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Technology and the Human Resource: An Out-of-Equilibrium Analysis

Mario Amendola
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Francesco Vona is an Italian student from the University "La Sapienza" in Rome. His main research interest is the analysis of skill and innovation and its implication for the income distribution, the labour market and the educational system. He has been visiting student at CRIC three years ago, just at the beginning of his PhD experience. This experience, and especially long discussions with Professor Stan Metcalfe, enriched his background and greatly contributed to outline his PhD research. Since September 2007, He went back to MIOIR to complete his dissertation, which eventually succeeds in April, and started a collaboration with Dr. Davide Consoli on many different subjects, namely: the analysis of the graduate labour market in Finland; a reinterpretation of the dynamic of the wage inequality in last three decades from an evolutionary perspective; the development of models for the analysis of demand in evolutionary economics.

Technology and the Human Resource: An Out-of-Equilibrium Analysis

by
Mario Amendola and Francesco Vona¹

1. Introduction

There is no doubt that innovation is nowadays the main determinant of economic growth and that the human resource is as a crucial factor of the process of innovation.

As the role played by this factor the mainstream viewpoint emphasizes labour market rigidities in the explanation of cross-countries differences in innovation and growth performances, and calls for reforms of labour market institutions to eliminate such rigidities (Krugman 1994, Nicoletti and Scarpetta 2003). This is part of a more general policy consensus on competitive markets as the engine of innovation and on monopolistic distortions as the main obstacle to competition.

In this context achieving a thorough flexibility of labour markets, i.e. low unemployment benefits, absence of firing costs and free wages fixing, is acknowledged as a strong incentive to favour innovative choices, growth and employment. It is well known fact that successful new product innovations enjoy higher returns, but also that they are risky activities and are characterised by a strong turnover and a pronounced creation and destruction of employment. Dismissal costs (employment protection) and rigid wages reduce the incentive for investment in risky, although very productive, technologies and help retaining human resources in low productive sectors, characterised by less risky, routine innovations (Saint Paul, 1997).

In this light adequate labour market conditions favour the ‘right’ investment and the realization of thoroughly innovative technologies. This choice, and the incentives that are conducive to it, are at the core of this analysis. This implies a view of production and technology according to which the productive capacity and its adequate utilisation (the gains of technology) are the automatic (immediate or delayed) result of a simple choice.

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A production theory of this kind, however, is consistent only with an equilibrium context. Only in equilibrium, in fact, it is possible to establish a relation between the basic magnitudes (output, capital employment) of the production process. This relation implies the functioning of a given productive capacity which is automatically adjusted to the best available technology and thus tends to regularize the behaviour of the economy. Only in equilibrium, then, it is possible to relate inputs and output on the basis of a relation defined *ex ante* by technical conditions, and determine returns and productivity as the expression of these conditions. In other words, once you are able to realise the conditions for the choice of the highly productive technology you have the results of this choice. Co-ordination problems, which might hamper the effective appropriation of the potential returns of technology, are excluded by the basic assumption.

This paper proposes an alternative view to critically re-examine the mainstream explanation of the transatlantic divergence, i.e. the reversal in the 'catching up' of the U.S. leadership, in a context where emerging coordination failures between investments in skills and new skill-biased technologies (SBT) are a direct consequence, on the one hand, of the sequential articulation over time of the processes, both of production and skill formation, and, on the other, of bounded rational agents. Our model has proved to be consistent with the explanation provided by the recent paper of Krueger and Kumar (2004) since, in most cases, the transition to the new technology is viable only if an increase in public investments in general and higher education compensates for decreasing capacity of investing in education among the unskilled workers. In particular, an out-of-equilibrium analysis enables us to stress the importance of educational policies especially in the critical initial phase of the technological transition. In the U.S., counter-cyclical policy interventions such as student aids and investments in higher education were probably essential in the 70s to contrast the initial decrease of output and of unskilled wages induced by the joint effect of the ICT revolution and of several adverse shocks, i.e. oil crisis.

2. Innovation as an out-of-equilibrium process

An equilibrium state of the economy as described above is just the opposite of what innovation implies.

Innovation is by definition modification of the existing productive capacity, and thus the breaking of a regular behaviour of the economy. As a consequence co-

ordination problems are likely to emerge across the economy. Innovation is then a process in real time (Georgescu-Roegen (1971), Hicks (1974)) that can be successful or not; technological opportunities do not imply productivity gains as the result of a simple choice. Returns of innovation depends not so much on the intrinsic characteristics of technology as on the co-ordination, both at the micro and the macro levels, that is necessary to ensure the viability of the innovation process.

Innovation implies a restructuring of productive capacity. Co-ordination issues arise in the first place in the production process itself, and specifically in the dynamics of the productive resources involved, due to the distortion of productive capacity that follows innovation. These issues, however, are not confined to the production process but extend to the whole economic system. New goods imply new types of production processes and new activities which, in turn, call for new forms of interaction among the existing agents and institutions or even the appearance of new actors and institutions (Metcalf 1995, 2001).

The key problem becomes to re-establish a balanced structure of productive capacity and to eliminate the market imbalances involved. This is a necessary condition for viability of the innovation process and the possibility to reap the advantages due to new technologies. In this light technology no longer appears as the precondition of the process of innovation but as the result of the latter, interpreted as an (essentially economic) co-ordination process (Amendola and Gaffard 1998).

The human resource plays a crucial role in this process of which the traditional theory offers only a market view. It is argued here that *creation of jobs* as opposed to merely *matching of demand and supply of labour*, is a relevant issue when dealing with innovation, as labour force is a part, an aspect of the productive capacity whose restructuring is the essence of the process of innovation. A process whose viability it has been showed requires adequate co-ordination mechanisms.

The role of the human resource, as well as the working of labour markets in terms of flexibility/rigidity, wages policy, employment protection, etc., must then be looked in relation to the viability of the innovation process. In this light learning appears as a key contribution to the construction/restructuring of productive capacity, in that it helps to re-establish the co-ordination between the accumulation of physical capital and of human capital.

The focus on learning, and on the co-ordination between the accumulation of the physical and the human capital, is all the more relevant in relation to general

purpose technologies, that is those pervasive technologies which (like, e.g., ICT technologies) are the main factor of growth of a knowledge economy.

These technologies are in strongly skill-biased, but have actually changed the requirements of tasks: on the one hand, by decreasing the demand of routine tasks that can be provided by computer; on the other hand, by increasing that of analytical tasks as expert thinking and flexible problem solving (Autor et al. 2003, Spitz-Oener 2006). Dealing with these changes implies a high level of general education that supplies adaptable skills (University degrees, PhDs..) rather than vocational training (mainly based on experience) traditionally important for the provision of specific skills (Nelson and Phelps 1969, Krueger and Kumar 2004).

The empirical evidence seems to support this hypothesis: in spite of their similar patterns of ICT investments and labour market institutions, the U.S. experienced a better productivity performance with respect to the U.K. e.g., as the right explanation of the better productivity performance of the U.S. with respect to the U.K., two economies with otherwise similar institutions, labour markets and patterns of ICT investments. In fact, in the year 1999 the fraction of at least graduate workers in the U.S. population was almost twice that of the U.K. (27.7% vs. 15.4%) and in the year 2002 the resources invested in university education were 2.65 % of GDP in the U.S. compared to 1.1% in the U.K. (Basu et al. 2003). This is even more so if we compare the U.S. with other European economies (Scapetta et al. 2000, Krueger and Kumar 2004).

However, the sensibly higher costs and the longer time to obtain a degree compared to vocational qualifications is likely to bring about a significant breaking of co-ordination between the process of accumulation of physical capital and that of the human resource. The latter must therefore be intensified and accelerated, provided adequate financial resources are available.

3. Financing the upgrading of the human resource

A capital market solution to the problem of the accumulation of human capital is unrealistic. Markets for educational loans are imperfect, due to the difficulties of both monitoring borrowers and of recovering investments (Galor and Zeira 1994). We must therefore turn to other financial sources.

Financing may be provided by unskilled workers, to pay a higher education for themselves or for their offspring. The inducement depends on the educational

premium (i.e. increased difference between skilled wages and unskilled wages due to the stronger demand for higher skills associated with the introduction of skill-biased technologies) and that the benefits of education, when referred to general purpose technologies, is fully appropriated only by who undertook it

Assuming that the cost of education is equal to the living cost plus a tuition fee, the amount required for one unskilled family to sustain the education of an offspring is at least equivalent to the double of the living cost—captured by the notion of subsistence wage, i.e. the income required for the basic needs—plus the tuition fee.

The positive difference between the actual unskilled wage and education costs measures the capacity of accumulation of human capital of the unskilled cohorts. Such capacity is greater the higher this difference and, of course, the higher the propensity to save of the unskilled worker.

This capacity, on the other hand, is negatively affected by a reduction of unskilled wages due to decreasing demand for lower skills resulting both from the shift of firms' demand towards higher skills, as just mentioned, and to a decline of productivity, output and employment that characterises the construction phase of new productive capacities, as will be illustrated.

Firms have no direct interest in financing a general higher education because the results cannot be appropriated. However, competition over scarce skilled workers may increase skilled wages up to the point of swallowing the entire rent of innovation. Firms may thus have an indirect interest due to both a reduction of skilled wages as the result of an increase in the number of skilled workers and by an increase in growth and productivity. Co-operative strategies to reduce the risk of opportunistic behaviour are in any case required to form institutional arrangements to enhance skill formation (joint ventures, agreements to finance universities...).

Given that market forces might not be effective in financing the required accumulation of human capital, a public policy of subsidies to higher education – whether financed by taxation out of profits of the firms or, we shall see, out of their idle balances - appears a likely option to restore coordination between human and physical capital accumulation when skill-biased technologies emerge.

This is even more so if we consider that often, in the early phases, the adoption of a new costly technology brings about a generalized output decrease - the well known 'productivity paradox' (Amendola and Gaffard 1998b) or 'machinery effect' of Ricardian tradition. The disequilibrium generated in the final goods market

feeds back in the labour market by shrinking the source of the supply of educational funds (the revenues and then the financial capacity of unskilled workers, hardly compensated by the increase in skilled wages) and, thus, by reducing the speed of the human capital accumulation. In this phase sustaining this accumulation by means of redistributive subsidies is clearly crucial in order to hamper the widening gap between physical and human capital.

If the redistributive tax is too high, notwithstanding a positive effect during the technological transition, it may also have a negative effect after the transition is completed, because on one side it can reduce the supply of unskilled labour (and via demand expectations, depress the economy) and, on the other, it can stimulate over-accumulation of skilled labour not consistent with the accumulation of physical capital.

In this paper it is argued that an out-of-equilibrium analysis focussed on the viability of innovation puts the ‘flexibility versus rigidity’ issue in a different perspective with respect to the mainstream policy approach. In particular, the more flexible the unskilled labour market is, the less smooth the technological transition will be, as opposed to the dominant policy consensus. As a matter of fact, the greater the downward reaction of unskilled wages to the introduction of skill-biased technologies the greater the reduction of the capacity of the unskilled cohorts to finance higher education. This capacity effect over compensates the incentive effect (widening the gap between skilled and unskilled wages). Both the technological transition and growth are slowed down, and both firms and skilled workers accumulate idle balances. Public subsidies are therefore crucial to ensure the viability of the transition. Rigidity of unskilled wages, on the contrary, dumps down fluctuations in the capacity to finance the accumulation of human capital and is, in a way, a surrogate of public subsidies.

The policy conjectures just outlined will be explored analytically by a model which derives on previous works (Amendola and Gaffard (1998a, 2006)). This presents innovation as an out-of-equilibrium process of creative destruction of productive capacity, and analyses, in particular, skill-biased technological changes. The main features of the model are sketched out in the next section.

The Model

Production

We consider an economy where in each firm production is carried out by means of fully vertically integrated processes of a Neo-Austrian type, using a heterogeneous primary input (labour). An elementary process of production considers explicitly the time profile of inputs and outputs and is represented by an input matrix defined on time and skills and an output vector defined only on time. The input matrix is:

$$\mathbf{A} = \begin{bmatrix} \mathbf{a}_u^c & \mathbf{a}_u^u \\ \mathbf{a}_s^c & \mathbf{a}_s^u \end{bmatrix}$$

whose elements represent the quantities of skilled s and unskilled u labour required in the successive periods of the phase of construction c (from 1 to n^c) and following it, of the phase of utilization u (from $n^c + 1$ to $n^c + n^u$) where the productive capacity generates an output.

The output vector is:

$$\mathbf{b} = [b_j]$$

with $b_j = 0, \forall j = 1 \dots n^c$, and $b_j = 0, \forall j = n^c + 1, \dots, n^c + n^u$

At each given moment t the productive capacity of a firm i is represented by the intensity vector:

$$\mathbf{x}(t) = [\mathbf{x}^c(t), \mathbf{x}^u(t)]$$

whose elements are the number of processes of age j in construction, x_j^c , and in utilization, x_j^u , referring to all the technologies in use.

In the Neo-Austrian framework, a skill-biased technology implies a relative increase in the requirement of skilled labour with respect to unskilled labour, provided that, at the factor prices prevailing when the shock occurs, the new technology is more profitable than the old one. In particular, we consider the case in which the relative increase in the requirement of skilled labour is concentrated in the phase of construction. This assumption captures the fact that skilled workers are the key input in the design and construction of a new productive capacity.

Decisions

Wages are paid before the output goes to market; thus in each period the "virtual" financial market opens before the labour market. At the beginning of the period, each firm (probably) faces a financial constraint. $F(t)$ is the available wage fund subject to the financial constraint:

$$F(t) = (1 - \mu)y(t-1) + f(t) + h_f(t-1)$$

where $y(t-1)$ are the money proceeds and μ is the fixed fraction of consumption out of profits, $h_f(t-1)$ are the idle money balances accumulated in the past, and $f(t)$ are the external financial resources. In particular, the external financial resources are such that: $f(t) = \min(f^D(t), f^S(t))$, where $f^D(t)$ is the demand of external funds determined according to the actual investments and production plans, and $f^S(t)$ is the money supplied by the central authority, which we assume growing at the steady state rate n . Together with the characteristic of the technology, the wage fund $F(t)$ determines the desired demand of labour of each type.

While the emergence of a financial constraint depends on the decisions of the monetary authority, a human constraint might emerge for two reasons: full employment, or excess demand of at least one essential skill.

The decision on how much to produce depends on expectations on final demand. In the case of an excess of capacity with respect to the expected final demand, the vector of processes in the phase of utilization is scaled down uniformly by partial utilization of the productive capacity inherited from the past.

Investments carried out (the rate of starts of new production processes) will then be the minimum between desired investments and that part of the available financial resources not required to carry out current production.

Markets and Prices

The effective demand for final output, $D(t)$, is:

$$D(t) = \frac{W(t) + (1 - \iota) \cdot \pi(t-1) + h^h(t-1) + \min(\iota \cdot \pi(t-1), K_s^D(t))}{p(t)}$$

where $W(t)$ is the wage fund entirely spent on consumption; $\pi(t)$ is consumption out-of-profits, which is a constant fraction μ of money proceeds y at time $(t-1)$ and is

entirely consumed in period t ; τ is the tax rate that finances public education; $K_s^D(t)$ is the funds demanded for being maintained during the educational program, while $\tau \pi(t)$ is the supply of educational funds; and finally $h^h(t-1)$ are the idle balances, if any, accumulated by households in the previous periods, in the case of an excess of demand in the same periods.

In turn, the supply of final output $S(t)$ is simply equal to the output produced in the period plus the real stocks, if any, accumulated in case of an excess supply in the previous periods and put immediately back on the market.

While production and investment decisions are updated during the period if plans cannot be fully realized, prices change only at the junction between periods as a consequence of market disequilibria observed in the previous period, given a reaction coefficient ν_p expressing the degree of flexibility of the market.

Likewise, wages react to disequilibria in the labour market. The reaction coefficient ν_h captures the degree of labour market rigidity, within the range of two polar cases: a purely market-based determination of wages, i.e. $\nu_h \rightarrow \infty$, and an institutionally driven rule, $\nu_h = 0$.

The activity of construction and utilization of productive capacity determines the vector of labour demand, whose elements are the demand for each type of skills, whereas the supply of skilled and unskilled workers depends itself on the distribution of income.

Skills upgrading

The supply of skills is not highly elastic to changes in the wage premium – the difference between skilled and unskilled wages - because skill formation takes time and, also, because there is potential complementarity among public and private decisions of investing in education.

For the sake of simplicity, we assume that $\phi(t)$, the fraction of people who want to become skilled at time t , is equal to the normalized wage premium. Becoming skilled is equivalent to attaining an educational program, which lasts for one year and costs ρ per person. Moreover, during the training period, a student does not work and, hence, receives a zero income.

Thereby, the effective cost of attaining the educational program is:

$$c_e(t) = \underline{w}(t) + \rho$$

where ρ is the tuition fee, while $\underline{w}(t)$ is the subsistence wage, defined as the minimum income needed to satisfy basic needs. Unskilled offsprings can attain education if and only if the unskilled wage is at least equivalent to the cost of education plus the minimum requirement for parents' subsistence:

$$w_u(t) \geq c_e(t) + \underline{w}(t)$$

The difference $w_u(t) - \underline{w}(t)$ leads the capacity of accumulating human capital of the economy. Moreover, since the qualitative behaviour of skill formation and inequality might change for different values of $w_u(t) - \underline{w}(t)$, the initial value of $w_u(t) - \underline{w}(t)$ crucially affects the capacity of adjusting to skill-biased shocks, as we shall see in what follows.

Out-of-equilibrium dynamics

We begin our analysis by assuming a steady state of the economy characterized by a configuration of the initial wage inequality that allows ensuring a balanced accumulation of human and physical capital

When skill-biased technological change pushes the economy out-of-equilibrium, two effects can be initially observed. On the one hand, if $w_s(t) - w_u(t)$ increases, the fraction of people who wants to become skilled increases as well, i.e. $\tilde{\phi}(t) \rightarrow \tilde{\phi}'(t)$. On the other hand, since skill-biased technical change might deteriorate the financial position of unskilled workers by reducing the unskilled wage a balanced path of accumulation of human and physical capital can not be ensured. This negative effect is strengthened by the fact that the adoption of a new costly technology usually brings initially about a generalized output decrease – the already mentioned machinery effect and productivity paradox - that affects employment, thus, further shrinking the revenues and the financial capacity of unskilled workers and hampering the process of skill formation at the right pace

In such a situation public subsidies for education emerge as a solution to make the technological transition viable. In particular, two competing types of policy will be analysed:

The first contemplates financing the required accumulation of human capital by means of a tax on consumption out of profits.

$$K_e^S(t) = \iota \cdot \pi(t-1)$$

This policy has redistributive effects that, first, favour firms' owners by removing the human constraint that prevents output to reach its new steady state level and, at the same time, by reducing skilled wages due to the increase of supply of skilled workers; secondly, it favours unskilled workers at the expense of skilled workers. This policy might have also a negative effect on final demand, both in the long and in the short run, as it shifts resources from current expenditures to investments.

A second policy option is to tax firms' idle balances

$$K_e^S(t) = \iota \cdot h_f(t-1)$$

The emergence of idle balances signals that investment decisions cannot be realized by firms individually, but rather by increasing the provision of public goods in the economy. In this case, negative effects on final demand do not emerge since idle balances can be interpreted as speculative financial investments. More generally, this kind of policy, at least in critical phase of the technological transition, does not reduce the current spending in order to increase public investments.

Let us now present the results of the simulation of this model.

The results of the Analysis

A first result is that a structural modification in the behaviour of the economy following a skill-biased technological shock occurs in correspondence to different initial levels of the difference between the unskilled wage and the subsistence wage. When this difference is relatively high, the fluctuations induced by the technological shock are gradually reabsorbed up to the point where the economy reaches a new steady state characterized by a higher level of the average income per-capita (**Figures 1**). Conversely, when this difference is relatively small, the technological transition is not viable (**Figures 2**). The model shows a threshold value of this difference $(w_u(0) - \underline{w}(0))^*$ that determines whether the economy converges to a higher skill steady state or not.

This result is consistent with the modern view on growth and inequality, whereby a more equal income distribution is associated with higher average level of unskilled wages. In the case of missing markets for education a more equal income distribution allows more people to undergo the cost of education and thus fosters human capital accumulation and ultimately growth (Galor and Tsiddon 1997).

A more interesting result is that the threshold corresponding to a qualitative change in the behaviour of the economy is function of the degree of labour market rigidities. The simulations show that the relation between labour market rigidities and this value is well-established and monotonic. In particular, the more rigid are the labour markets, the smaller the threshold required for the economy to converge to the high-skill steady state (**Figures 1**) and vice versa (**Figure 3**). It is worthwhile noticing that rigidities in the skilled and the unskilled labour markets play an asymmetric role provided that the parental income effect depends essentially on the unskilled wage, while the evolution of incentive effect is also related to the one of the skilled wage. As a matter of fact the simulations confirm that the more flexible is the unskilled labour market, the less smooth is the technological transition, whereas the opposite holds for the skilled labour markets (**Figures 4**).

Building upon these results we can now analyse the effects of public subsidies to education on human capital accumulation.

In particular, we examine the effects of the two policies: a tax on consumption out-of-profits and a tax on speculative investments. In the simulations, we will assume that the tax is imposed once the new technology is *à regime*, that is, only after having observed that, even once all the productive capacity that was using the old technology has ended its life cycle, the disequilibria created by the technological change have not been reabsorbed.

With rigid labour markets the minimum tax on profits rate required to assure the viability of the transition is very small. This proves that a very small reduction of current profits for redistributive purposes allows the economy to adapt to the new technology by increasing the provision of complementary resources, characterized by imperfect individual appropriability (**Figure 5**).

More generally, the tax rate must be set appropriately. On the one hand, a very small increase in the provision of public goods is not enough to offset the deterioration in the unskilled capacity of accumulating human capital. On the other hand, a too large tax rate would depress final demand as a consistent fraction of consumption out-of-profits flows into supplying educational funds.

More interesting for the explanation of the US-EU different performances is the outcome of increasing subsidies for education in a context of flexible labour markets. In this case the increase in the level of subsidies required to re-establish a balanced accumulation of physical and human capital is higher than in the case of

rigid labour markets. It conjures a set of "optimal" institutional configurations in which labour market rigidities and the provision of public goods are, to a certain extent, substitutes. In particular, the adverse effect of labour market flexibility on the technological transition can be reduced by increasing educational expenditures.

A tax on profits has a negative influence on final demand as it induces a net diversion of resources from consumption to investment in education. After the skill mismatch has been reabsorbed, this policy brings about an over-accumulation of educational funds that has no longer the effect of fostering skill formation. These perverse effects are mitigated provided that the increase in the tax rate is not permanent. However, even in this case, it takes a very long time for the degree of capacity to reach its steady state level and for the unemployment to be re-absorbed .

On the contrary, a tax on idle balances, allows quicker achievement of the higher skill steady state and re-absorption of unemployment, mainly because it does not affect the level of final demand during the transition. On the other hand, the flexibility of this policy also explains why the long-run degree of capacity utilization is higher than it would be with a tax on profits, thus allowing reaping all the gains of the new technology (**Figure 6**). As a matter of fact, one of the reasons why idle balances are accumulated is that the appearance of a skill mismatch hampers the firms from investing in new productive capacities as much as they want. Thus, as the mismatch is reabsorbed due to the policy carried out, idle balances are gradually decumulated and the effect of the policy disappears.

Concluding remarks

This work is a first attempt to address some of the most relevant issues for labour market inequalities, skill-biased technical change and productivity dynamics by means of a heterodox approach. In particular, our analysis has provided new insight on the explanation of the transatlantic divergence. Unlike the standard literature on the productivity paradox, the length and the persistency of low productivity levels has emerged as a consequence of policy failures and particular institutional configurations. The analysis implicitly identifies a set of "optimal" institutional configurations in which labour market rigidities and the provision of public goods are, to a certain extent, substitutes. Indeed, the adverse effect of labour market flexibility on the technological transition can be reduced by increasing educational expenditures. Interestingly, the resulting interaction of educational policy and labour market

rigidities in this analysis is coherent with the recent strand of literature emphasizing the crucial role of educational policies in explaining the productivity divergence between economies (Krueger and Kumar 2004, Vandebussche et al. 2006).

Moreover, especially in the critical initial phase of a technological revolution, educational policies are essential to counterbalance emerging inequality and thus to foster skill formation and technological diffusion. A counterintuitive result in terms of educational policies emerges: while at least a priori, the European higher-education system may guarantee higher social mobility and equality significant because of a significant cost saving in terms of fees, European students benefit less than Anglo-Saxon students from public aid schemes, namely grants and facilitated loans. Therefore, one can reach a completely different conclusion regarding the capacity of ensuring equal opportunities of the two systems: compared to a tuition-free system, an aid-based approach can better concentrate the financial support where needed. As a result, an aid-based approach, which includes both loans and grants, tends to foster general education attainments².

Finally, the tax on the idle balances offers a simple metaphor to state that the process of development must contemplate periods in which some of the complementary resources (i.e. skills, infrastructure..) must be built co-operatively and periods in which each individual fully grasps the gain of its investments. In this perspective, institutional and political flexibility makes the system able to adapt quickly to such a change, especially in the case of rigid labour markets. The sticky European decision process and the rigidity of the stability pact can therefore contribute to explain the long productivity slowdown of the euro area.

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² Figures from the Oecd educational dataset seem to support the latter conclusion as the Anglo-Saxon educational system does better than the European one--with the remarkable exceptions of Sweden, Finland and Netherlands--in terms of rates of participation, attainments, investments, students aids, etc.

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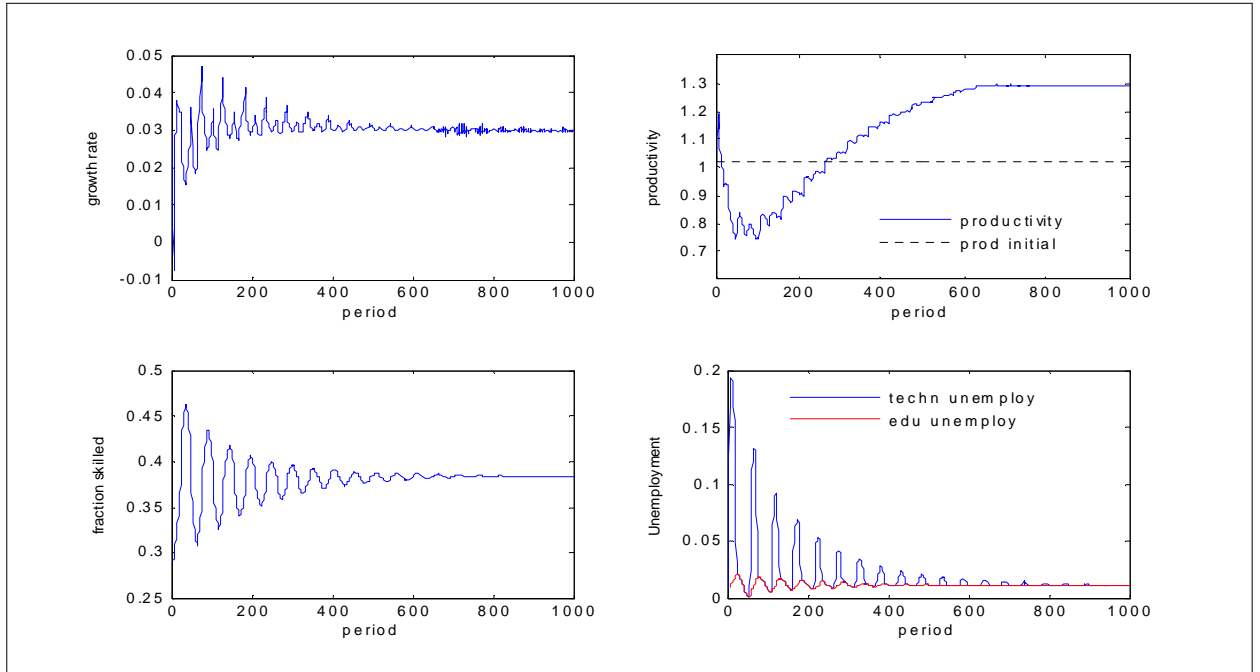


Figure 1: Rigid Labour Markets

$$v_s = 0.35, v_u = 0.25, w_u(0) - \underline{w}(0) > (w_u(0) - \underline{w}(0))^* = 0.6278$$

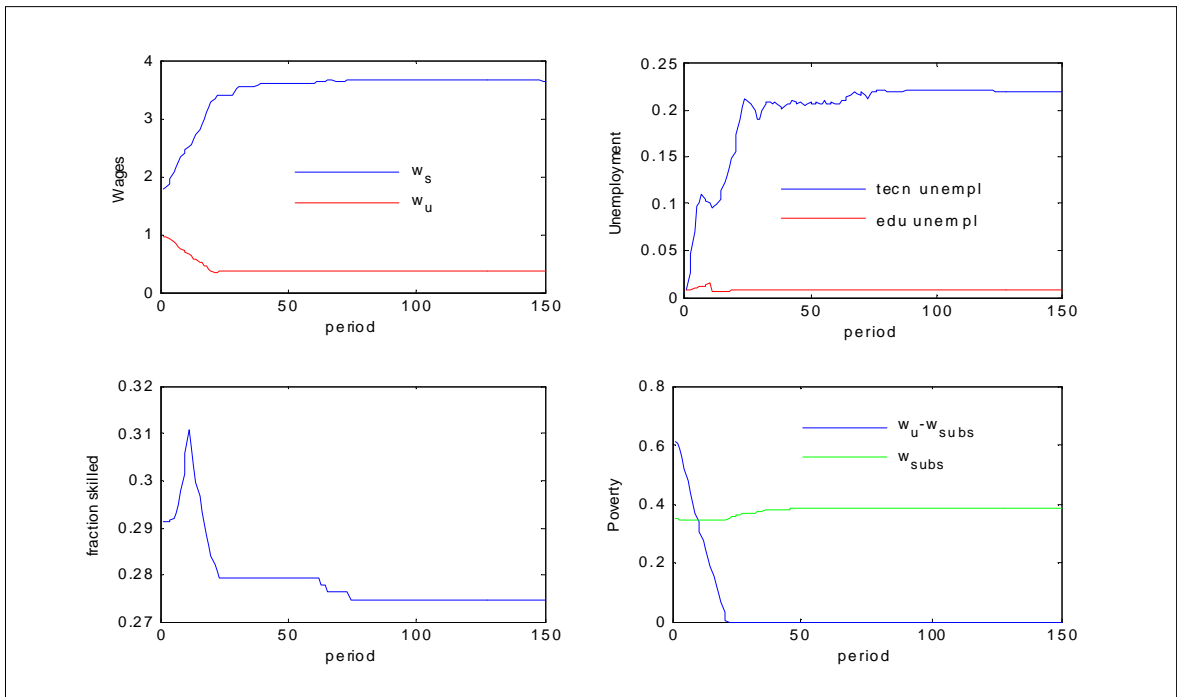
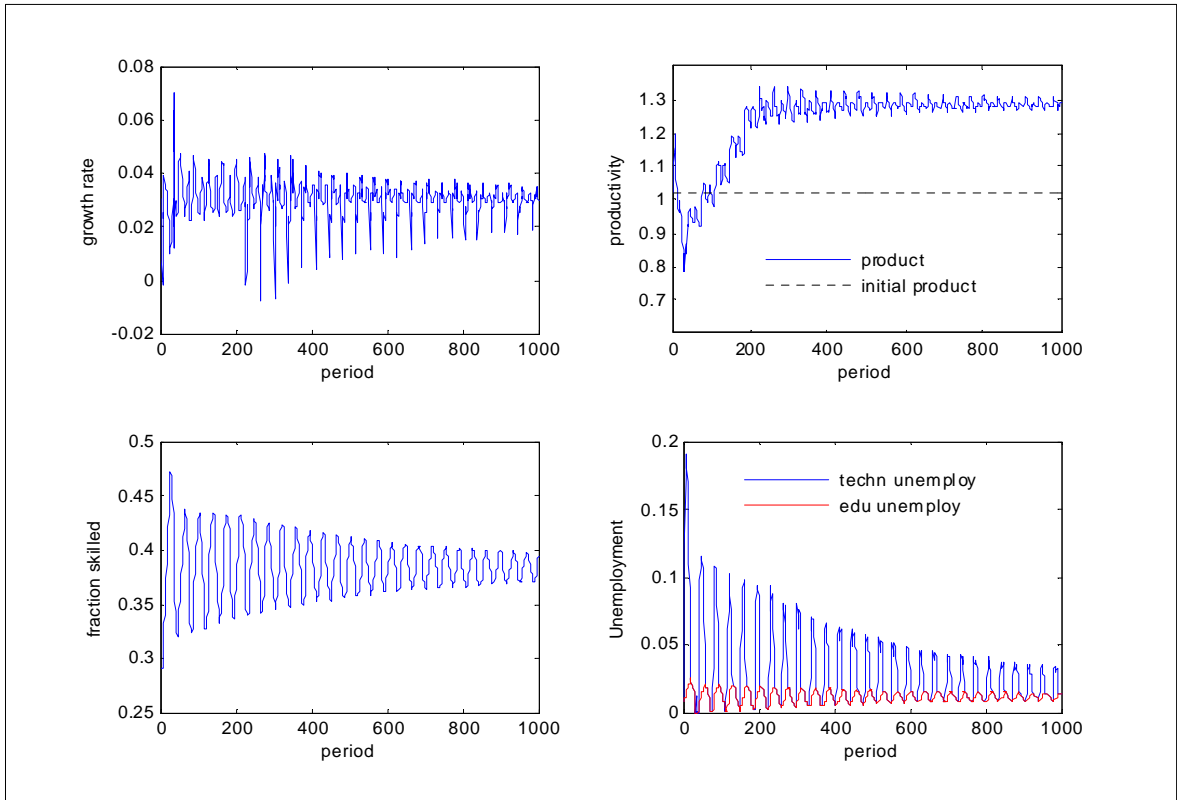


Figure 2: Unviable System $w_u(0) - \underline{w}(0) < (w_u(0) - \underline{w}(0))^*$



3: Flexible Labour Markets

$$v_s = 0.75, \quad v_u = 0.65, \quad w_u(0) - \underline{w}(0) > (w_u(0) - \underline{w}(0))^* = 0.7054$$

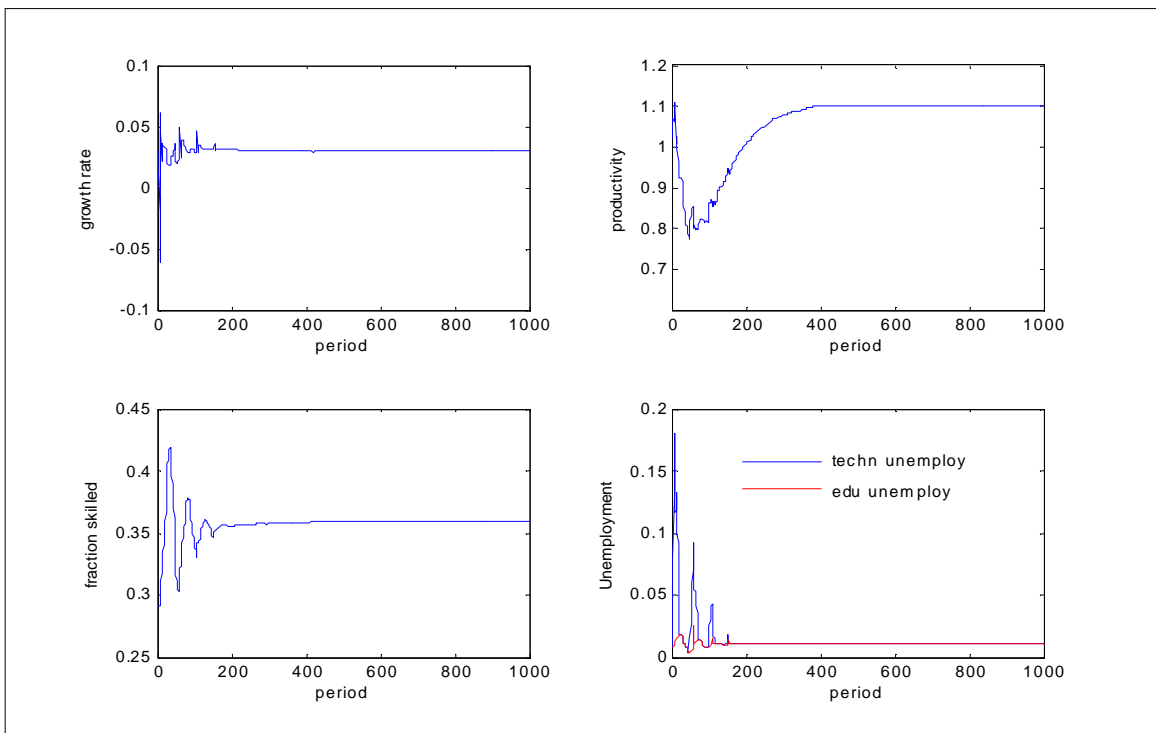


Figure 4: very flex skilled labour market, very rigid unskilled labour market

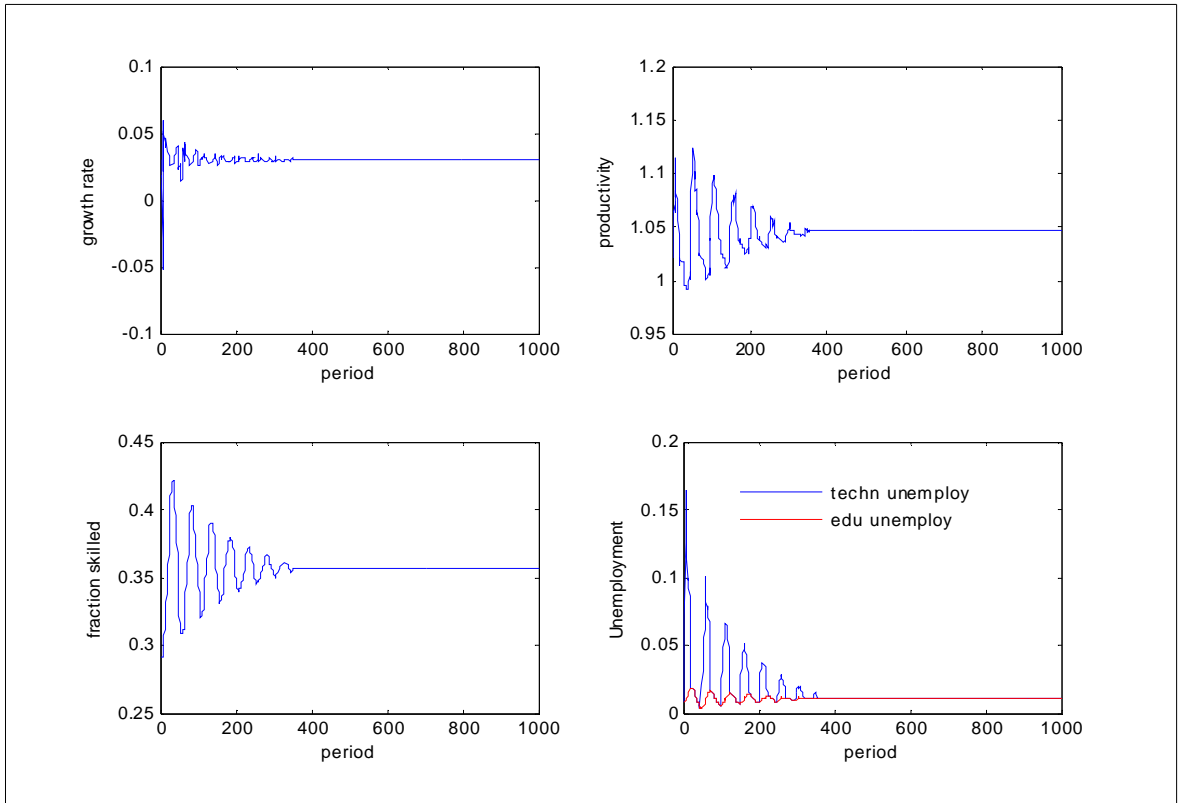


Figure 5: the effect of a tax on profits

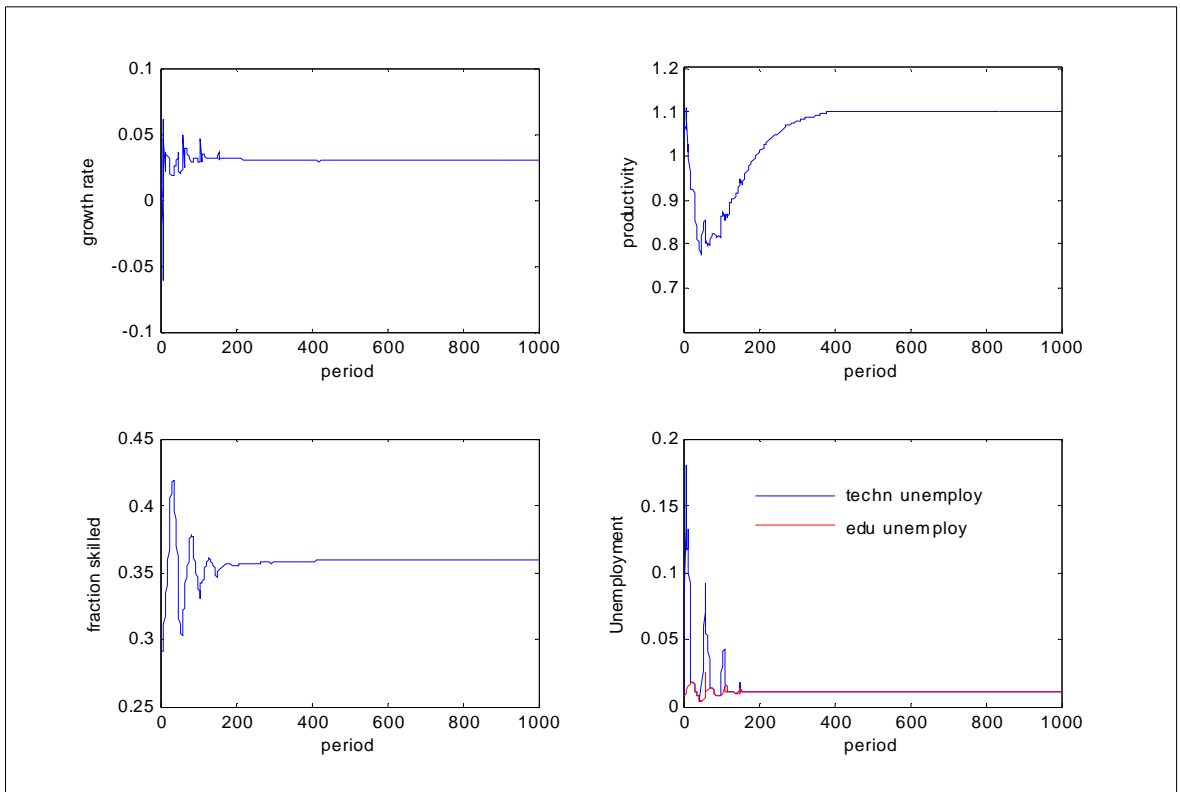


Figure 6: the effect of the tax on idle balances

