The Rise of Services and Balanced Growth in Theory and Data

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The idea that the process of economic growth is "balanced" has a long tradition in economics. This is motivated by Kaldor's facts, which suggest that along the growth path of an economic system there are some regularities of the data that hold constant. In particular, one of Kaldor's observations is that the capital/output ratio is constant. While this is true for the nominal capital to output ratio, when measured in real terms both the capital services to GDP and the investment to GDP ratios in U.S. data have displayed a positive trend in the post-war period. This appears to be a feature of non-balanced growth that can have important consequences for macroeconomic outcomes. It is well known, in fact, that in standard growth theory the constancy of the capital/output ratio implies that the extra output obtained by investing in an extra unit of capital (the marginal product of capital), and the return on investment projects (the real interest rate) are equal and constant over time. If the capital/output ratio changes along the growth path, this equality does not hold anymore, and the marginal product of capital and the real rate of interest might evolve differently. How differently can only be measured in a theory framework that can account for an increasing capital/output ratio along the growth path together with other salient features of long run growth.

In this research we show that a two-sector growth model of structural transformation from manufacturing to services can account for the increase in the investment/GDP ratio and the capital/GDP ratio, and can be used to measure the implications for the marginal product of capital, the real interest rate, and the growth rate of the economy. The model displays balanced growth when measured in terms of an appropriately chosen *numeraire*, that is an appropriate unit of value. However, when measured in terms of units of GDP or aggregate consumption, growth is "unbalanced" because of the price of services relative to manufactured goods changes and, given preferences, this changes the composition of the consumption basket and output. Thus, in this setting, the rise of the service sector in the economy affects the process of growth along several dimensions, which we show to be qualitatively consistent with the evidence for the U.S.

The model predicts the following patterns over the period: i) a fall in the marginal product of capital of 36% in units of GDP and of 43% in units of aggregate consumption; ii) a decline in the real interest rates of 5% in terms of GDP units and 7% in terms of consumption units; and iii) a decline of the GDP growth rate from 2.29% per year to 1.93% per year from the beginning to the end of the sample period. While the latter is an economically significant reduction, given that the standard deviation of annual per capita GDP growth in the U.S. between 1950 and 2015 is approximately 2.30%, statistically it is difficult to separate the trend fall from business cycles in the data.

A key point of this research is that the concept of balanced growth strictly depends on the units variables are expressed in. That is, whether we measure aggregate output in units of the manufactured good, or units of GDP. This is relevant when bringing the model to the *data*, because GDP in the data differs from nominal aggregate output divided by the price of one good. Instead, real GDP in the data is constructed using a chain-weighted Fisher index. Roughly speaking, the Fisher index weights the growth rate of individual components of GDP by their shares in GDP. This implies that, even if variables grow at a constant rate, if these rates are different and there is structural transformation, the growth rate of GDP is non-constant over time. Our results thus suggest that while the growth process is unbalanced in the data, a multi-sector model of balanced growth is still the best tool to analyze this process.

We then ask how well the model can account for the cross-country evidence on real investment rates. In cross-country data, real investment rates correlate positively with income per-capita, while nominal investment rates display a flat behavior. To analyze these differences in a theory framework, one usually has to assume either that countries are on different balanced growth paths, or that countries are at different stages of a transitional dynamic pattern. The first case is tractable, but requires to assume that countries differ in some deep parameter, while the second usually implies a strict relationship between investment rates and growth rates of output that is not always true. A two-sector model of structural transformation represents a new tool to analyze these differences: along a highly tractable balanced growth path in the theory, it predicts an increasing real investment rate as income grows, due to structural transformation. At the same time, the growth rate of GDP declines, but to a small extent compared to the change in the investment rate.

We compute the elasticity of real investment rates with respect to the share of services in private consumption in the data, finding an elasticity of 0.61. We then use the model to assess to what extent the process of structural transformation can account for this elasticity. The model provides an elasticity of 0.63, virtually the same as in the data. Thus, the different investment rates measured in cross country data can be accounted for by a unique model, displaying theoretical balanced growth, at different stages of development. Our results document that the time series evidence for the U.S. is remarkably consistent with the cross-country evidence, suggesting that, at least in terms of investment rates, most countries are following a similar growth path as the U.S.