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Kaldor's 1970 Regional Growth Model Revisited

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Abstract: Kaldor's 1970 paper 'The Case for Regional Policies' was republished in the sixtieth anniversary volume of the *Scottish Journal of Political Economy*. This paper reflects on the model after more than forty years, and argues that even though it has been criticised for its deterministic nature, it has lost none of its relevance. It predates the ideas of so-called 'new' growth theory, and the new economic geography of Krugman, and provides at least a partial explanation of why growth rates and levels of per capita income between regions and between countries can continue to persist and even widen in contrast to the predictions of orthodox equilibrium theory.

Key Words: Regional Growth; Kaldor; Uneven Development; Cumulative Causation.

JEL Codes: O18; R11

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Introduction

In the **si**xtieth anniversary issue of the *Scottish Journal of Political Economy*, Kaldor's 1970 paper 'The Case for Regional Policies' was reprinted as the most cited paper in the *Journal* during the decade 1963 to 1973 (Kaldor, 2013). I provided a commentary on the paper (Thirlwall, 2013) but was restricted for words. In the present paper, I reflect in more depth on the Kaldor 1970 regional growth model, and elaborate on its appeal and significance. After more than forty years it has lost none of its relevance, and provides at least a partial explanation of why growth rates and levels of per capita income between regions and between countries continue to persist and even widen.

The first point to make is that the origin of Kaldor's interest in regional economic growth is not entirely clear, but it did coincide with his switch of interest in the mid-1960s from the pure theory of growth (Kaldor, 1957, 1961) to the applied economics of growth when he became involved in policy-making in the United Kingdom at the highest level as Special Adviser to the Chancellor of the Exchequer in the 1964 Labour government. In his Cambridge Inaugural Lecture in 1966 (Kaldor, 1966) he addressed the causes of the slow rate of growth of the UK economy compared to the economies of continental Europe, and related them to the slow rate of growth of the manufacturing sector which was unable to draw on cheap surplus labour in agriculture. To compensate, Kaldor argued for a Selective Employment Tax (SET) on the service sector to release labour from 'over-manned' services, and a subsidy to employment in manufacturing, with an extra Regional Employment Premium (REP) to manufacturing industry in depressed regions (a form of regional devaluation).SET was introduced in 1966, and the REP in 1967, but then Kaldor soon changed his mind on the major cause of the UK's slow growth. It was not a shortage of labour in manufacturing; it was a balance of payments constraint on the growth of demand in the economy as a whole.

This is the background to Kaldor's address to the Scottish Economic Society in 1970 in which he presented a model of regional economic growth in purely verbal form, but which can be formalised as Dixon and I did in a paper in 1975 (Dixon and Thirlwall, 1975). Kaldor's ideas can be reduced to a four-equation, structural, model with cumulative features, reminiscent of a more general model of 'circular and cumulative causation' developed by Gunnar Myrdal in his book *Economic Theory and Underdeveloped Regions* (1957). Kaldor was more than familiar with Myrdal's ideas having worked with him in the Economic Commission for Europe (ECE) in Geneva from 1947 to 1949, and remained close friends.

The 1970 Model

The first proposition of the model is that regional growth is driven by export growth. Kaldor regarded exports as the only true autonomous component of aggregate demand, not just at the regional level but also at the national level because consumption and investment demand are largely induced by the growth of output itself. The more specialised regions are, the greater the importance of exports. The second proposition is that export growth depends largely on a region's changing price competitiveness and the growth of income outside the region. The third proposition is that the rate of change of a region's prices is determined by the difference between wage growth and labour productivity growth. Lastly, labour productivity growth is partly determined by the growth of output itself through static and dynamic increasing returns (captured by Verdoorn's Law)[2].

In equation form, the propositions may be specified as (t is a time subscript):

$$g_t = \Upsilon (x_t) \qquad (1)$$

where g_t is the growth of regional output, and x_t is the growth of exports.

$$x_t = \eta (p_{dt} - p_{ft}) + \varepsilon (z_t) \qquad (2)$$

where p_{dt} is the growth of domestic prices; p_{ft} is the growth of foreign prices measured in a common currency; z_t is the growth of income outside the region ; η (< 0) is the price elasticity of demand for exports, and ε (>0) is the income elasticity of demand for exports.

$$p_{dt} = w_t - r_t \qquad (3)$$

[2] In his 1966 Inaugural Lecture, Kaldor revived Verdoorn's Law which had lain virtually dormant for seventeen years since the publication of Verdoorn's paper in 1949. Verdoorn was one of Kaldor's research staff at the ECE from 1947 to 1949.

where w_t is the growth of wages, and r_t is the growth of labour productivity.

$$r_t = r_{at} + \lambda (g_t) \qquad (4)$$

where r_{at} is autonomous productivity growth and λ is the Verdoorn coefficient.

Substitution of equation (4) into (3) and the result into (2) and (1) gives the equilibrium growth of regional output as:

$$g_t = \frac{\gamma[\eta(w_t - r_{at} - p_{ft}) + \varepsilon(z_t)]}{1 + \gamma\eta\lambda} \qquad (5)$$

Remembering that $\eta < 0$, growth is shown to be negatively related to domestic wage increases, but positively related to foreign price increase and autonomous productivity growth. Growth is also positively related to the growth of external demand and the size of the Verdoorn coefficient. It is the Verdoorn coefficient (λ) that makes the model 'circular'; but whether growth is 'cumulative' (i.e. departs further and further away from equilibrium) depends on the behaviour of the model out of equilibrium. To make the model dynamic, and to assess whether it is stable or not, it is sufficient to put a one-period time lag into any of the equations. Dixon and I chose to put a one-period lag in the export growth equation giving $x_t = \eta(p_{dt-1} - p_{ft-1}) + \varepsilon(z_{t-1})$. Successive substitution as before gives a first order difference equation, of which the general solution to the homogenous part is:

$$g_t = A\,(-\Upsilon\eta\lambda)^t \qquad (6)$$

where A is the initial condition. Whether the model is stable or not out of equilibrium depends on the value of $(-\Upsilon\eta\lambda)$. If exports grow twice as fast as output, $\Upsilon = 0.5$. A typical value for the Verdoorn coefficient (λ) is 0.5. In this case the price elasticity of demand for exports (η) would have to exceed minus 4 for $(-\Upsilon\eta\lambda) > 1$, and for there to be 'explosive' growth. It is rare to find aggregate price elasticities of demand for exports as high as that, but in any case we don't observe in practice regional *growth* rates *diverging* – only *levels* of per capita income. This suggests that regional growth rate differences that are observed are associated with differences in regions' equilibrium growth rates largely determined by differences in the income elasticities of demand for exports (ε) and imports (π) associated with regional differences in the structure of production and trade: whether regions specialise in primary production or manufactured goods and sophisticated services.

Centre-Periphery Models

If the Verdoorn coefficient is ignored, and it is assumed that regional competitiveness stays constant, equation (5) (ignoring lags) can be written as:

$$g_t = \varepsilon (z_t)/\pi \qquad (7)$$

where π is the income elasticity of demand for imports and is equal to $1/\Upsilon$ if regional balance of payments equilibrium is a requirement with the growth of exports equal to the growth of imports. Equation (7) is the classic centre-periphery model of Prebisch (1959) where the growth of one region relative to others (g_t/z_t) is equi-proportional to the ratio of the income elasticity of demand for exports and imports (ε/π).Equation (7) can also be shown to be the dynamic analogue of the static Harrod trade multiplier, Y = X/m, where Y is the level of output; X is the level of exports, and m is the marginal propensity to import (Harrod, 1933; Thirlwall, 1982). Kaldor first revived the Harrod multiplier in a letter to *The Times* newspaper 15th March 1977, and argued that it is more important than Keynes's investment multiplier for understanding the pace and rhythm of economic growth in an open economy (Kaldor, 1981). Or, to put it another way, it is more difficult for a country to rectify an import-export gap than it is to rectify a savings-investment gap.

Regions within a country are particularly open, of course, and they also share a common currency. That is why there is no exchange rate in the original Kaldor model. It is possible to include one, however, by modifying the export growth equation (2) and then, if regional data are not available, to test the model at the national level as an alternative. That is what Dixon and I did; we applied the model to the UK economy and found it seriously over-predicted the UK's historical growth rate. We surmised that this was because the UK suffered perpetually balance of payments crises which constrained overall aggregate demand. It is a weakness of the original Kaldor model that import growth is not modelled and there is no balance of payments constraint. A balance of payments constraint is easily incorporated, however (see Thirlwall and Dixon, 1979). The export growth equation (2) can be modified to include the rate of change of the exchange rate (e) :

$$x_t = \eta(p_{dt} - p_{ft} - e_t) + \varepsilon (z_t) \qquad (8)$$

We can then add an equation for the rate of growth of imports (m):

$$m_t = \psi(p_{ft} - p_{dt} + e_t) + \pi (g_t) \quad (9)$$

where ψ (<0) is the price elasticity of demand for imports and π (>0) is the income elasticity of demand for imports.

Setting equation (8) equal to (9), and substituting equations (3) and (4) into (8) gives the balance of payments equilibrium growth rate of:

$$g_t = \frac{(1+\eta+\psi)[w_t - r_{at} - p_{ft} - e_t] + \varepsilon z_t}{\pi + \lambda(1+\eta+\psi)} \quad (10)$$

If there is no Verdoorn effect ($\lambda = 0$), and relative prices measured in a common currency remain unchanged, equation (10) collapses to equation (3).

Of course, regions within countries don't experience classic balance of payments problems in the sense that an exchange rate comes under pressure, but if import growth exceeds export growth and capital transfers (domestic and international) do not finance the difference, the balance of payments constraint will show up in slow growth and rising unemployment. Regional problems are balance of payments problems (Thirlwall, 1980) as we witness in the peripheral countries of the Eurozone today. A large part of the sovereign debt and private banking crisis in the Eurozone stems from the heavy borrowing by the deficit countries of Greece, Spain, Portugal and Italy from the surplus countries of Germany, the Netherlands and Austria (see Priewe, 2012). The free movement of capital facilitates the financing of deficits, but exposes countries to adverse internal and external macroeconomic shocks if the flows are debt-creating.

Significance and Adaptation of the Model

Kaldor's 1970 paper has been an inspiration to growth and development economists, critical of orthodox equilibrium growth theory which predicts that if economic and social divisions emerge between regions or countries, forces will come into play to narrow those differences. But the Kaldor model has had its critics, even those sympathetic to Kaldor's non-equilibrium view of the world. In particular, the deterministic nature of the model has come under attack which doesn't allow for the possibility of growth 'reversals' or 'catch-up' and its inconsistency with Kaldor's historical view of the growth and development process.

Setterfield (1997) was one of the first to raise concerns. He makes the model more flexible by allowing both the Verdoorn coefficient (λ) and the income elasticity of demand for exports (ε) to be endogenous on the grounds that initially successful regions or countries may get 'locked-in' to certain techniques of production and products inherited from the past which prevents them from adapting to a new environment leading to falls in λ and ε. Long run growth performance then becomes path dependent. Relatively high growth can endogenously break down depending on the specific technological and institutional environment – although not inevitably. Argyrous (2002) argues in fact that the Verdoorn coefficient and income elasticity of exports may rise before 'lock-in' sets in, particularly in the right historical conditions and with appropriate institutional structures, in which case the cumulative nature of growth will continue unabated. Roberts (2006) makes a similar point that the point of lock-in at which reversals may occur should not be thought of as a constant at which 'lock-in' inevitably occurs, but at which it may *tend* to occur, so that the threshold lacks intrinsic closure. This is the essence of 'open systems – ceteris paribus' modelling in which exogenous factors are explicitly allowed to influence system outcomes in a non-defined way. In this framework, all equilibria are *conditional* equilibria. There are not determinate outcomes but intermediate positions subject to potential revision by forces that are endogenous to the system. This keeps the possibility open that 'lock-in' might be avoided through human action or institutional change, including government policy. But eventually there is a conditional equilibrium. Even with 'lock-in', the economy ultimately settles down to an equilibrium.

Leon-Ledesma (2002) allows for growth 'reversals' and 'catch-up' by a different root. He adds three extra variables to the Verdoorn equation (4) to explain the growth of labour productivity: (i) the investment/GDP ratio; (ii) a measure of innovative activity, and (iii) a productivity gap variable. Innovative activity is then assumed to be a function of four factors :the growth of output; the cumulative sum of real output (to capture learning by doing); the level of education, and the productivity gap. This specification adds a fifth equation to the Kaldor four-equation model specified above. The parameters of the model determine whether growth is stable or not, and whether productivity levels diverge or converge. Applying the model to seventeen OECD countries using pooled data for the period 1965 to 1994, the author concludes "cumulative growth arises from the effect of the Verdoorn-Kaldor relationship and also from the induced effect that growth itself has on learning and non-price competitiveness. The diffusion of technology arising from the productivity gap, however, is a significant force that counteracts those forces favouring a 'catch-up' process."

There are certain similarities between Kaldor's model and the so-called new economic geography (NEG) pioneered by Krugman (1991), but there is nothing in Kaldor on the interaction between scale economies and transport costs which lies at the heart of the centripetal and centrifugal forces that lead in the Krugman model to regional agglomeration and dispersal, respectively. Recent work that combines NEG with endogenous growth theory, however, has moved in Kaldor's direction stressing technological spill-overs, learning by doing, and Allyn Young's (1928) concept of macro-increasing returns resulting from the interaction between activities subject to increasing returns and a price elastic demand for their product (Bhattacharjea, 2010)[3].

The NEG doesn't acknowledge Kaldor's 1970 paper, probably because it lacks formal modelling, but as Dixon and I (1975) showed, it is possible to formalise the model, and to appreciate its rich insights into the regional growth process. It also turns out to be a very flexible model and is easily augmented to allow for 'growth reversals' and 'catch-up' – to allow history to matter – as shown by Setterfield and Leon-Ledesma. The presence of increasing returns, which is central to Kaldor's vision of the growth and development process, makes a huge difference to the way regional and national economies function and is the major challenge to equilibrium theory that with its narrow neoclassical assumptions finds it difficult to explain persistent or growing regional divergence within and between countries.

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[3]Kaldor was a pupil of Allyn Young at the LSE in 1928 and took a full set of his lecture notes (Thirlwall, 1987; Sandilands, 1990). For a survey of endogenous regional growth, see Roberts and Setterfield (2013).

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