Statistical Malpractice

The Wall Street Journal does it. The San Francisco Examiner does it. The Los Angeles Times does it. And so do the Christian Science Monitor, the Atlanta Constitution and the Philadelphia Inquirer, for that matter. But what they do is incorrect and should not go unnoticed.

These and probably many other publications incorrectly calculate the annual rates of change in the various economic indicators that government agencies report. Their mistake is not in converting these monthly or quarterly figures to equivalent annual rates, though some economists question the value of paying close attention to what happens in short time periods. Indeed, the public tends to think in terms of annual rates of economic growth and inflation, so journalists rightfully render the monthly (or quarterly) figures more meaningful by presenting them in an annual context. The only problem is that they usually do it incorrectly.

Rule of thumb
The problem lies in the use of a simple rule of thumb, which performs quite nicely when dealing with small numbers but not when dealing with large numbers. Unfortunately, the inflation rate—to take the obvious example—is not small today. The rule of thumb involves multiplying monthly rates of change by 12 (or quarterly rates by

4) to get the equivalent annual rates of change.

The consumer-price index, for example, rose by 0.8 percent (seasonally adjusted) in April. Well, 0.8 times 12 is 9.6, so many newspapers reported that consumer prices had risen at an annual rate of 9.6 percent. This is not too far from the correct figure of 10.0, but it is off and the error increases with the magnitude of the monthly price change. Thus, when the wholesale price index increased by 1.1 percent last month, this was equivalent to an annual rate of 14.0 percent, not 13.2 percent as reported by some members of the press. Altogether, the rule of thumb applied to the consumer price index would have resulted in at least a small error in 20 of the past 23 months.

Compounding—the key
Converting a monthly rate to an annual rate involves finding the annual rate of change that would occur if the index rose at that same monthly rate for 12 months straight. The rule of thumb goes wrong because it does not capture the compounding effect. It ignores the fact that the base to which that constant monthly percentage is applied grows somewhat each month. Thus, the annual rate is always larger than the rule-of-thumb rate, although this difference may be less than a tenth of a percentage point when

the monthly rate is relatively low.
But compounding is the only way to
go, and without it one has only a
rough approximation.

Frequently, the rule-of-thumb con-
version will do the job. There is no
error to a tenth of a percent (which
is all we usually worry about) when
the monthly rate is less than 0.3 and
the quarterly rate is less than 1.0.
When inflation rates were below 3
percent in the 1950's and early
1960's, the rule of thumb was usual-
ly a pretty safe bet. But ever since
severe inflation reared its ugly
head, that rough approximation has
consistently understated the situa-
tion. Come the revolution when
inflation and other evils are ban-
ished from the land, the rule of
thumb can be resurrected. In the
meantime, let us go forth and com-
pound.

Deflating statistics
A second common error involves
the calculation of "real" or deflated
values of such economic phenome-
na as wages or GNP. During last
year's California cannery strike, for
example, a union leader claimed
that the real wages of cannery
workers had fallen by 13 percent
over the preceding three years. This
occurred, he said, because while
the average cannery worker's wage
increased by only 22.4 percent, the
CPI rose by 35.3 percent. The rule
of thumb, in this case, involves
simply subtracting the percentage
change in prices from the percent-
age change in wages. While any
decline in real wages is something
to complain about, this particular

calculation is off by several per-
centage points. The purchasing
power or real wages of cannery
workers actually declined by 9.5
percent, not 13.0 percent.

With this rule of thumb, the rough-
ness of the approximation increases
with both the *difference* between
the percentage changes in wages
and prices and the general *level* of
the percentage changes. Latin
American examples might be in-
structive, for those are countries
where changes in price and wage
levels historically have been quite
large. For example, in a country
where wages increased at 150 per-
cent and prices at 145 percent, the
rule of thumb would yield a rise in
real wages of 5.0 percent. But actu-
ally, there would be only a 2.4-
percent rise in real wages—less
than half the rule-of-thumb esti-
mate. So the error rises with the
general *level* of changes being
examined.

If the *difference* between the wage
and price changes is also large, the
rule of thumb provides estimates
that are essentially worthless. Sup-
pose the wage gain in our Latin
country remained at 150 percent
but the price rise was, by wise use
of monetary policy, restricted to
only 100 percent. A 50 percent gain
for workers? No. The gain in real
wages is just 25 percent.

Nature of bias
The bias is always in the same direc-
tion. The rule of thumb always
overstates the change in real wages.
When wages are rising more rapidly

than prices, as is generally the case, the rule of thumb makes things appear rosier for workers than they really are. However, when wages happen to be rising less rapidly than prices, as has been the case during much of the 1970's, the rule of thumb overstates the fall in real wages.

The difference between the rule of thumb estimate and the actual change can be seen by analyzing a simple formula for the *actual* change. If the percentage change in wages is w and the percentage change in prices is p, then the percentage change in real wages is 100 times $\frac{w-p}{100+p}$. The rule of thumb shortcuts the calculation by eliminating the denominator. As the rate of inflation, p, increases, the two calculations diverge.

When is the rule of thumb accurate, at least to a tenth of a percent? It's difficult to say, because this depends upon both the level and the relationship between the two percentage changes. Whenever the figures involved exceed 7 percent, or whenever the *difference* between the two percentage changes exceeds 6 percentage points, the rule of thumb will generate an error. But sometimes errors can result even from smaller numbers.

The conservative approach for the amateur statistician is always to use the formula given above, or some variant. At the least, any use of a rule-of-thumb calculation should always be accompanied with a qualification. But when rates of change are of the double (or greater) digit variety, even these qualifications may not be enough. What all this boils down to, unfortunately, is a new rule of thumb, to wit: "Whenever economic rates of change are large, use with caution the trusty old rules of thumb."

Michael Gorham

NEW PUBLICATION

A supplement to the Spring 1977 issue of the *Economic Review* entitled "The Monetarist Controversy" is presently being distributed to subscribers to the *Economic Review,* and is available free to readers of this publication by contacting the Public Information Section, Federal Reserve Bank of San Francisco, P.O. Box 7702, San Francisco 94120, phone (415) 544-2184.

"The Monetarist Controversy" contains a paper presented by Professor Franco Modigliani at the Federal Reserve Bank of San Francisco's January 1977 Economic Seminar with discussion by Professor Milton Friedman.

BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT
(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 5/18/77	Change from 5/11/77	Change from year ago Dollar	Percent
Loans (gross, adjusted) and investments*	96,217	− 17	+ 8,567	+ 9.77
Loans (gross, adjusted)—total	74,334	+ 498	+ 8,266	+ 12.51
Security loans	1,962	+ 136	+ 610	+ 45.12
Commercial and industrial	23,866	− 99	+ 1,570	+ 7.04
Real estate	22,935	+ 79	+ 2,942	+ 14.72
Consumer instalment	12,938	+ 42	+ 1,889	+ 17.10
U.S. Treasury securities	8,520	− 254	− 755	− 8.14
Other securities	13,363	− 261	+ 1,056	+ 8.58
Deposits (less cash items)—total*	94,247	− 67	+ 7,320	+ 8.42
Demand deposits (adjusted)	26,255	− 382	+ 2,674	+ 11.34
U.S. Government deposits	425	+ 52	− 214	− 33.49
Time deposits—total*	65,777	− 6	+ 4,467	+ 7.29
States and political subdivisions	5,857	+ 22	− 837	− 12.50
Savings deposits	31,929	− 124	+ 5,691	+ 21.69
Other time deposits‡	26,188	+ 95	− 54	− 0.21
Large negotiable CD's	9,322	+ 107	− 1,705	− 15.46

Weekly Averages of Daily Figures	Week ended 5/18/77	Week ended 5/11/77	Comparable year-ago period
Member Bank Reserve Position			
Excess Reserves (+)/Deficiency (−)	− 27	− 25	+ 47
Borrowings	4	8	16
Net free(+)/Net borrowed (−)	− 31	− 33	+ 31
Federal Funds—Seven Large Banks			
Interbank Federal fund transactions			
Net purchases (+)/Net sales (−)	+ 117	− 248	− 244
Transactions with U.S. security dealers			
Net loans (+)/Net borrowings (−)	+ 216	+ 214	+ 153

*Includes items not shown separately. ‡Individuals, partnerships and corporations.