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Economic Growth and Business Cycles: The Labor Supply Decision with Two Types of Technological Progress

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Abstract

An iiteq7man8eq7mpodel is described that leads ton8eq7mpultiplen8eq7mpacroecono8eq7mpic equilibr

problem with these approaches is that “capital accumulation cannot account for a large part of either long-run growth or cross-country income differences” (D. Romer, p. 95). This leaves Romer’s so-called “mystery variable,” the effectiveness of labor, “whose exact meaning is not determine consumption, because market clearing would imply that we would always be at full implications of the number of goods available, both within a country over time and in comparisons among countries, has resulted in a misunderstanding of the development process.

Consider first the addition of a desirable new good from a traditional household utility maximization perspective. A new good raises total utility, from the same resources,[6] as people substitute away from now relatively low-value marginal units of pre-existing goods toward reduced quantities of X and L consumed. Hence marginal utilities of all goods consumed become higher than before, at initial income levels, the latter being determined by initial equilibrium labor supply decisions. Integrating over these marginal utilities, total utility is seen to rise, potentially dramatically, in the presence of the new good. Thus, adding "transportation" to a world with "food" and "leisure" might add substantially to utility, if (is at all large.[8]

Viewed from an input market perspective, the derived demands for inputs have gone up, hence real income is higher than before, in line with the higher valued output (the traditional implication of the circular flow diagram). The competition in input markets from suppliers of the new good raises real wages throughout the economy.[9] There is, under the introduction of an independent good, no ambiguity regarding income versus substitution effects in labor supply—people will want to work more because wages have risen as a result of wanting *more* combined would be that whether more or less income would be generated depends on the price elasticity of demand for existing goods. That is, if on average existing goods are price elastic, technological progress that lowered existing goods' prices would result in more desired income, hence more work, with reduced leisure. If, conversely, existing goods were inelastically demanded, technological advance would lead to less expenditure and more leisure, with the unitary elastic case (e.g. Cobb-Douglas) seemingly representing the watershed case. However, these arguments fail to incorporate the wage increases that the productivity gains from the technological advance allow.

Existing goods become cheaper and we purchase more of them, but we also would be expected to purchase, at the new equilibrium, more leisure. As we acquire more of the existing goods considered collectively at their lower equilibrium prices, their marginal values will fall, relative to the marginal value of leisure. Thus, technological advance for existing goods lowers their marginal value relative to leisure at initial leisure levels, hence, we would generally be expected to work less, acquiring more leisure.[10]

Foreshadowing discussion to follow, the implications of the preceding variations in labor supply will be seen to have dynamic implications for saving as well—implications for business cycles. That is, in periods when there are an unusually large amount of desirable new goods being created, we will not only work more but we will dis-save or reduce the saving rate, depending on how intensely we desire the new goods. Conversely, in periods in which abnormally few desirable new goods are being created we will not only desire fewer work hours, but will also save at a higher than normal rate, in anticipation of greater new goods later.[11]

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supply to obtain the new goods, since they would be "crowding out" marginal amounts of existing goods, resulting in an overall increase in the marginal utility of income. But, a la Rostow as discussed below, there will also be diminishing marginal utility of new goods provision—that is, the gain in utility from a new good would be expected to be diminishing in the number of existing goods. In the context of the comparison of Equations 1) and 2), and suppressing the vector notation, there is a big percentage utility gain in adding the third good, for given (, when there are only two goods, but not when there are already n, for large n.[13]

In actual historical data, technological advance of both types will be occurring at rates with some expectation and some variance about that expectation. On average, a rough balancing of the two types of technological advance might be expected. If this proves to be the case, one would expect hours of work to appear to be a stationary series. But, the expected random variation in the relative importance in the two types of technological advance will be seen to have implications for growth/development patterns and for business cycle behavior.

IV. Growth Patterns and the Business Cycle

Returning to the stylized facts discussed in the introduction, consider first those countries with high incomes that are not "developed" as that word is usually employed. One cannot merely discover oil, for example, and expect that this will lead to meaningful development. Indeed, in a closed economy the discovery of oil would be expected to have little impact on development, because nothing about its discovery allows greater production of new goods, though it might render existing goods production less expensive, resulting in greater leisure demand and reduced incentives to acquire education. Even with trade, while there might be

[13] This explains why there are generally a fairly small number of menu selections at restaurants. Eventually the diminishing marginal value of variety is offset by the ever-growing marginal costs of ascertaining what is available.

large demands for the wide variety of newly imported goods in such countries, the local wage rate might not rise much (presuming that the locally-provided labor intensity of oil production, the traded good, is low). Moreover, there will be little incentive to invest in human capital, as the desired goods that incorporate greater human capital in their production are not produced domestically.[14]

Other stylized facts are that a) some countries exhibit zero or negligibly positive growth, b) others “take off” exhibiting high growth rates over a range of income, and c) highly developed countries tend to have the reduced growth rates traditionally associated with “mature” economies. In the context of the present model, this Rostow-like pattern can be explained by very low goods variety in the case of the extremely poor countries; hence there is little reason to work or invest in human capital with a long-term (and uncertain) payoffe

Thus, the impact of the two types of technological advance will vary with a country's position in the development process. The same relative amounts of technological progress in new goods will result in greater desires to generate income in countries where the number of goods is limited (as per the simple Cobb-Douglas example of Section II) than is the case in countries with a plethora of goods in widespread consumption.

To understand the substantial fluctuations about the growth path, regardless of the stage of growth, one might examine more fully the two types of technological advance and their interaction. Take the technological advance of existing goods, T_e, to be normally distributed with a time invariant mean, μ_e, and variance, σ_e. Similarly, let the technological advance of new goods, T_n, be distributed with mean μ_n and variance σ_n.

Under assumed independence[16] between the distributions T_e and T_n, consider various possibilities in the context of standard growth models, as modified to incorporate the fact that consumption and income are jointly endogenous via labor supply decisions. Starting from a random history for the two types of technological advance, there are four general cases: a) both types of technological advance are unusually large, b) both are unusually small, c) T_e is unusually large while T_n is unusually small, and d) T_n is unusually large while T_e is unusually small.

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The opposite pattern would occur if there were abnormally rapid technological advances in new goods combined with abnormally slow technological advance for existing goods. People will desire to work longer hours, giving up leisure to acquire the new goods. Additionally, in smoothing utility, they would want to dis-save in this period to acquire the abnormally large number of new good introductions, anticipating reduced rates of new goods in the future, when they would replace that saving. GDP will overstate the gain in welfare in periods such as this, since leisure is foregone.

V. Summary

The present attempt at understanding economic growth and the business cycle recognizes explicitly that we work to get the goods that we want. The goods that we want are usefully classified as falling into two broadly defined categories, existing goods and new goods.

By expanding existing notions of technical advance to allow for differential rates of technological advance for existing and for new goods, a rich tapestry of possible macroeconomic scenarios is woven. A given level of growth could be a result of any of a number of patterns of technological change, with quite different implications for welfare. That is, an “average” growth rate might result from average levels of both types of technological change, in which case both work-leisure decisions and saving decisions might be at normal levels. This would result in a smooth future growth path.

Similarly a given *average* rate of technological progress can result in widely varying levels of economic growth depending on whether the technological progress occurs in existing or new goods. For example, below average growth in technological advance for existing goods, and above average growth in technological advance in new goods, might result in increased

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discussion.

desired hours of work and dis-saving, with resulting near-term "boomtimes."[17] Alternatively, above average rates of technological advance for existing goods, with a relative dearth of new goods might result in desired hours of work falling and savings increasing, leading to a growth slowdown or recession.

In any of the preceding scenarios, and others that could be constructed, the quantitative value of GDP as even a short-run measure of welfare growth is called into question. Since different combinations of the two types of technological advance lead to different optimal goods-leisure combinations, failing to account for leisure matters. GDP will overstate utility gain when optimal leisure decreases in response to an existing pattern of relative technological advance, and conversely. In no case, of course, does technological advance of either type make us worse

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period two, the country will have a level of human capital that has not been augmented, hence might well find welfare lower than if that country had made themselves a bit worse off in period one, in order to reap the public good benefits of human capital enhancement. This could well account for why the Asian "tigers" have been experiencing rapid growth while other countries remain mired in poverty.[18]

existing goods are durable versus non-durable.

[18]Of course, the truly poor countries must first survive to the second period. At the lowest stages of development the future might well be discounted greatly.

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