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## Structural change, economic growth and natural resource booms: A structuralist perspective

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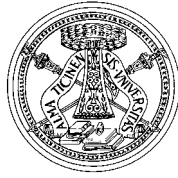
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**Quaderni di Dipartimento**

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

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# Economic Growth, Structural Change and Natural resource booms: A Structuralist Perspective

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Abstract

The recent increase in the world price of primary commodities has brought back to the forum the issue of the role of natural resources in the development process. Whilst improving terms of trade may help developing countries to grow faster in the short run, doubts still exist on the long-run consequences of natural resource booms. In this work, we present a structuralist two-sector model on economic growth, manufacturing development and the “Dutch disease”. We describe a multiple equilibria scenario, in which manufacturing development and labour productivity dynamics feed back each other. Natural resource booms, by affecting investment decisions and modifying the productive structure of backward economies, may set destabilising forces. De-industrialization processes may take place, shifting and confining developing countries in “underdevelopment” traps. Public intervention in the economic sphere may be required in order to free the economy from the poverty trap. Both short-run macro policies and long-run development strategies may play a role in feeding economic development.

Keywords: Structuralism, Structural Change, Manufacturing Development, 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 respectively, signing the best record from the early 80s. The huge increase in the international prices of raw materials and/or agricultural products is at the base of such an economic momentum. High primary commodity prices have relaxed the external balance constraint of several developing countries; have boosted their accumulation of imported capital goods; have allowed for production expansion, job creation and, ultimately, fast economic growth.

Notwithstanding the widespread enthusiasm about such remarkable economic performances, there is still the possibility for long-run negative consequences of high commodity prices on the development process. In the economic jargon, such an argument goes under the rubric “Dutch disease”. Actually, even if increasing commodity prices and improving terms of trade may foster growth in the short run, they may also have vicious long-run effects. De-industrialization, narrowing productive structures and, ultimately, a permanent slowdown in the pace of technological progress constitute some examples.

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According to the recent empirical literature on industrial development and economic growth, such long-run negative effects may be far more relevant than the positive short-run ones<sup>1</sup>.

In this paper we try to elaborate a structuralist approach on economic growth, industrial development and the potential “Dutch disease” effect of increasing commodity prices. In the first part of the paper, 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. The theoretical framework we assume is structuralist. A quantity-adjusting demand-constrained manufacturing sector is assumed, as opposed to a price-adjusting supply-constrained enclave sector. Moreover, an independent investment function drives capital accumulation in the manufacturing sector. In the second part of the paper we address the effects of increasing commodity prices on the development process of backward economies. According to the very traditional “Dutch disease” argument, here sweetened in a structuralist “sauce”, whilst natural resource booms may help accumulation in the short run, they may also trigger off de-industrialization and economic backwardness in the long run. Some plausible policy considerations are finally drawn on the base of the results our model leads to.

## **2. A simple model on structural change and economic development**

Let’s assume a dual developing economy. On the one hand, an enclave sector exists, producing commodities or natural resource-based goods through a Leontief production function. Its production is totally exported and firms do not have production linkages with the remaining of the domestic economy<sup>2</sup>. Following Taylor (2003), the enclave sector works in a “neoclassic” fashion. The price of the “enclave” good adjusts to ensure the market equilibrium. While firms in the enclave sector fully utilise the installed capacity, the equilibrium price basically depends on demand conditions on the international markets<sup>3</sup>. On the other hand, a home manufacturing sector is assumed. A Leontief-type production function determines the manufacturing aggregate supply. Contrary to the enclave sector, manufacturing behaves a la Kalecki. Whilst the manufactured good’s price is set according to a fixed mark-up rate on variable costs, production and capacity utilization adjust in order to meet the aggregate demand for manufactured goods. The home-economy manufactured good is both exported

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<sup>1</sup> According to Rodrik (2007), high-growing developing countries have managed to develop a wide industrial and manufacturing base. Moreover, manufacturing growth (de-industrialization) is positively linked with growth accelerations (economic declines) - a 2% increase in the growth rate of per-capita GDP lasting 8 years or more.

<sup>2</sup> The issue of the poor productive linkages between natural resource-based sectors and the remaining of the domestic economy is a well-known story in the field of development economics. See Hirschmann (1958), Seers (1964) and Baldwin (1966). See also Albala-Bertrand (2006) on Chile and UNCTAD (2005) on Africa.

<sup>3</sup> The reliance of the price of the enclave sector’s good on demand conditions on the international markets is mainly due to the peculiar characteristics of primary commodity markets. On the one hand, the international demand for primary commodities is historically subjected to abrupt fluctuations. On the other hand, due to the fertility constraints of the available lands and/or the production complexity of the mining sector, the supply of primary commodities is fairly inelastic. It may respond sluggishly to price increases, also in the medium run. In this context, the equilibrium price of primary commodities largely depends on demand fluctuations rather than on supply-side factors.

and demanded on the domestic market. Moreover and foremost, it is used both for consumption and investment purposes, this last point formalising the intra-industry productive linkages peculiar to manufacturing productions.

Two social classes exist into the economy: capitalists and workers. Profits earners and wage earners have different consumption patterns. Profits are fully saved and re-invested in capital accumulation. Due to “technological” restrictions or oligopolistic barriers to entry, capitals are not mobile across sectors. While the enclave sector profits finance capital goods’ imports in the enclave, manufacturing profits feed the demand for the home-produced investment good. For the sake of simplicity, we assume an institutionally determined wage rate. Wages are totally consumed. They are spent both on imported goods and on the domestic manufactured good, according to a fixed spending share.

According to the assumptions above, table 1 in appendix A recollects the main variables of the model. Equations (1)-(9), instead, formalise the main features of “our” two-sector developing economy.

$$P_m = (1 + \tau)wb_m \quad (1) \text{ mark-up pricing rule in the manufacturing sector}$$

$$P_m X_m = wL_m + r_m P_m K_m \quad (2) \text{ Income distribution in the manufacturing sector}$$

$$P_e X_e = wL_e + r_e P_e K_e \quad (3) \text{ Income distribution in the enclave sector}$$

$$X_e = a_e K_e \quad (4) \text{ Aggregate supply in the enclave sector}$$

$$X_m = uK_m \quad (5) \text{ Aggregate supply in the manufacturing sector}$$

$$L_e = b_e a_e K_e \quad (6) \text{ Employment in the enclave sector}$$

$$L_m = b_m uK_m \quad (7) \text{ Employment in the manufacturing sector}$$

$$P_m C_m = (1 - \alpha)(wL_m + wL_e) \quad (8) \text{ Consumption expenditures on the home-produced manufactured good}$$

$$P_i C_i = \alpha w(L_m + L_e) \quad (9) \text{ Consumption expenditures on the imported manufactured good}$$

## 2.1 The Short-run Equilibrium

In the short run, both the enclave sector and the manufacturing sector capital stocks are given by historical accumulation. Macroeconomic equilibrium is achieved when the markets for the enclave good

and the manufactured good are in equilibrium. Equations (10) and (11) represent the excess demand functions on the enclave good's market and on the manufactured good's market, respectively.

$$ED_e = P_e X_e - P_e E_e = 0 \quad (10)$$

$$ED_m = P_m X_m - P_m C_m - P_m E_m - P_m I_m = 0 \quad (11)$$

Adding up side-by-side equations (10) and (11); using equations (2), (3) and (8); “normalising” by the value of the capital stock in manufacturing and reminding that  $r_e P_i K_e = P_i I_e$  (i.e. enclave sector profits are fully used to sustain capital accumulation in the enclave), we can obtain a unique expression for the short-run macroeconomic equilibrium at home. It can be defined as follow:

$$r_m - g_m = \varepsilon + \phi \rho a_e / k - \rho g_e / k - \alpha \omega (b_e a_e / k + b_m u) \quad (12)$$

In order to reach a useful expression for the short-run equilibrium in the home economy, capital accumulation in manufacturing and in the enclave sector are to be defined more in depth. As far as  $g_e$  is concerned, starting from equation (3) and manipulating a bit, we get:

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

An independent investment demand function is assumed in the manufacturing sector. According to the structuralist theory, it is defined as follow:

$$g_m = \gamma_0 + \gamma_1 \pi u \quad (13)$$

In equation (13),  $\gamma_0$  constitutes the well-known autonomous component in the investment demand function. It formalises the Keynesian-type “animal spirits” by domestic entrepreneurs. Moreover, capital accumulation in manufacturing is a positive function of the capacity utilization “ $u$ ”, via the positive effects that capacity utilization has on the manufacturing profits rate  $r_m$  (i.e.  $r_m = \pi u$ ). Putting the expressions for  $g_e$  and  $g_m$  in equation (12), we can solve equation (12) for the capacity utilization “ $u$ ”.

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

The economic meaning of equation (14) is straightforward. Capacity utilization in the manufacturing sector must adjust to clear up the manufactured good's market and to lead to the short-run

macroeconomic equilibrium. It is a positive function of the economic injections appearing at the numerator of equation (14): the exogenous component of the investment demand function  $\gamma_0$ ; the manufacturing sector's exports  $\varepsilon$ ; the domestic expenditures from wage earners employed in the enclave sector. At the same time, " $u$ " is a positive function of the endogenous component in the investment demand function  $\gamma\pi$ , which appears at the denominator of equation (14). Economic leakages, i.e. saved profits and import flows reduce capacity utilization.

Before passing on to analyse the long-run behaviour of the model, a few words more are to be said about capacity utilization in the manufacturing sector. Special concern is to be reserved to the economic factors affecting manufacturing exports. Differently from the early development theories, which were mainly concentrated on developing domestic markets, current economic thought stresses the relevance of non traditional exports as leading source of growth. Two fundamental assumptions can be done about manufacturing exports of the home economy.

1)  $\varepsilon = f(y_m)$ , with  $f'(y_m) > 0$ : According to the model set-up, the manufactured good's price is a positive function of the labour/output technological coefficient  $b_m$  (which is fixed in the short-run) and a negative one of the manufacturing sector labour productivity  $y_m = 1/b_m$ . If the monetary wage and the mark-up rate are constant, a higher labour productivity means lower price and a higher international competitiveness of the home-produced manufactured good. By increasing the price competitiveness of the domestic manufactured goods, a higher labour productivity may boost manufacturing exports, the export/capital ratio  $\varepsilon$  and the capacity utilization " $u$ ".

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 pre-condition to the accumulation of human capital and technological knowledge<sup>4</sup>. 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 qualities. Following Young (1928), Kaldor (1967), McCombie and Thirlwall (1994), manufacturing is characterised by *macroeconomic* increasing returns to scale, due to its own capabilities to give rise to an

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<sup>4</sup> 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 into complex industrial systems? A well-elaborated training policy should also take into account how employing on the labour market the formal competencies acquired during the schooling years. The home economy productive structure definitely matters to stimulate and "shape" the accumulation of human capital.

extensive social division of labour. Whilst this aspect has important implications on the labour productivity dynamics, to see below, it is also fundamental for technological progress, which largely depends on dense productive linkages between interconnected activities.

According to this perspective, different productive structures, and different degrees of manufacturing development, may produce different patterns in the accumulation of fundamental economic “assets” such as labour skills, technological knowledge, and innovation capabilities. These factors, in turn, affect the international competitiveness of an economic system and its export performances<sup>5</sup>. In our model, such an aspect might be formalised through a positive relationship between manufacturing exports  $\mathcal{E}$  and the manufacturing sector’s capital stock  $K_m$ . Nevertheless, we prefer assuming  $\mathcal{E}$  to be positively influenced by the capital stock ratio  $k$ . On the one hand, the positive relationship between  $\mathcal{E}$  and  $k$  preserves the direct positive impact  $K_m$  may have on manufacturing exports (now scaled for the capital stock in the enclave sector). On the other hand, it may better formalise the role of different productive structures and different levels of manufacturing development in affecting the international competitiveness and the economic performances of the home economy.

On the basis of these assumptions, we can now go on and consider the long-run implications of manufacturing development and structural change on the development process of backward economies.

### 3. Manufacturing development and economic dynamics

Following Ros and Skott (1998), economic dynamics can be formalised through a two-by-two dynamic equation system for the growth rate of the labour productivity and for the capital stock ratio  $k$ .

For the sake of simplicity, let assume that the labour productivity in the enclave sector is constant<sup>6</sup>. The labour productivity in the manufacturing, instead, evolves according to the following simple linear dynamic equation:

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

“hat” variables standing for percentage growth rates.

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<sup>5</sup> In sight of future references on manufacturing development and the labour productivity dynamics, see also Gylfason (2001) on the negative affects of natural resource booms on the accumulation of human capital and technological innovations.

<sup>6</sup> This assumption reflects the vast theoretical literature on decreasing/constant returns to scale in natural resource-based productions and increasing returns to scale in manufacturing (Matzujama, 1991; Ros, 2000). Moreover, it may formalise the empirical evidence on the productive systems of most developing countries. In several backward economies, whilst natural resource-based productions use modern capital intensive production processes, many domestic manufacturing activities lie far behind the worldwide technological frontier (Katz and Stumpo, 2001). Labour productivity in natural resource-based enclave sectors may be even higher than manufacturing labour productivity. From a dynamic perspective, however, manufacturing sectors “offers greater opportunities for the generation of value added than the primary sector” (UNCTAD, 2006). The relative underdevelopment of manufacturing in most developing countries even widens the possibilities for greater increases in manufacturing labour productivity compared to the labour productivity dynamics in the enclave sector.



According to Hausmann and Klinger (2007), the evolution and the transformations of an economic system are strongly path-dependent. The existing productive pattern affects the overall learning capabilities of the economy, as well as the scope for technological innovations and new industries to take place. In a way, what is currently produced determines what could be produced in the future. Once again, manufacturing productions and industrialised productive structures seem to show more opportunities than other sectors to acquire new competencies, to accumulate technological knowledge, to generate an extended social division of labour and, ultimately to sustain the labour productivity dynamics. In our model, such a relationship between manufacturing development and the labour productivity dynamics is caught in equation (15) through the positive effects that the relative capital stock ratio  $k$  has on the growth rate of the labour productivity in the manufacturing sector<sup>7</sup>.

The positive relationship between  $k$  and  $y_m$  notwithstanding, labour productivity dynamics may 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. In equation (15), the parameter  $\varphi$  constitutes an “exogenous” component in the labour productivity dynamics.

As to structural change and the degree of manufacturing development in the home economy, straightforward calculations lead us to equation (16):

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

Equations (15) and (16) give rise to a two-by-two dynamic equation system. Its stability properties can be analysed by considering the corresponding Jacobian matrix. The stability analysis of the model is carried out in the mathematical appendix B to the work.

From a graphical point of view, the dynamic behaviour of our model can be represented through a phase diagram. There are many different scenarios. First of all, the two loci for constant values of  $y_m$  and  $k$  may not cross (figure 1). Secondly, a unique equilibrium point may exist, the locus for  $(\hat{y}_m = 0)$  being tangent to the locus for  $(\hat{k} = 0)$  – see figure 2. Finally, the two loci may cross twice, generating multiple equilibria.

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<sup>7</sup> See also Sachs and Warner (2001) on the relationships between natural resource-biased productive structures, manufacturing development and economic growth.

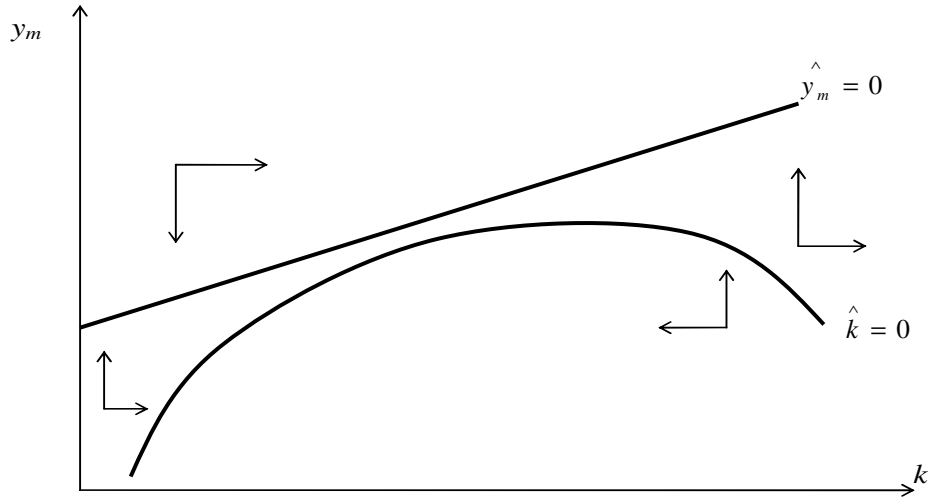


Figure 1 – No intersection between the ( $\hat{y}_m = 0$ ) locus and the ( $\hat{k} = 0$ ) locus.

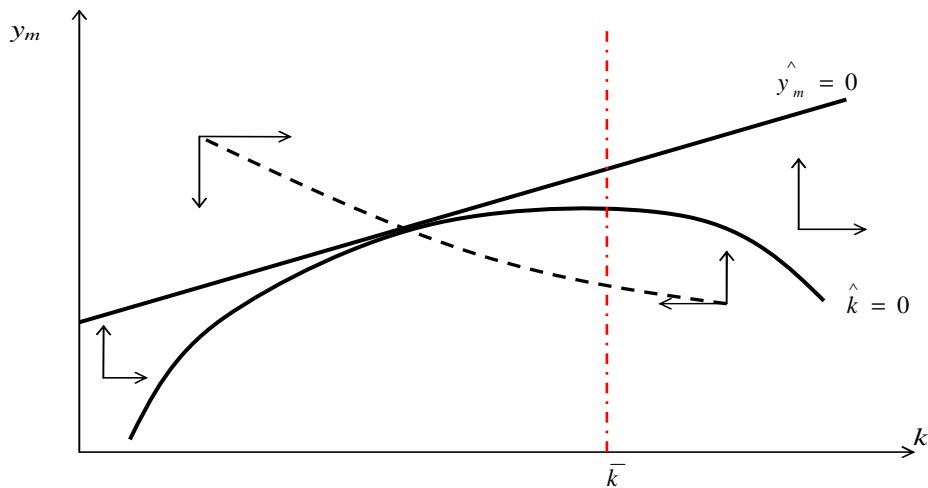


Figure 2 – The case for a unique equilibrium point

Compatibly with the aim of the paper, the case for multiple equilibria turns out to be particularly interesting. On the one hand, it stresses the possibility for a “poverty trap” to exist, in which scant productive structures go hand in hand with a low labour productivity in manufacturing and low real wages. On the other hand, it witnesses that increases in the enclave good’s price may have significant long-run destabilising effects. In what follows, we will focus our analysis on the multiple equilibria scenario.

When the two loci cross twice, two long-run equilibria exist. In the neighbourhood of the south-west corner in figure 3.a and 3.b, a “low” long-run equilibrium emerges ( $E_L$  in figures 3.a and 3.b). It is characterised by a relatively de-industrialised productive structure, as represented by a low value of the capital stock ratio  $k$ , and a low level of the manufacturing labour productivity. In the north-east part of

the phase diagram, the intersection between the ( $\hat{k} = 0$ ) locus and the ( $\hat{y}_m = 0$ ) locus generates a “high” long-run equilibrium ( $E_H$  in figures 3.a and 3.b). Contrary to the former one, it couples a highly industrialised productive structure with high levels of the manufacturing labour productivity.

The “low” and the “high” long-run equilibria show different dynamics (see the mathematical appendix B). At the “low” long-run equilibrium in figure 3.a and 3.b, a stable dynamics emerges. The trace of the corresponding Jacobian matrix  $J_{EL}$  is negative, while its determinant is positive. Any shock hitting the economy will be “neutralised” and the economic system will autonomously come back to the “low” long-run equilibrium. At the “high” long-run equilibrium in figure 3.a, the signs of the partial derivatives contained in the Jacobian matrix  $J_{EL}^I$  are equal to those appearing in the Jacobian matrix  $J_{EL}$  (see the mathematical appendix B). The stability condition  $\det.(J_{EL}^I) > 0$ , however, is now violated. A saddle path emerges.

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

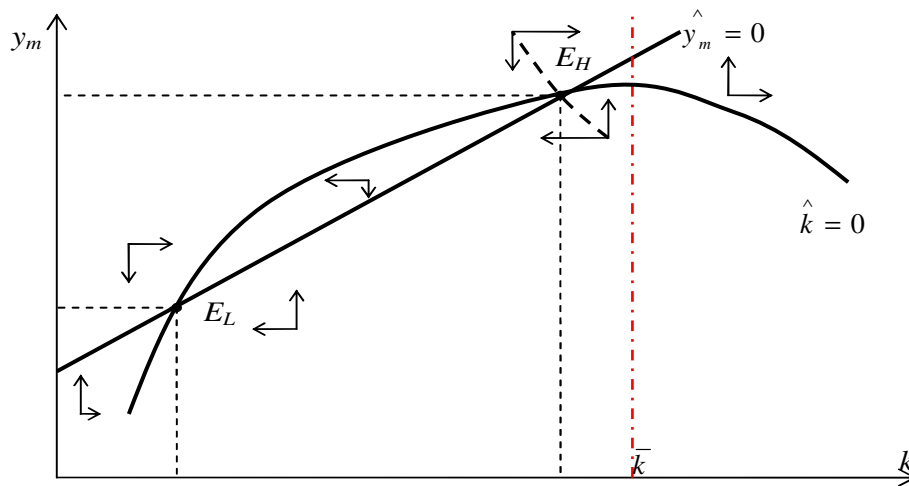


Figure 3.a – Multiple equilibria with  $E_H$  crossing in the upward-sloping phase of the ( $\hat{k} = 0$ ) locus

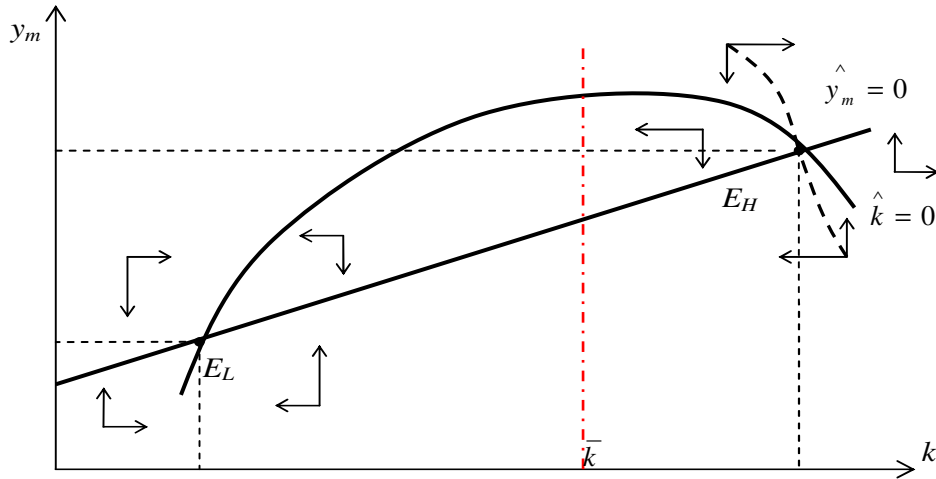


Figure 3.b – Multiple equilibria with  $E_H$  lying on the downward-sloping arm of the  $(\hat{k} = 0)$  locus

Two points is worth stressing about the economic implications of the dynamic analysis above. First of all, the positive relationship between structural change, manufacturing development and productivity growth stands up. According to our theoretical framework, economic development is mainly a structural phenomenon. On the one hand, a persistently “poor” productive structure, where enclave productions lead and manufacturing-type production networks lack, heavily hinders economic development. On the other hand, structural changes and, in particular, manufacturing development, as represented by a growing  $k$  value, is the main source of log-run economic development.

Secondly, structural changes and economic development are not trivial issues. On the contrary, undiversified productive structures and a low (manufacturing) labour productivity may feed back each other, generating “vicious” circle in which developing countries may remain stuck in. This is exactly the economic meaning of equilibrium  $E_L$  in figures 3.a and 3.b. In enclave sector-biased economic systems, where manufacturing is substantially absent, the likelihood for product diversification and technological innovation to take place is reduced. On the one hand, this has a negative and direct effect on the home-economy export performances. On the other hand, it lowers the manufacturing labour productivity, hence price competitiveness. Both capacity utilization “ $u$ ” and capital accumulation in manufacturing are curtailed. Ceteris paribus, a poorly dynamic manufacturing sector even exacerbates the backwardness of the home-economy productive structure. Ultimately, a “poverty trap” arises, in which productive underdevelopment dampens productivity growth and vice versa.

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

Historically, economic literature has identified the long-run deterioration in the terms of trade of developing countries as a main source of economic imbalances and turbulences. This is the case of Latin America in the aftermath of the Great Depression, as well as of many African countries in the

post-Second World War period. In this sense, the recent upward trend in the international price of primary commodities should be received as a good news by developing countries. Increasing terms of trade, by augmenting the value of several developing country exports, may relax their external balance constraints and ease foreign debt payments. Similarly, they may foster capital accumulation in expanding industries. The ensuing job creation may help people to escape from informality and to find a more productive and better remunerated formal employment.

Besides these positive effects, improving terms of trade 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 booms<sup>8</sup>. “Dutch disease” is the term commonly used for the de-industrialization case. According to this perspective, natural resource discoveries or huge increases in commodity prices represent economic shocks, which may affect agents’ expectations, economic behaviours and macro-aggregate dynamics. By increasing expected profits or future income flows, for instance, rising commodity prices may entail growing consumption expenditures and/or new investment projects. Analogously, they may increase the labour demand in natural resource-based industries. In a neoclassical setting, where full employment holds true, these facts lead to rising real wages, inflation acceleration, real appreciation and a lower competitiveness of the domestic manufactured goods. Eventually, manufactured goods’ exports decrease and the home-economy manufacturing sector shrinks.

In this paper, we reconsider the “Dutch disease” argument in a pretty different and structuralist fashion. In particular, we address how increasing commodity prices affect economic dynamics by influencing capital accumulation in the enclave sector and the evolution of the home economy productive structure. This is how it goes. According to our model, the price of the “enclave” good affects the enclave sector profit rate. Higher  $P_e$  values increase the enclave sector profitability by raising  $P_e/P_b$ , that is the enclave good’ price ratio in terms of the imported capital good. Higher profits in the enclave in turn lead to faster capital accumulation  $g_e$  in the enclave. *Ceteris paribus*, for any given level of capital accumulation in manufacturing, an increasingly natural resource-biased productive structure emerges, as represented by decreasing  $k$  values. According to our model, such a de-industrialization phenomenon implies wide and pervasive economic consequences. First of all, the pace of technological innovation may slow down and the scope for product innovation and differentiation gets narrow. The acquisition of new labour skills, competencies and technical knowledge may turn out to be hindered. Eventually, a decreasing labour productivity in manufacturing goes hand-in-hand with decreasing manufacturing exports, the home economy getting “locked-in” into a de-industrialization and “underdevelopment trap”.

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<sup>8</sup> See Ros (2000) for a review and a theoretical analysis of the various theories supporting (rejecting) the negative consequences of natural resource booms on economic development.

Analytically, the long-run consequences of natural resource booms may be assessed through our two-by-two dynamic equations system. 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. Indeed, the price of the “enclave” good does not directly affect the labour productivity dynamics in the manufacturing sector, so that:

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

A completely different picture appears when equation (16) is taken into account. 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  $P_e$  value underpins the enclave sector profit rate and the ensuing capital accumulation by improving the price ratio  $P_e/P_r$ . Given the positive relationship connecting  $g_m$  to  $y_m$ , the manufacturing labour productivity must increase in order to raise manufacturing investments and to keep  $\hat{k}$  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. The ensuing dynamic effects are portrayed in figure 4. Due to the upward shift in the locus for  $(\hat{k} = 0)$ , two new long-run equilibria appear, i.e.  $E_L$  and  $E_H$  in figure 4. More relevantly, a destabilising dynamics may be set in. Actually, point A does not represent an equilibrium point any longer. On the contrary, due to the dynamic forces working at it, the home economy may enter a “perverse” dynamic path shifting it from point A to the “low” equilibrium  $E_L$ .

Once reached the equilibrium point  $E_L$ , the home economy finds itself stuck in an “underdevelopment trap”. De-industrialization and permanent reductions in the manufacturing labour productivity constitute the main features of the new stable equilibrium point. In such a context, also turnaround and downturns in commodity prices may likely be useless to bring the economy back on a sustained development process. More easily, they will just produce temporary cycles and fluctuations ending up in the “low” stable equilibrium  $E_L$ . If so, the long-run negative effects of temporary natural resource booms turn out to be clear.

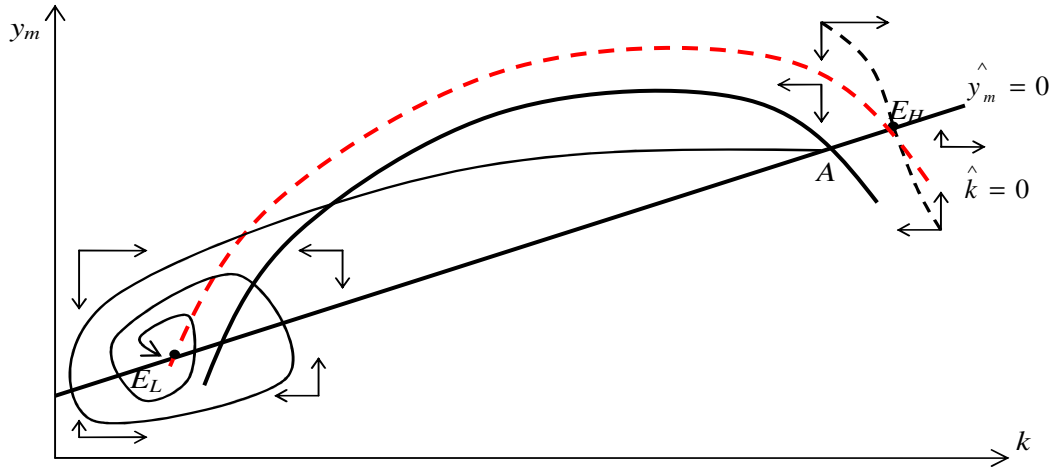


Figure 4 – Long-run Destabilising effects of natural resource booms

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

The existence of poverty traps is usually considered a good reason to justify the public interventions in the economic sphere. The “Big Push” strategy proposed by most development economists at the beginning of the 50s was exactly conceived so as to free developing countries from underdevelopment traps. Following this approach, the multiple equilibria scenario described in our model opens wide room for a broad set of policy measures aiming to break perverse economic cycles and boost economic development. Both short-run anti-cyclical macroeconomic policies and long-term development measures may be taken into account.

As to short-run macro policies, a sound macroeconomic framework is generally considered a necessary requirement to sustain economic growth and development. In particular, anti-cyclical macro policies, by reducing economic imbalances and fluctuations, may lower the uncertainty associated to investment decisions and stimulate new entrepreneurial initiatives. In terms of 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 “animal spirits” of domestic entrepreneurs, leading them to foster capital accumulation in the manufacturing sector. Parameter  $\gamma_0$  in the investment demand equation (13) jumps up.

The long-lasting consequences of a well-calibrated short-run macroeconomic management are clear. In figure 5, while the locus for ( $\hat{y}_m = 0$ ) does not change, the locus for ( $\hat{k} = 0$ ) shifts downward. Two new long-run equilibria (points  $E_L$  and  $E_H$ ) appear. From a dynamic point of view, the manufacturing labour productivity undoubtedly increases. Should the home economy originally be at point A in figure 5, an improved short-run macroeconomic management would shift it to the new “low” long-run

equilibrium (point  $E_L$  in figure 5), thus increasing the long-run value of the manufacturing labour productivity. Should the economy initially be at the “high” long-run equilibrium, counter-cyclical macro policies may bring about a virtuous process between manufacturing development and permanent increases in the labour productivity. Point B being on the right of the equilibrium point  $E_{H}$ , capital accumulation in the manufacturing sector constantly outstrips capital accumulation in the enclave. While the capital stock ratio  $k$  increases and manufacturing development takes place, the manufacturing labour productivity constantly rises. An increasing labour productivity in turn raises the competitiveness of the home-produced manufactured good. The home-economy manufacturing exports increase as well. Higher demand injections ultimately lead to a rising capacity utilization of the installed capacity (via equation (14)), this way sustaining capital accumulation even further. Manufacturing development and increasing labour productivity go hand-in-hand in an unbounded growth process.

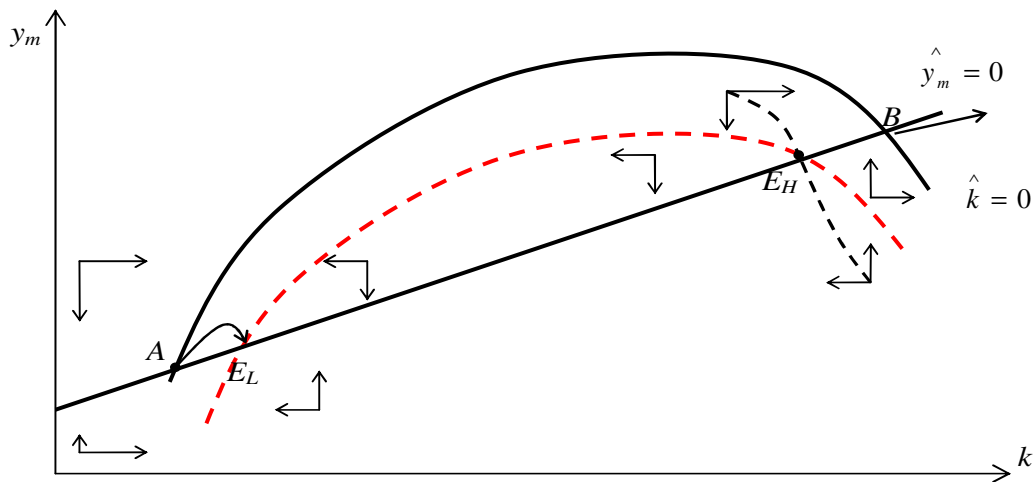


Figure 5 – The long-run effects of short-run counter-cyclical macro policies

Long-term development policies generally aim to increase the growth potential of an economic system. 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 the market mechanisms. Its intervention in the economic sphere should be restricted to remove market imperfections and to provide some fundamental productive inputs and infrastructure<sup>9</sup>. The structuralist standpoint is much wider. According to it, a well designed development policy is a complex mix of strategic trade measures, technology and industrial policies. In this framework, also market-distorting measures may be taken into account.

<sup>9</sup> According to Sachs and at (2004), an international aid-led program of productive investments in basic infrastructures is the core of the “Big Push” strategy designed to foster the African development towards the Millennium Goals.



Independently from the debate on the most promising long-term 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 long-term development policy, for instance, may reasonably increase parameter  $\varphi$  in equation (15), i.e. the “exogenous” component in the growth rate of the manufacturing labour productivity. Alternatively, or perhaps complementarily, successful long-term development policies may raise parameter  $\xi$ , i.e. the effects of the home-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  $\varphi$  value shifts the locus for ( $\hat{y}_m = 0$ ) up, an increase in  $\xi$  raises its slope.

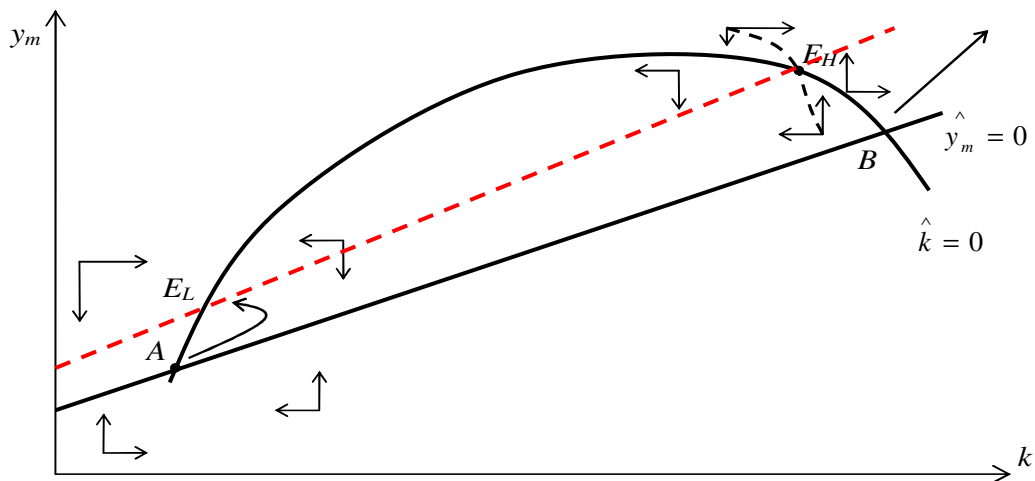


Figure 6 – The long-run effects of long-term industrial policies

The economic consequences are pretty similar to those analysed before. The “low” long-run equilibrium moves to the right from point  $A$  to point  $E_L$ . At the “high” long-run equilibrium destabilising but positive forces are set in. A constantly increasing manufacturing labour productivity couples with an economic system that progressively moves away from relying on the enclave sector. In this last scenario, the persistent increases in the manufacturing labour productivity may be even stronger than those observed in the case of simple short-run macro policies. Due to the higher  $\xi$  values, long-run development policies may persistently improve the labour productivity dynamics associated to manufacturing development<sup>10</sup>.

According to the analysis above, a mix of anti-cyclical short-run policies and long-run development measures may be the main way to eradicate the obstacles to economic development and to push

<sup>10</sup> Increases in parameter  $\varphi$  have an analogous effect on the long-run growth rate of the manufacturing labour productivity.

developing countries out of poverty traps. In our model, a vigorous upward movement in the dynamic equation for the labour productivity and a contemporaneous downward shift in the dynamic equation for the capital stock ratio  $k$  may lead the two curves not to intersect any longer. If so, the “low” long-run equilibrium and the poverty trap in the multiple equilibria scenario 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 basis of a persistent manufacturing development and of the labour productivity growth may be set in motion. A left-to-right unbounded development process may take place, featuring constant increases in the capital stock ratio  $k$  and in the manufacturing labour productivity.

## Conclusions

From the early 2000s on, economic growth in most developing countries has gained momentum. The huge increase in the international prices of their 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 and risks. When associated to de-industrialisation processes and to the overdependence on natural resource-based productions, natural resource booms may be a curse rather than a blessing for the economic development of backward economies.

In this work, we develop a simple structuralist model on the long-run development effects of natural resource booms. A two-sector framework has been adopted. A Kaleckian manufacturing sector stands alongside a neoclassical-type natural resource-based enclave sector. Due to the productive/technological properties peculiar to manufacturing, manufacturing development is designed as the driving force of long-run economic development. The relative expansion of the manufacturing sector vis-à-vis the enclave sector determines the growth rate of the manufacturing labour productivity. Three results of our model 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” long-run equilibrium and a “high” unstable long-run equilibrium exist. In the “low” equilibrium, a poorly developed manufacturing sector (compared to the enclave sector) give rise to a poverty trap in which developing countries may be stuck in. A low level of manufacturing productivity characterises the “low” equilibrium. In the “high” equilibrium, high labour productivity in the manufacturing is the result of an industrialised productive structure shifted away from relying on natural resource-based productions.
- 2) Natural resource booms affect economic development by changing the sectoral pattern of productive investments and modifying the productive structures of developing countries. In particular, huge increases in the international prices of primary commodities raise the profitability of

natural resource-based productions. A higher enclave sector profitability in turn stimulates investments in the enclave. The enclave sector expands compared to manufacturing. De-industrialization happens and a natural resource-biased productive structure emerges. Temporary natural resource booms may generate destabilising forces having long-lasting consequences on the development process. A perverse spiral between de-industrialization and a decreasing manufacturing labour productivity may shift the home economy towards the “low” long-run equilibrium and the connected “poverty trap”.

3) Multiple equilibria cum poverty traps generally ask for an intervention of public authorities in the economic sphere. A mix of anti-cyclical macro policies and long-run development strategies may be the most appropriate policy recipe 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 capital accumulation in manufacturing. 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. The departure from natural resource-based productive structures and manufacturing development may couple with permanent increases in labour productivity in an endless growth process.

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## Appendix A

In the appendix A to the work, we report a list of the main variables contained in the formal model.

Table 1 – Economic variables of the model

$P_e$	Price of the enclave sector good
$P_m$	Price of the home-produced manufactured good
$P_i$	Price of the imported manufactured good
$X_e$	Aggregate output of the enclave sector
$X_m$	Aggregate output of the domestic manufacturing sector
$w$	Monetary wage
$\omega = w/P_m$	Real wage rate in terms of the home produced-manufactured good
$P_i/P_m = \rho$	The imported good/home-produced manufactured good price ratio
$P_e/P_i = \phi$	The enclave good/imported good price ratio
$r_e$	Profit rate in the enclave sector
$r_m$	Profit rate in the manufacturing sector
$\pi$	The short-run fixed manufacturing sector profit share
$K_e$	Installed capital stock in the enclave sector
$K_m$	Installed capital stock in the manufacturing sector
$K_m/K_e = k$	Manufacturing/enclave sector capital stock ratio
$L_e$	Employed labour force in the enclave sector
$L_m$	Employed labour force in the manufacturing sector
$b_e$	Labour-output technologic coefficient in the enclave sector
$b_m$	Labour-output technological coefficient in the manufacturing sector
$b_i$	Labour-output coefficient in the foreign manufacturing sector
$a_e$	Output-Capital technological coefficient in the enclave sector
$u = X_m/K_m$	Capacity utilization in the domestic manufacturing sector
$E_e$	Exports of the enclave sector
$E_m$	Exports of the domestic manufacturing sector
$E_m/K_m = \varepsilon$	Ratio between manufacturing exports and installed capital stock $K_m$
$I_e$	Investment demand in the enclave sector
$I_m$	Investment demand in the manufacturing sector
$I_e/K_e = g_e$	Capital stock growth rate in the enclave sector
$I_m/K_m = g_m$	Capital stock growth rate in the manufacturing sector
$a$	Consumption expenditure share on imported manufactured goods

## Appendix B

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

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:

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

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

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

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

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

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:

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

The sign of equation (B.3) is not defined. While the denominator is positive, due to the positive effects  $y_m$  has on both  $\varepsilon$  and  $\omega$ , the numerator has an uncertain sign. Indeed, while  $(\partial \varepsilon / \partial k)k^2$  is surely positive, the term “ $(1 - \alpha)b_e a_e \omega$ ” is negative. In order to find a clear condition on the numerator sign, let's take the numerator of equation (B.3) and manipulate a bit. One gets the following expression:

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

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

It is easy to verify that condition (B.4) is never met when  $k$  is small and tends towards zero. In that case,  $h$  is equal to zero while  $z$  is equal to 1. Condition (B.4) more likely holds when  $k$  increases, becoming true when  $k$  tends towards infinity. In that case, while  $h$  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 (B.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  $\bar{k}$ .

Stability properties of the long-run equilibria

According to the analysis above and the phase diagrams in the main text, several dynamic scenarios exist. The case for multiple equilibria deserves special attention. As shown in figure 3.a and 3.b, when the locus for  $(\hat{y}_m = 0)$  and the locus for  $(\hat{k} = 0)$  cross twice, two different long-run equilibria appear. They have different dynamic properties. In order to assess them let's consider the specific Jacobian matrix associated to each equilibrium.

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:

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

This is exactly what happens in figure 3.a and 3.b, when the locus for  $(\hat{k} = 0)$  crosses the locus for  $(\hat{y}_m = 0)$  from below. Actually, condition (B.5) may be easily met at the “low” equilibrium in the north-west corner of figures 3.a and 3.b: the slope of  $(\hat{k} = 0)$  tends towards “ $+\infty$ ” when  $k$  tends towards zero.

As to the “high” equilibrium  $E_{H}$ , a distinction is to be done according to the slope of the  $(\hat{k} = 0)$  locus. Two different Jacobian matrices,  $(J^1_{EH})$  and  $(J^2_{EH})$ , exist. The Jacobian matrix  $(J^1_{EH})$  refers to the “high” long-run equilibrium in figure 3.a, which lies on the upward-sloping section of the locus for  $(\hat{k} = 0)$ .

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

The Jacobian matrix  $(J^2_{EH})$ , instead, refers to the “high” long-run equilibrium in figure 3.b, which lies on the downward-sloping arm of the locus for  $(\hat{k} = 0)$ .

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

The signs of the partial derivatives included in matrix  $J^1_{EH}$  are equal to those referring to the matrix  $J_{EL}$ .

In figure 3.a, at the “high” equilibrium point, the locus for  $(\hat{k} = 0)$  is upward-sloping. 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. While the matrix trace is surely negative, the sign of the determinant  $\det.(J^1_{EH})$  is



uncertain. Differently from equilibrium  $E_L$ , the condition (B.5) is now violated at the “high” long-run equilibrium in figure 3.b. The locus for  $(\hat{k} = 0)$  crosses the locus for  $(\hat{y}_m = 0)$  from above, so that the determinant  $\det.(J^1_{EH})$  of matrix  $J^1_{EH}$  turns out to be negative. As represented in figure 3.a, a saddle-path dynamics emerges.

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