The Statistics Corner: The GDP Revisions and Understanding Sluggish Productivity Growth

By Martin Fleming*

FROM THE PERSPECTIVE of early 1996, the recent revisions to both the National Income and Product Account (NIPA) methodology and the Gross Domestic Product (GDP) data have left the economics profession in a state of suspended animation. With the method of calculating GDP so fundamentally revised and every macroeconomic data point restated, every macro relationship must be reestimated. Surely this is a once-in-a-generation if not once-in-a-life-time change.

It is very unusual in this era of antigovernment rhetoric and emotion to have a government agency, BEA, being the driving force for change in the economy and the economics profession. One could certainly observe that, to date, BEA has been less than completely successful in persuading the profession of the need for change, motivating economists to anticipate change in data analysis and model construction, and in conveying the merits of the change to the journalists who cover economics. Barring some sort of yet untried marketing device, overcoming professional inertia among economists has surely got to be one of the most difficult assignments anyone can undertake.

NEED FOR IMPROVED DATA SOURCES

While creating change in organizations and professions is very difficult but very important, in the era in which we live, it is not the only problem BEA faces. While the new chain-weighted methodology is appropriate and useful for analyzing activity in today's global economy, it does rely on existing data sources. The revised methodology is, on balance, an improvement but it does not eliminate the need for increased expenditure for additional and improved data sources.

For instance, a substantial number of medium and large size corporations are making massive expenditures on corporate-wide, networked information systems for financial, marketing, manufacturing and human resources purposes. Such expenditures involve roughly equal doses of consulting, programming and systems development time, i.e., labor, and hardware and software purchases. The construction of such systems are just as surely capital expenditures as the purchase of a new piece of machinery or equipment was fifty years ago. Such expenditures are only partly captured in the GDP data, and the revisions do nothing to alter this omission.[1] In addition, there remain substantial shortcomings in the coverage and timeliness of the source data for expenditures by consumers for financial services and healthcare as well as expenditures by state and local governments. All of these source data problems have seriously hampered our ability to forecast future economic activity. (See Fleming, Jordan and Lang.)

Rectifying these source data problems is very expensive and, thus, presents much greater difficulty for BEA. By contrast, implementing the revised GDP methodology is much less expensive, although not free by any means. As a result, the revised methodology was implemented in conjunction with the scheduled base period revision from 1987 to 1992 in 1995.[2]

THE NEW METHODOLOGY

The case for the new methodology has been made clearly and has been available for some time for those who have the interest and the time to invest in gaining an understanding.[3] Without reviewing the details of the approach here, in essence, the methodology introduces two new concepts to GDP calculations.

First, the Fisher Ideal index is employed. This index is employed in response to the concern that buyers are substituting among commodities as a result of changing relative prices. Thus, in order to separate changes in spending that raise or lower standards of living from those that merely represent an alternative way of achieving the same standard of living, the old GDP calculation method was not appropriate. The Fisher Ideal index was selected because it has been

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[1] See footnotes at end of text.

shown to be among a class of index numbers that permit a very good approximation to an "exact" formula. It is also easy to compute and use. (See Triplett and Diewert.)

The chain-type annual-weighted quantity index is as follows:

$$Q_t = \sqrt{\frac{\Sigma P_b q_t}{\Sigma P_b q_b} \bullet \frac{\Sigma P_t q_t}{\Sigma P_t q_b}} \qquad (1)$$

where Q_t = Fisher Ideal Quantity Index
p = price
q = quantity
b = lagged base period
t = current period

It is important to bear in mind that p represents the price of the good or service when expenditures are being used to measure GDP. However, in calculations by industry or sector the p represent value-added per unit, which is the difference between the unit price and the cost of materials or purchased services per unit.

Second, each period the growth of each individual quantity of goods and services is weighted by that quantity's current and lagged share of nominal GDP. With the share lagged by just one year, in the case of annual data, and a centered one-year lag, in the case of quarterly estimates, the base period is constantly rolling forward. (See Prakken and Guirl) The old method employed a fixed base period that was applied to all periods and was updated periodically.

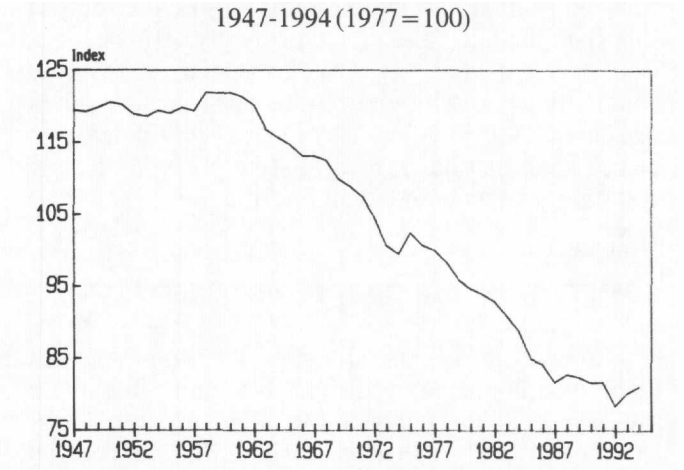
CHANGING RELATIVE PRICES

Therefore, one's view of the appropriateness of the new GDP methodology turns, in large part, on how important changing relative prices are as an economic phenomena. While economists often think of declining relative prices in terms of the declining prices of personal computers, it may well turn out that the phenomena of declining relative prices is more important than previously thought.

To understand the significance of the phenomena, beyond just a technology trend limited to PCs, is to understand the trend in relative prices in the manufacturing sector. The attached figure shows that, beginning in late 1950s, relative prices of goods produced by the manufacturing sector began to decline. With only infrequent interruption, relative prices of manufactured goods have declined steadily over the past forty years. Depending upon how important one believes the manufacturing sector is to the overall economy, one is more or less concerned about the downward trend in relative prices. While the manufacturing sector accounts for only about 20 percent of overall GDP, it purchases goods and services from many other sectors, such as transportation, communications and utilities, retail trade, wholesale distribution, financial services and other business services. Some estimates place the total direct and indirect impact of the manufacturing sector on the economy as high as 50 percent. There is also reason to believe that, as the sector has reduced its demand for labor in recent years, its impact has been even greater.

U.S. Manufacturing Relative Prices

1947-1994 (1977 = 100)



If in fact this trend is real, its causes are not well understood. Economists often cite advances in technology as the most important cause of the problem. However, like all little understood phenomena, the causes are undoubtedly much more complex. The tremendous advances in technology that have occurred over the past several decades have clearly had a very substantial impact on economic activity.

1. They have permitted most markets to become global in nature. Not only in terms of transportation and communications but also in terms of the wide and rapid spread of business know-how.
2. Not just globally but also in the U.S. economy, technology and business know-how have spread rapidly, thus permitting business opportunities to emerge in all corners of the nation.
3. The spread of technology and business know-how has made the accumulation and use of knowledge a much more important resource in economic activity in contrast to a previous era, when physical strength and capital equipment were the keys to success.

To the extent that economists have thought of issues related to technological change and their impact on macro trends, they have thought of these forces as causes of change in the demand for goods and services. These changes in demand, in turn, have caused a shift in the demand for labor such that more skilled and educated workers are now in greater demand and those without such skills are suffering from a decline in demand for their skills.

The problem with this analysis is that relative prices have continued to decline while the share of manufactured goods in real spending has remained

unchanged or increased slightly. (See Lawrence and Slaughter, p. 207.) Such a shift is suggestive of a shift in supply, as opposed to a shift in demand. After a shift in supply, the increase in the quantity demanded may well appear as if it is an increase in demand, but it is only the adjustment of the market in response to the falling price.

Thus, advances in technology have permitted a very substantial and increasingly rapid expansion of supply in the U.S. and global economy. This expansion in supply has, in turn, created a much more competitive economic environment than at any point in the past. (See Fleming 1996.) It is the increase in competition that has forced relative prices to decline and thus for value added and productivity growth to slow.

COMPETITION HAS COSTS AND BENEFITS

Competition is generally viewed by economists as being unambiguously positive. It is quite frequently prescribed as the cure-all for economic problems. However, what is often overlooked is that competition has both costs and benefits. For every buyer who wins by paying a lower price and capturing more value, there are producers and workers who are receiving lower prices for their goods and losing value-added that could have been distributed among stakeholders.

1. While increased competition will certainly increase overall economic welfare, the question arises as to what the resulting distribution will be and if it is in the long-term interest of the economy.
2. In addition, economists have typically thought of increases in competition on a market-by-market basis. While increasing the competitiveness and efficiency in one market, e.g., the telecommunications or airline market, may be beneficial to the economy as a whole, it is not clear that the same can be said when the level of competition increases on an economy-wide basis. While general equilibrium analysis can show that an economy-wide increase in competition will improve the resulting equilibrium, one must be careful to distinguish between an increase in welfare versus growth in income, wealth and employment.
3. When the response to competition by managers and owners has often been a cost reduction and downsizing/layoff strategy, one can question whether there is an alternative or complementary approach that attempts to enhance each firm's competitive position in the marketplace as opposed to becoming engaged in a race between relative prices and costs to determine which can be reduced faster.

In a competitive environment, economic analysis assumes that workers will earn the value of their marginal product and, thus, increases in productivity will be reflected in increasing wages. However, when it is assumed that competitive forces create a tendency for wages to equal the value of the marginal product of labor, this analysis often overlooks the possibility of changing relative prices.

Equation (2) shows the sources of change in the marginal value product of labor. If one assumes a perfectly competitive market, then there will be a sufficiently large number of buyers and sellers so that no one individual can impact the outcome of the market. Thus, if one seller adds more labor and thus more output is placed on the market, prices will be unaffected. Therefore, the second term on the right hand side of equation (2) will go to zero. Under such circumstances, wages will tend toward the value of the marginal product of labor. However, in most markets such circumstances do not exist and adding labor can drive down the price of the product, everything else equal. While the world is clearly more complex than this model suggests, it is certainly possible to see rising productivity and falling prices with wages declining or failing to keep pace with changes in productivity.

$$w = \frac{\delta pq}{\delta L} = p\,\frac{\delta q}{\delta L} + q\,\frac{\delta p}{\delta L} \qquad (2)$$

where
- w = wage
- p = value-added per unit
- q = quantity
- L = labor

If this line of thinking is correct, it is very possible to have divergent trends in units of output per worker and in relative prices. Thus, when productivity is measured on the macro level as value-added per worker, declining relative prices can act as an offset to the growth in physical output per worker.

PRODUCTIVITY – SLOWER OR NOT?

This perspective can assist in addressing some of the issues that have been raised with respect to the new method of calculating GDP. Various economists and other observers have questioned the validity of the data resulting from the new GDP calculation method. These questioners say that anecdotal evidence suggests that the typical company is making more money, using more advanced technology and employing fewer people. Therefore, data that suggest that productivity growth is now slower than previously thought is nonsensical. What did all those pink slips issued by the *Fortune* 1,000 accomplish?

There are a number of problems with such a view. However, part of our problem is a semantic one. For much of economic history, the trend in relative prices mattered little. So the trend in value-added and productivity could be thought of as synonymous. Now more precision is required. As shown in equation (3),

productivity is the number of units of physical output per unit of labor. Productivity can be measured in physical units or by appropriately deflating the nominal value of output. Value-added, by contrast, is the difference between revenue and the cost of materials and purchased services. As shown in equation (3), real value-added per worker is productivity times the real value-added per unit. This is a very important concept because it represents those funds, in real terms, that remain to be distributed among workers, managers, owners, lenders, governments and other stakeholders, after paying for outside purchases. In a period of declining relative prices, productivity gains can only go so far to boost the growth of value-added.

$$V_a = \frac{pq}{p_b L} \qquad (3)$$

where V_a = Real value-added per worker
p = value-added per unit
q = quantity
L = labor

CONCLUSION

While it is almost certainly true that downsizing was, and perhaps still is, necessary among *Fortune* 1,000 companies, we may now be learning that the race to reduce costs and employment levels is not the final solution to our nation's economic problems. Ultimately, the solution must involve creating and retaining more value in the marketplace with the level of cost and employment necessary to deliver that value.[4] There is much still to be learned in that process – the role of government, how labor and management can work together, what organizations must do to be more effective in the global market, and on and on.

To the extent that the GDP revision provides assistance in focusing on these goals, then BEA has made an important contribution to the process of helping the United States compete more effectively in the world economy. While there is a desperate need for more and better source data, the new GDP calculation may well be a small step in the right direction.

FOOTNOTES

[1] It is difficult to predict, *a priori*, whether such a change would have a positive or negative effect on productivity. However, one suspects the effect would be positive as expenditures that are viewed as for the purchase of service will become investment spending and thus funded from value-added. Such a change could raise both the level and rate of growth of productivity.

[2] A similar observation can be made with respect to the implementation of the United Nations System of National Accounts. On balance, the increased compatibility with data from other nations and the increased sophistication in the use of balance sheet concepts are improvements. But the data are ultimately limited by the availability of source data.

[3] In Allan Young's 1992 paper, he outlines the method and presents the advantages in a very few pages – 32 through 36 – of a much longer article on the revised methodology. More details on the methodology are presented in Allan Young's 1993 paper and in Prakken and Guirl.

[4] It is of significance to note that equations (1), (2) and (3) all involve the measurement and use of value-added. In a competitive world, income and wealth can only be increased if additional value is created and retained by producers.

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