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Productivity and National Standards of Living

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Productivity and National Standards of Living

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Summary

Among the goals of economic policy is a rising standard of living, and it is generally understood that the means to that end is rising productivity. Productivity relates the quantity of goods and services produced, and the income generated as a result of that production, to the amount of labor (e.g., hours worked or number of workers) required to produce it. The most commonly used measure of the living standard of a nation, is simply the ratio of that income to the total population, without regard to how the income is actually distributed. If a relatively small share of a nation's population works, there will be a large difference between the level of productivity and that measure of the national standard of living.

Productivity varies over time, and it varies across countries as well. The link between productivity and living standards is not a direct one, therefore countries with a high level of productivity may not necessarily have the highest standard of living. Gross domestic product (GDP) per capita can rise in the absence of an increase in productivity if (1) employees increase the number of hours they work (hours per employee); (2) the share of the labor force that is employed rises (i.e., the unemployment rate drops); or (3) the share of the population that is in the labor force rises (presuming that the share of any new jobseekers who get jobs is at least as large as the share of those already in the labor force who have jobs).

A large labor contribution can offset low productivity to raise a nation's standard of living. Korea, for example has the second-lowest GDP per hour, but because its workers work more hours than in any other country shown here, its per capita GDP is not as close to the bottom of the ranking. The United States has the second highest per capita GDP after Norway. The United States is also second to Norway in terms of productivity. France and Germany have relatively high levels of productivity, but because they both have relatively low employment (and high unemployment rates), and in France's case a relatively small share of the population in the labor force, they fall to the middle with respect to per capita GDP.

There is little question that rising productivity is the single most important factor behind rising living standards, but the proportion of a nation's population that is working is also important. The larger that proportion is, the more goods and services there are to go around. The share of the population that is working is only partly subject to the influence of policymakers. The size of the labor force is largely a function of demographic factors, but the share of that labor force that is employed can vary with short-term economic conditions, as well as policies that affect the cost of labor.

This report will not be updated.

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Productivity varies over time, and it also varies across countries. The link between productivity and living standards is not a direct one, therefore countries with a high level of productivity may not necessarily have the highest standard of living. This report examines the link between productivity and living standards. It does not address the distribution of either economic well-being or the gains from productivity, but simply looks at averages.

From Productivity to the Standard of Living

The standard measure of the production of goods and services for a nation is gross domestic product (GDP). GDP measures the total value of goods and services produced within a nation's borders. Productivity is a measure of how much work is required to produce it. The most basic unit of labor is the hour, thus productivity can be measured as GDP divided by the total number of hours worked. Productivity may also be measured as the average contribution of each employee to total production, or simply GDP divided by employment.

The broadest measure of the living standard of a nation is GDP divided by the total population. Per capita GDP says nothing about how those national resources are distributed.[1] But the proceeds from productivity gains are shared and do not accrue solely to workers and the owners of capital. Much of the sharing is simply done within individual households, but may also come about through policies that redistribute income, or by public sector investments that benefit everyone. Per capita GDP is probably the best single statistical measure of national living standards, and is especially useful for comparisons as it is available for a large number of countries.

To show how per capita GDP and productivity are related, per capita GDP can be expressed as the product of ratios reflecting the relationship between the overall population and the amount of work done. Per capita GDP obviously depends on the level of GDP and the population, but the relationship can be decomposed in a way that may shed some further light. The following equation shows the decomposition of GDP.The equation shows that per capita GDP can be expressed as the product of four ratios: GDP divided by labor hours, which is labor productivity; labor hours per employee; the share of the labor force that is employed, and the size of labor force relative to the overall population.[2]

[1] It is also limited in that, for the most part, it only counts those items for which there is a value defined in a market, and does not take into account some activities that have economic value, leisure time for example.

[2] GDP is a measure or the dollar value of production in a given year, and so hours in this case refers to the number of (continued...)

$$\frac{GDP}{population} = \frac{GDP}{hours} \times \frac{hours}{employees} \times \frac{employees}{labor\ force} \times \frac{labor\ force}{population}$$

The equation shows what factors contribute to per capita GDP. First, per capita GDP depends, in part, on the level of productivity (GDP divided by hours).[3] An increase in productivity, other things being equal, will raise the average standard of living. That much is widely understood. As the equation shows, however, per capita GDP may change for reasons entirely unrelated to productivity.

From a purely arithmetical standpoint, it would appear that neither hours, the number of employees, nor the size of the labor force could have any effect on per capita GDP. Suppose, for example, the number of hours worked increased, while the other variables remained unchanged. In that case, the hours-to-employees ratio would rise, but it would be offset by a decline in the GDP-to-hours ratio, leaving per capita GDP unchanged.

But while the equation allows for an accounting of the factors that separate productivity from per capita GDP, it does not make clear that the variables themselves are interdependent. For example, it is unlikely that an increase in hours worked would have no effect on GDP. Only if the increase in hours worked yielded no additional production of goods and services, would the increase in hours not raise per capita GDP.

Similarly, an increase in the number of employees would raise the employment-to-labor force ratio while causing the hours-to-employees ratio to fall. It is unlikely, however, that employment would rise without a corresponding increase in the number of hours worked.

Finally, an increase in the labor force by itself, other things being equal, would have no direct effect on per capita GDP because it would lead to both an increase in the labor force-to-population ratio and a decline the ratio of employment to the labor force. But that would only hold true if all of any increase in the labor force remained unemployed.

GDP per capita can rise in the absence of an increase in productivity if (1) employees increase the number of hours they work (hours per employee); (2) the share of the labor force that is employed rises (i.e., the unemployment rate drops); or (3) the share of the population that is in the labor force rises (presuming that the share of any new jobseekers who get jobs is at least as large as the share of those already in the labor force who have jobs).

This breakdown also illustrates a weakness in using GDP per capita as a measure of living standards. Leisure has a value, as does unpaid work done in the home, but those values are not included in the measure of GDP. Thus, an increase in GDP brought about by an increase in work may overstate the true increase in economic well-being, since it requires the sacrifice of leisure.

What is the relationship between GDP and the labor that produces it? Economic theory provides some basis for answering that question. Labor is generally assumed to have the characteristic that, in the short run, each additional employee contributes a smaller amount of production than did the

(...continued)

hours worked in the course of a year.

[3] For more on productivity, see CRS Report RL32456, *Productivity: Will the Faster Growth Rate Continue?*, by Brian W. Cashell.

one hired just before. In other words, among those seeking work the ones who are relatively more productive tend to be hired first. This is referred to as diminishing marginal product of labor.[4] If that is true, then with reference to the equation above, increases in employment may generate proportional increases in hours, but they might not lead to proportional increases in GDP. In other words, each new worker tends to bring down the average productivity of labor.

That is not to say that increases in employment over time will tend to reduce average labor productivity. Rather, it says that, other things being equal, a higher ratio of employment to the labor force is likely to mean a lower ratio of GDP to hours, or a lower average level of labor productivity. Over longer periods of time, growth in the stock of physical capital, a more educated labor force, and technological progress will all contribute to gains in productivity. But, comparing two otherwise identical economies at a given point in time, the one with a larger share of its labor force employed will likely have lower average productivity.

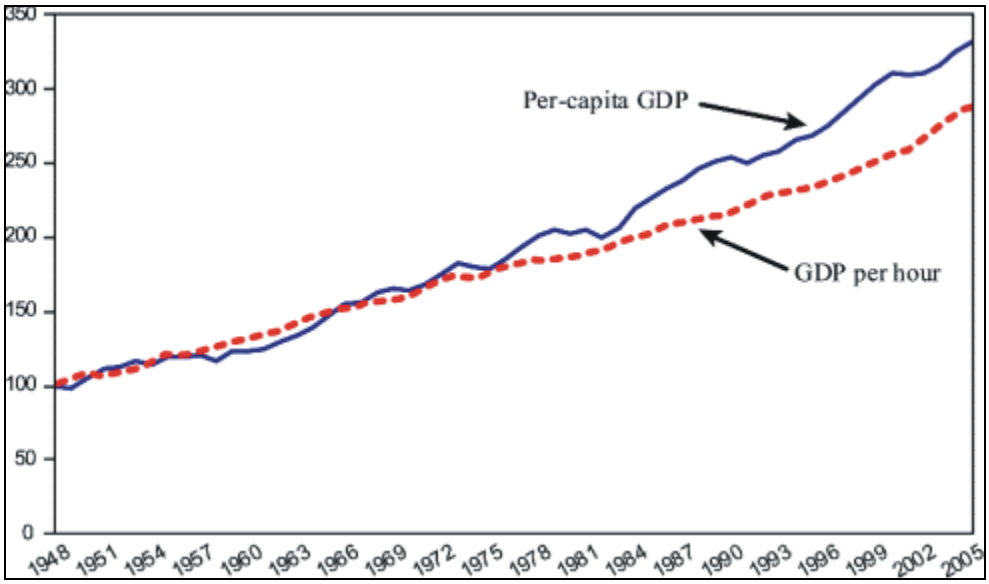
It is less clear whether there is a similar relationship between hours worked and the level of productivity. Individual worker productivity is generally presumed to be determined by education, training, experience, and the quantity of capital available. Further, most workers contribute roughly the same number of hours so that, at least in the short run, an increase in hours is unlikely to happen without an increase in employment. Unless the productivity of individuals is significantly affected by the number of hours they work, an increase in hours might be expected to result in a roughly proportionate increase in GDP.

The share of the population that is in the labor force is not likely to affect productivity directly. But, other things being equal, it is an important factor in the level of per capita GDP. Given two otherwise equivalent economies, the one with a higher percentage of its population in the labor force will also have a higher level of GDP, unless the additional members of the labor force are unemployed (a higher unemployment rate) or they contribute nothing to the production of goods and services. That would mean a higher per capita GDP as well.

Figure 1 shows how per capita real GDP and real GDP per hour in the United States have grown since 1948. The two series are shown as indexes set equal to 100 in 1948. From 1948 through the mid-1970s, the two measures grew at about the same rate. Since the mid-1970s, they have diverged. Given the equation presented above, the reason for that divergence must be an increase in either the number of hours worked per employee, a decline in the unemployment rate, or an increase in the proportion of the population in the labor force.

[4] This could also happen even if all workers were equally productive. With a fixed stock of capital, each additional hire would tend to reduce the amount of capital available to each worker.

Figure 1. Per Capita GDP and Productivity



Source: Department of Commerce, Bureau of Economic Analysis.

Hours worked per employee cannot account for the divergence because they have been declining steadily since 1948. Between 1973 and 2006, the index of average weekly hours published by BLS fell by 7.5%. Neither can the share of the labor force employed be the reason for the divergence. The civilian unemployment rate in 1973 was 4.9% compared with 4.6% in 2006, hardly enough of a change to have made a difference. That leaves the share of the population in the labor force to examine.

The Bureau of Labor Statistics (BLS) bases its measure of the labor force on the non-institutional population aged 16 and older. From that population, the BLS measure of the labor force is the sum of those who are employed and those who are actively looking for work. Given that, the ratio of the labor force to the population was little changed between 1948 and 1975. In 1948, it was 59% and, in 1975, it was 61%. By 2006, however, it had risen to 66%. Two developments account for that increase. First was a substantial increase in the labor force participation rate of women. For men, there was a slight decline, from 78% to 73%, between 1975 and 2006. But for women, the share of the population in the labor force rose from 46% to 60%.

The second factor that caused the labor force to grow more rapidly than the population was the aging of the baby-boom generation. The baby-boom generation is generally considered to include those who were born between 1946 and 1964. This cohort began entering the labor force in 1962 and was all in by 1980.

Most economists agree that, since World War II, the U.S. economy has experienced several shifts in the long-run rate of productivity growth. The particular reasons for all of those shifts are not entirely clear, but the data show that beginning in about 1973, productivity growth slowed significantly from its rate of growth up to that point. Then in 1995, it appears to have accelerated. **Table 1** presents growth rates over those intervals for productivity, as well as for the other factors that enter the calculation of per capita GDP.

Table 1. Growth Rates for Selected Measures

	Annual Rate of Change (%)		
	1947 to 1973	**1973 to 1995**	**1995 to 2006**
Per capita real GDP	2.45	1.77	2.15
Real GDP per hour	2.30	1.33	2.07
Hours per employee	0.09	-0.27	-0.18
Employment / labor force	-0.04	-0.03	0.09
Labor force / population	0.09	0.74	0.16

Sources: Department of Commerce, Bureau of Economic Analysis; Department of Labor, Bureau of Labor Statistics.

These figures illustrate some interesting facts. First, it is clear that growth in per capita GDP fell after 1973. In part, that was due to the decline in productivity growth. The growth rate of real GDP per hour worked (productivity) fell by almost a full percentage point. Moreover, growth in the number of hours worked per employee also fell by almost 0.4 percentage point after 1973. But the declines in productivity and hours worked were not completely reflected in per capita real GDP. The growth rate of per capita real GDP only fell by about 0.7 percentage point. The reason was a big jump in the share of the total population in the labor force. Growth in that ratio jumped nearly 0.7 percentage point, offsetting some of the decline in growth or hours and productivity.

The data also show that, after 1995, productivity growth picked up again although not quite to the pre-1973 rate. There were also increases in the rates of growth of both hours worked per employee and the share of the population in the labor force. The increase in the growth rate of per capita GDP was only about half of the increase in the growth rate of productivity, however. The reason is that the growth rate of the share of the population in the labor force fell by nearly 0.6 percentage point. The reason for that drop is that the share of the population in the labor force stabilized after all the baby boomers were old enough to be counted as part of the labor force, and were no longer a factor pushing up the ratio.

The biggest reason for the discrepancy between per capita GDP growth and productivity growth has been changes in the share of the population in the labor force. Absent those changes, the data suggest that changes in productivity growth would have been fully reflected in the growth rate of per capita GDP.

But just as the entry of the baby-boom generation into the labor market caused per capita GDP to grow faster than productivity for a time, as the baby boomers age and exit the labor market there is likely to be an extended period where per capita GDP grows more slowly than productivity, as happened in the late 1950s and early 1960s. Actuaries at the Social Security Administration project that labor force growth will fall below population growth for much of the period between 2010 and 2035. The difference between the two is about 0.3 percentage point. The 2007 Social Security trustee's intermediate projection also assumes a productivity growth rate of 1.7%, suggesting that they expect the per capita GDP growth rate to be about 1.4%.[5]

[5] See the trustee's 2007 report at http://www.ssa.gov/OACT/TR/TR07/.

International Comparisons

Having established the connection between productivity and per capita GDP makes it possible to assess how the United States compares with other industrialized countries. Per capita GDP is the single most widely used measure to make international comparisons of living standards, but comparing GDP across countries is complicated because it is calculated in different currencies. Exchange rates resulting from trading in currency markets are not suitable for converting GDPs from various countries into a common unit of account. Those exchange rates are influenced by cross-country differences in prices, and they are also subject to the influence of changes in financial markets.

Exchange rates are greatly affected by international flows of financial capital. They may rise or fall because of speculation in a currency or because of changes in interest rates. For example, a rise in interest rates in one country will tend to draw in foreign capital. Foreign investors, however, must first buy that country's currency in order to buy financial assets denominated in that country's currency. That drives up the value of that country's currency without there having been any change in the price levels of goods and services either in that country or abroad.

Because of those complications, economists have devised a way of estimating an exchange rate that is based only on the differences in the prices of goods and services across countries. This is referred to as the purchasing power parity currency conversion rate (PPP). For example, if a liter of soda costs $2.00 in the United States and 2.30 euros in France, then the PPP conversion ratio for that particular item is 2.3/2, or 1.15. PPP ratios for entire economies are based on weighted averages reflecting all of the goods and services that add up to GDP. The price an American would have to pay for that soda would reflect not only the difference in price but also the relative values of the two currencies. The PPP allows cross-country comparisons of the prices paid by residents of a country for goods and services in that country. Estimates of GDP can thus be converted to a common unit of account, or currency, to allow comparisons of economic well being in different countries.

Table 2 presents data for 27 countries for which the Organisation for Economic Co-operation and Development (OECD) has published comparable figures.[6] The amounts have all been converted to U.S. dollars using OECD estimates of purchasing power parity exchange rates. The first column shows per capita GDP. The second column shows GDP per employee, which is a measure of the productivity of the working population. The third column shows GDP per hour worked. For each measure, the country's ranking is also given.

The United States has the second highest per capita GDP after Norway. Two measures of productivity are shown. Norway has the highest production per worker, and the United States is second. With respect to production per hour worked, however, the United States is sixth, after Norway, Belgium, the Netherlands, Ireland, and France. The figures show a considerable range across countries. Mexico has a per capita GDP that is just 22.5% of Norway's, and a GDP per hour that is 20.5% of Norway's.

[6] These data are taken from the OECD *Factbook 2007*.

High levels of productivity do not necessarily make for a correspondingly high national living standard. Even though France and Germany have a higher GDP per hour than the United States, their per capita GDPs are less than three-fourths of that of the United States.[7]

Table 2. Living Standards and Productivity, 2005

	Per Capita GDP		GDP Per Employee		GDP Per Hour	
	$U.S.	Rank	$U.S.	Rank	$U.S.	Rank
Australia	$34,483	7	$70,005	8	$40.47	13
Austria	34,398	8	68,777	11	41.53	10
Belgium	33,110	11	81,294	4	52.99	2
Canada	34,058	10	67,976	13	39.13	15
Czech Republic	20,634	23	44,409	24	22.18	25
Denmark	34,158	9	67,005	15	43.20	8
Finland	30,957	15	67,894	14	39.61	14
France	31,176	14	76,639	6	49.57	5
Germany	30,776	17	65,379	17	45.50	7
Greece	29,588	18	79,167	5	38.56	16
Hungary	17,488	25	45,747	23	22.94	23
Iceland	36,149	4	66,346	16	36.98	18
Ireland	39,022	3	82,585	3	50.42	4
Italy	28,284	19	73,715	7	40.93	12
Japan	30,844	16	61,997	20	34.93	20
Korea	22,098	22	46,692	22	19.84	26
Mexico	10,628	27	27,310	27	14.31	27
Netherlands	35,110	6	69,951	9	51.17	3
New Zealand	25,958	21	51,333	12	28.38	21
Norway	47,199	1	95,317	1	70.09	1
Portugal	19,862	24	41,186	25	24.44	22
Slovak Republic	15,983	26	38,855	26	22.34	24
Spain	27,400	20	62,672	19	35.43	19
Sweden	32,115	13	68,173	12	42.96	9
Switzerland	35,951	5	63,932	18	38.54	17
United Kingdom	32,986	12	68,875	10	41.19	11
United States	41,827	2	87,483	2	48.49	6

Source: Organisation for Economic Co-operation and Development.

[7] See Margarida Duarta and Diego Restuccia, "The Productivity of Nations," Federal Reserve Bank of Richmond *Economic Quarterly*, Summer 2006, pp. 195- 223.

Table 3 presents data showing how the share of a nation's population that contributes labor may influence its measured standard of living. A high per capita GDP may be the result of high productivity, or it can be the result of a large proportion of a nation's population working, or working a high number of hours.[8] A large labor contribution can offset low productivity to raise a nation's standard of living. Korea, for example has the second-lowest GDP per hour, but because its workers work more hours than in any other country shown here, its per capita GDP is not as close to the bottom of the ranking.

Iceland is another example. With respect to productivity it places in the bottom half of countries shown here, but because it employs a relatively large proportion of its population it ranks much higher with respect to per capita GDP. France and Germany, in contrast have relatively high levels of productivity as measured by GDP per hour, but because they both have relatively low employment (and high unemployment rates), and in France's case a relatively small share of the population in the labor force, they fall to the middle with respect to per capita GDP.

It may be in the case of countries like Germany and France, that there is a small trade-off between the national average level of productivity, and the proportion of the labor force that is employed. In those countries where labor costs are relatively high, perhaps because of relatively greater regulation of labor markets, some who might otherwise be hired are not because they are not productive enough to cover the costs of hiring them.

Table 3. Labor Contribution to Living Standards, 2005

Country	Average Hours Per Employee		Employees as a % of the Labor Force		Labor Force as a % of the Population	
	Hours	Rank	%	Rank	%	Rank
Australia	1730	14	94.9	13	51.9	11
Austria	1656	19	94.2	14	53.1	5
Belgium	1534	24	91.6	22	44.5	23
Canada	1737	13	93.2	16	53.7	3
Czech Republic	2002	3	92.0	20	50.5	13
Denmark	1551	22	95.2	9	53.6	4
Finland	1714	15	91.6	21	49.8	17
France	1546	23	90.1	25	45.1	22
Germany	1437	25	90.9	23	51.8	12
Greece	2053	2	89.6	26	41.7	24
Hungary	1994	4	92.7	17	41.2	26
Iceland	1794	9	97.4	1	55.9	2
Ireland	1638	20	95.6	6	49.4	18
Italy	1801	8	92.2	19	41.6	25
Japan	1775	10	95.6	7	52.1	9

[8] See Bart van Ark and Robert H. McGuckin, "International comparisons of labor productivity and per capita income," *Monthly Labor Review*, July 1999, pp. 33-41.

Country	Average Hours Per Employee		Employees as a % of the Labor Force		Labor Force as a % of the Population	
	Hours	Rank	%	Rank	%	Rank
Korea	2354	1	96.3	4	49.2	19
Mexico	1909	5	96.5	2	40.3	27
Netherlands	1367	26	95.0	11	52.8	6
New Zealand	1809	6	96.3	3	52.5	7
Norway	1360	27	95.4	8	51.9	10
Portugal	1685	16	92.3	18	52.2	8
Slovak Republic	1739	12	83.8	27	49.1	20
Spain	1769	11	90.8	24	48.1	21
Sweden	1587	21	94.2	15	50.0	16
Switzerland	1659	18	95.7	5	58.8	1
United Kingdom	1672	17	95.2	10	50.3	15
United States	1804	7	94.9	12	50.4	14

Source: Organisation for Economic Co-operation and Development.

Conclusion

Per capita income may be one of the most widely cited measures of national standards of living, but it is limited in that it says nothing about how income is distributed. Nonetheless, there is little question that rising productivity is the single most important factor behind rising living standards, but the proportion of a nation's population that is working is also important. The larger that proportion is, the more goods and services there are to go around. The share of the population that is working is only partly subject to the influence of policymakers. The size of the labor force is largely a function of demographic factors, but the share of that labor force that is employed can vary with short-term economic conditions, as well as policies that affect the cost of labor.

It may also be the case that one nation's average level of productivity is lower than another's because it employs a larger share of its less skilled and less productive workers. But even if those workers are relatively less productive, the goods and services they produce represent an addition to the nation's living standard. Higher productivity is not the only way to raise living standards. High levels of labor force participation and employment are also important.

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