*Volatility (Mobility) *section extracted from On the Measurement of Social Tensions

6. Growth volatility and social tension

Growth rates inform whether and to what extent people are becoming better or worse off over time. Not surprisingly, therefore, magnitudes of growth rates are always the focus of attention when economists discuss alternative strategies of economic development. In practice there is large volatility in growth rates. They can fluctuate widely from negatives to positives. This volatility can create social tension particularly when people's standard of living is falling. The fluctuating growth rates create uncertainty among economic agents about their business decisions as to when they should make investments, or when they should hire and fire workers. The policy making becomes difficult for the government under the regime of volatile growth. The poor also suffer because they feel insecure when their incomes are widely fluctuating.

The volatility in growth rates is viewed here as causing social tension. This section develops a model to measure the loss of social welfare attributed entirely due to volatility in growth rates.

Suppose μ_t is the per capita income of the society in period t and there are n time periods, then a simple inter temporal social welfare function may be defined as

$$Ln(\mu^*) = \frac{1}{n}\sum_{t=1}^{n} Ln(\mu_t) \qquad (19)$$

where μ^* is the money metric social welfare for the entire n periods. Let r_t be the growth rate of per capita income in the year between $t-1$ and t, then definition $\mu_t = \mu_{t-1}(1+r_t)$ must hold. Substituting sequentially μ_t in terms of μ_1 gives

$$\mu_t = \mu_1(1+r_2)(1+r_3) - - - - (1+r_t)$$

which on taking on logarithm of both sides gives

$$Ln(\mu_t) = Ln(\mu_1) + \sum_{j=2}^{t} ln(1+r_j)$$

which on substituting in (19) gives

$$Ln(\mu^*) = Ln(\mu_1) + \frac{n-1}{2}\sum_{t=2}^{n} w_t Ln(1+r_t) \qquad (20)$$

Where: $w_t = \frac{2(n-t+1)}{n(n-1)}$

Such that $\sum_{t=2}^{n} w_t = 1$, which provides the relationship between the aggregate welfare level measured by μ^* and the growth rates.

It is reasonable to assume that when all growth rates are equal, there is no volatility in growth in which case social welfare must be maximum so the loss of social welfare from the maximum provides a welfare measure of growth volatility. To measure the impact of volatility on social welfare, a counter factual is that all growth rates are equal to the average growth rate given by

$$\bar{r} = \sum_{t=2}^{n} w_t r_t \qquad (21)$$

which on substituting in (20) gives a new welfare function

$$Ln(\mu_M^*) = Ln(\mu_1) + \frac{n-1}{2} Ln(1+\bar{r}) \qquad (22)$$

Because of the concavity of logarithmic function, the following relationship will always hold:

$\sum_{t=2}^{n} w_t Ln(1 + r_t) \leq Ln(\sum_{t=2}^{n} w_t (1 + r_t))$

Which on using (21) immediately gives

$$\sum_{t=2}^{n} w_t Ln(1 + r_t) \leq Ln(1 + \bar{r})$$

This equation holds for all values of growth rates r_t. Thus on comparing (20) and (22) leads to

$Ln(\mu_M^*) \geq Ln(\mu^*)$

Thus μ_M^* is the maximum value of money metric social welfare when there is no growth volatility, i.e. when all growth rates are equal. The loss of social welfare due to the volatility of growth rates is given by

$$V = (\mu_M^* - \mu^*) \tag{23}$$

which is the proposed measure of social tension caused due to growth rate volatility. It can easily be verified that $V = 0$ when all growth rates are equal.

8.4 Growth volatility and social tension (empirical Evidence)

The social tension due to volatility of growth is measured by the loss of social welfare in a temporal social welfare function. There are year to year differences in growth rates between PNAD per capita income and per capita GDP. It is noted in Figure 8 that per capita incomes from PNAD has more volatile growth rates than per capita GDP. Table 5 presents the growth rates of per capita GDP, household income and income of the bottom 40% population. The volatility index presented in the last three rows of Table 5 is calculated for the three periods: 1992-2001, 2001-2012 and 1992-2012. The following conclusions are summarized.

1. The per capita GDP has lower volatility than the per capita household income.
2. The bottom 40% of the population suffers higher volatility in per capita income than the whole population. This is an important observation revealing that the poor have not only lower incomes but also suffer from more volatile incomes.
3. There is greater volatility of growth rates in the period 1992-2001 than in the subsequent period 2001-2012.
4. The social welfare in the new millennium has not only improved but also has become less volatile.

Table 5: Growth rates of per capita GDP, income and income of bottom 40% population: Brazil 1993-2012

	Per capita GDP	Per capita income	Per capita income bottom 40%
Volatility: 1992-2001	1.82	2.96	3.32
Volatility: 2001-2012	1.02	0.56	0.73
Volatility: 1992-2012	1.21	1.12	1.28

Source: PNAD/IBGE. Prepared by the author.

Aggregate Risk - The bottom 40% of the population suffers higher volatility in per capita income than the whole population. This is an important observation revealing that the poor have not only lower incomes but also suffer from more volatile income.