ESSAY 3

SUSTAINABILITY, ECONOMIC GROWTH AND EMPLOYMENT[16]

Carlos Eduardo Frickmann Young[17]

1. INTRODUCTION

The trade-off between sustainability and economic growth is still the subject of controversy. The use of macroeconomic growth models subject to environmental constraints is an interesting theoretical way to treat the problem.

In general, studies on this theme use neoclassical macroeconomic models, where the objective is to find the optimal path of growth. The optimal growth path means that path which maximises social welfare in a certain period of time. Sustainability appears as a constraint, imposing an additional intertemporal goal. For example, utility per capita (or consumption per capita, or capital stock level) cannot be decreasing (for a review in this issue see Pezzey, 1989).

However, a very important assumption is usually made: 'conventional' factors of production - man-made capital and labour - are fully employed. The justification for this procedure is derived from the belief that there is no involuntary unemployment in the long term. But there is no definitive evidence (empirical or theoretical) supporting this belief. On the contrary, long term unemployment characterizes the majority of economies, especially in developing countries. Hence, the determination of effective demand, and the functioning of an economy out of the full-employment equilibrium, is the main issue for several approaches not considered mainstream (Keynes, 1973; Kalecki, 1991a). Economic growth is not thought of as oscillating around an assured long run equilibrium path since full-employment is not an assumption but a desired objective.

The aim of this paper is to present a simplified non-conventional macroeconomic model which relates effective demand and the sustainable use of natural resources. It supposes a small non-developed economy based on the exports of a natural resource and with a heavy income

[16] I am grateful for the comments of Prof. David W. Pearce.

[17] Universidade Federal do Rio de Janeiro and visiting fellow at CSERGE-UCL.

concentration. 'Optimal growth' is understood as maintaining labour full-employed[18] and sustainability is defined as maintaining a non-decreasing capital stock level. The model is based in a modified Kaleckian equation of income determination (Kalecki, 1991b) where exports of the natural resource substitute for the role of investment as autonomous expenditure. Therefore, employment is a direct function of resource depletion and is negatively related to sustainability.

The paper shows the effects of changes in some macroeconomic variables (income distribution, terms of trade, external debt, exchange rate) on sustainability. The paper concludes that the management of macroeconomic variables influences the sustainability of natural resource based economies.

2. THE MACROECONOMIC MODEL

We suppose an economy is characterized by a huge disproportion in the income distribution. As a simplification, there are two basic classes, 'poor' and 'rich'[19], each one with very distinct patterns of income and consumption. Four distinct uses for final products are possible: investment, consumer goods for the 'rich', consumer goods for the 'poor', and exports. Thus, this economy can be divided into four departments, each one representing the integrated production (including all intermediate consumption) of final demand categories (see Table 1).

Table 1: Production and Income Generation

$$P(I) + P(Cr) + P(Cp) + P(X) = P$$
$$W(I) + W(Cr) + W(Cp) + W(X) = W$$
$$M(I) + M(Cr) + M(Cp) + M(X) = M$$
$$\text{---------- (sum of columns)}$$
$$I + Cr + Cp + X = Yg+M$$

where: P: gross profits (including rents)
W: wages
M: total imports (including imported inputs)
I: gross investment
Cr: consumer goods for the 'rich'
Cp: consumer goods for the 'poor'

[18] This condition itself may not warrant optimality in neoclassical terms, but it is certainly a necessary condition.

[19] In the original model 'workers' and 'capitalists', respectively (Kalecki 1991b).

X: exports

Yg: gross income

The 'poor' receive wages and spend all their income. Hence, the production of consumer goods to the poor is equal to the total amount of wages.

$$Cp = W \quad (1)$$

The 'rich' receive the profits obtained from domestic production and exports. Since the economic importance of the domestic market is small, the consumption level of the rich is a function of exports.

$$Cr = r.X \quad (0<r<1) \quad (2)$$

The investment in man-made capital is assumed to be equal to its depreciation and is done with imported equipment. Since there is no domestic production of capital goods, P(I) and W(I) are equal to zero, and there are no multiplier effects from it.

Exports are totally based on the natural resource. Their value in domestic prices is a function of the international price of the resource (p_i), the exchange rate (e) and the quantity depleted (Q).

$$X = p_i.e.Q \quad (3)$$

Kn(t) is the economic value of the stocks of the natural resource in the period t. The rate of growth of Kn if the resource is not depleted is g, and expresses changes both in economic and physical terms. The rate of actual depletion of the resource is d. The variation of Kn in time can be expressed as:

$$Q = d.Kn \quad (4)$$

$$S(t) = \frac{dKn(t)}{dt} = (g-d).Kn(t) \quad (5)$$

By assumption, there is no change in man-made capital stock. Hence, S(t) is the 'sustainability indicator'[20].

[20] Following the definitions presented in Pearce and Atkinson (1992), it is a 'weak-sustainability indicator'.

The imports are proportional to the net product level (Y).

$$M = m.Y \qquad (0<m<1) \quad (6)$$

Analogously to Kalecki (1991b), the net product can be determined as follows (the complete development of the model is shown in the Appendix):

$$Y = \frac{1}{1+m}.\left(1+r+\frac{r.wr+ wx}{1-wp}\right).X = \alpha.X \quad (7)$$

where: wr: the share of wages in the total income of consumer goods to the 'rich'

wx: the share of wages in the total income of exports department

wp: the share of wages in the total income of consumer goods to the 'poor'

α: income-multiplier of autonomous expenditure (X)

The product level is a direct function of the exports, i.e., the depletion of the natural resource. Assuming m, r, wr, wx, wp and the labour-productivity as constants, there is one level of natural resource exports (X^*) which assures full-employment.

$$Y^* = \alpha.X^* \quad (7a)$$

The full-employment extraction level and correspondent rate of depletion are:

$$Q^* = \frac{X^*}{p_i.e} \quad (8)$$

$$d^* = \frac{Q^*}{Kn} \quad (9)$$

Consequently, there are three possibilities for the sustainability of this economy:

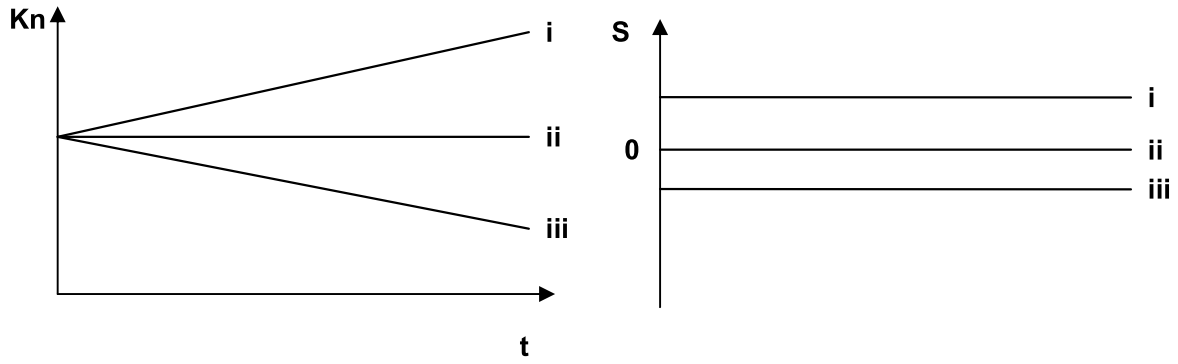
(i) $d^* < g$ Full-employment is compatible with an increasing level of sustainability (S>0).

(ii) $d^* = g$ Full-employment implies a constant level of sustainability (S=0).

(iii) $d^* < g$ Full-employment implies a decreasing level of sustainability (S<0).

Figure 1 presents these results:

Figure 1



In situations (i) and (ii), the ambition of full-employment in the present does not compromise the same objective in the future. However, in situation (iii), short-run full-employment means unemployment in the long run. In this case, changes in the macroeconomic conditions are strictly necessary to reconcile sustainability and full-employment.

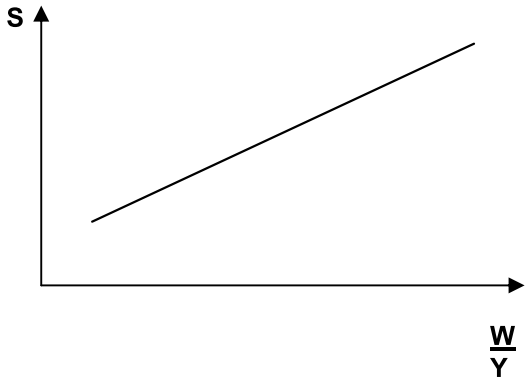
It becomes clear that the macroeconomic environment has important impacts on sustainability. In the next session, the model is used to highlight these impacts in sustainability due to changes in some macroeconomic variables.

3. CHANGE IN MACROECONOMIC VARIABLES

3.1 Improvement in income distribution

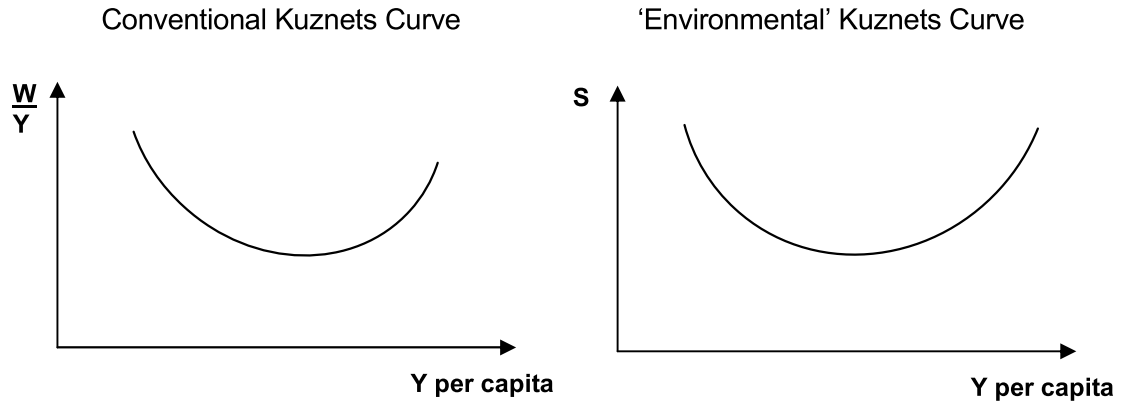
In that case, wages represent a bigger share of total income. As a consequence of the increase in wr, wp and wx, the multiplier α becomes bigger. It means that a smaller depletion of the natural resource is necessary to maintain full-employment. Due to the reduction of d^*, sustainability increases when the share of the 'poor' in total income increases (see Figure 2).

Figure 2



If the income distribution along the time behaves as a Kuznets Curve, i.e., with a U-shape for the ratio wages-total income, the sustainability function will also have a U-shape format (see Figure 3).

Figure 3



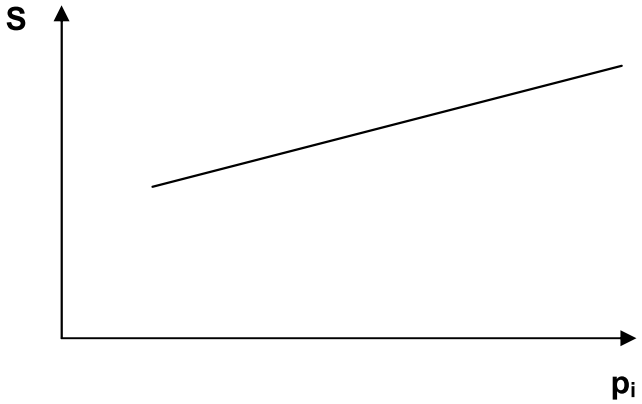
There is an important assumption for these results. It is supposed that there is unemployed capacity in the production of 'poor' consumer goods. If not, the excessive demand will start an inflationary process and a fall of real wages, which would restore the income distribution to its original situation.

3.2 Change in terms of trade (price of the resource in the international market)

There is a controversy about the price path of natural resources in international trade. There are two opposing positions: the 'Hotelling Rule', which points to an increasing price due to growing scarcity of the resource, and the 'Prebisch-Singer Rule', which points to a decrease of natural resources prices in the long term. Both situations can be examined and their results are symmetric.

In the first case, there is an increase in the value of the exports measured in domestic prices ($d^{*'} < d^{*}$). Therefore, a smaller depletion can lead to full-employment. On the other hand, a loss in terms of trade implies the necessity to expand depletion ($d^{*'} > d^{*}$). Figure 4 illustrates these results.

Figure 4



3.3 Structural adjustment and external indebtedness

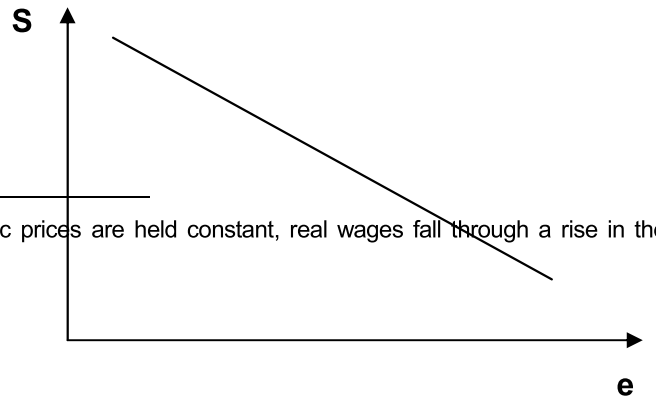
In general, developing countries have relatively high levels of external indebtedness. The payment of the service of the debt implies the necessity to increase exports. Hence, adjustment programmes to stimulate exports are very frequent. In our hypothetical case, two solutions are possible.

The first one is a shortage of the supply, considering that the country has a monopolistic power in the international market for the resource. The shortage produces a rise in the price of the resource and a reduction in the depletion rate, as discussed above.

But the exporter country usually has a small share of the international trade of the resource. A devaluation of the exchange rate (i.e. increasing e) is often recommended to stimulate exports. The resource can be sold at a lower internat-ional price without damage to the exporter's profit measured in domestic prices.

The devaluation also changes the income distribution against the 'poor', since real wages decrease[21]. Therefore, the fall in sustainability should be bigger than in the case discussed in section 3.2 (see Figure 5).

Figure 5



[21] If wages in domestic prices are held constant, real wages fall through a rise in the prices of imported consumer goods.

e^{I} : revaluation e_{I} : devaluation

4. CONCLUSION

The purpose of this paper has been to present a dilemma: the pursuit of current full-employment in economies based on natural resources depletion can bring future unemployment. In poor countries, the degrees of freedom to 'postpone' welfare are strongly reduced since people live very close to subsistence.

However, the management of macroeconomic variables influences decisions related to the exhaustion of the resources. In some circumstances the results on sustainability are positive, in others negative. Table 2 reviews the principal hypothetical cases discussed in this paper.

Table 2

Macroeconomic circumstance	Effect on sustainability
Improvement in the income distribution	Increase
Loss in terms of trade	Decrease
Devaluation of exchange rate	Decrease

In more mathematical terms:

$$S(t) = f\{g(t), d(t), w(t), p_i(t), e(t)\}$$
$$\quad + \quad - \quad + \quad + \quad -$$

Nevertheless, it is important to highlight two of the assumptions adopted. The most important is the absence of domestic production of capital goods. Withdrawing this assumption can lead to different results, since current depletion can be used to enlarge the stock of man-made capital, with positive effects on long-run employment.

The second one is the belief about the future economic importance of the resource. Forecasts

are generally based on current trends but unexpected changes in technology and consumers' preferences may make depletion economically not feasible. Past experiences (latex in Brazil, saltpetre in Chile, etc.) are not sufficient to prevent new cases, since the course of technical progress and human behaviour are uncertain.

The extreme simplicity of the model requires that results in this paper should not be viewed as definitive statements. Empirical case study analysis is essential for a better comprehension[22].

References

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[22] A good example is Jonish, 1992.

Appendix

Equation (1) can be re-written as:

$$Cp = W(I) + W(Cr) + W(Cp) + W(X)$$

By assumption, W(I) is null. Assuming wr=W(Cr)/Cr; wp=W(Cp)/Cp and wx=W(X)/X:

$$Cp = wr.Cr + wp.Cp + wx.X$$

$$Cp = \frac{wr.Cr + wx.X}{1 - wp} \quad (10)$$

The general macroeconomic equation is:

$$Yg + M = I + Cr + Cp + X$$

Investment is just equal to depreciation, so the net income is:

$$Y + M = Cr + Cp + X$$

Using equations (2), (6) and (10):

$$Y + m.Y = r.X + \frac{wr.(r.X) + wx.X}{1 - wp} + X$$

$$Y = \frac{1}{1+m}.\left(1 + r + \frac{r.wr + wx}{1 - wp}\right).X$$