

Economic Growth, Structural Change and Natural Resource Booms: A Structuralist Perspective

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Abstract

In this paper we present a structuralist two-sector model on economic growth, structural change and natural resource booms. We describe a multiple equilibria scenario, in which manufacturing development is the main source of economic development. Natural resource booms, by modifying the productive structure of the economy, may set destabilising forces. De-industrialization processes may take place, confining developing countries in poverty traps. Public intervention in the economic sphere, both through short-run macro policies and long-run development strategies, may help to free the economy from poverty traps and to foster the development process.

Keywords: Structural Change, Industrialization, Dutch Disease

JEL Classification: B50, O14, Q33

1. Introduction

Economic growth has considerably accelerated during the last five years in most developing countries. According to UNCTAD (2007), between 2003 and 2007, per capita GDP has grown by 3.0 percent and 3.5 percent yearly in Africa and Latin America, signing the best record from the early 1980s. The increase in the international prices of raw materials and agricultural products explains such an economic momentum. High prices of primary commodities have relaxed the external balance constraint of several developing countries; have favoured the accumulation of imported capital goods; have allowed for production expansion, job creation and, ultimately, fast economic growth.

These remarkable performances notwithstanding, natural resource booms may also have negative consequences on the development process of backward economies. Actually, economic studies have extensively addressed such a possibility. The effects of natural resource abundance on economic development were firstly considered by some development economists in the 1950s and 1960s. Hirschman (1958), Seers (1964), and Baldwin (1966) propose argumentative treatments on this issue. According to them, natural resource-based sectors are separated enclaves in the productive systems of developing countries. Therefore, natural resource industries, differently from manufacturing, hardly promote domestic industrialization and economic progress. Manufacturing development is to pursue so as to achieve fast economic growth. In the 1970s and the 1980s the “Dutch Disease” literature has

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formalised the potential outcomes of natural resource booms. Corden and Neary (1982) propose a static neoclassical model in which natural resource booms induce manufacturing to shrink by drawing productive inputs out of tradable manufacturing activities and moving them towards non-tradable and natural resource industries. Bruno and Sachs (1982) extend this finding to a multi-period setting. Following Sachs and Warner (1995), the “Dutch Disease” literature identifies de-industrialization as main consequence of natural resource discoveries or booming prices of primary commodities. Nevertheless, nothing is said about the relationship between industrialization and economic progress, so that the effects of natural resource booms on economic growth remain blurred. Sachs and Warner (1995) make the point a bit clearer by proposing an overlapping-generation model. Following Matzujama (1992), they assume tradable manufacturing activities to be source of economy-wide technical knowledge. In this context, natural resource booms reduce growth by withdrawing productive factors out of manufacturing and lowering the accumulation of technological knowledge. More recently, Gylfason and Zoega (2006) reconsider the issue through a neoclassical growth model. According to them, in the long run, natural resource abundance hampers growth by cutting saving and reducing physical capital accumulation.

Structuralist literature put great emphasis on the relationship between productive structures and economic growth. Latin American structuralism sees in natural resource-biased productive structures, as opposed to industrialized systems, the roots of North-South uneven development. Perhaps due to such a pre-ordered view, structuralism has largely neglected the long-run effects of natural resource booms. Following Dutt (2003), high prices of exported commodities may favour growth by relaxing the trade balance constraint. Nevertheless, this holds in the short run only. In the medium run, according to the Prebisch-Singer hypothesis, the attempt to raise growth induces developing countries’ terms of trade to deteriorate. In the long run, economic growth is uniquely determined by the Thirlwall law. In this paper we try to fill the gap and elaborate a structuralist perspective on the long-run consequences of natural resource booms. In a way, we follow Sachs and Warner (1995) by providing a formal model on natural resource booms, de-industrialization and economic development. Differently from them, we want to analyse the issue in a structuralist framework. The structuralist spirit of our model emerges in two points.

- 1) Following Taylor (1983), we propose a two-sector model. A domestic manufacturing sector and a natural resource sector are assumed, each of them having peculiar properties. The latter behaves in a neoclassical fashion and appears as a separated enclave in the productive structure of the economy. Domestic manufacturing, instead, works in a Kalecki way. The price of the domestic manufactured good is set according to a mark-up rule on variable costs, whilst manufacturing output and capacity utilization adjust to clear the market.
- 2) We assume natural resource booms to affect economic development by altering the productive structure of developing countries. Actually, this is a well-known fact in economic literature.

According to Sachs and Warner (1995), natural resource booms hamper growth by drawing productive inputs out of tradable manufacturing and allocating them elsewhere, this way affecting the sectoral composition of the economy. Like other models, however, the point remains somehow implicit, given that they do not explicitly consider the “relative dimension” of different industries. In this paper, differently from previous formalizations, we explicitly consider the relative importance of domestic manufacturing compared to the natural resource sector. The ratio between the manufacturing capital stock and the enclave sector’s capital stock is the economic variable which captures the sectoral composition of the economy and the degree of manufacturing development. In so doing, we introduce further departures with respect to the traditional “Dutch Disease” literature. In the latter, productive factors’ allocation relies on static price-driven adjustments. Differently, we describe changes in the productive structures as a dynamic process, which depends on capital accumulation. In our model, natural resource booms affect physical capital’s investments in manufacturing and in the enclave, and therefore the expansion (contraction) of manufacturing vis-à-vis natural resource-based productions. The economy may increasingly shift away from or depend on natural resources. Eventually, according to the structuralist approach, alternative industrial trajectories will have lasting consequences on economic development.

The paper is divided in two parts. In the first part, we build up a general two-sector structuralist model on economic dynamics and industrial development. The attention is on structural change and manufacturing development as leading engines of productivity growth. In the second part, we address the effects of increasing commodity prices on the development process. According to the “Dutch disease” argument, here treated in a structuralist context, we show how increasing commodity prices can be source of economic backwardness by affecting the relative importance of domestic manufacturing compared to natural resource industries. Some policy considerations are finally drawn.

2. A simple model on structural change and economic development

Let assume a dual economy, in which both a natural resource sector and a domestic manufacturing sector exist. The natural resource-based sector produces primary commodities through a fixed-coefficient production function and totally exports its output. According to Hirschman (1958), Seers (1964) and Baldwin (1966), the natural resource sector is an enclave in the domestic economy without productive linkages with the rest of the productive system¹. The enclave imports from abroad the capital goods used in the production process. Following Taylor (1983) and Dutt (1996), we assume the enclave sector to work in a neoclassical fashion. Whilst the price P_e of the “enclave” good is exogenously determined on international markets, enclave’s firms fully utilise the installed capacity K_e . No restrictions are assumed as far as the labour supply is concerned. Equations (1), (2) and (3) describe the economic behaviour of the enclave.

¹ See Albala-Bertrand (2006) on Chile and UNCTAD (2005) on Africa.

$$X_e = a_e K_e \quad (1)$$

$$L_e = b_e a_e K_e \quad (2)$$

$$P_e X_e = w L_e + r_e P_i K_e \quad (3)$$

In equation (1), X_e stands for the enclave's output and a_e is the output/capital technological coefficient. Equation (2) determines labour demand in the enclave, L_e and b_e being the employment level and the labour/output coefficient, respectively. Finally, equation (3) describes income distribution in the enclave: w is the economy-wide monetary wage rate (to be discussed below) and r_e the profit rate in the enclave. P_i is the price of the imported capital good used in the natural resource sector.

Also domestic manufacturing adopts a Leontief production technology. Contrary to the enclave, domestic manufacturing behaves a la Kalecki. The price P_m of the domestic manufactured good is set according to a fixed mark-up rate on variable costs, whilst aggregate production X_m and capacity utilization u adjust to satisfy aggregate demand. The home-economy manufactured good is both exported and sold internally. Moreover and foremost, it is used both for consumption and investment purposes at home. This last point formalizes the productive linkages peculiar to manufacturing. Equations (4), (5), (6) and (7) describe how manufacturing works.

$$P_m = (1 + \tau) w b_m \quad (4)$$

$$X_m = u K_m \quad (5)$$

$$L_m = b_m u K_m \quad (6)$$

$$P_m X_m = w L_m + r_m P_m K_m \quad (7)$$

Equation (4) captures the price-setting rule in manufacturing, τ being the mark-up rate and b_m the manufacturing labour/output coefficient. Equation (5) determines manufacturing output according to capacity utilization u and the accumulated capital stock K_m . On the base of equation (5), equation (6) establishes manufacturing employment L_m . Equation (7), finally, defines how manufacturing output is distributed among productive inputs, r_m being the manufacturing profit rate.

According to equations (3) and (7), two social classes exist in the economy: capitalists and workers. Following the structuralist perspective, we assume a uniform wage rate across sectors, established exogenously on the base of institutional factors. Workers fully spend it on both imported goods and

domestic manufactured goods according to fixed spending shares. On the contrary, let assume profits to be fully saved and re-invested in capital accumulation. Moreover, assume capitals not to move across sectors, due to “technological” restrictions or oligopolistic barriers to entry². In the enclave, neoclassical capital accumulation takes place, saved profits financing capital goods’ imports. In manufacturing, sectoral profits stimulate capital accumulation through an independent investment demand. For the sake of simplicity, we neglect capital goods’ imports in the manufacturing sector. Equations (8), (9), (10) and (11) describe both consumption and investment decisions.

$$P_m C_m = (1 - \alpha)(wL_m + wL_e) \quad (8)$$

$$P_i C_i = \alpha w(L_m + L_e) \quad (9)$$

$$g_e = r_e = \left(1 - \frac{\omega b_e}{\phi \rho}\right) \phi \alpha_e \quad (10)$$

$$g_m = \gamma_0 + \gamma_1 \pi u \quad (11)$$

Equations (8) and (9) formalize consumption demands. C_m (C_i) stands for real consumptions of the home-produced manufactured good (imported manufactured good), whilst $(1 - \alpha)$ is the corresponding spending share. Equation (10) follows from equation (3) and formalizes capital accumulation in the enclave. According to our assumptions, the growth rate of the enclave’s capital stock g_e ($=I_e/K_e$) is nothing but the enclave’s profit rate r_e . In equation (10), it depends on the real wage in terms of the home-produced manufactured good ω ($=w/P_m$), the price ratio between the enclave good and the imported good ϕ ($=P_e/P_i$), and on the relative price between the enclave good and the domestic manufactured good ρ ($=P_e/P_m$). Equation (11) gives the investment demand function in manufacturing g_m ($=I_m/K_m$). The formalization we adopt follows the post-Keynesian literature (Taylor, 2004). In equation (11), γ_0 captures the Keynesian-type “animal spirits” by domestic entrepreneurs. Further, capital accumulation in manufacturing is a positive function of capacity utilization “ u ”, due to the positive effects capacity utilization carries on sectoral profits r_m (i.e. $r_m = \pi u$) through the manufacturing profit share π .

² The evolutionary literature on sectoral systems of innovations emphasises the existence of persistent differences across sectors. According to it, capitals may not move freely across industries and sectoral profits differ due to the entry/exit barriers induced by sector-specific technical “paradigms”, localised and cumulative technological knowledge, different market structures and strategic interactions among firms.

2.1 The Short-run Equilibrium

In the short run, capital stocks in the enclave and in manufacturing are given by historical accumulation. Macroeconomic equilibrium is achieved when the markets for the enclave good and the manufactured good are in equilibrium simultaneously. Equations (12) and (13) represent the excess demand functions on the enclave good's market and on the manufactured good's market, respectively.

$$ED_e = P_e E_e - P_e X_e = 0 \quad (12)$$

$$ED_m = P_m C_m + P_m E_m + P_m I_m - P_m X_m = 0 \quad (13)$$

In equation (12), E_e stands for the enclave's exports. In equation (13), instead, E_m represents real manufacturing exports. Adding up side-by-side equations (12) and (13); using equations (1) to (11) and "normalising" by the value of the manufacturing capital stock, we obtain a general expression for the short-run macroeconomic equilibrium. In equation (14), we solve it for the manufacturing capacity utilization:

$$u = \frac{[\gamma_0 + \varepsilon + (1 - \alpha)\omega b_e a_e / k]}{[\alpha + (1 - \alpha - \gamma_1)\pi]} \quad (14)$$

In equation (14) k ($=K_m/K_e$) is the ratio between the enclave sector's capital stock and the manufacturing sector's capital stock. The economic meaning of equation (14) is straightforward. Capacity utilization in manufacturing adjusts to clear up the manufactured good's market and to ensure the short-run macroeconomic equilibrium. Capacity utilization is a positive function of economic injections appearing at the numerator of equation (14): the exogenous component of the investment demand function γ_0 ; the manufacturing exports/capital stock ratio ε ($=E_m/K_m$); the domestic expenditures from employees in the enclave sector. Moreover, it positively depends on the endogenous component of the investment demand function $\gamma_1\pi$, which appears at the denominator of equation (14). On the contrary, economic leakages, i.e. saved profits and import flows, reduce capacity utilization.

Before analysing the dynamics of the model, a few words more are to be said about manufacturing capacity utilization. Special concern is to be reserved to the economic factors affecting manufacturing exports. Two fundamental assumptions are adopted.

1) $\varepsilon = f(y_m)$, with $f'(y_m) > 0$: According to the model set-up, the price of the home-produced manufactured good's price is a positive function of the labour/output technological coefficient b_m and a negative one of the manufacturing labour productivity $y_m = 1/b_m$. If the monetary wage and the mark-up rate are constant, a higher labour productivity means lower prices and a higher international

competitiveness of the home-produced manufactured good. By increasing the price competitiveness of the domestic manufactured good, a higher labour productivity may improve manufacturing exports, the export/capital ratio ε and therefore capacity utilization “ u ” in equation (14).

2) $\varepsilon = f(k)$, with $f'(k) > 0$: Export performances not only depend on price competition. According to the evolutionist theory (Dosi and Soete, 1988; Soete, 1992; Montobbio and Rampa, 2004), technological factors such as product differentiation may be even more relevant export-enhancing factors than price competitiveness. In this regard, not all industries have the same properties in terms of technological innovation. Manufacturing activities seem to have some peculiar features compared to other sectors. According to Greenwald and Stiglitz (2006), industrial enterprises usually require a wider spectrum of labour skills and competencies, so that manufacturing development is often a precondition to the accumulation of human capital and technological knowledge³. Moreover, manufacturing activities, more than other industries, may support R&D efforts and generate technological innovations in terms of production efficiency, new products, rising product quality. Following Young (1928), Kaldor (1967), McCombie and Thirlwall (1994), manufacturing is characterised by *macroeconomic* increasing returns to scale, due to its own capabilities to generate an extensive social division of labour. This aspect has important implications on labour productivity dynamics, to see below. Moreover, it is fundamental for technological progress, which largely depends on dense productive linkages among interconnected activities.

According to this perspective, different productive structures and different degrees of manufacturing development may produce different paths in the accumulation of fundamental economic “assets”. A natural resource-based economy, in which domestic manufacturing is poorly developed compared to the enclave, likely provides weak stimuli to accumulate human capital, due to the capital-intensive nature of the prevailing sector (Cimoli and Roviola, 2008). Further, natural resource industries exploit abundant productive inputs as strategic competitive factors, therefore paying scant attention to product innovation. Technological innovation plays a much more relevant role in manufacturing, although significant differences exist among low-tech and hi-tech industries. A well-developed industrial base is therefore necessary to promote innovation, as well as the formation of institutions favouring economy-wide technological progress (Cimoli and Roviola, 2008)⁴. Human capital, technological knowledge and innovation capabilities all affect the international competitiveness of an economy. Compatibly, industrialized productive structures and manufacturing development result to be fundamental to improve the export performances of developing countries. From a theoretical

³ Following Rodrik (2004), the accumulation of human capital is often demand-constrained rather than supply-constrained. Why should people invest in acquiring a higher formal knowledge if there are no opportunities to exploit it in highly remunerated jobs in complex industrial systems? The productive structure of an economy definitely matters to stimulate and “shape” the accumulation of human capital.

⁴ See Gylfason (2001) and Gylfason and Zoega (2006) on the crowding-out effect that natural resource abundance may have on the accumulation of both human and physical capital, as well as on the introduction of technological progress.

perspective, a positive relationship between manufacturing exports \mathcal{E} and the manufacturing capital stock K_m might formalize this point. In our model, we prefer assuming \mathcal{E} to be positively influenced by the capital stock ratio k , i.e. the economic variable here adapted to proxy the productive structure of the economy. On the one hand, the positive relationship between \mathcal{E} and k maintains the direct impact K_m may have on manufacturing exports, here scaled for the capital stock in the enclave. On the other hand, it better catches the effects of different productive structures and different levels of manufacturing development on the international competitiveness of the economy.

On the base of these assumptions, we now analyse how manufacturing development and structural changes affect the development process of backward economies.

3. Manufacturing development and economic dynamics

Following Ros and Skott (1998), we describe the economic dynamics of the economy through a two-by-two dynamic equation system. For the sake of simplicity, let assume labour productivity in the enclave to be constant⁵. On the contrary, let assume labour productivity in manufacturing to evolve according to the following dynamic equation (“hat” variables stand for percentage growth rates):

$$\hat{y}_m = \varphi + \xi k - \theta y_m \quad (15)$$

In equation (15), parameter φ constitutes an “exogenous” component in the labour productivity dynamics. Parameter ξ , instead, formalizes a positive relationship between the evolution of manufacturing labour productivity and the capital stock ratio k . According to Hausmann and Klinger (2007), the evolution of an economy is strongly path-dependent. The existing productive pattern affects the overall learning capabilities of the economy and the scope for technological innovations. In a way, what is currently produced determines what could be produced in the future. Consequently, different productive structures do not only affect the “short-run” competitiveness of an economy. They also have dynamic consequences on the development process. Following Greenwald and Stiglitz (2006), there is a positive relationship between the labour productivity dynamics and the degree of manufacturing development. Once again, the economic rationale behind such a relation relies on the peculiar properties traditionally attached to manufacturing. According to the structuralist tradition, industrialized productive systems have greater opportunities than natural resource-based economies to

⁵ We follow the theoretical literature assuming decreasing/constant returns to scale in natural resource productions and increasing returns to scale in manufacturing (Matzujama, 1991; Ros, 2000). Moreover, we formalize some empirical evidence on productive systems in developing countries. In most backward economies, the natural resource sector uses mature capital-intensive production techniques, whilst domestic manufacturing lies far behind the worldwide technological frontier (Katz and Stumpo, 2001). Labour productivity in the former is often higher than manufacturing labour productivity. Nevertheless, manufacturing “offers greater opportunities for the generation of value added than the primary sector (UNCTAD, 2006, p. 25)”. Manufacturing underdevelopment in most developing countries even widens the scope for greater increases in manufacturing labour productivity compared to labour productivity in the enclave.

accumulate technological knowledge. Further and foremost, following Adam Smith, industrialized productive systems may generate an extensive social division of labour. Whilst this aspect has implications on the capability to introduce technological improvements (Cimoli and Dosi, 1995), it also affects the dynamics of labour productivity. Equation (15) properly aims at formalizing the positive nexus that likely connects industrial development to the growth rate of manufacturing labour productivity.

The positive relationship between \hat{k} and y_m notwithstanding, labour productivity dynamics might not be unbounded. The negative effect of y_m on its own growth rate in equation (15) constitutes a stabilising element in the labour productivity dynamics.

As to the evolution of the productive structure of the economy, straightforward calculations lead us to equation (16):

$$\hat{k} = g_m - g_e \quad (16)$$

Equation (16) formalizes the relative expansion (contraction) of domestic manufacturing compared to the natural resource sector, this way defining the industrial trajectory of the economy. Differently from the traditional “Dutch Disease” models, we assume changes in the sectoral composition of the economy not to depend on static price-driven factor allocation adjustments. On the contrary, equation (16) describes a dynamic process which relies on the (relative) investment patterns in manufacturing and in the enclave. According to equation (16), when g_m outstrips g_e , manufacturing is expanding faster than the enclave sector. The capital stock ratio \hat{k} increases and the economy progressively shifts away from relying on natural resources. Contrary, when capital accumulation in the enclave is higher than capital accumulation in manufacturing, the productive structure of the economy increasingly concentrates on exploiting domestic natural resources. De-industrialization takes place. On the base of the argumentations above, these opposite industrial trajectories have lasting consequences on the development process. These consequences are analysed below, together with the effects that natural resource booms may carry on economic progress.

3.1 The long-run equilibrium

Equations (15) and (16) compose a two-by-two dynamic equation system. Its stability properties can be analysed by considering the corresponding Jacobian matrix. The stability analysis is carried out in the mathematical appendix to the paper. Different scenarios exist. In figure 1, the two loci for constant values of y_m and \hat{k} do not cross, so that any long-run equilibrium emerges. In figure 2, a unique equilibrium point exists, the locus for $(\hat{y}_m = 0)$ being tangent to the locus for $(\hat{k} = 0)$. Finally, in figures 3.a and 3.b the two loci cross twice, generating multiple equilibria. In the neighbourhood of the

south-west corner in figures 3.a and 3.b, a “low” equilibrium E_L emerges. It is characterised by a de-industrialised productive structure (i.e. a low value of the capital stock ratio \hat{k}) and a low level of the manufacturing labour productivity. In the north-east part of figures 3.a and 3.b, the intersection between the $(\hat{k} = 0)$ locus and the $(\hat{y}_m = 0)$ locus generates a “high” equilibrium E_H . Contrary to the former one, it combines an industrialised productive structure with high levels of manufacturing labour productivity.

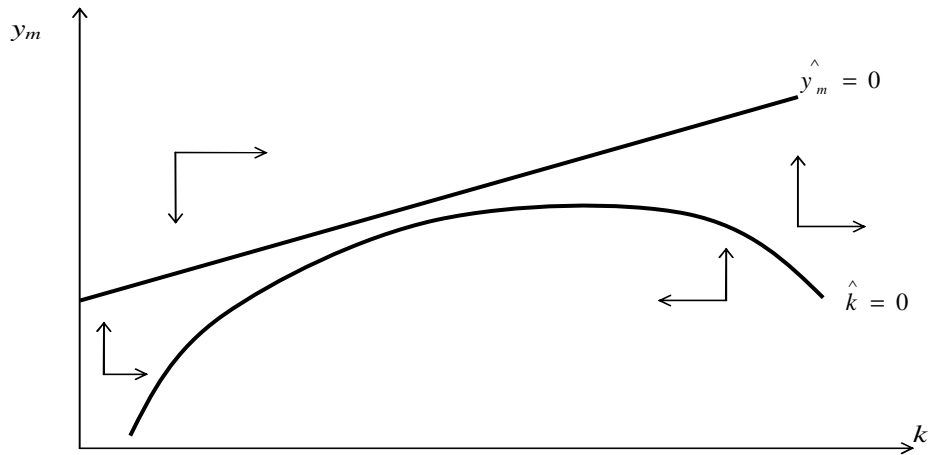


Figure 1 – No intersection between the $(\hat{y}_m = 0)$ locus and the $(\hat{k} = 0)$ locus.

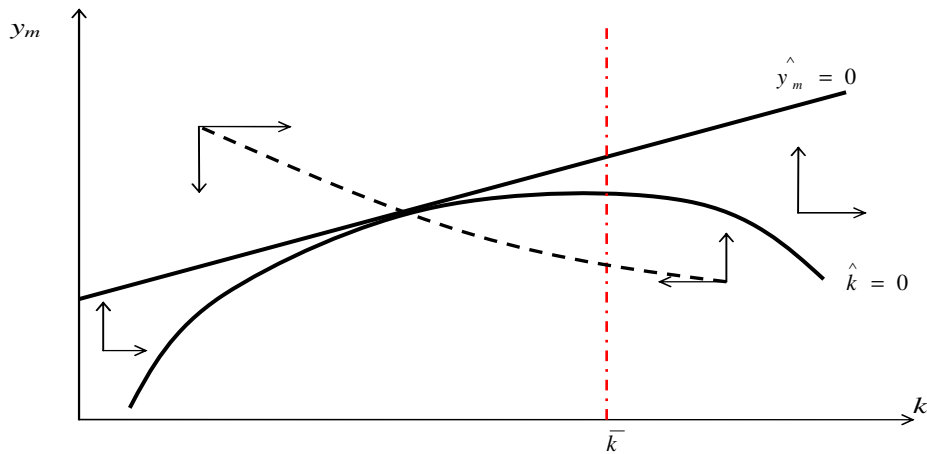


Figure 2 – The case for a unique equilibrium point.

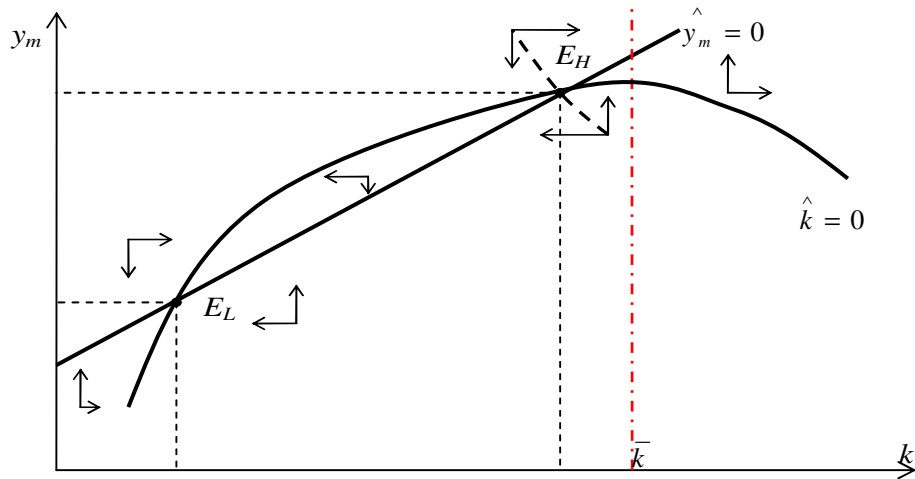


Figure 3.a – Multiple equilibria with E_H crossing in the upward-sloping arm of the $(\hat{k} = 0)$ locus

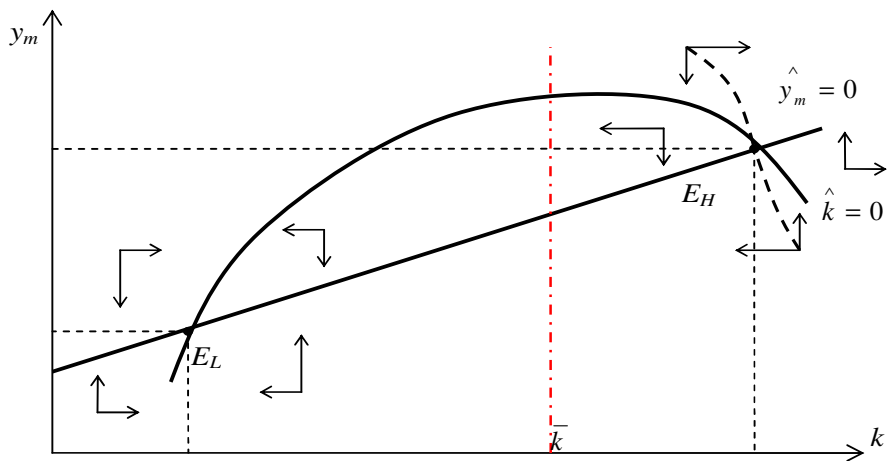


Figure 3.b – Multiple equilibria with E_H lying on the downward-sloping arm of the $(\hat{k} = 0)$ locus

The case for multiple equilibria is of main interest. Actually, the “low” and the “high” equilibria show different dynamics (see the mathematical appendix). At the “low” equilibrium, a stable dynamics emerges. Any shock hitting the economy is “neutralised” and the economic system autonomously returns to the equilibrium. On the contrary, a saddle-path dynamics characterises the “high” equilibrium. Three points is worth noting about the economic implications of such different dynamics. First, the positive relationship between structural change, manufacturing development and productivity growth stands up. According to the structuralist perspective, economic development is a structural phenomenon. An underdeveloped productive structure, where enclave productions lead and manufacturing productions lack, heavily hinders economic development. Structural changes, and

manufacturing development (as represented by a growing k value), are the main source of economic progress.

Second, the stability of the “low” equilibrium E_L stresses the possibility for “poverty traps” to exist, in which de-industrialized productive structures go hand-in-hand with low levels of labour productivity and of real wages. In this sense, structural changes and economic development are not automatic events, which soon or later will inevitably take place. In enclave-biased economies, the likelihood for technological innovation to take place is reduced. Moreover, manufacturing labour productivity may be low. Both facts reduce the economy’s competitiveness and export performances, so that capacity utilization “ n ” and manufacturing capital accumulation are curtailed. *Ceteris paribus*, a stagnant manufacturing sector even exacerbates the backwardness of the economy and its dependence on natural resources. Ultimately, a “poverty trap” arises, in which productive underdevelopment dampens productivity growth and vice versa.

Last but not least, the saddle-path dynamics associated to the “high” equilibrium witnesses that economic shocks may have significant destabilising effects. This is the case of abrupt increases in the price of primary commodities, which may shift the economy away from the “high” equilibrium and push it towards the “low” equilibrium by feeding de-industrialization processes. The long-run economic consequences of natural resource-led de-industrialization are the core of the analysis developed in the next section.

4. Increasing commodity prices, the “Dutch disease” and the long-run economic dynamics

Historically, economic literature has identified the deterioration in the terms of trade of developing countries as a potential source of economic turbulences (Prebisch, 1959; Singer, 1950). Therefore, the recent upward trend in the international price of primary commodities should be received as good news by developing countries. Increasing terms of trade, by augmenting the value of developing countries’ exports, may relax their external balance constraints and ease foreign debt payments. Similarly, they may foster capital goods’ imports in expanding sector. The ensuing job creation may help people to escape from informality and to find a better remunerated formal employment.

Besides these positive effects, natural resource booms may also produce deeper and long-lasting consequences in terms of changing productive patterns. Economic literature has long debated the pro-industrialization or anti-industrialization consequences of natural resource booms⁶. “Dutch disease” is the term commonly used for the de-industrialization case. According to Corden and Neary (1982), Corden (1984), Neary and Van Wijnbergen (1986), natural resource booms lead to de-industrialization by drawing productive factors out of tradable good sectors, manufacturing in particular, and moving

⁶ See Ros (2000) for a survey on the “Dutch Disease”. See Auty (2001), and Collier and Hoeffler (1998) on the effects that natural resource abundance may have on economic development by favouring the diffusion of rent-seeking activities, political corruption and, in extreme cases, war conflicts.

them in non-tradable and natural resource-based sectors. According to them, increases in commodity prices or natural resource discoveries increase labour demand in the natural resource sector. Moreover, they also increase domestic wealth, hence the consumption demands for both tradable and non-tradable goods. In a static neoclassical setting, where full employment holds true, these events lead to rising real wages and to the appreciation of the real exchange rate. Whilst employment increases in the non-tradable sector and (perhaps) in the natural resource sector, it decreases in manufacturing, cutting down manufacturing output. Taylor (1983) reaches analogous results in a structuralist short-run model. According to him, when natural resource sectors expand, their demand for non-tradable inputs increase, bidding up their prices. When a mark-up pricing rule characterises manufacturing, also the manufactured good's price increases. A real exchange appreciation occurs, reducing manufacturing exports and output.

More recently, several analyses have stressed how natural resource abundance may hinder economic development by displacing the accumulation of human and physical capital (Gylfason, 2001; Gylfason and Zoega, 2006). In Gylfason, Herbertsson and Zoega (1999), natural resource abundance impedes the development of a human capital-intensive sector by increasing the volatility of the exchange rate. In Hausmann and Rigobon (2003), the transmitting channel of the “Dutch Disease” is the determination of the interest rate on financial markets. In underdeveloped economies, where non-resource tradable activities largely lack, natural resource booms generate a high volatility of the relative prices between tradable and non-tradable goods. Relative price volatility, in turn, increases the economic risk of businesses in the tradable sectors, hence the interest rates claimed to finance them. High sector-specific interest rates hurt the non-resource tradable sector, inducing it to contract and, eventually, to disappear. In this paper we reconsider the “Dutch Disease” argument making explicit the relationship among natural resource booms, changing productive structures and economic development. According to the structuralist approach, the way natural resource booms affect economic development is by changing k , i.e. the sectoral composition of the economy. The perspective we adopt is dynamic. Changes in commodity prices influence capital accumulation in the enclave vis-à-vis manufacturing capital accumulation. This, in turn, modifies the evolution of the capital stock ratio k and of the productive structure of the economy. Different industrial trajectories emerge, having lasting consequences on economic development.

Let assume the price P_e of the enclave good to increase, due to an increasing demand for primary commodities (or perhaps financial speculations) on international markets. Increasing P_e values improve the profitability of the enclave by raising P_e/P_b , i.e. the price of the enclave good in terms of the imported capital good. Higher profits in turn foster capital accumulation g_e in the natural resource sector. Ceteris paribus, for any given level of manufacturing capital accumulation, k is reduced and a natural resource-biased economy emerges. Manufacturing loses relevance compared to natural resource productions. Such a de-industrialization process entails pervasive economic consequences. The pace of

technological innovation may slow down. The acquisition of new technical knowledge may be hindered. Consequently and compatibly, manufacturing labour productivity decreases. Both effects work to reduce manufacturing exports and capacity utilization. Manufacturing capital accumulation is curtailed and de-industrialization reinforced. Eventually, the economy may find itself concentrated on the exploitation of natural resources and the development process stuck in a “poverty trap”. Even abrupt reductions in the prices of primary commodities may prove to be useless to feed industrialization and bring the economy out of the trap.

Analytically, let’s take equations (15) and (16) and totally differentiate them with respect to y_m and P_e . As to equation (16), nothing relevant happens. The price of the “enclave” good does not enter the equation for the labour productivity dynamics, so that:

$$\left. \frac{\partial y_m}{\partial P_e} \right|_{\hat{y}_m=0} = 0$$

As to equation (16), proceeding as before, we have:

$$\left. \frac{\partial y_m}{\partial P_e} \right|_{\hat{k}=0} = \frac{(\partial g_e / \partial P_e)[\alpha + (1 - \alpha - \gamma_1)\pi]}{\gamma_1\pi\{(\partial \varepsilon / \partial y_m) + [(1 - \alpha)a_e b_e (\partial \omega / \partial y_m) / k]\}} > 0$$

A higher price of the enclave good (P_e) underpins profits in the enclave and the ensuing capital formation. Given the positive relationship connecting g_m to y_m , manufacturing labour productivity should increase to raise manufacturing investments and to keep k constant. In terms of figures 3.a and 3.b, while the locus for ($\hat{y}_m = 0$) does not change, the locus for ($\hat{k} = 0$) shifts upward. Due to the upward shift in the locus for ($\hat{k} = 0$), two new equilibria appear, E_L and E_H in figure 4. A destabilising dynamics is set. Actually, point A is not an equilibrium point any longer. On the contrary, due to the dynamic forces working at it, the economy enters a “perverse” dynamic path. De-industrialization induces manufacturing labour productivity, manufacturing exports and capacity utilization to decrease. This, in turn, further leads the economy to specialize in the natural resource sector. Eventually, the economy automatically moves to the “low” equilibrium E_L , in which manufacturing labour productivity and real wages are cut down compared to the “high” equilibrium.

More relevantly, once reached the “low” equilibrium E_L , the economy turns locked in a “poverty trap”. At the “low” equilibrium, the (prevalent) specialization on the exploitation of natural resources hampers the dynamics of manufacturing labour productivity. Low values of the manufacturing labour productivity in turn obstacles industrialization to take place. The economy is unable to feed a joint process of manufacturing development, improving labour productivity and increasing real wages. In this context, also downturns in the price of primary commodities may likely be useless to bring the

economy back on a sustained development process. Reductions in the international price of the enclave good will alter the “low” equilibrium. Moreover, they will produce temporary fluctuations around the equilibrium point E_L . Nevertheless, due to the self-sustaining forces generated by underdeveloped productive structures, fluctuations will end up in the “low” stable equilibrium E_L . If so, the long-lasting negative effects of temporary natural resource booms appear clearly. This picture also explains why resource-abundant countries may be unable to grow faster and feed economic development even in case of low prices of primary commodity (Hausmann and Rigobon, 2003).

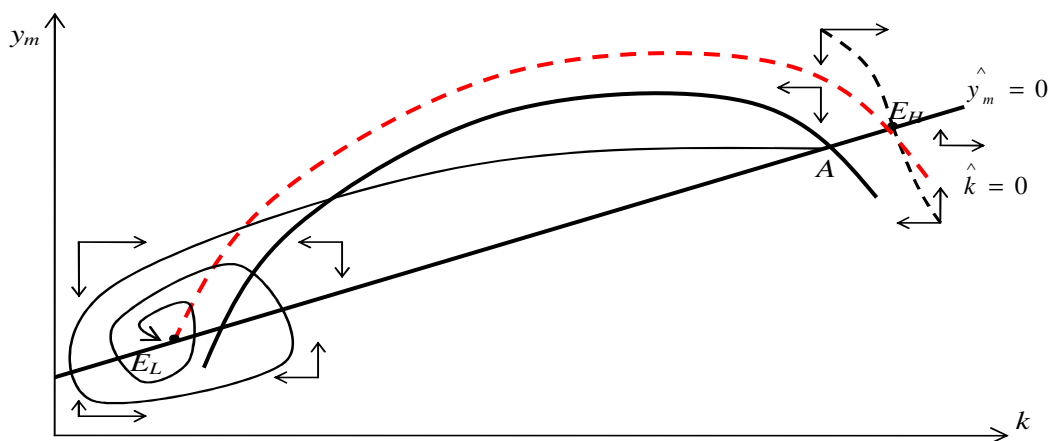


Figure 4 – Long-run destabilising effects of natural resource booms.

5. Multiple equilibria, poverty traps and the role of economic policies

The poverty trap associated to the “low” equilibrium impedes the economy to develop. In the economic literature, the existence of poverty traps like that we describe has been often considered a good reason for public authorities to intervene in the economic sphere⁷. The “Big Push” strategy elaborated at the beginning of the 50s is an example of policy recipe aptly conceived to free developing countries from persistent underdevelopment. Also in this paper we consider a broad set of policy measures to break perverse economic cycles and boost economic progress. Both short-run anti-cyclical macroeconomic policies and long-term development strategies can be taken into account.

As to short-run macro policies, a sound macroeconomic framework is generally considered a necessary condition to sustain economic growth. Anti-cyclical macro policies, by reducing economic fluctuations, may lower the uncertainty of investment decisions and stimulate new entrepreneurial initiatives. In our model, given capital accumulation in the enclave sector, which basically depends on exogenous factors (i.e. the international price of primary commodities), counter-cyclical macro policies may stimulate the

⁷ See Sachs and others (2004) on the international aid program to sustain African development towards the Millennium Goals.

“animal spirits” of domestic entrepreneurs, leading them to foster manufacturing capital accumulation. Consequently, parameter γ_0 may jumps up in the investment demand equation (equation (11)). In figure 5, we portray the consequences of a well-calibrated anti-cyclical macroeconomic management. Due to the increase in parameter γ_0 , whilst the locus for $(\hat{y}_m = 0)$ does not move, the locus for $(\hat{k} = 0)$ shifts downward. Two new equilibria (points E_L and E_H) and two different dynamics emerge. Should the economy originally be at point A, the short-run anti-cyclical measures will shift it to the new “low” equilibrium E_L . The equilibrium value of the manufacturing labour productivity undoubtedly increases. Should the economy initially be at point B, counter-cyclical macro policies may bring about a virtuous process between manufacturing development and the labour productivity dynamics. At point B, due to the increased confidence of domestic entrepreneurs, manufacturing capital accumulation outstrips capital accumulation in the enclave. As a consequence, the capital stock ratio k increases and industrialization takes place, bidding up manufacturing labour productivity. Both the structural shift of the economy towards manufacturing productions and the ensuing increases of manufacturing labour productivity raises the competitiveness of the economy. Manufacturing exports, output and capacity utilization all increase, sustaining industrialization even further. Eventually, manufacturing development and the labour productivity dynamics feed back each other in an unbounded growth process.

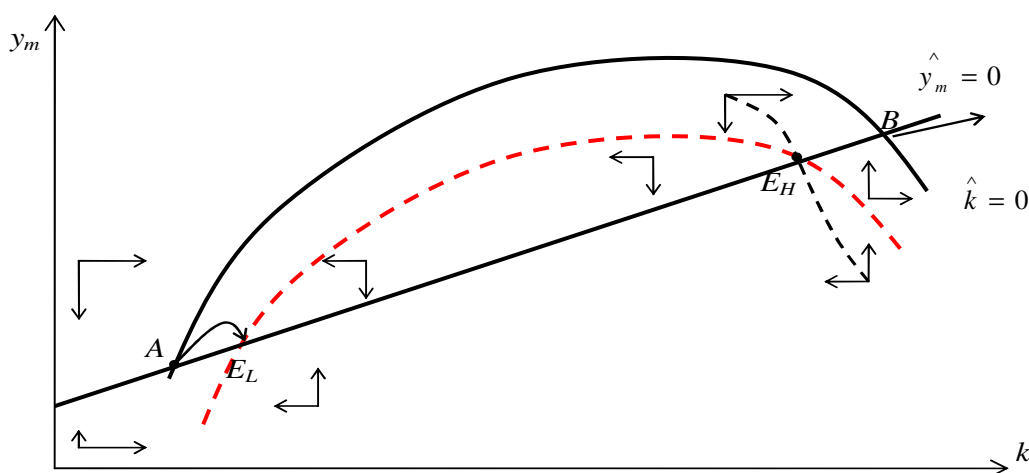


Figure 5 – The long-run effects of short-run counter-cyclical macro policies.

Long-term development policies generally aim to increase the growth potential of an economy. In the neoclassical perspective, perfectly competitive markets constitute the best economic environment to promote economic efficiency, innovation, and productivity growth. In such a context, the State should not interfere with market mechanisms. The structuralist standpoint is much wider. According to it, development policies are a complex mix of strategic trade measures, technology and industrial policies. In this framework, also market-distorting measures may be taken into account.

Independently from the debate on the most promising development strategy, in our model these kinds of policies may be assumed to influence the values of the parameters affecting the labour productivity dynamics. A sound development policy, for instance, may reasonably increase parameter φ in equation (15), i.e. the “exogenous” component in the growth rate of manufacturing labour productivity. Alternatively, or perhaps complementarily, successful long-term development policies may raise parameter ξ , i.e. the effects of the economy productive structure on the labour productivity dynamics. In the following figure 6 we portray the joint effects of these policy-induced parametrical shifts. Whilst a higher φ value shifts the locus for $(\hat{y}_m = 0)$ up, an increase in ξ raises its slope.

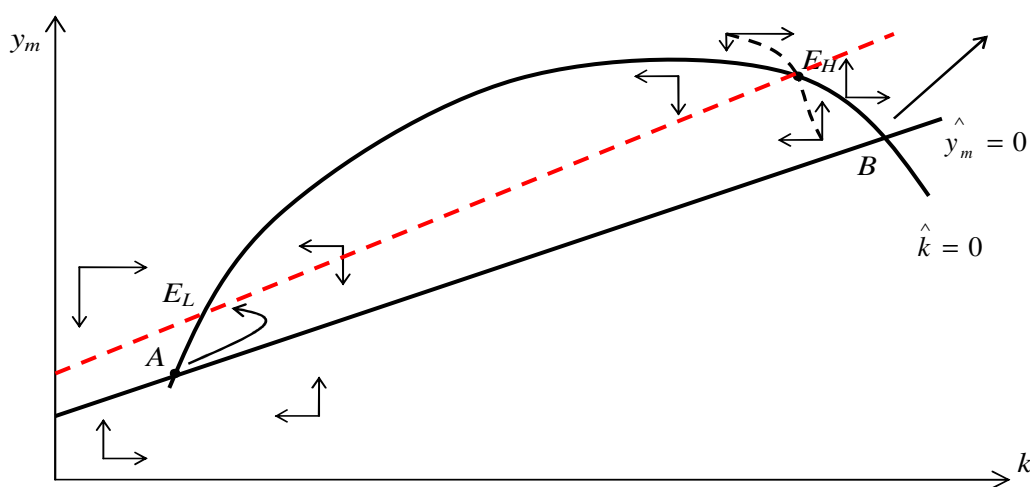


Figure 6 – The long-run effects of long-term industrial policies

The economic consequences are pretty similar to those analysed before. The “low” equilibrium moves to the right from point A to point E_L . At the “high” equilibrium destabilising but positive forces are set in. The economy progressively moves away from relying on natural resource and the capital stock ratio k increases. Moreover, a constantly growing manufacturing labour productivity is both the consequence and the cause of the industrialization process. In this scenario, the increases in manufacturing labour productivity may be even stronger than those observed in the case of simple short-run macro policies. Due to the higher ξ values, long-run development policies may persistently improve the labour productivity dynamics associated to manufacturing development⁸.

According to the analysis above, a mix of anti-cyclical short-run policies and long-run development measures may be the way to eradicate the obstacles to economic development and to push developing countries out of poverty traps. In our model, a vigorous upward shift in the equation for the labour productivity dynamics and a contemporaneous downward shift in the equation for the capital stock ratio dynamics may lead the two curves not to intersect any longer. If so, the “low” equilibrium and the

⁸ Increases in parameter φ have analogous effects on the long-run growth rate of manufacturing labour productivity.

poverty trap would simply disappear. At the same time, an economic dynamics similar to that depicted in figure 1 would be established. The dynamic forces at the base of the industrialization process and of the labour productivity growth are set in motion. A left-to-right unbounded development process may take place, in which the capital stock ratio k and the manufacturing labour productivity grow unbounded.

Conclusions

From the early 2000s, economic growth in most developing countries has gained momentum. The huge increase in the international prices of primary commodity exports lies behind their remarkable economic performances. Improving terms of trade have allowed several developing countries to relax their trade balance constraints and to raise capital goods' imports. Such positive facts notwithstanding, the economic picture of most developing countries also presents some shadows. Actually, natural resource booms may be a curse rather than a blessing for backward economies, when they are associated to the de-industrialisation of their productive systems and to the overdependence on the exploitation of natural resources.

In this work, we develop a structuralist perspective on the long-run effects of natural resource booms. A two-sector framework has been adopted, in which both a Kaleckian manufacturing sector and a neoclassical-type natural resource sector are assumed. Due to the productive/technological properties peculiar to manufacturing, manufacturing development is designed as the driving force of economic progress. The relative expansion of manufacturing vis-à-vis the enclave determines the growth rate of manufacturing labour productivity. Three results are worth stressing.

- 1) Due to the feedbacks between manufacturing development and the labour productivity dynamics, multiple long-run equilibria may appear. Both a stable "low" equilibrium and a "high" unstable equilibrium exist. In the "low" equilibrium, natural resource-biased productive structures oblige developing countries in a poverty trap. A low level of manufacturing productivity characterises such an equilibrium. In the "high" equilibrium, a high level of manufacturing labour productivity is the result of an industrialized productive structure shifted away from relying on natural resources.
- 2) Natural resource booms affect economic development by changing the sectoral pattern of the economy. In particular, huge increases in the international prices of primary commodities raise the profitability of natural resource productions. Higher profits in the enclave in turn stimulate sectoral investments, so that natural resource productions expand compared to manufacturing. De-industrialization happens and a natural resource-biased productive structure emerges. A perverse spiral between de-industrialization and a decreasing manufacturing labour productivity may shift the economy towards the "low" equilibrium and the connected "poverty trap". Eventually, temporary natural resource booms may have bad lasting consequences on the long-run development process.

3) The existence of poverty traps asks for the intervention of public authorities in the economic sphere. A mix of short-run anti-cyclical macro policies and long-run development policies may be the proper strategy to push developing countries out of poverty traps. Anti-cyclical macro policies, by reducing economic fluctuations and macroeconomic uncertainty, stimulate the entrepreneurs' animal spirits and manufacturing capital accumulation. Long-run development policies increase the growth potential of manufacturing labour productivity. If sufficiently strong, the joint effects of these policies may set developing countries on a virtuous path. Manufacturing development and the departure from natural resource-based productive structures may continuously increase labour productivity in an endless growth process.

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Mathematical Appendix

In the mathematical appendix, we present the stability analysis of the model. First, we derive the two loci for $(\hat{y}_m = 0)$ and $(\hat{k} = 0)$. Second, we take into account the dynamic properties of the multiple long-run equilibria described in the main text.

A.1 Derivation of the two loci for $(\hat{y}_m = 0)$ and $(\hat{k} = 0)$

The stability analysis of equation (15) is pretty simple. Putting equation (15) equal to zero and totally differentiating, we get:

$$F = \varphi + \xi k - \theta y_m = 0 \text{ Hence: } \theta dy_m = \xi dk \text{ so that:}$$

$$\left. \frac{dy_m}{dk} \right|_{\hat{y}_m=0} = \xi / \theta > 0 \quad (\text{a.1})$$

The $(\hat{y}_m = 0)$ locus is a simple straight line, having a constant positive slope (i.e. ξ / θ) and intercept equal to (φ / θ) .

The stability analysis of equation (16) gets slightly more complicated. The condition for k to be constant requires $g_m = g_e$. Such a condition can be restated as follow:

$$\gamma_0 + \gamma_1 \pi \frac{\gamma_0 + \varepsilon(k, y_m) + [(1 - \alpha)b_e a_e \omega(y_m) / k]}{[\alpha + (1 - \alpha - \gamma_1)\pi]} = g_e \quad (\text{a.2})$$

Totally differentiating equation (16) with respect to k and y_m , we get:

$$\gamma_1 \pi \frac{(\partial \varepsilon / \partial k) - [(1 - \alpha)b_e a_e \omega / k^2]}{[\alpha + (1 - \alpha - \gamma_1)\pi]} dk + \gamma_1 \pi \frac{(\partial \varepsilon / \partial y_m) + [(1 - \alpha)b_e a_e (\partial \omega / \partial y_m) / k]}{[\alpha + (1 - \alpha - \gamma_1)\pi]} dy_m = 0$$

So that:

$$\left. \frac{dy_m}{dk} \right|_{\hat{k}=0} = - \frac{(\partial \varepsilon / \partial k)k^2 - (1 - \alpha)b_e a_e \omega}{k\{(\partial \varepsilon / \partial y_m) + [(1 - \alpha)b_e a_e (\partial \omega / \partial y_m) / k]\}} \quad (\text{a.3})$$

The sign of equation (a.3) is uncertain. Whilst the denominator is positive, due to the positive effects y_m has on both ε and ω , the numerator has an uncertain sign. The term $(\partial \varepsilon / \partial k)k^2$ is surely positive. The term “ $(1 - \alpha)b_e a_e \omega$ ”, instead, is negative. In order to find a clear condition on the numerator’s sign, let’s take the numerator of equation (a.3) and manipulate a bit. One gets the following expression:

$$(\partial \varepsilon / \partial k)k^2 - (1 - \alpha)b_e a_e \omega > 0 \text{ if } \eta h > z \quad (\text{a.4})$$

$$\text{With } h = \frac{\varepsilon}{[\gamma_0 + \varepsilon + (1 - \alpha)b_e a_e \omega / k]}; \quad z = \frac{1}{\{1 + (\gamma_0 + \varepsilon) / [(1 - \alpha)b_e a_e \omega / k]\}} \text{ and } \eta = \frac{(\partial \varepsilon / \partial k)k}{\varepsilon}$$

It is easy to verify that condition (a.4) is never met when k is small and tends towards zero. In that case, b is equal to zero whilst z is equal to 1. Condition (a.4) more likely holds when k increases, becoming true when k tends towards infinity. In that case, while b tends towards $(\varepsilon / (\gamma_0 + \varepsilon))$, z becomes equal to zero. If we assume that a threshold level \bar{k} exists, according to which the numerator of equation (a.3) passes from being negative to being positive, we get:

$$\left. \frac{dy_m}{dk} \right|_{\hat{k}=0} = - \frac{(\partial \varepsilon / \partial k)k^2 - (1 - \alpha)b_e a_e \omega}{k\{(\partial \varepsilon / \partial y_m) + [(1 - \alpha)b_e a_e (\partial \omega / \partial y_m)]\}} > 0 \text{ when } k < \bar{k} \text{ and } \eta h < z$$

$$\left. \frac{dy_m}{dk} \right|_{\hat{k}=0} = - \frac{(\partial \varepsilon / \partial k)k^2 - (1 - \alpha)b_e a_e \omega}{k\{(\partial \varepsilon / \partial y_m) + [(1 - \alpha)b_e a_e (\partial \omega / \partial y_m)]\}} < 0 \text{ when } k > \bar{k} \text{ and } \eta h > z$$

The locus for $(\hat{k} = 0)$ appears as an inverted U-shaped curve, having a maximum at the threshold level \bar{k} .

A.2 Stability properties of the long-run equilibria

In figure 3.a and 3.b, multiple long-run equilibria appear. They have different dynamic properties. In order to assess them, let consider the specific Jacobian matrix associated to each of them.

As to the “low” equilibrium E_L in figures 3.a and 3.b, we have:

$$J_{EL} = \begin{bmatrix} (\partial \hat{y}_m^- / \partial y_m) & (\partial \hat{y}_m^+ / \partial k) \\ (\partial \hat{k}^+ / \partial y_m) & (\partial \hat{k}^- / \partial k) \end{bmatrix}$$

According to the signs of the partial derivatives included in the matrix J_{EL} , the matrix trace is surely negative. This is not the case for the determinant, whose sign is uncertain. The standard stability condition requires the determinant to be positive, so that:

$$\det.(J_{EL}) > 0 \text{ if } -\frac{(\partial \dot{k}/\partial k)}{(\partial \dot{k}/\partial y_m)} > -\frac{(\partial \dot{y}_m/\partial k)}{(\partial \dot{y}_m/\partial y_m)} \quad (\text{a.5})$$

In figures 3.a and 3.b, the locus for $(\hat{k} = 0)$ crosses the locus for $(\hat{y}_m = 0)$ from below, given that the slope of $(\hat{k} = 0)$ tends towards “ $+\infty$ ” when k tends towards zero. Condition (a.5) holds true at the “low” equilibrium, so that a stable dynamics characterises E_L .

As to the “high” equilibrium E_H , a distinction is to be done according to the slope of the $(\hat{k} = 0)$ locus. In figure 3.a, the “high” equilibrium lies on the upward-sloping arm of the locus for $(\hat{y}_m = 0)$. Accordingly, the Jacobian matrix (J^1_{EH}) describes economic dynamics around equilibrium E_H in figure 3.a.

$$J^1_{EH} = \begin{bmatrix} (\partial \hat{y}_m^- / \partial y_m) & (\partial \hat{y}_m^+ / \partial k) \\ (\partial \hat{k} / \partial y_m)_+ & (\partial \hat{k} / \partial k)_- \end{bmatrix}$$

The signs of the partial derivatives included in matrix J^1_{EH} are equal to those referring to matrix J_{EL} . The relative capital stock k has a negative impact on its own growth rate. The locus for constant values of y_m , instead, slopes upward. The matrix trace is surely negative, whilst the sign of the determinant $\det.(J^1_{EH})$ is uncertain. Differently from equilibrium E_L , condition (a.5) is now violated. At the “high” equilibrium in figure 3.a, the locus for $(\hat{k} = 0)$ crosses the locus for $(\hat{y}_m = 0)$ from above, so that the determinant $\det.(J^1_{EH})$ turns out to be negative. A saddle-path dynamics characterises the “high” equilibrium in figure 3.a.

The Jacobian matrix (J^2_{EH}) determines economic dynamics around the “high” long-run equilibrium in figure 3.b.

$$J^2_{EH} = \begin{bmatrix} (\partial \hat{y}_m^- / \partial y_m) & (\partial \hat{y}_m^+ / \partial k) \\ (\partial \hat{k} / \partial y_m)_+ & (\partial \hat{k} / \partial k)_+ \end{bmatrix}$$

In figure 3.b, the “high” equilibrium lies on the downward-sloping arm of the ($\hat{k} = 0$) locus. The capital stock ratio k positively affects its own dynamics. Therefore, the signs of the partial derivatives of the Jacobian matrix J_{EH}^2 are different from those included in matrices J_{EL} and J_{EL}^1 . Whilst the sign of the matrix trace is uncertain, the sign of the corresponding determinant remains negative, giving rise to a saddle path dynamics.