TECHNOLOGICAL CHANGE, EFFICIENCY GAINS AND CAPITAL ACCUMULATION IN LABOUR PRODUCTIVITY GROWTH AND CONVERGENCE: AN APPLICATION TO THE SPANISH REGIONS

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According to neoclassical growth theory, diminishing returns to accumulable factors constrain the possibilities of growth of an economy, pointing to exogenous technical progress as the source of long-run growth. At the same time, decreasing returns on capital appear to be driving force towards convergence since poorer economies experience higher returns on investment and consequently higher growth rates. On the other hand, endogenous growth theory provides a new perspective on the factors behind technology, and attribute differences in technology with being one of the sources of persistent differences between economies. Empirical research on economic growth has gained in interest in recent years and points to total factor productivity (TFP) growth as the main source of economic growth since factor accumulation alone can not explain the growth differences between economies.

In most empirical work, however, it is assumed that all units of production are efficient, so that TFP growth is identified with technological change. The possibility that part of this growth may have its origin in efficiency gains is therefore neglected, and biased estimates of technological progress will be obtained in the presence of inefficiencies (Grosskopf, 1993). In order to avoid such a bias, it becomes necessary to estimate a production frontier that shows the maximum technically attainable level of production. Inefficient behaviour could be measured by the difference between the actual level of production and the maximum possible level defined by the frontier. This in turn would allow us to decompose TFP growth into technological progress (shifts in the production frontier) and changes in efficiency (movements toward or away from the frontier).

In this context, we here analyse the productivity growth of the Spanish regions between 1965 and 1995, decomposing TFP gains into technological progress and efficiency change by means of Malmquist pro-

ductivity indices. On the basis of this decomposition, labour productivity growth may be broken down into components attributable to technological change (shifts in the frontier), efficiency gains (movements toward the frontier) and capital accumulation (movements along the frontier). This analysis is carried out at the aggregate level and for the main sectors of private activity.

Once the components of labour productivity growth have been analysed, we shall center on their relative contributions to convergence. A first approach to analysing convergence is based on the commonly used concept of β-convergence (introduced by Barro and Sala-i-Martin, 1992). However, following Quah's (1993, 1997) suggestion, the dynamics of the overall distribution is also analysed, both for the distribution of labour productivity and for each of its components.

Thus, the approach followed in this study is based on the work initiated by Färe *et al*. (1994), where a link between the economic growth and convergence literature, on the one hand, and the production frontier approach, on the other, was established. Furthermore, in the spirit of Quah's approach, the evolution of the whole distribution is considered. Consequently, the analysis of the dynamics of the entire distribution of labour productivity and the factors behind it –technological progress, efficiency gains and capital accumulation– combine both approaches, yielding new insights into the process of productivity growth and convergence experienced by the Spanish regions over the last thirty years**.**