price, exhibits substantial covariation with demand (as proxied by capacity utilization). On the other hand, neither the contract price nor the lead time appear related to demand conditions (over the subsample covering moderate levels of demand). While Equation 3 implies that the premium is not related to 'normal' lead variation, Equations 4 through 6 reveal that the premium depends on demand conditions. This is important, because relative price variation should only depend on variation in underlying material characteristics in equal access markets. If all customers were quoted a constant lead time and price for contract steel as capacity utilization rates increased within this range, no customer would be willing to pay increasing premiums for spot steel as demand pressures increase. Yet, although spot steel is not more appealing relative to contract steel as demand increases in this range (since the lead-time difference is roughly constant), the amount by which the spot price increases with demand pressure is substantial.

These equations (4 through 6) indicate that as demand increases over moderate levels, consumers purchasing in the contract market do not incur any significant price increases or longer lead times. On the other hand, the monotonic rise of the spot price with capacity utilization means that consumers buying in the spot market experience progressively poorer prices and/or lead times as demand rises. Taken together, this evidence strongly suggests that some consumers receive preferential treatment from contract producers, and those who do not get the preferential treatment are forced to pay substantial premiums on the spot market, especially when demand is high.

Finally, when Equation 5 is rerun over the entire sample, lead time in the contract market does tend to increase with capacity utilization:

7) $w_c = 1.5 + 1.0\ CAPU$
(8.5) (4.8) (t statistics)

DW = .369 FOA = .810 R^2 = .105
n = 203 DM = 2.4

This result is expected. When demand increases well above moderate levels, producers act to minimize the potentially adverse

effects of such demand increases on the opportunity sets of their most loyal customers, i.e., they quote longer lead times to transients in order to be able to reserve space in the production queue for loyal customers. However, when aggregate demand becomes sufficiently high, firms must use lead time and/or price increases to allocate production capacity even among their loyal customers.

The major findings of the empirical part of this study are the establishment of the significant relationship between the price premium and the lead time premium between the two markets (evidence from Equation 3). However, this relationship cannot be observed when demand is moderate because of: 1) the expected and realized differences in both price and lead time between the two markets and 2) small systematic variations in the price premium relative to changes in lead-time differences (evidence from Equation 2). The premium, however, does seem to be related to the business cycle (proxied by capacity utilization). Therefore, variation is not the result of material characteristics (i.e., lead time) when demand is moderate, but does seem to be systematically related to the business cycle, which implies some underlying long-run arrangement of risk sharing.

Benefits of the contract market: a theory of long-run behavior

Conceptually, rigid pricing agreements between consumers and producers emerge as a consequence of a particular type of vertical arrangement between buyers and sellers. For producers, a capital outlay is akin to a gamble. If producers are risk averse, they will choose 'too small' a gamble (i.e., too little capital in the aggregate) which implies that the distribution of market prices will be higher than if producers were risk-neutral. The object of the vertical arrangement is to induce risk-averse producers to behave as if they were closer to being risk-neutral, thus reducing the expected expenditures of consumers of steel by reducing prices over the long run.

The capital decision is a gamble because the outlay must be made long before the return from it becomes known (in this analysis, the capital outlay once made is fixed). For example, rolling mills can require an up-front capital investment of over six hundred million dollars and typically remain operative for fifteen or more years. The magnitude of the capital outlay is important because it determines the location of a producer's variable cost curve over the horizon during which he produces. At any point in time, a producer in a competitive market will choose a quantity to equate the exogenous market price to his marginal cost. However, since a producer's marginal cost depends on his prior choice of capital, the producer's profits at any time are solely a function of initial choice of capital.

In the absence of demand uncertainty, a producer's discounted profit stream is a deterministic function of his initial capital outlay. Thus, the producer realizes that if he chooses a given capital outlay, K', and the price is p' each period, he will make a profit of p'*q' - C(q';K') each period gross of his initial cost of capital, where q' is the optimal choice of quantity given p' and his variable cost curve $C(q';K')$, which is determined by his choice of K.

Demand uncertainty, however, implies that the future prices are random. The producer associates a different *distribution* of discounted expected profits with each possible initial choice of K. The initial capital outlay is a fixed sum that can be regarded as equivalent to a bet. The discounted expected return to the bet increases as the producer places larger bets, but so does the spread in the return distribution to the bet (i.e., the spread increases as a consequence of the spread in the distribution of market prices). How large a bet is the producer willing to take?

Risk-averse producers, like risk-averse consumers, undertake smaller bets than if they were risk-neutral. In particular, an economy of risk-averse agents chooses a smaller capital outlay than an economy of risk-neutral agents. Since the aggregate supply curve (the economy's variable marginal cost curve) depends directly on the aggregate choice of K (assume all producers are identical), the supply curve in a risk-averse economy will lie to the left of that in a risk-neutral economy. This means that, for a given demand, prices in a risk-averse economy are always higher than would be the case in a risk-neutral economy.

Risk-averse producers could be induced to behave as if they were closer to risk neutral if they could somehow reduce the spread in the

distribution of the return to their capital gamble. The reason for such a spread is that when market prices are high the return to any given choice of K is high, while conversely, when market prices are low the return to the same choice of K is low. If there were a market offering fair (constant expected value) insurance to producers, so that producers could enact *ex ante* trades offering real value when demand is high (the insurance premium) in exchange for receiving value when demand is low (the insurance payoff), risk-averse firms could be induced to behave as if they were risk neutral. This is because producers would simply choose capital to maximize expected profits, and then use the fair-insurance market to obtain these expected profits with certainty.

In the absence of such insurance markets, however, consumers can provide at least partial insurance through vertical arrangements with firms. They do so by making transfer payments to firms when demand is low and producers experience low returns, while customers receive rebates when demand is high. This form of insurance involves paying higher than spot prices when demand is low and receiving lower than spot prices when demand is high.

Coalitions of consumers and producers who engage in this type of risk sharing benefit because this insurance enables firms to expand their capital and, thus, achieve lower marginal costs. Firms can induce consumers to enter the arrangement by offering them lower expected expenditures, although over certain periods consumers will pay higher prices. Not all consumers would benefit by such an arrangement, since the producer could only promise to reduce expected expenditures over the long haul. Transient consumers of steel would be remiss to pay higher than market prices for the promise of lower than market prices when demand is high if they did not expect to consume a sufficient supply of steel in the future to justify paying the current premium.

A problem with this arrangement is that though not all consumers could actually benefit by it, all consumers would have an incentive to say that they would support the insurance scheme during periods of high demand when they receive the price rebate. For this reason, producers distinguish loyal from transient customers. Only those consumers who have paid premiums when demand was low obtain preferential treatment when demand is high. Thus, firms employ a self-selection mechanism by basing insurance payouts on a consumer's past purchasing history. Only those consumers who can potentially benefit from such long-term arrangements pay the premiums and obtain the benefits.

Favorable treatment may assume the form of price and/or lead-time reductions when demand is high (since reductions in lead time are equivalent to cutting the price). Within this context, it is possible to rationalize the earlier finding of this study that the spot price rose during periods of moderate but increasing demand pressure, but the domestic price and lead time remained constant. As demand rose, domestic producers quoted progressively higher prices and/or longer lead times to transient customers, who proceeded to turn to the spot market and bid up the price. At the same time, loyal customers began to enjoy the benefits of their coverage.[10]

Implications for the 1990s

The evidence presented in this study shows that: 1) it is important to analyze some economic goods with the same physical attributes as differentiated products and 2) an appropriately defined price comparison can provide evidence that argues against the prevailing view that the rigid pricing by integrated producers is incompatible with competitive pricing. Instead, rigid prices are the outcome of long-term arrangements between producers and consumers, which establish a contract market that is distinct from the spot market. The contract market establishes the dependence between the prices consumers face at any given time and past commitments to particular producers. Rigid prices emerge as the outcome of an insurance arrangement between consumers and firms in which consumers agree to bear part of the risk of a firm's capital outlay. Such an arrangement induces risk-averse producers to choose larger initial capital outlays and, thus, enables them to achieve lower marginal costs than if they bore the total risk of the capital gamble themselves. However, this insurance scheme requires the consumer to pay premiums over the spot market price during recessions, while they receive

rebates during booms. This description of pricing behavior is valuable in clarifying vague and often misleading explanations in past studies of why consumers will buy steel that seems overpriced during normal periods of economic activity.

An essential feature of these specialized arrangements is a mechanism to insure that both producer and customer keep their end of the bargain when they both may have short-run incentives to break the arrangement. This study has presented a theory to explain how such a mechanism can be implemented and how it can be mutually beneficial to both parties to remain loyal to the special arrangement.

The modeling of two competing steel markets may shed new light on the decline of the steel industry, as well as the future prospects for integrated producers. Once consumers were convinced in the early 1980s that world capacity was more than adequate to meet their needs even if demand were high, they were increasingly unwilling to pay price premiums to integrated producers during normal periods. The integrated producers' commitment to a shrinking contract market could have contributed to the whole industry's decline, because they were not positioned to compete aggressively on price alone in the growing spot market.

To be sure, the integrated producers are gradually adjusting to the new market reality, but adjustment takes time. The integrated producers' capital stock may have been uniquely designed to meet the needs of their customers most efficiently when demand was high. The most appropriate technology under the new conditions may be quite different. Today, integrated producers are investing heavily in new technologies. As the adjustment process is completed, integrated producers may be able to compete more aggressively with mini-mills and foreign producers than they have in the past.

FOOTNOTES

[1]For example, studies of integrated steel producers, who generally control all stages of the steel-making process from ore to finished steel product (or 'Big Steel', currently defined as USX Corp., Bethlehem Steel Corp., Inland Steel Industries Corp., LTV Corp., and Armco Inc.), have long depicted steel producers as textbook examples of oligopolists, following administered pricing policies. See De Vany and Frey (1982) and Gardner Means (1957).

[2]See, for example, Acs (1984) for a more detailed description.

[3]See, for example, Raia (1988), p. 39.

[4]See, for example, Hogan (1972), p. 3.

[5]See *Purchasing Magazine* (1974), p. 26.

[6]The contract price of steel is a weighted average of contract prices of all domestic steel products, where the weights on each product are the value of the product as a proportion of total U.S. shipments in 1977. The spot price is the price quoted on the Antwerp spot market, adjusted to include cost, insurance, and freight (c.i.f) paid by a 'typical' domestic steel purchaser. These data were supplied by Paine Webber. The price data are adjusted by the producer price index for finished goods to remove the influence of inflation. Average lead time on domestic steel is constructed by dividing unfilled orders at the end of each month by shipments of the following month. A similar measure of lead time was used in earlier studies. See, for example, Gregory (1971). These data were taken from the *Survey of Current Business*, various issues.

[7]Interestingly, Equation 2 determines the average lead time for the spot market as roughly 3 months (i.e., 415/133 = 3.1), which is reasonable, given past studies such as Jondrow, et al, 1982), which found foreign steel delivery times to be about 3 months.

[8]The high positive correlation in the residuals of Equation 2 will lead to downward bias in the standard errors, and this bias will be further exacerbated by significant low-order positive autocorrelation in w_C. Most of the autocorrelation in the residuals can be corrected by taking first differences (or, applying more sophisticated versions of generalized least squares models). Such procedures tend to eliminate most of the variation in both the independent and dependent variables, however, since they also exhibit strong positive low-order serial correlation. This leads to poor parameter estimates.

[9]Figure 1 also shows that the premium varies countercyclically. However, the objection to using this as support for price rigidity is that such variation could possibly reflect covariation with an underlying nonphysical characteristic, such as lead time that varies with the business cycle. If so, the premium's observed correlation with the business cycle might be incidental. However, Figure 4 depicts variation in the premium not explained by lead time variation, and it is clear that this 'residual' variation still exhibits strong comovement with the business cycle. Thus, Figure 4 provides considerably stronger support for the hypothesis of rigid pricing.

[10]For a more formal analysis of the long-run benefits of the insurance agreement, see Erceg, et al, (1989).

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