# NOTES

## MEASURING ECONOMIC GROWTH

BY H. A. FELL AND C. C. GREENFIELD

*Census and Statistics Department, Hong Kong*

The post-war concern with measuring the economic success of a country by its growth in G.D.P., or any other of the national income aggregates, has in recent years been overtaken by concern, additionally, with the distribution of this growth. If substantial increases in G.D.P. have been achieved, but it is mainly the wealthy minority of a country who have benefited, then many would not view this as constituting successful economic development.

Consequently, the national income aggregates have been subject to much criticism for their failure to give any indication of the distribution of the benefits of growth, and hence, any indication of changing welfare patterns. A response to this challenge has been the development of Social Accounting Matrices in which the household sector is broken down by income level, or more often, by other characteristics that have policy significance and are correlated with income level (such as rural/urban in developing countries). Once this is done, then one can track the trends in income distribution, plan or assess government policies with regard to this, and compare the situation between countries.

The purpose of this note is to point out some very simple, but potentially very meaningful, other ways of measuring and comparing economic growth once one has data on household income by income level, or by whatever other characteristics are of policy concern.

Suppose that there are two countries, A and B, with identical population size and structure, identical income size and distribution in the initial period 1, and identical growth in total income, but not its distribution, between period 1 and 2. These assumptions are made purely in order to highlight the effect of differential distributions of income growth. It is assumed that problems of exchange rate conversion have been overcome through a Kravis-type exercise. Our hypothetical example is then as shown in Table 1.

As can be seen, income in both countries grew by $14\frac{1}{3}$ percent, but the distribution of this growth was very different. In country A, the high income group households were the main beneficiaries, whereas in country B, the low income households were the main beneficiaries.

Now normalize the base period incomes so that they sum to unity for convenience in using them as weights. Weight the growth in income by the base period income weights. Table 2 shows the results.

TABLE 1

COUNTRY A

| Income Group | Population (million) | Income Period 1 ($ million) | Income Period 2 ($ million) | Growth over period % |
|---|---|---|---|---|
| High | 0.5 | 1,500 | 1,800 | 20 |
| Medium | 1.5 | 1,000 | 1,100 | 10 |
| Low | 3.0 | 500 | 530 | 6 |
| Total | 5.0 | 3,000 | 3,430 | $14.\dot{3}$ ($14\frac{1}{3}$) |

COUNTRY B

| Income Group | Population (million) | Income Period 1 ($ million) | Income Period 2 ($ million) | Growth over period % |
|---|---|---|---|---|
| High | 0.5 | 1,500 | 1,550 | 3.3 |
| Medium | 1.5 | 1,000 | 1,130 | 13.0 |
| Low | 3.0 | 500 | 750 | 50.0 |
| Total | 5.0 | 3,000 | 3,430 | 14.3 ($14\frac{1}{3}$) |

TABLE 2

| Income Group | Country A (a) Income Weight | Country A (b) Growth % | Country A (a)×(b) % | Country B (a) Income Weight | Country B (b) Growth % | Country B (a)×(b) % |
|---|---|---|---|---|---|---|
| High | 0.50 | 20 | 10.0 | 0.50 | 3.3 | $1.\dot{6}$ |
| Medium | $0.3\dot{3}$ | 10 | $3.\dot{3}$ | $0.3\dot{3}$ | 13.0 | $4.\dot{3}$ |
| Low | $0.1\dot{6}$ | 6 | 1.0 | $0.1\dot{6}$ | 50.0 | $8.\dot{3}$ |
| Total | 1.00 | | $14.\dot{3}$ | 1.00 | | $14.\dot{3}$ |

As can be seen, the estimated growth of $14\frac{1}{3}$ per cent, derived by dividing total income in period two by total income in period one, is equivalent to calculating a weighted growth rate, with base period income as the weights. This is always true, the algebraic proof being trivially simple:

$$T_1^{-1}\left[H_1\left(\frac{H_2}{H_1}-1\right)+M_1\left(\frac{M_2}{M_1}-1\right)+L_1\left(\frac{L_2}{L_1}-1\right)\right]$$

$$=T_1^{-1}\left[(H_2+M_2+L_2)-(H_1+M_1+L_1)\right]$$

$$=\frac{T_2}{T_1}-1.$$

Where $H_1$, $M_1$ and $L_1$ are the base period incomes of high, medium and low

income households, and $H_2$, $M_2$ and $L_2$ the corresponding incomes in period 2. $T_1$ is the base period total income and $T_2$ the current period total.

Although this is a very simple point, possibly well-known by some, it is not generally realized. It equally implies, of course, that the standard international measurement of economic growth as the ratio of, say, current G.D.P. to that of another time period can be viewed as a weighted rate, using the earlier period income distribution as weights.

Once this is recognised, then the question naturally arises why one should want to use the base period income distribution as weights. The only reason would seem to be where one wants the base period total times the growth factor to equal the new period total. Given a concern for income distribution, then one might well prefer to use population for weighting. Normalizing the population figures in Table 1 and using these to weight the growth rates gives the result shown in Table 3.

TABLE 3

| | Country A | | | Country B | | |
|---|---|---|---|---|---|---|
| Income Group | (a) Population Weight | (b) Growth % | (a) × (b) % | (a) Population Weight | (b) Growth % | (a) × (b) % |
| High | 0.1 | 20 | 2.0 | 0.1 | $3.\dot{3}$ | $0.\dot{3}$ |
| Medium | 0.3 | 10 | 3.0 | 0.3 | 13.0 | 3.9 |
| Low | 0.6 | 6 | 3.6 | 0.6 | 50.0 | 30.0 |
| Total | 1.0 | | 8.6 | 1.0 | | 34.2 |

Whereas under the conventional measure of growth both countries performed equally well, if we say that we want to measure the success of economic growth in relation to the number of people who benefit from it, as in Table 3, then country B has been much more successful than country A. There could be countries, of course, where the lowest income group is a minority of the population. Depending upon the policies of the country, then one might not wish to weight by population. A preferred weighting, in any case, might be the normalized inverse of income, or better, if the data were available, normalized inverse of wealth. Normalizing the inverse of income in Table 1, and using this as weights, gives the result shown in Table 4.

TABLE 4

| | Country A | | | Country B | | |
|---|---|---|---|---|---|---|
| Income Group | (a) Inverse of Income Weight | (b) Growth % | (a) × (b) % | (a) Inverse Income Weight | (b) Growth % | (a) × (b) % |
| High | 2/11 | 20 | $3.\dot{6}\dot{3}$ | 2/11 | $3.\dot{3}$ | 0.61 |
| Medium | 3/11 | 10 | $2.\dot{7}\dot{2}$ | 3/11 | 13.0 | $3.\dot{5}\dot{4}$ |
| Low | 6/11 | 6 | $3.\dot{2}\dot{7}$ | 6/11 | 50.0 | $27.\dot{2}\dot{7}$ |
| Total | 1 | | 9.64 | 1 | | 31.42 |

Again country B has been much more successful than country A if the policy view is taken that the distribution of economic growth should be in inverse relation to the distribution of income in the base period. From the point of view of economic theory, this could be regarded as employing an approximation for the diminishing marginal utility of income—an extra dollar in income for a rich household has lower marginal utility than an extra dollar to a poor household.

The above weighting systems are, of course, arbitrary, but they are just as valid as the conventional measure of growth with its implicit weighting by base period income distribution if one is concerned with analysing changes in the distribution of income between countries, or for a given country over time. Other forms of weighting or variations on the above might well be preferable, depending upon the nature of the problem.

Whilst a Social Accounting Matrix would be the best source of data for such analysis, other sources could clearly be used if this was not available. Household surveys providing income data, or private consumption expenditure estimates in the G.D.P. if broken down by household type, could also be employed.