

## The Drag of Energy and Manufacturing on Productivity Growth

By Willem Van Zandweghe

*Labor productivity has been surprisingly weak recently. One reason for the weakness is that the changing industry mix, from manufacturing and energy toward the production of services, has slowed overall productivity growth. A counterfactual exercise suggests the decline in manufacturing over the year from mid-2014 has subtracted about 0.25 percentage point from productivity growth, while the retreat of energy activity has subtracted about 0.5 percentage point.*

Over the last year and a half, the strong dollar and low price of oil have dampened activity in the highly productive manufacturing and energy-producing industries, while cheaper imports and gasoline have supported consumer spending growth in the less productive services industries. At the same time, aggregate productivity growth, which forecasters expected to accelerate as capital spending strengthened during the economic recovery, has slowed further from its already tepid pace. Output per hour in the business sector increased about 0.25 percent on average in 2014 and 2015, down from an average annual growth rate of about 0.75 percent in 2012 and 2013.

**Table 1: Relative productivity levels**

Manufacturing	Mining	Private services
1.10	2.59	0.97

Note: numbers give the ratio of the average level of real value added per hour in each industry to the average level of real value added per hour in the private sector for the period from 2006:Q2 to 2015:Q3.

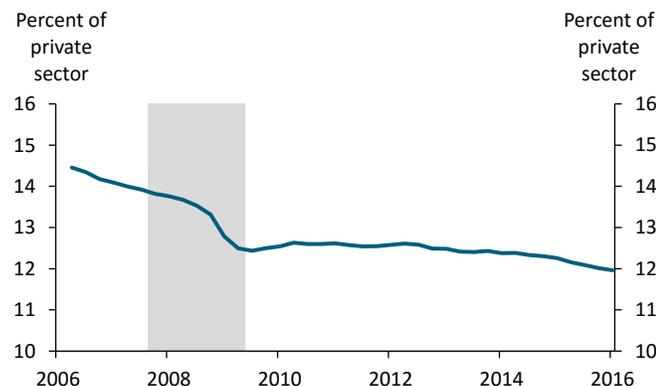
Sources: Bureau of Economic Analysis, Bureau of Labor Statistics, and Haver Analytics.

Mining—which consists largely of oil and gas production—and manufacturing are capital-intensive and therefore productive activities. Table 1 shows the level of labor productivity in the mining and manufacturing industries relative to the level of labor productivity in the private sector as a whole. Productivity in manufacturing exceeds average productivity in the private sector by about 10 percent, while productivity in

mining is about two and a half times higher than the average. In contrast, productivity in the private services-producing industry is slightly lower than in the overall private sector.<sup>1</sup> Thus, a significant shift in economic activity from mining and manufacturing to services is likely to dampen aggregate productivity growth for some time.

To better assess whether economic activity has shifted meaningfully since mid-2014, I examine how the share of hours worked in each industry has evolved. To see why hours worked is the relevant measure of industry activity, first note that real value added in the private sector consists of the sum of the real value added in its various industries.<sup>2</sup> Then, since real value added in

**Chart 1: Share of hours worked in manufacturing**



Note: Gray bar denotes NBER-defined recession.

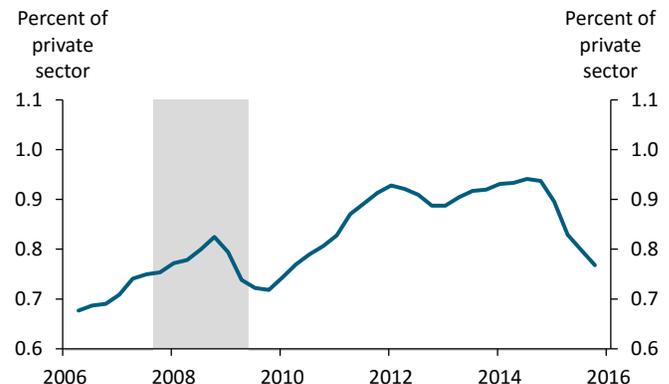
Sources: Bureau of Labor Statistics and Haver Analytics.

each industry is the product of hours worked and real value added per hour (productivity) in the industry, it follows that aggregate productivity is the average of industry productivity levels weighted by their share of total hours worked.<sup>3</sup> Thus, I can measure shifts in activity across industries by the changes in their shares of hours worked.

The shares of hours worked in manufacturing and mining have declined in the last year and a half. Chart 1 shows hours worked in manufacturing as a percentage of hours worked in the private sector. The share of hours worked in manufacturing has steadily trended down in the three decades leading up to the Great Recession. After stabilizing during the recovery, manufacturing's share of hours has once again declined by a modest 0.24 percentage point from 2014:Q3 to 2015:Q3. The mining industry has faced a more dramatic decline in hours worked. In a reversal of the post-recession boom, mining employment dropped from its peak of 904,000 in September 2014 to 720,000 in March 2016. As a result, the share of hours worked in mining fell 0.14 percentage point from 2014:Q3 to 2015:Q3 (Chart 2). In contrast, the share of hours worked in services has recently increased. Chart 3 shows services' share of hours has been relatively stable since the recession but has edged up 0.14 percentage point from 2014:Q3 to 2015:Q3.

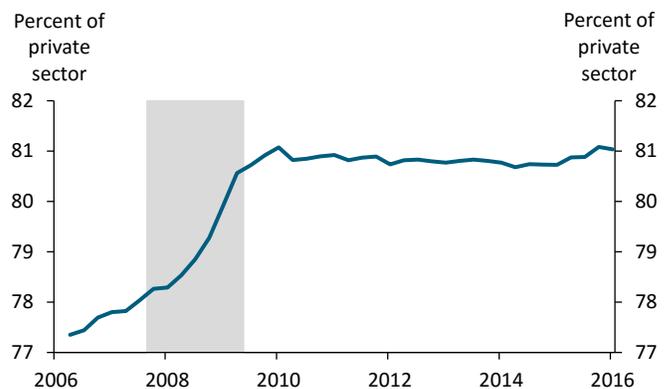
The relative decline of manufacturing and mining may have contributed substantially to the recent slow pace of productivity growth. Manufacturing's contribution to overall productivity growth from 2014:Q3 to 2015:Q3 was negative (-0.14 percentage point), while mining's contribution remained essentially unchanged (-0.02 percentage point) as the decline in the share of hours worked was offset by an outsized increase in mining productivity (16.3 percent).<sup>4</sup> To estimate the drag on aggregate productivity, I perform a counterfactual exercise. If the shares of hours worked in manufacturing and mining in 2015:Q3 had remained at their 2014:Q3 levels, the contributions of manufacturing and mining to overall productivity growth would have been 0.13 percentage point and 0.45 percentage point, respectively. Thus, the shift away from manufacturing has dragged down aggregate productivity growth by 0.27 percentage point (the difference between the actual contribution of -0.14 percentage point and the counterfactual of 0.13 percentage point), and the shift away from mining has dragged down growth by an even larger 0.47 percentage point. Moreover,

**Chart 2: Share of hours worked in mining**



Note: Gray bar denotes NBER-defined recession.  
Sources: Bureau of Labor Statistics and Haver Analytics.

**Chart 3: Share of hours worked in services**



Note: Gray bar denotes NBER-defined recession.  
Sources: Bureau of Labor Statistics and Haver Analytics.

accounting for the increase in services activity would increase the estimated drag on productivity, as productivity in the services industry has edged down since mid-2014.

In sum, a conservative estimate puts the negative effects of the recent declines in manufacturing and mining activity on overall productivity growth at about 0.25 percentage point and 0.5 percentage point, respectively. Not only do manufacturing and mining have high productivity levels compared with the services industry, they historically also have higher rates of productivity growth (hence the higher levels). Thus, even if the industry mix stabilizes, the relative rise of services and relative declines of manufacturing and mining are likely to have a persistent negative effect on productivity growth going forward.

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<sup>1</sup> The analysis takes the private sector as the aggregate unit because it allows breaking out the services sector. The private sector consists of the business sector, nonprofits, and private households. Productivity growth in the private sector has been even weaker than in the business sector.

<sup>2</sup> Real value added of industries does not add up exactly to real GDP in the national accounts due to the use of chain-weighted price indexes, but the deviation is small. The difference between the top line GDP and the sum of the most detailed lines is only 0.59 percent on average from 2005:Q1 to 2015:Q3.

<sup>3</sup> Using  $P$  to denote productivity and  $L$  to denote hours, I can write:

$$P = \frac{L_1}{L} P_1 + \frac{L_2}{L} P_2 + \dots + \frac{L_N}{L} P_N,$$

where the subscripts denote industries 1, 2, ...,  $N$ .

<sup>4</sup> To compute the contribution of each industry to productivity growth, I convert the formula in footnote 3 to growth rates as follows:

$$\frac{P_t - P_{t-1}}{P_{t-1}} = \frac{(l_{1t} P_{1t} - l_{1,t-1} P_{1,t-1})}{P_{t-1}} + \dots + \frac{(l_{Nt} P_{Nt} - l_{N,t-1} P_{N,t-1})}{P_{t-1}},$$

where  $l_{it} = L_{it}/L_t$  is the share of hours worked in industry  $i = 1, \dots, N$ .

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