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The Relationship between Manufacturing Production and Goods Output

Charles Steindel

The sharp divergence in the 2001 recession between two key economic indicators—manufacturing production and goods output—could suggest that one indicator is flawed, casting doubt on the reliability of its overall series. This analysis finds no evidence of error. Rather, the strength of spending on consumer—relative to capital—goods and the growth of merchandising services in the sale of consumer goods more likely explain the recent deviation.

A curious phenomenon of the 2001 recession was the sharp divergence between two arguably similar economic indicators: the manufacturing component of industrial production and the goods output component of GDP.¹ Adding to the peculiarity is the fact that the indicators' movements were much more alike in the previous recession, 1990-91.

Beginning in mid-2000, manufacturing, or “factory,” production experienced significant declines. The measure, which accounts for about 80 percent of industrial production, fell roughly 6 3/4 percent from June 2000 through December 2001. In the year and a half that followed, production grew very little. Although a more pronounced revival began to take hold in mid-2003, by spring 2004 factory production still fell short of its 2000 peak.

The GDP data tell a different story. The 2001 downturn witnessed virtually no drop in overall GDP, and there has been substantial growth since then. Yet GDP encompasses more than just manufacturing activity, so it may not neces-

sarily move in step with manufacturing production.² Within the GDP data, however, is a series—goods output—that measures U.S. production of goods. The name suggests that the series, which accounts for about 40 percent of GDP, measures the same type of activity as manufacturing production does. Yet this series, like overall GDP, has behaved quite differently than the factory output numbers in recent years, undergoing only a mild decline in the 2001 recession and displaying sustained growth afterward.

The recent divergence of these two sets of data raises a pertinent question about the U.S. economy. Namely, are manufacturing production and goods output measuring the same type of activity? If they are, their separate paths could suggest that one indicator has been in error and thus cast doubt on the reliability of the overall industrial production or GDP number.

In this edition of *Current Issues*, we investigate the reasons for the varying paths of manufacturing production and goods output during the most recent recession—and

the possibility that one series has missed the mark. We begin by defining the components of the two indicators. Then, after adjusting the two series for differences in the products they cover, we chart their relationship over the long term and during four key business cycles of the past thirty years.

Our investigation yields no evidence of error in either series. We find that the recent divergence in the paths of the two indicators is, to a significant degree, in keeping with the long-run tendency of goods output to grow more strongly than manufacturing production. In addition, while the two indicators' contrary movements during the most recent recession and recovery differ sharply from their more uniform movements during the business cycle of the early 1990s, they conform in important respects to their movements in the cycles of the mid-1970s and early 1980s.

Having rejected the possibility of indicator error, we argue that the divergence between goods output and manufacturing production in the 2001 recession and subsequent recovery stems largely from two interrelated trends: the strength of spending on consumer goods relative to spending on capital goods, and the growing importance of merchandising services in the sale of consumer goods. Since the output of service sector workers who bring consumer goods to market is counted in goods output but not in manufacturing production, these trends very likely helped buoy the goods output figure during the recession and beyond.

Manufacturing Production and Goods Output

Manufacturing production is a robust measure of the value-added of factories. The value-added of an economic establishment is its sales less its purchases of inputs from outside sources. The labor of employees and the services supplied by capital owned by an establishment are not considered inputs when calculating value-added. In the industrial production data, goods and energy—not purchased services—are considered inputs. Manufacturing production thus consists of the sales of the sector, with purchases of energy and raw and intermediate materials netted out.³

A key strength of the manufacturing production concept is its independence of many organizational details attached to manufacturing firms. For example, the measure is not changed if a manufacturing firm's accounting, design, marketing, or janitorial services are performed in-house or by vendors, as long as the services do not affect sales or purchases of goods and energy. Manufacturing production is unaffected even if assembly-line workers are employed by a vendor rather than by a manufacturing firm.

The other measure we examine, goods output, cumulates spending on goods in the United States by households, busi-

nesses, and governments (including the buildup of inventories) plus exports of goods less imports of goods. At first glance, this concept appears quite similar to manufacturing production: U.S. spending on goods other than imports seems much the same as spending on goods produced in the United States, which in turn should be equivalent to the output of American factories.

In truth, however, there is a striking difference between the two measures (see box). The data on goods purchases in the United States include retail spending on imported consumer goods. The import series netted out in the computation of goods output is the payments to foreign producers and shippers, not the purchases of imported goods by final users. The retail price of an import is much larger than the price paid to the foreign supplier. Substantial costs are incurred transporting imports within the United States, marketing the products, and financing all stages of the transaction. These costs represent output produced in the United States and are included in goods output, but not in manufacturing production.

An everyday example of the significance of this “domestic service content” of imported consumer goods is the merchandising of lower priced garments. A very large share, likely more than half, of such garments sold in the United States are imported—that is, their labels say “made in” someplace other than the United States.⁴ Yet the designers of the garments, the distributors from the docks to the stores, the shop employees who sell them, the advertising firms that market them, and the businesses that finance the transaction are for the most part

The Components of Manufacturing Production and Goods Output

Manufacturing production can be defined as sales of U.S. manufacturers (including inventory accumulation) less manufacturers' purchases of energy, domestic raw materials, and imports. Goods output can be defined as sales of goods (including inventory accumulation) plus exports of goods less imports of goods—a formulation that is equivalent to sales of U.S. manufacturers plus the output of U.S. merchandisers.

Note that sales of U.S. manufacturers is a component of both aggregates. The key difference between the aggregates is the output of U.S. merchandisers of goods, a component that is included in goods output only. The output of U.S. merchandisers equals that portion of the revenue from sales of goods that is not earned by producers. This output is produced in the service sector of the economy, but it is intimately connected to the production and sale of goods.

Table 1
Share of 1997 Purchase Price Received by Producer
 Percent

Goods	Share
Consumer	
Durable	58.1
Nondurable	63.2
Capital	84.8

Source: Lawson et al. (2002).

Note: Producer revenues include payments for imports.

engaged in production in the United States. They are producing U.S. “goods output” while helping to design, ship, market, and finance products assembled elsewhere.

Accordingly, a major distinction between the two indicators is the inclusion in goods output of the domestic service content of retail spending, whether the consumer good is made in a U.S. factory or abroad. Of course, the sale of capital goods also includes service inputs provided outside the factory. However, these inputs are less important in producing and delivering capital goods to final purchasers than in producing and delivering consumer goods, with the result that a much larger share of the purchase price accrues to a capital goods producer than to a consumer goods producer (Table 1).

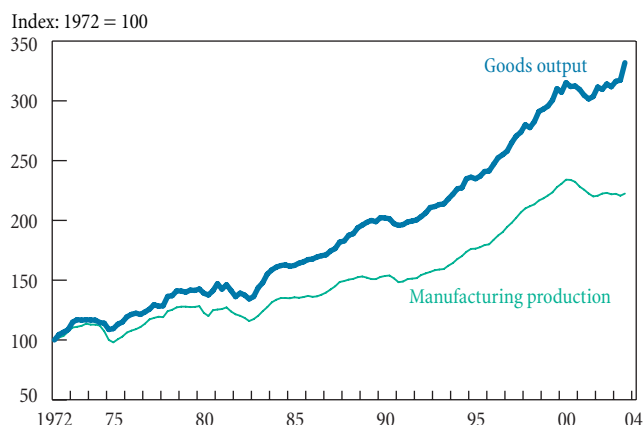
Long-Run and Cyclical Behavior of the Two Measures

Although manufacturing production and goods output differ conceptually, the two series may typically grow and shrink together. If so, the divergence in recent years may have been ephemeral, perhaps indicating that the current estimate of one of the measures is unreliable.⁵

To explore this possibility, we study the relative behavior of the two aggregates over the long run and during key business cycles. Since the aggregates do not encompass the same menu of products, we begin by making the two series as comparable as possible—that is, we modify them so that they measure activity associated with similar products.

First, goods output includes software sales, but software output is not part of manufacturing production. Accordingly, we remove from goods output software sales to businesses and consumers. Second, goods output includes sales of items produced on farms and in mines. We can exclude farm output from the goods output figures. As for items produced in mines, data on mine output comparable to the data on factory output are part of the overall industrial production measure. Thus, we can add them to manufacturing production. By resolving these two differences, we obtain a series on non-farm, nonsoftware goods and a series on the production of factories and mines that focus on comparable products.⁶ Our

Chart 1
Goods Output and Manufacturing Production over the Long Run



Sources: U.S. Department of Commerce, Bureau of Economic Analysis; Board of Governors of the Federal Reserve System; author’s calculations.

adjusted goods output series measures the value-added generated in the United States in the course of selling these products, including the value-added of U.S. producers; our modified manufacturing production series measures the value-added generated by U.S. producers of these products.

We can now compare movements in the two adjusted series over the long term (Chart 1). Since 1972, goods output has consistently grown more strongly than manufacturing production—at an average rate of 3.5 percent, compared with 2.6 percent.

The cyclical behavior of the two adjusted aggregates in recessions and in early recoveries is tracked in Table 2 (bold entries), along with the behavior of the actual aggregates. For the most part, our adjusted series look much like the actual ones. The major exception is 1982-83, when the adjusted measure of manufacturing production grew considerably less than the actual headline series while the adjusted measure of goods output grew more rapidly. A mining slump occurred in 1983; thus, the adjusted manufacturing production series, which includes mining output, grew less rapidly than narrow factory production. That year also saw a significant drought that pared farm output; thus, the adjusted goods output series, which excludes farm output, grew more rapidly.

The adjusted data suggest that in the typical cycle, manufacturing production drops more rapidly than goods output in a recession and rebounds more slowly in a recovery—with the major exception being the early 1990s. We illustrate this point in Chart 2, which shows the cyclical movement of the two series with their values at cyclical peaks (the 1980:1 peak is omitted). In the episodes starting in 1973:4 and 2001:1, manufacturing production declined much more notably than goods output during the recession and took

Table 2
Behavior of Manufacturing Production and Goods Output during and after Recent Recessions: The Actual and Adjusted Series

Percent			
Period	Change in Manufacturing Production	Change in GDP	Change in Goods Output
Recession			
1973:4-1975:1	-13.0	-3.1	-6.8
	-12.0		-7.0
1981:3-1982:4	-8.4	-2.6	-8.0
	-9.0		-8.2
1990:3-1991:1	-4.0	-1.3	-2.5
	-3.6		-2.8
2001:1-2001:4	-3.7	0.0	-1.6
	-3.6		-1.9
First year of expansion			
1975:1-1976:1	7.1	6.1	9.1
	6.2		9.8
1982:4-1983:4	12.2	7.7	12.0
	10.0		15.5
1991:1-1992:1	2.9	2.7	2.5
	2.3		2.2
2001:4-2002:4	1.0	2.8	2.5
	0.8		2.7

Sources: U.S. Department of Commerce, Bureau of Economic Analysis; Board of Governors of the Federal Reserve System; author's calculations.

Note: Bold figures represent the adjusted manufacturing production and goods output series.

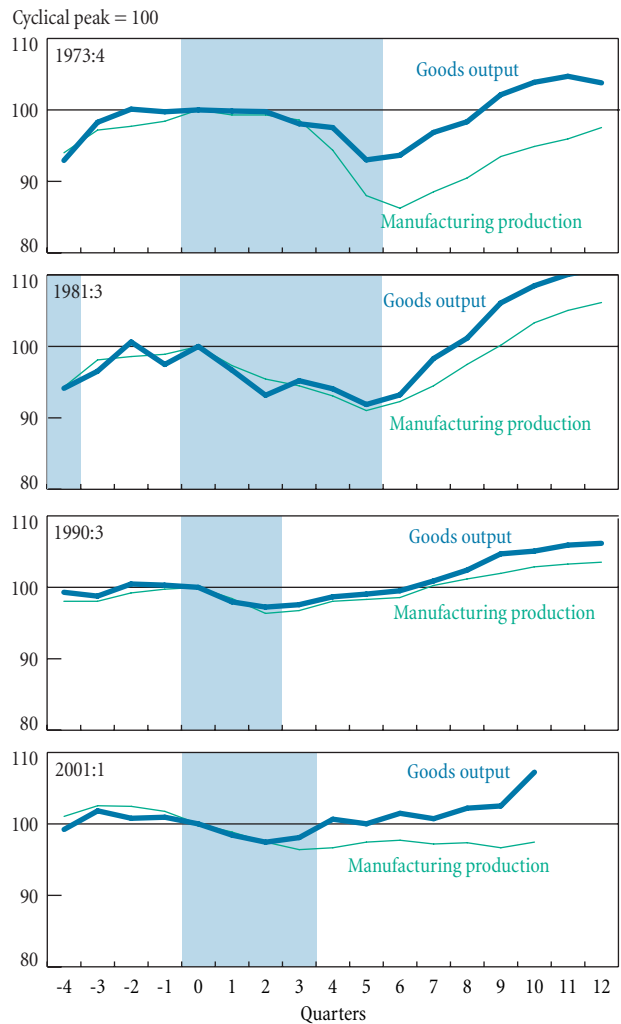
much longer to recover to previous peaks. In the early 1980s, the two series behaved similarly in the downturn, but goods output grew more briskly during the upturn. However, in the 1990s episode, the movements in goods output and manufacturing production were very similar, during both the recession and the recovery.

This cyclical comparison suggests that the more peculiar experience is not that of 2001 but that of 1990-91, because the swing in goods output was then comparable to the swing in manufacturing production. In view of the other episodes, it was unusual for a manufacturing cycle of the magnitude seen in the early 1990s to have been associated with such a significant swing in goods output; goods output is typically much more stable than manufacturing production. By contrast, the recent divergence in these aggregates appears to be consistent with their variant paths in the mid-1970s and (to some extent) their paths in the 1980s, suggesting that neither aggregate has missed its mark.

The Role of Service Inputs

Goods output incorporates all of the service sector activity associated with the sale of goods. The higher long-run trend of goods output compared with manufacturing production suggests that the relative importance of the service inputs to the

Chart 2
Goods Output and Manufacturing Production in Cyclical Downturns



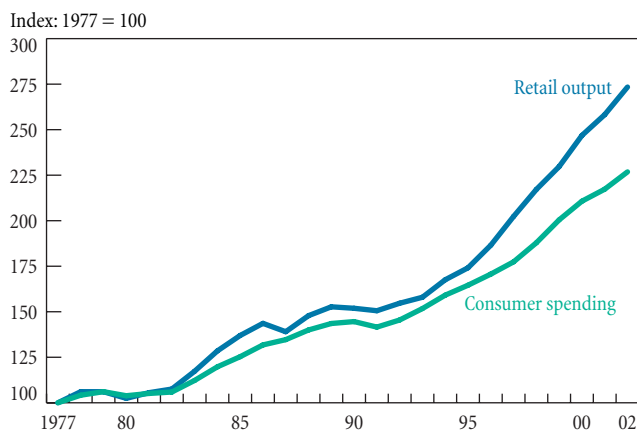
Sources: U.S. Department of Commerce, Bureau of Economic Analysis; Board of Governors of the Federal Reserve System; author's calculations.

Note: The shaded areas indicate periods designated national recessions by the National Bureau of Economic Research.

sale of goods has been growing. In this part of our analysis, we consider two factors that may have combined to account for this growth: a shift in spending to goods whose purchase price incorporates a higher fraction of U.S. service input and an increase in the service inputs to goods in general.

As we have observed, an imported good requires some U.S. service sector inputs in order to be sold. Thus, the growth of trade and, in particular, the rising significance of imports have, all things equal, likely elevated goods output relative to manufacturing production.⁷ Although the greater importance of trade does not by itself represent a change in the fundamental service intensity of goods sold—imported shirts, for example, do not require more selling effort by

Chart 3
Retail Output and Consumer Spending on Goods



Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Notes: The data do not incorporate the recent benchmark revisions to the National Income and Product Accounts because the longer term GDP by-industry data have not been updated; thus, they end in 2002. The revisions appear to have had little effect on the consumer goods data.

retailers than do domestic products—the trade factor can be viewed as a spending shift to more service-intensive goods.

One can also argue that there has been some increase in the underlying service intensity of a major portion of goods output. With few exceptions, consumers acquire goods from retailers and retailers sell goods to consumers. The output, or value-added, of retailers is a “service” produced to deliver consumer goods to purchasers and, for many products, is likely the largest service in the production-distribution pipeline. Since the early 1980s, retail output has grown more rapidly than consumer spending on goods (Chart 3). This phenomenon suggests that the service component of goods output over the long run has increased for reasons other than the mere rise in the import share of purchases.⁸

The Role of Spending

As we have suggested, the divergence of manufacturing production and goods output over recent decades likely stems from long-run forces such as the increasing importance of foreign trade and the growth in service inputs to the sale of consumer goods. Yet such long-run forces may not play a role in a sharp short-term divergence like the one in 2001. In particular, trends in the fundamental service intensity of the marketing of individual products seem unlikely to vary much with short-term swings in the economy. Moreover, the usual erosion in import volumes in cyclical downturns would likely work to reduce goods output relative to factory production. The cyclical divergences may owe more to swings in the composition of goods demand and to differences in the sale and production of major categories of goods.

In particular, as Table 3 shows, recessions see greater declines in capital spending than in consumer spending. Indeed, in two of the last four recessions of any length (we exclude the extremely brief 1980 downturn), consumer spending on goods was higher at the end of the downturn than at the beginning. In addition, in three of the recessions, the drop in real spending on capital goods was at least 5 percentage points deeper than the change in spending on consumer goods.

The exception is 1990-91: While the decline in capital spending was indeed a bit deeper than the decrease in consumer spending, the margin was less than half the margin in the other downturns. The early 1990s were also unusual in that real consumer spending on goods had not yet reached its peak prerecession level one year into the recovery. (The only other recent recession to see a drop in consumer spending was 1973-75, but spending quickly rebounded above prerecession levels in the early stages of the recovery.)

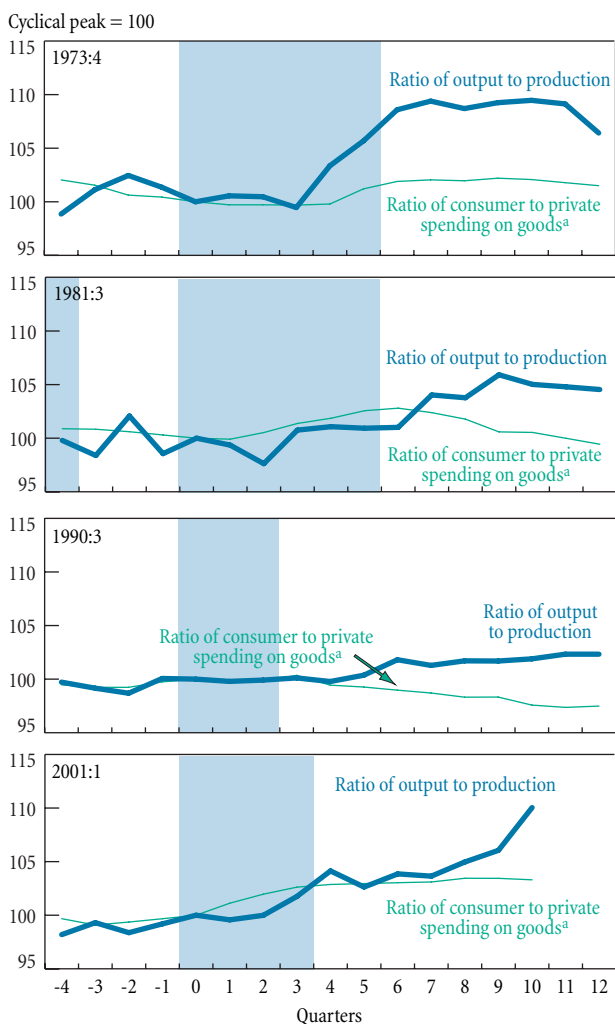
Why should the relative strength in consumer spending affect the relative performance of goods output and manufacturing production? As we have observed, consumer goods appear to require a higher fraction of service inputs to bring to market than do capital goods. A decline in production associated with a drop in spending on capital goods may involve less of a drop in related service sector inputs (and thus in overall goods output) than does a comparable decline in spending on consumer goods. The 2001 downturn was similar to most recessions in that the overwhelming share of weakness in goods spending was associated with a capital goods slump; the 1990-91 recession was atypical because the consumer share of the spending decline was unusually high.

Table 3
Changes in Consumer Goods Spending and Capital Goods Spending during and after Recent Recessions
Percent

Period	Consumer Goods	Capital Goods
Recession		
1973:4-1975:1	-2.2	-9.5
1981:3-1982:4	0.6	-9.7
1990:3-1991:1	-1.5	-3.4
2001:1-2001:4	4.2	-8.4
First year of expansion		
1975:1-1976:1	5.9	1.8
1982:4-1983:4	7.5	20.3
1991:1-1992:1	2.4	1.5
2001:4-2002:4	2.5	1.6

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Chart 4
Goods Output, Manufacturing Production,
and the Composition of Private Demand for Goods



Sources: U.S. Department of Commerce, Bureau of Economic Analysis; Board of Governors of the Federal Reserve System; author's calculations.

Note: The shaded areas indicate periods designated national recessions by the National Bureau of Economic Research.

^aExcludes software.

Chart 4 illustrates the performance of goods output relative to manufacturing production and consumer spending relative to private goods spending (spending on consumer and capital goods) during the periods around the last four recessions. In the cycles of the 1980s, 1990s, and early 2000s, there appears to be some association between the two series, at least just prior to and during each recession.⁹ The stronger performance of goods output in the most recent downturn, compared with 1990-91, occurred while the composition of spending on goods was shifting strongly toward consumer products and away from capital goods. In the early 1990s, movements in consumer spending were more similar to

those in capital spending and movements in goods output were more like those in manufacturing production. Accordingly, it appears that in periods around recessions, gains in goods output relative to manufacturing production may be connected to gains in consumer spending relative to capital spending.

Conclusion

Despite their apparent similarity, manufacturing production as an indicator of U.S. factory output is a different measure than goods output: the value-added associated with the sale of all goods in the nation. Using as a starting point the sharp divergence between manufacturing production and goods output in the 2001 recession, this study has explored the long-run and cyclical relationships between the indicators as well as two interrelated factors that have influenced the behavior of the measures.

Goods output has been growing relative to manufacturing production for many years. We attribute the growth in part to the rising significance of imported goods as well as to increased service inputs to the sale of all goods, whether manufactured in domestic or foreign plants.

The two indicators have also been affected by the relationship between spending on capital goods and on consumer goods. Compared with capital goods, consumer goods appear to require a larger share of post-factory production service inputs to bring to market. Recessions generally result in much larger declines in spending on capital goods—and in manufacturing production of these goods—than on consumer goods, and goods output typically is more stable than manufacturing production in cyclical downturns.

In 2000-01, there was a major decline in spending on capital goods (Table 3). By contrast, household demand for consumer goods continued to rise during the period. As spending on consumer goods continued to increase, the output of the millions of Americans employed in merchandising services—the design, finance, marketing, and transportation of consumer goods, both domestically produced and imported—would have held firm in 2000-01. This output, by workers in the service-producing sector, is included in the goods output component of GDP, but not in the manufacturing production component of industrial production. Taken together, these two developments help explain why goods output was considerably stronger than manufacturing production during the most recent recession and why the indicators moved in opposite directions.

By comparison, the 1990-91 downturn saw unusual weakness in consumer spending on goods as well as sluggishness in the output of the nonmanufacturing sectors

involved in the sale of these goods.¹⁰ Declines in production associated with flagging consumer demand are more likely to result in weakness in goods output than are comparable declines in capital goods production. This sluggishness in goods output helps account for the similarity of the two series' movements in the 1990-91 recession and in the early stage of the subsequent recovery.

The differences between the two most recent downturns suggest that the relationship between the overall economy and these two key indicators of economic activity can fluctuate, reflecting changes in the nature of demand and in the corresponding magnitude of the inputs outside the factory gates used to produce goods. Accordingly, while goods production is a crucial part of the economy, much of this output takes place outside the factory gates. Researchers who analyze only the manufacturing production data therefore have a limited view of the overall goods production process.

Notes

1. The industrial production measure is issued by the Board of Governors of the Federal Reserve System; the GDP measure is released by the U.S. Commerce Department's Bureau of Economic Analysis. Note that this study does not incorporate the July 30, 2004, revisions to the GDP data.
2. For instance, the strength of homebuilding, a part of GDP but not of manufacturing production, helps explain why GDP has been stronger than manufacturing output over the past few years and why the 2001 recession had a fairly small effect on GDP. Nordhaus (2002) and Kliesen (2003) discuss the broad contours of the 2001 recession and how the downturn compares with others.
3. Here, the sales of the sector include the change in factory inventories. The concept of industrial production is discussed fully in Board of Governors of the Federal Reserve System (1986).
4. In many instances, as the label states, the fabric is made in the United States and shipped to a foreign plant for sewing.
5. For Hatzius (2004), the divergence suggests a marked overstatement of GDP.
6. The author thanks Carol Corrado and Kristen Hamden of the Board of Governors of the Federal Reserve System for data on the aggregate production of factories and mines. Note that these adjustments do not make the two aggregates completely comparable. For instance, the adjusted manufacturing measure still includes production of construction materials, which are inputs to the structures output component of GDP.

7. By contrast, an exported good may or may not require more U.S.-produced services to sell it than an identical item produced and sold domestically.

8. Of course, retailing is not the only service-producing industry involved in the production, distribution, and sale of consumer goods. For instance, there are major contributions from advertising and finance. In principle, the growth of retail output relative to consumer spending on goods may simply reflect declines in these other service inputs, as opposed to a decrease in the fraction of sales revenue accruing to domestic and foreign manufacturers of consumer goods. However, the receipts of advertising agencies in the 1990s kept pace with consumer spending on goods (U.S. Census Bureau 2003), and the growth of the nominal output of financial corporations has been markedly faster. It would be surprising if there were a sizable drop in demand by retailers for advertising and financial services relative to their sales. Thus, the fast growth of retail output relative to consumer spending may well indicate a rise in the general importance of services in the sale of consumer goods.

9. Some very preliminary econometric results, available from the author at <charles.steindel@ny.frb.org>, suggest that a shift in spending from capital goods to consumer goods is associated with an increase in goods output relative to manufacturing production. However, the size and standard error of the estimated elasticity are sensitive to the specification. A more thorough analysis—taking into account more of the details of changes in demand and perhaps separating long- and short-term trends—would test more effectively some of the propositions advanced in this article.

10. Blanchard (1993) notes the unusual patterns of the 1990-91 recession.

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