Inflation in the Service Sector

Inflation rates for services have exceeded those for goods in every year since 1949, except during periods of large oil price increases. From 1949 to 1981, the GNP deflator for expenditures on services rose at an average annual rate of 4.8 percent compared with 3.7 percent for goods. Since 1982, the gap between the two indexes has widened to 3.5 percent, with services rising at an average of 5.5 percent and goods at 2.0 percent

These figures suggest that the recent decline in inflation rates is not necessarily the result of inflation having been "wrung out" of the system by the protracted recession of the 1980s. Instead, the burden of the decline has been borne disproportionately by the manufacturing sector, where the recession, the increase in foreign competition resulting from the dollar's appreciation, and the conditions of oversupply in raw materials markets have been responsible for unprecedented slackness in prices in recent years. In contrast, the recent behavior of service inflation suggests that, absent the unusual circumstances in manufacturing, the economy would again be prone to high inflation rates. Thus, the future course of inflation depends critically on the behavior of inflation in services.

Several explanations have been advanced for high inflation rates in services One is that service price indexes are constructed in ways that systematically overstate price increases by accounting inadequately for improvements in the quality of the services delivered. Accounting for changes in the quality of services is held to be fraught with practical difficulties. Unlike durable and nondurable goods, little tangible is left to examine for quality changes once a service has been rendered. In general, quality improvements cause increases not only in the costs of products, but also in benefit to consumers. Correctly constructed output and price measures would treat these increased benefits as equivalent to increases in the quantity of the product, not in its price.

A second type of explanation regards the existing data as accurate and seeks to explain them on economic grounds. One such approach notes that, unlike manufacturing, the personal element in the provision of many services limits the scope for improvements in labor productivity. In manufacturing, the faster growth of labor productivity affords more room to grant wage increases without passing them on to prices. In order to maintain its labor force, the service sector must match the wage increases in manufacturing. However, there is no offsetting productivity improvement for services, whose prices must then rise in order to maintain profit margins. Thus, labor productivity growth differentials can cause prices in the two sectors to diverge.[1]

Another approach focuses instead on the fast growth of the nondistributive services sector[2] in recent years.

[1]See William J Baumol, "The Macroeconomics of Unbalanced Growth The Anatomy of Urban Crisis," *American Economic Review*, 57 (1967), pages 415-426

[2]This sector is defined here as comprising Finance, Insurance, and Real Estate, and the Services sector proper In the sequel, it will be referred to as "services" for brevity's sake, unless ambiguity arises

After remaining roughly constant during the 1950s and 1960s, the share of nondistributive services in real output grew to 35 percent by the 1980s (Table 1). This rapid expansion has maintained upward pressure on both wages and prices in the sector, a situation exacerbated by its disproportionate and increasing reliance on female labor

These three perspectives on the inflation gap between services and goods have very different implications for future service price inflation If service price increases are systematically overstated, the problem of service price inflation is more apparent than real, but if inherent productivity growth differences are the cause, it is here to stay Finally, if service price inflation results from the growth of demand for services, then it may be mitigated if service sector growth slows down in the future.

The purpose of this article is to contribute to a deeper understanding of the inflation differential between services and manufacturing, by examining the success of these explanations in accounting for the post-war data The analysis shows that there is no proof positive of the mismeasurement view. Nor do the data suggest that the inflation differential is explained exclusively by sectoral differences in productivity growth rates. There is, however, some evidence suggesting that continued growth of the service sector relative to the manufacturing sector, reflected by the tightening of the female labor market relative to the male market, has been behind the high rate of service sector inflation.

Overview of service price inflation

This section describes more fully the course of inflation in different industries in the economy and forms the basis for the choice of industries that are the focus of the rest of the analysis.[3] The broadest grouping of service industries, often called the "service-producing

[3]The available measures of service price inflation are distinguished by method of classification (by consumers' expenditure category or by industry of origin) and by breadth of coverage The data on GNP deflators by industry are discussed here because they are consistent with the wage and productivity data to be used in the subsequent analysis Other sources of data on service price inflation are the deflators for components of GNP and personal consumption expenditures (PCE), and the consumer price index (CPI) The GNP deflator for services involves purchases by the government, foreigners, and consumers, the third category being the largest Since GNP accounts register final rather than intermediate transactions, purchases of services by business are excluded

PCE deflators are calculated by a method that aggregates information on real and current dollar outlays on subcategories of consumption expenditures The real figures for most of these subcategories are calculated by deflating current dollar expenditures by the CPI for comparable commodities and services Hence, the underlying price information in the PCE is largely the same as that in the CPI The two indexes exhibit very similar movements at a disaggregated level and only differ in the aggregate as a result of different weighting schemes The disaggregated PCE data may also be roughly compared with the industry data for categories of expenditures that bear similar titles The two sets of inflation rates tell roughly the same story

Table 1

Inflation and Productivity by Industry

		Service-Producing Industries						
					Nondistributive Services			
	Manufacturing	Total	Transportation & Public Util	Wholesale & Retail	Total	Finance & Insurance	Real Estate	Services
Inflation rates*								
1949-85	3 3	4 3	4 4	3 6	4 9	5 4	4 0	5 4
1949-69	2 1	2 6	2 6	1 9	3 3	4 3	2 1	4 0
1970-81	5 9	6 9	6 9	6 7	7 1	7 4	6 5	7 5
1982-85	1 9	5 4	6 2	3 2	6 4	5 4	6 4	6 8
Productivity growth*								
1949-85	2 7	1 3	2 8	1 3	0 8	0 1	2 1	0 6
1949-69	2 8	2 0	3 2	1 8	1 5	0 2	4 3	1 0
1970-81	2 0	0 4	2 2	0 2	0	0	−0 5	0 2
1982-85	4 7	0 2	1 9	1 4	−0 6	0 1	−1 6	−0 2
Share of output†								
1950-59	27	54	10	18	27	4	9	13
1960-69	26	57	9	18	29	4	11	14
1982-85	25	65	11	19	35	5	13	18
Share of employment†								
1950-59	38	53	10	22	21	4	1	16
1960-69	36	56	8	23	25	5	1	19
1982-85	26	67	7	26	34	6	1	27

*Percent per annum
†Percent of nonfarm business sector

sector," comprises transportation and public utilities, wholesale and retail trade, finance, insurance and real estate (FIRE), and the catch-all group "services." Inflation performance is not uniform across service-producing industries (Table 1). The behavior of prices in wholesale and retail trade differs moderately from that in manufacturing, and transportation and public utilities prices started to increase rapidly only in response to energy price shocks. It is the "nondistributive" services—FIRE and the narrow service industries—that have been the source of persistently high inflation rates, exceeding those in manufacturing by 1.6 percentage points per year since 1949, and 4.5 percentage points from 1982 to 1985.[4]

The table shows several other features of nondistributive services that set them apart from the rest of the economy. First, the growth of labor productivity in this group of industries has been considerably lower in each period than in manufacturing. As noted above, this may be a consequence of the inherently limited scope for labor-saving improvements in service activities. Alternatively, it may reflect inaccurate measurement, causing inflation figures to be biased upward and growth of output (and hence, output per worker) to be biased downward. Second, the share of these industries in total output has grown from 29 to 35 percent since the 1960s, after remaining relatively stable for two decades. Manufacturing and distributive services show essentially no change. Third, employment in nondistributive services accounted for 21 percent of nonfarm business workers in the 1950s, rising to 34 percent by the 1980s; the share of manufacturing employment declined from 38 percent to 26 percent over the same period. The faster rate of growth in services' employment share than its output share is a reflection of the disparate rates of labor productivity growth in the two sectors.

Two industries, business services and medical care, have grown in size relative to the rest of the nondistributive services sector, while personal and domestic services have shrunk, the latter quite dramatically (Table 2). However, while nondistributive services comprises a diverse group of activities, inflation in services is not restricted to a few specific areas (such as health care); it is a feature of practically all such services. Hence, a first analysis of service price inflation should focus on features common to all service activities. Two such approaches are examined below

Mismeasurement of service price inflation

One explanation for high service price inflation is that it is systematically overstated because published data fail to take into account improvements in the quality of the services delivered. To see what is at issue here, consider the concrete case of a durable good such as a refrigerator. As frost-free refrigerators come to dominate the market, the price of the average refrigerator

[4]The wage, price, output, and employment series in this article are taken from annual data by industry in the National Income and Product Accounts At the time of writing, data for 1986 were not available Comparable data for 1986, taken from the National Income and Product Accounts and Bureau of Labor Statistics sources suggest that the trends described here have moderated only slightly, if at all

Table 2

Output and Employment Shares and Inflation in Nondistributive Services Industries

	Rate of Inflation*				Share of Output†		Share of Employment†	
	1949-85	1949-69	1970-81	1982-85	1949-69	1982-85	1949-69	1982-85
Finance & insurance	5 4	4 3	7 4	5 4	15	14	21	20
Real estate	4 0	2 1	6 5	6 4	37	37	5	5
Hotels & lodging	5 6	3 3	8 3	9 7	3	2	5	5
Personal services	4 9	3 3	7 4	5 4	9	6	13	8
Business services	5 6	4 9	6 3	7 6	10	16	11	21
Entertainment	4 9	3 8	5 9	4 8	3	2	5	4
Medical care	5 4	3 9	7 5	6 7	11	16	15	25
Legal services	7 3	5 0	9 4	12 9	4	3	2	3
Education	6 3	6 3	6 4	6 2	2	2	6	6
Domestic services	5 0	3 7	8 4	1 6	4	1	17	3

*Percent per annum
†Percent of nondistributive service sector

rises because the frost-free variety costs more. Price indexes that merely record the price of the average refrigerator will thus register increases, and all other things being equal, refrigerators will exhibit more inflation than commodities that have not undergone quality improvements. Correct measures of prices and output (that are comparable with earlier figures) should, however, reflect the fact that the average refrigerator constitutes "more" refrigerator than it did before the introduction of frost-free technology. Hence, quality improvements should be represented as increases in output and may not necessarily cause increases in the prices of the (quality-adjusted) goods. The argument asserts further that the problems of capturing quality improvements are greater in the case of services than in the case of goods. The quality of many services, for example legal counsel, can only be observed at the time the service is rendered, whereas for goods something tangible remains to be examined after purchase.

These problems will cause measures of the growth in labor productivity (output per worker) to be biased downward, because not enough of the increase in expenditures is attributed to growth in real output. Other aspects of the methods of measurement of industry prices and output can cause output and labor productivity measures to be understated and inflation estimates to be biased upward. In some industries, no direct measurements of prices are available, and real output has to be extrapolated from some measure of inputs to the production process, often an indicator of employment. Setting the growth of real output equal to the growth of employment obviously allows for no growth in labor productivity. In summary, the problems posed by quality changes and the intangible nature of service output make it difficult to divide successive observations on expenditures into information on prices and quantities that are comparable over time.

In the absence of direct information on quality and productivity changes with which the measured price and output data can be compared, it is difficult to come to any definite conclusions about the extent of the quality bias in services. However, several indirect and circumstantial pieces of evidence seem to suggest that measurement biases may not be the major cause of the inflation differential between services and goods.

The CPI takes systematic account of quality changes only in the case of automobiles, where the effects of annual model changes are analyzed using cost data supplied by manufacturers. For other goods and services, information on quality changes enters the measurement of prices in an *ad hoc* manner: if a field representative (the person who samples prices in stores, hospitals, and so on) believes a quality change has occurred, he or she notifies a "quality specialist" at the Bureau of Labor Statistics, who determines whether an adjustment needs to be made. Changes in the specifications of appliances are as likely to be picked up by this method as improvements in medical diagnostic procedures through the use of more sophisticated equipment. Similarly, changes in the longevity of durable goods are as likely to be missed as changes in the degree to which providers of services "cut corners."[5] While there are changes in service quality that are not taken into account by the CPI, it is not clear that changes in the quality of goods are captured substantially better.[6]

The significance of quality measurement problems is also called into doubt by consideration of specific components of the CPI. For categories such as medical care and entertainment, indexes are calculated for both the relevant services (visits to doctors' offices and entrance to sporting events) and the corresponding goods (drugs and sporting goods). If, for example, there is fast growth of demand for medical care, we would expect the prices of both the goods and services related to medical care to rise quickly. In contrast, if the difficulties of capturing service quality changes were the main cause of higher price inflation in services than in goods, we would expect to see the goods in these categories experience low inflation rates relative to the corresponding services. The gap between inflation rates for goods and services in these expenditure categories is, with few exceptions, substantially less than the gap between overall goods and services inflation rates (Table 3). With the same exceptions, the detailed goods inflation rates are typically no less than the corresponding overall goods inflation rates. Thus, these data suggest that whatever causes the prices of medical care, personal care, entertainment, education, and housekeeping services to rise rapidly also infects the prices of the corresponding commodities. For example, the data are consistent with growing demand for these categories of expenditure. It is not what would be expected were the differential treatment of quality improvements in goods and services responsible for the observed high service inflation rates. Only for home maintenance after 1982 and apparel is the discrepancy between the commodities and services indexes similar to that between overall goods and services inflation. This divergence of prices could be explained by

[5]In "Determining the Effects of Quality Changes on the CPI," (*Monthly Labor Review*, May 1971), Jack Triplett surveyed a number of studies of quality bias in medical care prices and found no conclusive evidence of an upward bias in this component of the CPI. He also suggested that it was not possible to rule out a deterioration of quality in services, in which case the price indexes would be biased downward.

[6]The author would like to thank (without implication) Patrick Jackman for useful discussions on which this argument is based.

Table 3

Average Annual Inflation Rates of Related Goods and Services in the CPI

Category	1977-86		1977-81		1982-86	
	Goods	Services	Goods	Services	Goods	Services
Home maintenance	4 9	7 3	8 0	10 0	1 8	4 6
Housekeeping	5 9	5 9	8 4	8 4	3 5	3 4
Apparel	3 7	7.8	4 8	10 3	2 1	5 2
Medical care	8 1	9 1	8 2	10 1	8 0	8 1
Personal care	6 2	6 2	7 5	7 8	4 9	4 5
Entertainment	5 2	6 1	7 0	6 4	3 4	5 8
Education	9 1	9 6	8 4	9 0	9 8	10 1
Goods in CPI*	5 2		7 1		3 2	
Services in CPI†	7 0		8 5		6 0	

*Excludes food, energy, and used cars
†Excludes energy

increasing competition from imports, especially during the period of the dollar's appreciation.

An alternative perspective on the accuracy of service price inflation rates is provided by examining in detail the construction of price series for different industries. Ideally, inflation in the value added price deflator for an industry is the difference between the rates of growth of current dollar value added (receipts net of materials purchases) and real value added. In practice, the method used to arrive at price indexes varies from industry to industry, depending on the availability and reliability of data. For some industries, data on purchases of intermediate goods are not available, and real value added is approximated by "extrapolation" of an index of some measure of real activity, such as real personal consumption expenditures or employment. This has the effect of measuring the real value of total rather than net output.[7] (Inflation is then the difference in the rates of growth of the current dollar and real output measures). In other cases, a deflator is calculated directly by combining personal consumption deflators and detailed earnings data for products and industries contained in the particular industry aggregate.[8]

[7]For some industries, notably banking and credit agencies, and holding and other investment companies, no direct measure of current dollar output is available since many services are performed without explicit charges The practice employed is to *impute* a value for these services In the case of banking, this imputation is based on the excess of interest income over interest disbursed For a full discussion, see John A Gorman, "Alternative Measures of the Real Output of Commercial Banks," in *Production and Productivity in the Service Industries*, ed Victor Fuchs (New York National Bureau of Economic Research, 1969)

[8]For example the deflator for amusement and recreation services is derived by combining price data on admissions to various sporting and artistic events Details of the construction of these indexes are to be found in Martin L Marimont, "Measuring Output for Industries Providing Services OBE Concepts and Methods," in Fuchs, *op cit*

Evidently, some of these methods of measurement ignore productivity improvements to a greater or lesser degree. If real output is measured by employment, then productivity growth is, by definition, zero. Similarly, if prices are measured by earnings, then to the extent that earnings rise because of productivity increases, real output growth will be understated and inflation overstated. In contrast, extrapolation of real output from measures such as the number of admissions to sporting events permits productivity growth to be nonzero and does not necessarily attribute productivity improvements to inflation Thus, the extent to which productivity growth is missed and incorporated in inflation should be related to the methods used to measure prices and output, if incorrect accounting for productivity growth is a serious problem.

Grouping industries according to the way their prices are measured should show whether the industries in any particular group experience inflation rates that differ significantly from those in other groups. For example, if measurement of output by employment biases estimates of inflation upward relative to other methods of measurement, we would expect higher average inflation in this measurement group. To assess the long-term importance of measurement problems, we calculated the average inflation rates for the industries in each measurement group for each decade. The ordering of measurement groups by inflation rates changes in each decade (Table 4). In particular, industries using an employment indicator to measure output (group E) show no tendency toward systematically higher average inflation rates than other groups.

Differences in measurement methods thus do not appear to explain the differences in inflation among service industries. Of course, the finding that measurement methods do not explain the variations in inflation

rates *among* service industries does not allow us to conclude that they do not contribute to the gap *between* goods inflation and the inflation of the service sector as a whole. It may be that some feature of service sector real output growth is missed systematically by all measurement methods, and wrongly attributed to price inflation. This type of mismeasurement would not be detected as the particular consequence of one measurement method as opposed to another. Nevertheless, if the measurement method used for an industry were responsible for the level of its inflation rate, then variations in measurement methods should be related to variations in inflation rates among service industries.

This section has examined the extent to which high rates of service sector inflation can be explained by failure to take account of quality and productivity improvements. We have not turned up *positive* evidence of mismeasurement. This result does not allow us to conclude that data on the service sector is accurate, for which a case-by-case analysis of measurement procedures would be required However, it does suggest that it may be more fruitful to attempt to explain the manufacturing/services inflation differential on economic grounds.

Economic explanations of sectoral inflation rates

In this section we investigate the economic determinants of the manufacturing/services inflation differential.[9] We find support for the view that the differential stems from the higher growth rate of demand for services than for manufactured goods. An alternative view, stressing sectoral differences in productivity growth, is somewhat at odds with the evidence. These conclusions are based both on an informal examination of relevant data and on the estimation of a three-equation econometric model explaining the manufacturing/services inflation differential, manufacturing wage inflation, and service wage inflation

After experimenting with a variety of forms of the inflation differential equation, we conclude that unit labor cost changes are important determinants, that there is no clear indication of effects from aggregate demand variables, and that variables capturing changes in international competitiveness do not register a large effect. Thus, wage movements are central to the behavior of the price inflation differential.

It is possible to distinguish the "productivity growth differential" and "services demand growth" views of the inflation process mentioned earlier by the behavior they prescribe for sectoral wage inflation. Only if wages are tightly linked, because workers can find jobs with equal ease in the two sectors, will productivity growth differentials be the principal cause of the inflation differential. Otherwise, wages can be set to match productivity changes in each industry without fear of losing workers to another sector. This behavior leaves unit labor costs

[9]The definition of services used in this section of the paper is nondistributive services *excluding* real estate Real estate is excluded because the output figure is chiefly an imputation for the services provided by owner-occupied housing However, no imputation is made for the corresponding labor of homeowners

Footnote 9 continued
The employment figures for real estate in Table 2 only include real estate agents and janitorial staff Thus, "output per head" has an interpretation for this industry very different from its meaning in other industries, and the industry is thus omitted to preserve the homogeneity of the data

Table 4

Average Inflation Rates of Nondistributive Service Industries* Grouped According to the Method of Measurement of Prices

Group	A	B	C†	D†	E†
Measurement Method	Prices Based On Earnings Index	Prices Taken Directly from CPI or Personal Consumption Deflators	Total Real Output Extrapolated	Net Real Output Extrapolated	Employment Extrapolated
1950s	4 5	2 9	2 5	3 3	5 6
1960s	4 2	2 4	3 6	2 9	3 5
1970s	5 8	6 2	7 9	9 3	6 9
1980s‡	9 6	7 6	9 8	−0 6	7.8

*Industry inflation rates are weighted by the industry's share of group nominal output
†Under these methods, an index of real output is first calculated The industry inflation rate is then the difference between the rates of growth of industry gross product originating (in current dollars) and of the real output measure
‡1980-85

Note Group A Motion pictures, Medical services, Educational services, Nonprofit membership organizations, Miscellaneous professional services, and Private households, Group B Banking, Credit agencies, holding, and other investment companies, Real estate, Personal services, Automobile repair and services, and garages, Amusement and recreation services, except motion pictures, and Legal services, Group C Hotels and other lodging places, Group D Insurance carriers, Group E Insurance agents, brokers, and service, Security and commodity brokers, Miscellaneous business services, and Miscellaneous repair services

unchanged and hence puts no upward pressure on the prices in one industry as opposed to another. Alternatively, differences in sectoral wage behavior can show that the inflation differential is driven by the faster growth of demand for services if the two sectors draw on different labor force groups (services being predominantly female and manufacturing disproportionately male), and if wage inflation is systematically related to the tightness of these labor markets.

To capture these effects, we ran modified Phillips-curve wage equations for each sector. These included the wage growth of the other sector among the explanatory variables, as well as the male and female unemployment rates We found that there is little interdependence between the wages in the two sectors, contradicting the productivity differential view. However, the female unemployment rate turns out to be an important determinant of service wage inflation, while the male unemployment rate is not This result conforms with the demand-induced view of the inflation differential.

We now proceed to discuss the findings in detail, starting with the inflation differential equation. Output and employment in the service sector are less volatile and cyclically sensitive than they are in manufacturing Similarly, the service sector is typically more sheltered from foreign competition and developments in foreign economies than the manufacturing sector. The extent to which these differences are reflected in the price behavior of the two industries is an empirical matter. Manufacturing prices should be more sensitive to movements in the costs of materials, particularly oil. In contrast, service sector prices should be more responsive to changes in labor costs, as these are a higher proportion of total costs in services than in manufacturing

The estimated inflation differential equation suggests that relative price inflation is most strongly related to changes in energy prices and unit labor costs (Box 1). Energy prices exerted a highly significant effect, raising manufacturing inflation relative to services inflation when they rose.[10] By far the bulk of relative price movements is explained by changes in unit labor costs.[11] After these variables are taken into account, there is little left that can be explained statistically by indicators of international competitiveness, such as the exchange rate or the relative prices of imports and exports, or by indicators of the stage of the business cycle, such as real GNP or the prime age male unemployment rate. This does

[10]The large effect of energy prices on inflation remains even when the manufacturing sector is redefined to exclude petroleum production

[11]If prices are marked up on costs, we would expect the coefficients of unit labor costs to be similar to labor's share in total revenue, which is approximately 60 percent in manufacturing and 75 percent in services

Box 1. Inflation Differential Equations

Our econometric analysis of the manufacturing/services inflation differential attempted to relate it to determinants of the individual sectoral inflation rates of which it is composed Two representative equations are shown below They demonstrate the relative lack of importance of aggregate demand factors (the prime age male unemployment rate) and prices of competing foreign goods (the exchange rate) in explaining the differential The conclusions are not sensitive to the particular specification of the variables employed For example, the percentage changes in the real exchange rate (exchange rate times the ratio of foreign to domestic producer price indexes), the price of nonpetroleum imports, and the price of nonpetroleum imports relative to manufacturing prices all yielded small and insignificant coefficients when they were entered in place of the growth in the exchange rate The level and rate of growth of real GNP, and rates of change of the prime age male and female unemployment rates also had negligible effects. The regressions were run on annual data for the period 1954-85.

$$P_m - P_s =$$

$$\underset{(95)}{.85} + \underset{(.25)}{.02e} - \underset{(-72)}{.13upm_{-1}} + \underset{(5.5)}{13pe_{-1}} + \underset{(4.1)}{44ulc_m} - \underset{(-5.2)}{.83ulc_s}$$

$$\bar{R}^2 = 0.7 \qquad S\,E = 1\,2 \qquad DW = 2\,23$$

$$P_m - P_s = \underset{(0\,7)}{.46} + \underset{(5.5)}{.13pe_{-1}} + \underset{(5\,8)}{.50ulc_m} - \underset{-(5.9)}{.88ulc_s},$$

$$\bar{R}^2 = 0\,7 \qquad S.E. = 1.2 \qquad DW = 2\,18$$

(t-statistics are in parentheses beneath the coefficients)

where

p = inflation rate of sectoral price deflator,
upm = prime age male unemployment rate,
pe = rate of change of producer price index for energy, and
ulc = rate of growth of unit labor costs.

The subscript m refers to the manufacturing sector, while s denotes nondistributive services. The subscript -1 indicates that the variable in question is lagged one year.

not mean that these factors are ultimately irrelevant. For instance, unit labor costs in manufacturing fell relative to those in services in the 1980s, and this is held to be due, at least in part, to the influence of import competition on wage concessions. In summary, our analysis of the inflation differential equation suggests that to explain the excess of service price inflation over manufacturing price inflation we should look to the determinants of unit labor costs in each industry. This approach is also supported by the statistical results presented in Box 1. These results suggest that if no changes occur in the economic determinants of the differential, the differential will be negligible.

The change in unit labor costs is the difference between wage inflation and productivity growth. As mentioned above, we are interested in establishing whether the cause of the inflation differential is the different rates of productivity growth between the two sectors, or whether it is the different rates of growth of consumer demand. These two causes have different implications for the functioning of the labor market, and ultimately for the behavior of wages in the two sectors.

The productivity-differential explanation requires that labor is mobile between sectors, in which case wages of comparably skilled workers in both sectors will move in the same way. If not, then workers would tend to move away from the sector paying the lower wages, which would then have to bid up wages to stem the attrition in its labor force. The theory assumes that improvements in productivity accrue to workers in the form of increased wages. By definition, wages can rise as fast as productivity without causing unit labor costs to rise. Consider what would occur in a typical year, when productivity rose faster in manufacturing than in services. Initially, manufacturing wages rise to the extent of the manufacturing productivity increase. In order not to lose its labor force, services must keep wages increasing at the same rate as manufacturing wages. But this means that unit labor costs will rise faster in services than in manufacturing because the service wage increase (which is dictated by manufacturing productivity growth) is not fully offset by service productivity growth. As both sectors adjust prices to maintain their profit margins, prices will tend to rise faster in services, a situation that is exacerbated by the greater share of labor in service sector costs and by the need of the service sector to expand its labor force to meet increasing demand.

Alternatively, consider what will occur if labor is immobile between the two sectors. Higher productivity growth in manufacturing than in services now exerts no upward pressure on service sector wages, since workers are unable to move to manufacturing jobs. Thus, there is no "push" on service sector wages, and hence on prices, that has its source in the superior productivity performance of the manufacturing sector. However, if demand for services is growing sufficiently fast, service wages will tend to rise to attract more labor. The faster services demand grows, relative to the pool of available labor, the faster the industry will have to raise wages. Of course, the fact that productivity growth is low in services will mean that service *prices* will rise more quickly than they would have were productivity better. But slow productivity growth in services is not a necessary ingredient of high wage inflation according to this view, whereas it is central when labor is mobile between the two sectors. When labor does not move freely between manufacturing and services, the "pull" of excess demand for service sector labor is the driving force.[12]

The basic facts of low service sector productivity growth with high inflation, and high manufacturing productivity growth with relatively low inflation, are in broad conformity with the mobile labor view. A deeper analysis, however, supports the view that inflation has resulted from increased demand for services in the face of immobility of labor from manufacturing to services. There is indeed a large difference in the demographic composition of the manufacturing and nondistributive services labor forces (Table 5). Three-fifths of workers in nondistributive services are female, whereas women make up only one-third of the manufacturing labor force. The proportion of women in nondistributive services was only 50 percent in the 1950s. To achieve such growth, nondistributive services have accounted for 45 percent of new female jobs created since 1963, although the sector represented only 38 percent of female employment in recent years, and about 35 percent in 1963. During this period, the female participation rate has risen by about one-third. Meanwhile, wages have risen faster in nondistributive services than in manufacturing, especially in recent years. While the female labor force has grown rapidly, the upward pressure on wages suggests that nondistributive services demand has grown faster.

Further data suggest that the service industries whose employment is growing fast will not be able to alleviate the upward pressure on wages by attempting to attract male workers in large numbers. The traditional employers of the prime age male labor force—manufacturing industries—continue to pay substantially higher wages than service industries, although the gap is narrowing. The average hourly wage in manufacturing was $9.03 over the period 1982-86; in services, it was 16 percent lower, at $7.58. While some workers

[12]It should be noted that both of these scenarios describe a two-sector economy Since our empirical analysis does not deal with all the sectors in the economy, this theoretical discusssion should be regarded as only a suggestive guide to the interpretation of the empirical results

Table 5

Labor Market Statistics by Sector

Sector	Growth in Wages and Salaries per Full-Time Equivalent Employee				Female Share of Industry Employment*†	Industry Share of Total Employment*†	Industry Share of Total Female Employment*†	Share of Increase in Total Female Employment since 1963
	1949-85	1949-69	1970-81	1982-85				
Manufacturing	5 8	4 7	7 8	5 6	34	20	15	8
Distributive services	5 1	4 2	7 2	3 8	42	29	27	28
Nondistributive services	6 0	4 9	7 8	6 4	60	28	38	45

*Average over 1983-85
†Nonfarm economy

displaced from declining manufacturing industries have moved to jobs in the service sector, the loss of pay and status involved tends to make this transition a slow one.[13] Making service jobs more acceptable in the near future to this group of workers could presumably be accomplished only by increasing wages rapidly. Thus, it is plausible that the pressure on wages in the service sector is aggravated by the "immobility" of workers in other sectors paying higher wages In the long run, this immobility may lessen, as service wages continue to rise relative to manufacturing wages.

Other labor market statistics, consistent with this view of continued strength in the female labor market, suggest an explanation of the recent divergence of price and wage inflation rates in manufacturing and services. The unemployment rate for females aged 20 and above averaged 6.7 percent from 1982 to 1985, while for prime age males, it averaged 6.8 percent. These figures reverse the pattern of the preceding two decades when the male rate was always below the female rate by an average of 1 2 percentage points While the pressures on the female labor market, originating largely in the nondistributive services sector, have continued unabated into the 1980s, those on the male labor market have declined substantially. The result has been that service sector wages and prices have grown faster than manufacturing wages in the 1980s.

To weigh the merits of the two views, it is useful to employ a more formal approach that involves statistical estimation of the determinants of wage inflation in the two industries (Box 2). The estimates for each industry attempt to account for aggregate demand pressure, captured by the prime age male unemployment rate, and for inflationary expectations Unlike typical aggregate wage equations, they include the wage growth of the other industry, the female unemployment rate, and sectoral productivity growth terms to capture sector-specific effects The other industry's wage growth captures the extent of the transmission of labor market pressures between sectors If labor is mobile between manufacturing and services, we would expect long-run wage movements to be similar in the two sectors, that is, we would expect wage movements in one industry to match closely wage changes of the other By the same reasoning, the smaller the influence of wage growth in the other industry, the less important are spillovers of wage pressure from one sector in determining wage movements in the other

In contrast, the female unemployment rate is included to capture the notion that labor is immobile between sectors. This theory suggests that pressures on service sector wages emanate from scarcity of the labor employed by the sector, which is predominantly female. If it is valid, we would expect the female unemployment rate to be the principal labor market variable in the services wage equation and to be relatively unimportant in the manufacturing equation

The results show that manufacturing wage inflation is not directly influenced by service wage growth and is most strongly correlated with movements in the CPI It also responds to the prime age male unemployment rate, albeit insignificantly,[14] and is insensitive to the female unemployment rate

Service wage growth displays a weak response to manufacturing wage changes· only 29 percent of these changes are passed through into service sector wage inflation. In a perfectly mobile labor market, much more should be passed through in the long run Service wages differ most dramatically from manufacturing in their response to unemployment. While manufacturing

[13]See Kenneth B Noble, "Millions Who Lose Plant Jobs Pay in Shift to Services," *New York Times*, February 7, 1986, page 1

[14]Michael Bruno and Jeffrey Sachs find a similar result for the United States and cite several other studies that are in agreement with theirs See *The Economics of Worldwide Stagflation* (Cambridge, 1985), Chapters 9 and 10

Box 2. Wage Inflation Equations

We estimate wage equations that are amended versions of augmented Phillips curves for the two sectors. The equation for the service sector is

$$w_s = a_o + a_1 w_m + a_2 w_{m_{-1}} + a_3 \pi_s + a_4 \pi_{s_{-1}} + a_5 upm + a_6 uf + a_7 pc_{-1} + error,$$

where w_s and w_m are the annual growth of wages and salaries per employee in services and manufacturing respectively, π_s is annual labor productivity growth, upm and uf are the prime age male and female unemployment rate, and pc_{-1} is the lagged value of the rate of growth of the consumer price index, included as a measure of inflationary expectations. The equation for manufacturing wage growth is the same, except that service wage growth replaces w_m and $w_{m_{-1}}$ on the right hand side, and manufacturing productivity growth replaces π_s and $\pi_{s_{-1}}$.*

$$w_m = b_o + b_1 w_s + b_2 w_{s_{-1}} + b_3 \pi_m + b_4 \pi_{m_{-1}} + b_5 upm + b_6 uf + b_7 pc_{-1} + error.$$

The econometric estimation of the sectoral wage equations pays particular attention to the problems of "simultaneity" that are present in the two equations. The service wage equation says that a one percent increase in manufacturing wage growth causes service wage growth to increase immediately by a_1 percent, while the manufacturing wage equation implies that a one percent increase in service wage growth leads to a contemporaneous increase in manufacturing wage growth of b_o percent. Using regression techniques, we can only estimate the *correlation* between manufacturing wage growth and service wage growth. This means that if we run the manufacturing wage regressions, for example, we do not know whether the estimated coefficient of service wage growth reflects the value of b_o, a_o, or some combination of both (w_m and w_s can be positively correlated, but because w_m affects w_s, and not vice versa). It is possible, however, to test for the presence of simultaneous relationships by examining the correlations of w_m with variables that we believe affect w_s without affecting w_m.†

*Further lags of each right hand side variable were not significant in either equation

†The testing procedure used is described in detail in the working paper, of which this article is a summary, available on request from the author

Such tests reveal that any correlation between contemporaneous manufacturing and service wage growth is not the result of the direct effect of services wage growth on manufacturing wage growth. The lagged value of service wage growth is also insignificant in the manufacturing equation. The equations used annual data from 1954 to 1985. The final versions of the equations estimated are:

$$w_s = \underset{(4.2)}{6.2} + \underset{(1.5)}{.22} w_m + \underset{(0.6)}{.07} w_{m_{-1}} + \underset{(1.8)}{.34} \pi_s - \underset{(-1.2)}{.23} \pi_{s_{-1}}$$

$$+ \underset{(0.6)}{.15} upm - \underset{(-2.3)}{.87} uf + \underset{(3.8)}{.61} pc_{-1}$$

$$\bar{R}^2 = 0.83 \quad SE = 0.84 \quad DW = 1.71$$

$$w_m = \underset{(2.9)}{.46} + \underset{(0.9)}{.07} \pi_m + \underset{(0.1)}{.01} \pi_{m_{-1}} - \underset{(-1.5)}{.51} upm$$

$$+ \underset{(.01)}{.01} uf + \underset{(5.7)}{.74} pc_{-1}$$

$$\bar{R}^2 = .73 \quad SE = 1.158 \quad DW = 1.73.$$

Several tests of the significance of the effect of manufacturing wages on service wages were carried out. If $a_o + a_1 = 1$, then increases in manufacturing wages are passed through fully to the service sector, indicating substantial interdependence of the two sectors. The t-statistic for this hypothesis is 3.68, whereas the .005 significance level is 2.8. Thus, the hypothesis is soundly rejected. The coefficients a_o and a_1 are, in fact, insignificantly different from zero. The hypothesis that they are both zero yields an F-statistic of 1.36, whereas the 5 percent significance level is 3.4. Thus, the predictions of the mobile labor model are not supported by the data. In contrast, the female unemployment rate has significant negative coefficients in the services equation, but is practically irrelevant for the determination of manufacturing wages. The importance of the effects of the prime age male unemployment rate is the reverse. These results suggest that conditions peculiar to the female labor market may be important in the determination of service sector wage growth, and hence inflation.

wage growth is somewhat moderated by increases in the prime age male unemployment rate, and not at all by the female unemployment rate, service wage inflation responds in a roughly opposite manner. Decreases in female unemployment have a substantial inflationary effect on service sector wages, while changes in male unemployment have neither a large nor significant impact. These results suggest that there has been substantial immobility between the services and manufacturing sectors. Service sector wages respond to movements in the female unemployment rate, since women constitute a major source of workers for this sector.

Thus the influence of one sector's wage growth on the other is at best weak. This result, in turn, suggests that productivity growth differences between manufacturing and services do not explain the difference between their inflation rates. In contrast, the analysis produces some evidence that the two labor markets are separated. each sector's wage inflation is most responsive to the unemployment rate of the demographic group that constitutes the bulk of its labor force

Given that the data support the view that labor does not move freely between the two sectors, what is to be inferred about the source of the higher inflation rates in services? A story consistent with the evidence is that service price inflation has been driven by growing demand for services relative to manufacturing This, in turn, has caused an increase in the demand for labor in services, which has drawn disproportionately on the female labor force. The effects of the growth in demand have been to tighten the female labor market relative to the male labor market, resulting in greater upward pressure on wages and prices in services than in manufacturing.

Conclusion

This article has considered several explanations for the high rate of price inflation in service industries relative to manufacturing In spite of the difficulties of capturing quality changes in services, no positive evidence was turned up to substantiate the view that the inflation differential stems from data collection or measurement problems. While a more complete analysis is required before this view can be dismissed, it seemed promising to attempt to explain the data on economic grounds.

The principal source of wage and price differentials between services and manufacturing seems to be the growth of demand for services against a background of low labor mobility between manufacturing and services. The implications of this model appeared to be more in line with the behavior of wages than an alternative model that traced the inflation differential to underlying differences in productivity growth between the two sectors.[15]

The aggregate historical record is consistent with the view that growth in demand for services has outstripped growth in the available labor supply, causing wages to rise rapidly and putting upward pressure on prices. Recent developments do not suggest any significant change in this trend. For example, average earnings in finance, insurance, and service industries have grown at about 4 percent per annum since 1984, while price increases have slowed by about one-half of a percentage point, but remain above 4 percent. During the same period, annual employment growth has consistently exceeded 5 percent. Thus, demand pressures on nondistributive services do not appear to be easing.

[15]Of course, a more detailed study focusing on individual industries and on their wage and price inflation rather than on the aggregate differential might suggest a more significant role for the behavior of labor productivity

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