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Great and Almost-Great Magnitudes in Economics

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When writing about his experiences on the Manhattan Project, Stan Ulam (1976, pp. 147–148) describes how, "if one gets a feeling for no more than a dozen... radiation and nuclear constants, one can imagine the subatomic world almost tangibly, and manipulate the picture dimensionally and qualitatively, before calculating more precise relationships."

Along similar lines, Lawrence Klein (1962) writes about the importance of the "five great ratios in economics." Klein notes that "these ratios constitute a system of equations that might serve to explain trend growth for an economy," and he proceeds to build just such a model. He adds (p. 183), "The constancy or stability of the ratios is not absolute; they do fluctuate, especially over the trade cycle. Therefore, they are most useful in a growth model and not in a business-cycle model."

Again similarly, anyone who had the good fortune to hear Simon Kuznets discuss an economic question, or to watch him examine a page of data, is likely to remember him calling from memory one or more basic parameters, and then manipulating the parameters to check the reasonableness of some theoretical or empirical assertion.

Which ratios and key magnitudes should an educated economist know? An inevitably personal selection is offered below. (Klein's list included 1, 2, 3, and 8 below, and the "capital-labor ratio.") The list is presented in the form of a quiz to liven up the exercise of pondering them, and therefore a question mark follows each title. For those of you whose eyes share with mine the sinful propensity of straying to the "answer" before you have formulated your own, the ratios are partially concealed in paragraphs of explanation.

A more extended discussion would treat the inclusion of each item, and would address deep and interesting questions about the nature and change in each number.

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A Kuznets might have at his fingertips the knowledge necessary for such a discussion, but prudence should keep us lesser mortals from even thinking about the job.

This much is clear: Many of these magnitudes become mushier as one ponders them more, for both conceptual and measurement reasons. Therefore, when using such magnitudes for back-of-the-envelope approximations, it is advisable to approach the estimate along two or more paths to see if they converge. On the other hand, for most approximations the magnitudes need not be exact; in my experience, approximations would not be less helpful even if one of the magnitudes is off by 25 percent in either direction or, in many cases, even if the range is within half or double the number fixed upon.

As much as possible, the sources of the data are easily available standard references, especially the 1989 Statistical Abstract of the United States (SAUS), the 1989 Economic Report of the President (ERP), and the Historical Statistics of the United States; HSUS is the fount for additional background. Units are omitted if they are obvious.

1. The ratio of savings (personal and total) to income?

The ratio of gross saving to national income in 1987 was \$560.4/\$3678.7 = .15, whereas it was \$91.4/\$473.3 = .19 when Klein wrote in 1962. The ratio of gross investment to national income is similar (ERP, Tables B-23, B-28). The measurement of savings is fraught with difficulty. The ratio of gross saving to national income seems less stable recently. The government deficit derives a big wedge between private saving and total saving. And because saving in the form of investment in education has increased, long run comparisons of monetary saving ratios have become less meaningful (SAUS, Tables 695, 696). One might generalize that magnitudes which embody valuations are subject to extreme changes in meaning over long periods of time. Also, methods of measuring savings vary considerably from economy to economy, making comparisons between, say, the Japanese and the U.S. savings/income ratio a treacherous endeavor.

2. Labor's share of output?

Whether there are "laws of production" governing the shares of output that flow to labor and capital has long been a subject of controversy. In the first edition of his *Economics*, Paul Samuelson (1948) could show labor's share to be 65 percent (it was .645 in 1950). Harking back to Paul Douglas in 1919, he wrote, "It is rather remarkable how nearly constant are the proportions of the various categories over long periods of time.... [T]otal wages seem always to add up to about two-thirds of the total." But as of 1987, labor's share in the United States is \$2683.4/\$3678.7 = .73 (ERP, p. 334; SAUS, Tables 691, 692).[1]

[1]The definition of labor income used here is the same as that used in Samuelson. It includes the government sector and does not count any of proprietors' income in wages and salaries. The ratio in the private sector alone is a bit higher, .75 versus .73 in 1985. Also, the contributions of labor and capital in production are not discussed separately in this list. The main reason is to avoid argument about whether an aggregate production function is meaningful. In theory, at least, the distributive shares will be equal to the inputs to production.

3. The capital-output ratio?

The ratio of the net value of the nonresidential fixed tangible reproducible capital stock of private business to total compensation of employees less wages and salaries of government employees in 1985 was ($7232 − $3433)/($2368 − $372) = 1.9. These figures are from the 1987 SAUS, Tables 708, 754; later editions give only gross data. Using gross data yields a ratio of 2.8 for the same year (1989 SAUS, Table 744).

Using GNP as his denominator, Raymond Goldsmith (1985, p. 42) finds no trend in the U.S. capital-output ratio back to 1875.[2] However, he finds relatively great variation among nations—a range from 1.31 for Mexico and 1.44 for France to 3.31 for Great Britain, with the U.S. at 1.73, in approximately 1978 (all presumably akin to net data). Goldsmith also provides an excellent discussion of problems encountered in trying to construct meaningful capital-output ratios. A crucial problem is that "capital" has traditionally meant physical capital, but human capital calls out to be included in any discussion of the subject.

The capital-output ratio may be useful for short-run analyses such as the change in output to be expected from an increment of investment, or the increment of investment necessary for a given increase in employment. However, I have argued elsewhere (Simon, 1986, Appendix 1) that the concept is not meaningful in a long-run context, because in the long run the value of capital is a function of the price of output which in turn is a function of productivity (just as the value of a piece of farmland is determined by the value of the output from that land), and hence the value of aggregate capital has no independent life of its own.[3]

Milton Friedman suggests (undated 1989 note) that the net wealth/income ratio is more meaningful than the capital/output ratio. But the latter refers to the production process as the former does not.

4. Ratio of the value of output of agricultural land to its market price?

In long-settled agricultural areas, the price of land is clearly not a function of the cost of developing "found" land into productive acreage, though it is affected somewhat by recent investments in the quality of the land. Rather, the price of land is mainly a "rent" whose value depends on the value of the output from that land. Colin Clark (1957) showed that the ratio has been remarkably similar—between 3 and 4—across the world and throughout history. This ratio predicted the fall in farmland prices in the U.S. in the 1980s, in the sense that the ratio rose far beyond the historical range in the 1960s and 1970s.

5. The "real" riskless rate of interest in various eras?

This ratio is less observable than others in the list because no loan is wholly without risk of default. Also, specifying a "real" rate means choosing a price series to

[2]Goldsmith also includes livestock as an asset, which I do not. The inclusion of the government sector in GNP is the reason that GNP is not used in the calculation here.

[3]In correspondence with me, Robert Solow has argued that this ratio is not useful in the short run because the capital utilization rate "may fluctuate quite a lot from year to year." He also does not agree with my argument about the long run.

adjust for inflation (or deflation). Yet we can estimate this ratio with confidence, and it is almost trendless. In Rome for a hundred years around the beginning of the Common Era, the rate was as low as 4 percent (Homer, 1963, passim and p. 64). Alfred Marshall (1920, p. 558) could say unqualifiedly, "At present time the net interest on capital in England is a little under three percent per annum for "first-rate stock-exchange securities." And while M. Friedman and Anna Schwartz (1982, Chapter 10) had to exert great econometric effort to determine the differences between the rates in the United States and the United Kingdom between 1867 and 1975, and to establish trends. A 3 percent rate would not be unreasonable for any rough model of the United States in our times.

6. The rate of return on common stocks?

Alfred Cowles and his associates gathered data on the stock behavior from 1871 to 1938, and James H. Lorie and associates at the University of Chicago did the same from 1926 to 1976; Roger G. Ibbotson and Rex A. Sinquefield annually prepare updated series starting in 1926. Jack W. Wilson and Charles P. Jones (1987) connected the value-weighted Cowles and Ibbotson-Sinquefield series and estimated an inflation-adjusted compound annual return of 6.6 percent. The results for the periods 1871–1925 and 1926–1985 are identical to within .07 percent, with no observable difference in variability.

7. The price-earnings ratio for common stocks?

Value Line plots a P/E ratio of 13.6 against a quarterly stock price range from 1920 to the present, and there seems to be no trend in the residuals. A multiplier of 22.5 times dividends falls below stock prices since the 1950s, indicating a lower rate of payouts, apparently due to taxes. The geometric mean of a Cowles sample of price/earnings ratios from 1871 to 1938 is 13.5 (calculated from data in Cowles and Associates, 1939, pp. 404–407). Most other choices of interwar endpoints than these would show a higher P/E for the later period, though the difference is probably not trustworthy. (An increase in P/E ratio would be consistent with higher rates of secular growth in later years.)[4]

8. The velocity of money?

A common theoretical concept of the velocity of money is the ratio of annual transactions to the stock of money. Another concept, called "income velocity," employs the more easily measured national income in place of transactions (but the behavioral interpretation is not the same; Benjamin Friedman, 1988, p. 58). It is most commonly defined as the ratio of GNP to currency plus demand deposits plus time deposits plus some other financial assets (M2), though gross product is theoretically inferior to net national product.

[4]Some readers may not know, as I did not until recently, why the P/E ratio and the rate of return (ratio 6) are not simply inverses of each other. Total earnings used in the P/E ratio are accounting values (of which dividends are a part) rather than dividends plus stock-price changes. The P/E ratio therefore represents the current outlook of investors about future prospects, to the extent that prices reflect a long-run outlook, rather than realized gains.

For 1987 the ratio was (in billions) \$4527/\$2901 = 1.56. That is, the stock of money is equal to about two-thirds of a year's GNP (ERP, p. 308, 385). But this ratio should not be considered constant. M. Friedman and Schwartz (1982) show that during the previous century the stock of money increased faster than net income in the United States (but slower in the United Kingdom). Even the regularity of increase disappeared sharply in the 1980s, however, as a symposium in the Summer 1988 issue of this journal discussed. (For commentary, see B. Friedman, 1988, especially Figure 2; William Poole, 1988, especially Figure 1; ERP 1988, pp. 32–34.) Recent changes in financial institutions have muddied the definitions of the various categories of money, creating new difficulties for research on the subject.

9. The shares of the labor force in the farming, manufacturing, and service sectors, now and in earlier times?

The most fundamental economic change in history has been the shift from almost all labor being devoted to farming to only a small fraction of employed civilians doing so. In the United States, less than 3 percent of the workforce worked on farms in 1987 (ERP, p. 345, Table B-32). Moreover, many agricultural workers have other jobs, too, so even this ratio is an overstatement. Decrease in agriculture's share is roughly the inverse of increase in per person income.

The services industry, narrowly defined, now accounts for 24 percent of all employees on nonagricultural payrolls, up from 12 percent in 1950; construction has risen rapidly, also. A broader definition of service industries that includes transportation, public utilities, financial, wholesale trade, and especially retail trade (but not government) now accounts for 59 percent of all employees. A still broader definition of services that includes government workers (mainly state and local government and excluding the armed forces) raises the total of service industry jobs to 76 percent of the total. Manufacturing accounts for about 19 percent of all nonagricultural jobs, down from 34 percent in 1950 (ERP, 356–357, Table B-43). But manufacturing's share of GNP has not fallen since World War II as has its share of the labor force (ERP, p. 317, Table B-7).

10. Ratio of investment to GNP?

The ratio of gross private domestic investment to GNP is \$713/\$4527 = 16 percent, as of 1987; it was 16 percent in 1980, 14 percent in 1970, 15 percent in 1960, and 19 percent in 1950 (ERP, p. 308).

Net foreign investment income and the government deficit are the main elements that make savings different from investment in magnitude. Net foreign investment of \$157 billion is an important segment in gross private domestic investment of \$713 billion in 1987. After decades of being mostly small and positive, it turned negative in 1983 (ERP, p. 340, Table B-28). Until World War I, foreign ownings in the United States exceeded U.S. ownings abroad; the sharpest increase was in the 1830s (HSUS, 868–869).

Net foreign investment income continues to be positive, but has fallen almost halfway from its peak in 1981 (ERP, p. 424, Table B-102).

11. Ratio of industrial concentration among the largest firms?

The main long-term data available with respect to industrial concentration pertain to particular manufacturing industries. Despite all the changes in the structure of production and distribution, mobility into and out of the ranks of the largest firms, and the waves of mergers, the proportion of manufacturing industries in which the four largest firms accounted for 50 percent or more of output has remained impressively close to the 33 percent estimated by Warren Nutter for 1904. In Morris Adelman's words (quoted by F. M. Scherer, 1979, p. 70), "Any tendency either way, if it does exist, must be at the place of a glacial drift." But Scherer (1970, p. 63) finds evidence of ups and downs, and judges that "the patterns revealed are sufficiently complex and varied to mask evidence of an unambiguous long-term general trend." He also concludes, however, with respect to the post-World War II period, that "concentration in U.S. manufacturing industries increased at most modestly over a period of 35 years" (3rd edition forthcoming in 1990, xerox p. 48). The declining share of manufacturing in the economy, the increasing tendency for manufacturing firms to straddle industries, and the growing interpenetration of the manufacturing and service sectors, make this measurement of concentration less and less clear or meaningful, though.

The share of the economy as a whole accounted for by the 100 largest nonfinancial firms as of the 1970s was roughly a third, as measured by payroll, sales, and value added. In particular, the share of employment is lower than a third, and the share of assets and investment is higher than a third (Scherer, 1979, 44–50). The largest firms' share rose in the years following World War II. The rise in assets concentration continued into the 1980s, but the value-added concentration leveled off in the 1960s (Scherer, forthcoming, Figure 3.1). Furthermore, the within-industry data mentioned above suggest that it is premature to conclude that the long-run trend is increasing to an important extent. (In a letter of March 13, 1989, Scherer comments: "I'm skeptical whether one can characterize industrial concentration ratios as among the great constants of economics.")

12. Ratio of national government spending and taxing to GNP?

In fiscal year 1987, U.S. federal outlays were \$1004/\$4434 = 22.6 percent of GNP, and receipts were \$854/\$4434 = 19.2 percent. Consequently, the deficit was 3.4 percent. In rough terms, these ratios have been the same since the late 1950s, although spending has generally been a little lower. But in 1940, outlays were 10 percent of GNP and receipts were 6.8 percent (ERP, p. 397).

13. Ratio of government transfers and defense to GNP?

In 1986, "social welfare" outlays other than for education were (\$771 − \$179)/\$4240 = 14 percent of GNP.[5] Of the total, (\$472 − \$15)/(\$771 − \$179) = 77

[5]Included in social welfare outlays are social insurance, public aid, health and medical programs, veterans' programs, housing, and miscellaneous; education is included in the usual definition but is subtracted in this calculation. Social Insurance is by far the largest category—\$390/(\$771 − \$179) = 66 percent. If the age distribution of the population were the same now as in earlier eras, social insurance would be sufficiently less that the federal deficit would be vastly smaller.

percent came from the federal government and the remaining 23 percent from state and local governments (SAUS, Tables 565, 689).

In 1987, expenditures on the military services were \$282/\$4527 = 6 percent of GNP (SAUS, p. 326, Table 526, ERP, p. 308, Table B-1).

In the postwar era, spending on defense has generally declined as a share of national income, although the ratio did increase in the first half of the 1980s. Social welfare outlays have generally increased. However, social welfare and defense expenditures are at present much higher proportions of the national income than they were prior to World War II.

14. Ratio of imports and exports to GNP?

Merchandise exports from the U.S. in 1987 were \$250/\$4527 = 5.5 percent of GNP, and imports were \$410/\$4527 = 9.1 percent; the difference is (\$410 − \$250)/\$4527 = 3.5 percent of GNP. Exports drifted up from 3.5 percent in 1950 but imports, after being roughly in balance with exports, leaped up starting in 1977 (ERP, p. 424, Table B-102, p. 308, Table B-1).

An Invitation

Ratios belong in the economist's toolbox, useful to economists of all specialties. Yet this sort of lore is seldom collected or taught systematically, but instead must be learned piecemeal in discussion or re-invented on the job. Therefore, I would appreciate suggestions about other important ratios, trends, and magnitudes that could be added to future versions of the list.

■ *I appreciate suggestions of magnitudes by Royall Brandis, Marvin Frankel, Robert Gillespie, Donald Hodgman, Lawerence Klein, and Koji Taira. Comments about the specification of particular ratios came from Martin Bailey (No. 10), Milton Friedman (Nos. 3, 8, 10), David Meiselman (No. 8), Larry Neal (No. 5), Lee Preston (No. 11), F. M. Scherer (No. 11), and Robert Solow (No. 8). The three editors of this journal promoted this piece from a mere list of labels into a quantified collection, and chivvied it into its present shape; I am grateful for their ideas and energy.*

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