Technology and the Human Resource

An out-of-equilibrium analysis

The market view

Innovation as the crucial factor of growth.

The role of the human resource.

The mainstrean viewpoint emphasizes labour market rigidities in the explanation of across-countries differences in innovation and growth performances, and calls for reforms of labour markets institutions to eliminate Monopolistic distortions that appear as the main obstacle to the working of competition.

Flexibility, actually coming down to hiring and firing conditions and free wages fixing is a main structural reform reckoned as a strong incentive favouring innovative choices, growth and employment.

Innovations that introduce new products and, if successful, have higher returns are risky 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 to retain human resources in low productive sectors.

Favourable market conditions favour the ‘right’ investment: the choice of innovative technologies.

The underlying view of production and technology implies: the new productive capacity and its adequate utilisation (the gains of technology) are the automatic (immediate or delayed) result of the availability of the required productive resources and of the way in which they are combined (the technology).

This is the result of a simple choice.

The equilibrium context

The production theory underlying this approach is consistent only with an equilibrium context.
Only in equilibrium we can count on an established relation between the basic magnitudes (output, capital employment) of the production process.
This established relation supposes the functioning of a given productive capacity - defined in terms of given production coefficients - that brings about a regular behaviour of the economy.
Only in equilibrium, then, we can relate inputs and output on the basis of a given relation defined ex ante by technical

conditions, and hence determine returns and productivity
as the expression of these conditions Co-ordination problems,
which might hamper the effective appropriation of the
potential returns of technology, are excluded by assumption.
The production process is then synchronised: inputs and
output are analytically contemporaneous in that
there are always proceeds agains which costs can
be set and a ‘current’ productive activity out of which
they can be financed

Innovation as an out-of-equilibrium process

Innovation is by definition the modification of a given productive capacity, and hence the breaking of a regular behaviour of the economy.

Production processes are no longer synchronised: as a consequence co-ordination problems arise in the economy

Innovation is then a process (in real time) that can be successful or not; technological opportunities do not

imply productivity gains as the result of a simple choice.

Actually obtaining the 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 level, required to make the innovation process viable.

Innovation implies in the first place a restructuring of productive capacity. Co-ordination problems arise in the first place in the production process itself, - concerning the dynamics of the productive resources involved - due to the distortion of productive capacity resulting from innovation,

The main problem is then to re-establish a balanced structure of productive capacity and to eliminate the market imbalances involved. This is what makes the innovation process viable and allows to ripe the gains of technology. 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.

The traditional theory captures only a market view of human capital, not its role in an out-of-equilibrium process like innovation.
In the latter context creation of jobs is the crucial issue, not the matching of demand and supply of labour.
To create jobs we have to create productive capacity as employment is a part, an aspect of productive capacity.
Innovation (restructuring of productive capacity), we have seen, is not the simple result of a choice, it is a process implying the appearance of imbalances and thus needing the working of co-ordination mechanisms for its viability.

The role of the human resource, as well as the working of

labour markets (flexibility/rigidity, wages policy, employment protection…) must be looked in the perspective of the viability of the innovation process.
In this light learning appear as the main contribution of the human resource to the process of construction/restructuring of productive capacity, by helping to re-establish the co-ordination between the accumulation of the physical and the human capital.

GPT and SBTC

Main factor of growth: intense Science-based Technological Change (SBTC) triggered by ICT revolution, typical General Purpose Technologies (GPT).

GPT have changed the requirements of skills: high level general education providing expert thinking and flexible problem solving (University degrees, PHDs..) rather than vocational training (mainly based on experience) which can be expressed in rules and routines.

(explanation of productivity differentials between US and UK: similar labour market institutions, similar pattern of

ICT investments, different endowments of college graduates. All the more between US and other EU countries)

Viability of the innovation process is threatened by co-ordination problems, paramount co-ordination failures between investments in human capital and those in physical capital embodying new skill-biased technologies.

The construction time of high level of education skills is generally longer than vocational training and hence likely to bring about important co-ordination failures. It calls therefore for an intense accumulation of human capital

Skill-biased technological change induces a mismatch between supply and demand of skills, which brings about an increase in the difference between skilled and unskilled wages. This provides an incentive for unskilled people to be willing to enter an education process, receiving a zero income during this process (the stronger the incentive, the greater the wage differential).

However, the supply of skills does not reacts elastically to changes in the wage premium because:

a) skill formation takes time
b) an induced decrease in the unskilled wages reduces the unskilled capacity to invest in education, with the incentive effect being overcome by the capacity effect

The main problem is missing capital markets for educational grants (difficulties of monitoring borrowers and recovering investments) which does not allow to finance the required accumulation of human capital in coordination with the accumulation of physical capital.

Surrogates:

1) Financing comes out of the unskilled workers themselves. The inducement is given by the educational premium (higher skilled wages) and by the fact that the result of the education process with GPT is fully appropriated by the those undertakin this process.

Assuming that the cost of education is equal to the subsistanc
wage of unskilled workers plus an educational fee, the amoun
required for one unskilled worker to sustain the education of
one person is at least equivalent to the double of the subsistan
wage plus the educational fee.

The positive difference between the actual unskilled wage
and this education cost measures the capacity of accumulatio
of human capital of the unskilled cohorts.
This capacity is the greater the higher this difference and the
higher the propensity to save of the unskilled

2) Financing on the part of the firms

The firms have no direct interest in financing a higher general education because they cannot appropriate the results.

However, competition over scarce skilled workers may increase skilled wage up to the point of swallowing the entire rent of innovation.

Firms may thus have an indirect interest represented by a reduction of skilled wages as the result of an increase in the number of skilled workers.

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…)

3) Public subsidies for the public good education

Subsidize the acquisition of higher education by providing a subsidy (not greater than the subsistence wage to finance only those really motivated and not to have an excess of skilled people) financed by taxation out of profits of the firms.

This appears as the best way to relax the financial constraint to the required human capital accumulation (although this is

a necessary but not a sufficient condition for viable innovation an growth, as increasing skills are relevant only if the demand for these skills is growing as well)

Why:
Individual decisions of saving (increasing savings) to finance higher education may feed back negatively on the current demand for goods. A disequilibrium in a market (for funds for education) may bring about a disequilibrium in another market (final goods) that feeds back in the original market (less final demand means unemployment and wage decreases),generating cumulative, self-reinforcing recessions. On the contrary, redistributive subsidies both allow to maintain the level of final demand and to relax the unskilled

workers financial constraint.

Most often at the beginning the adoption of a new costly technology brings about a generalized output decrease (machinery effect - productivity paradox). The disequilibrium 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 reducing the speed of the human capital accumulation.
In this phase the sustain to this accumulation represented by redistributive subsidies is clearly crucial in order to hamper a widening of the gap between the physical and the human capital.

However, if the redistributive tax is too high, although it has a positive effect during the technological transition, may alsc have a negative effect after the transition si completed, becau on one side it can reduce the supply of unskilled labour (and via demand expectations, depress the economy) and on the other bring about an over-accumulation of skilled labour, not consistent with the accumulation of physical capital.

Flexibility vs. Rigidity of wages

The more flexible is the unskilled labour market, the less easy is the technological transition. The unskilled capacity to finance education deteriorates as the result of reductions in unskilled wages. This capacity effect over compensates the incentive effect (widening of 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 then crucial to make the transition viable

A certain 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.