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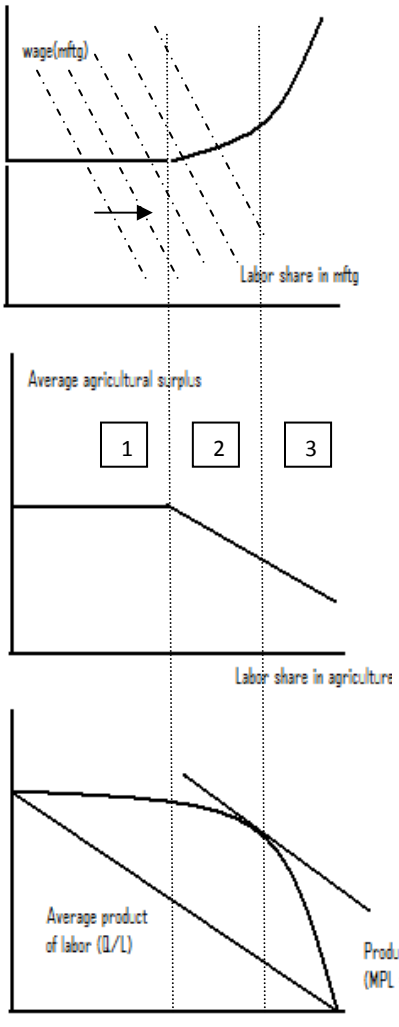
Macroeconomics Essay #1

What is meant by balanced growth? How do economic theorists reconcile balanced growth with structural change?

According to the Palgrave Dictionary of Economics, balanced growth has two different meanings. In macroeconomics, balanced growth occurs when output and capital stock grow at the same rate, consistent with Kaldor's stylized facts that overall, growth rate of output, the capital-output ratio, the real interest rate, and the labor share of income remain broadly constant over time. In development economics, however, balanced growth has an additional meaning, in which it refers to the simultaneous, coordinated expansion of several sectors – a classic feature of single-sector neoclassical growth models. [i]

As Temple argues, the steady-state models that dominate the field – the stylized apparatus of the balanced growth path – ignores intersectoral resource movement and structural transformation inherent to economic development.[ii] Whether rigorous economic analysis requires balanced growth paths, however, remains a hotly contested issue. Although Temple believes that balanced growth path concepts are irrelevant in understanding economic transition, most scholars disagree, resulting in the creation of multi-sector models that eventually reach outcomes consistent with balanced growth. Although these models initially assume unbalanced growth processes across sectors, convergence onto a balanced trajectory occurs, contingent on the fulfillment of a very specific set of conditions, such as in the models proposed by Kongsamut, Rebelo, and Xie (2001) and Ngai and Pissarides (2004)[iii]. To validate the model, theorists present empirical facts or case studies to substantiate the assumptions about the processes of structural transformation and the conditions leading to balanced growth. This paper will focus on the Lewis Model and the Kongsamut, Rebelo, and Xie Model, and then more broadly discuss the implications of such efforts.

Lewis Model and Extensions:



Contrary to the precepts of balanced growth, the Lewis model distinguishes the agriculture sector from the industrial sector, and assumes different production functions, wage determination institutions, and savings behavior across the two sectors. Notably, although the manufacturing wage is determined by the marginal product of labor, the agricultural wage is paid on another basis, such as the average share of total product of labor, which exceeds the marginal product of labor. In fact, initially, the marginal product of labor in agriculture is zero – workers can be diverted to the manufacturing sector without affecting aggregate agricultural output. In addition, the model assumes that capitalists save and reinvest profits, while landlord rental income from land is wholly consumed on manufactured goods.

As shown in the figure on the left, in Zone 1, surplus agriculture exists such that more labor can be diverted into manufacturing without increasing the industry wage or affecting agricultural output. The increase in the capital-labor ratio increases the marginal product of labor in industry, thus driving demand for increased labor. Profits increase, savings increase, labor shifts from agriculture to manufacturing, and the modern sector expands through capital accumulation and growth – the foundations of development.

Eventually, however, enough labor gets pulled away agriculture such that agricultural output begins to diminish, as seen in Zone 2. In this zone, the marginal product of labor in agriculture starts to rise. Agriculture prices also rise, which negatively affect the terms of trade of the industrial sector. In turn, the reservation wage steadily increases as labor diverted from the agriculture sector needs to be compensated more in light of higher agriculture prices and a rising agricultural wage. Disguised unemployment, however, remains an issue since the average product of labor in agriculture continues to exceed the marginal product (labor is paid more than its marginal product).

When enough labor has been diverted into manufacturing, the marginal product of labor in agriculture eventually rises to match that of manufacturing (border of Zone 3). At this commercialization point of agriculture, the model returns to balanced growth, where the labor markets are integrated and wages and profits across the two sectors return to the traditional neo-classical framework. Surplus labor in agriculture is fully exhausted, labor is paid its marginal product, and the dualistic economy becomes fully integrated on a balanced growth path.[iv]

A modified version of the Lewis model by Dixit also provides a framework of growth in which structural transformation across sectors eventually converge to the balanced growth, one-sector Solow path. The Lewis-Solow model assumes that the production function in agriculture is linear ($Y_a=A_a*L_a$) and the production function in industry has constant elasticity of substitution ($Y_m=[\delta K^{-p}+(1-\delta)(A_m*L_m)^{-p}]^{-1/p}$, where the elasticity of substitution is characterized by: σ=a/(1+p). With wages determined independently of the allocation of labor across sectors, agricultural production ties down the wage across the two sectors: $w_a=w_m=A_a$. The exogenous wage determines the capital-labor ratio in the industrial sector and the rental rate of capital, r. Hence, drawing from the aggregate value-added identity, output per worker can be expressed as: $Y/L = w + r*K/L = A_a + r(A_a, A_m)*k$, where k is the aggregate capital-labor ratio. In short, Y/L is a composite production function that is linear in the capital-labor ratio, but with an intercept that depends solely on agricultural productivity. Beyond a threshold level of the aggregate capital-labor ratio, the agricultural sector closes down, thus returning the economy to the one-sector Solow model with a constant elasticity of substitution aggregate production function.[v]

Demand-side transition to balanced growth: The Kongsamut, Rebelo, and Xie Model (2001)[vi]

As another example, the Kongsamut, Rebelo, and Xie (2001) paper seeks to reconcile Kaldor's stylized facts with Kuznet's facts, which document the aggregate decline of agriculture and rise of services in the US economy from 1940 to 1999 (see Appendix for listing of these facts). Hence, the authors propose a three-sector model (agriculture, manufacturing, and services), in which production exhibits constant returns to scale (homogenous of degree one), technological progress is labor-augmenting, output agriculture and services are wholly consumed, and output of manufacturing can either be consumed or invested. Land and international trade are not considered to maintain a structure close to standard growth models. Since capital and labor are fully mobile, an efficient allocation implies that the marginal rate of transformation must be equated across the three production sectors. Hence, sectoral movements originate from differences in the income elasticity of demand for the different goods.

The momentary utility function the authors assume is characterized by:

$$U = \int_0^\infty \frac{[(A_t - \bar{A})^\beta M^\gamma (S_t + \bar{S})^\theta]^{1-\sigma} - 1}{1-\sigma} * e^{-pt} dt \quad (1)$$

In this equation, A_t signifies output of agriculture, $\bar{A}$ is the level of subsistence consumption, M is manufacturing output, S_t is output of services, and $\bar{S}$ reflects non-market services (home production of services). The authors assume that all parameters are strictly positive, and that β+θ+γ=1. As a result, a key feature of the utility function is that the income elasticity of demand for agriculture is less than one, the income elasticity of demand for manufacturing goods is equal to one, and the income elasticity of demand for services is greater than one. In other words, as income increases, households spend less of their income on food and more on services.

Solving for the competitive equilibrium in the economy by maximizing the utility function subject to the economy-wide resource constraint, $M_t + \dot{K}_t + \delta K_t + P_A A_t + P_S S_t = B_M * F(K_t, X_t)$[vii], yields the following results. The real interest rate is $r = B_M * F_1(k, 1) - \delta$ (2), where k is capital stock adjusted for labor-augmenting technical progress. The optimal allocation of consumption across sectors also requires the fulfillment of the following conditions:

$$\frac{P_A(A_t - \bar{A})}{\beta} = \frac{M_t}{\gamma} \quad (3)$$

$$\frac{P_S(S_t + \bar{S})}{\theta} = \frac{M_t}{\gamma} \quad (4)$$

In addition, the optimal allocation of consumption of manufacturing goods over time is given by: $\frac{\dot{M}}{M} = \frac{r-p}{\sigma}$ (5). Although a balanced growth path occurs when $\bar{A}$ and $\bar{S}$ = 0 and k is consistent with the real interest rate, thus returning to the classical growth model, the authors focus on the more interesting case in which both $\bar{A}$ and $\bar{S}$ are strictly positive.

Equations (3), (4), and (5) imply that despite a constant real interest rate, households do not choose to increase consumption of A and S by a constant rate. In order for the real interest rate to be constant, k must also be constant. Hence, the economy's resource constraint can be written as:

$$M_t + \dot{K}_t + \delta K_t + P_A A_t + P_S S_t = B_M * F(k, 1)X_t \quad (6)$$

Although the RHS of (6) grows at rate g, the LHS appears to be incompatible because while M_t, $\dot{K}_t$, and δK_t grow at rate g, but A_t and S_t do not. Thus, requiring that the real interest rate be constant appears to be incompatible with the equations describing competitive equilibrium.

Balanced growth, however, occurs when the following restriction holds: $\bar{A}B_S = \bar{S}B_A$. Under this condition, $P_S\bar{S}_t - P_A\bar{A}_t = 0$, which allows the resource constraint to be re-written as (7). In such a case, since both $(A_t - \bar{A})$ and $(S_t + \bar{S})$ grow at rate g, balanced growth is achieved.

$$M_t + \dot{K}_t + \delta K_t + P_A(A_t - \bar{A}) + P_S(S_t + \bar{S}) = B_M * F(k, 1)X_t \quad (7)$$

Reconciliation with Balanced Growth: A Useful Exercise?

By assuming $P_S S_t - P_A A_t = 0$, Kongsamut, Rebelo, and Xie reconcile unbalanced growth processes with a balanced growth path. The assumption that the market value of subsistence agriculture can be exactly equal to the market value of non-market services, however, is highly tenuous at best. The intuition, however, that $\bar{A}$ and $\bar{S}$ push the income elasticity of demand below and above one respectively, however, provides useful insight about the convergence process to balanced growth. At low income levels, the divergence in income elasticity of demand drive inter-sectoral resource allocation. As income rises, however, the effect diminishes since $\bar{A}$ and $\bar{S}$ are set at fixed quantities and at higher incomes, the elasticity is not nearly as steep. Hence, the economy converges to a standard balanced growth path, featuring constant relative prices, constant aggregate labor share of income, constant growth rate for capital and aggregate output, and time-varying sectoral growth rates and employment shares in the three sectors, as according to the Kuznets Facts.

From a broader perspective, although economic theorists have proposed demand and supply-driven unbalanced growth models that are consistent with a balanced growth path upon the fulfillment of certain conditions, the restrictions are often too constraining. As Krugman argued, important contributions of development theorists in the early half of the last century failed to be incorporated because they lacked the mathematical, formal foundations that were required by the an increasingly model-oriented economic mainstream, or they relied on specific conditions of market failure or incompleteness that were difficult to generalize.[viii]

In conclusion, whether reconciling balanced growth with structural transformation is a useful exercise or a red herring remains debatable. Although such efforts provide an interesting intellectual exercise, often times, the observance of unbalanced growth itself is the desired outcome when analyzing developing economies.

Appendix:

Kaldor's Stylized Facts:[ix]

1. Output per worker exhibits continuing growth, contrary to the Inada conditions of diminishing growth of productivity
2. Capital per worker demonstrates continuing growth
3. Rate of return on capital remains steady
4. Capital-output ratio remain steady
5. Labor and capital receive constant shares of total income through time
6. The growth rate of productivity differs substantially across countries

The Kuznets Facts:

	Share of Total Employment	Share of Total Consumption Expenditures
Agriculture	Declines	declines
Manufacturing	stable[7]	stable
Services	Increases	increases

The Kuznets Facts reflect the trajectory of the United States from 1940 to 1999, in which agriculture accounted for a steadily decreasing share of employment and total consumption, manufacturing remained stability, and services increased.

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[i] Durlauf, Steven, Blume, Lawrence. The New Palgrave Dictionary of Economics (Second Edition). Palgrave Macmillan, 2008.

[ii] Temple, Jonathan. "Dual Economy Models: A Primer for Growth Economists." The Manchester School. Volume 73, Number 4, 2005

[iii] Ngai, Rachel, Pissarides, Christopher. "Balanced Growth with Structural Change." Center for Economic Performance. March 2004.

[iv] Ray, Debraj. Development Economics. Princeton University Press, 1998.

[v] Temple, Jonathan. "Dual Economy Models: A Primer for Growth Economists." The Manchester School. Volume 73, Number 4, 2005

[vi] Kongsamut, Piyabha, Rebelo, Sergio, Xie, Danyang. "Beyond Balanced Growth." IMF Working Paper. June 2001.

[vii] Due to proportional production functions across sectors, prices are in terms of manufacturing goods. For example, $P_A=B_M/B_A$

[viii] Krugman, Paul. "Towards a Counter-Counterrevolution in Developent Theory." Proceedings of Annual World Bank Conference on Developmental Economics, 1992.

[ix] Kaldor, Nicholas. "Capital Accumulation and Economic Growth." The Theory of Capital. St. Martin's Press, 1961. pp. 177-222.