Introduction and Overview*

In my graduate courses in growth theory in the early 1960s, I liked macro better than micro. The reason had nothing to do with level of aggregation, but rather with a difference in approach. In macro at the time, we would write down plausible behavioral relations, phrased as a difference (differential) equation system, and let the adaptive dynamics play out. What would happen? What would we learn? The macro approach seemed closer to behavior and more open to novelty and imagination (word in parentheses added).

John Conlisk (2004) in a *Festschrift* for
Nobel Laureate Herbert Simon

This book is about conceptualizing the process of economic adjustment and growth and testing it with empirical methods, supported by a case study of an emerging market economy. Economic growth is measured as rates of increase in per capita real *GDP* (Gross Domestic Product) in a closed economy and in per capita real *GNI* (Gross National Income) in an open economy. The critical components of a successful economic growth strategy include physical, financial, and educational infrastructures supported by macro financial stabilization policies to moderate aggregate demand and structural reforms to boost aggregate supply.

Economic development is a much broader concept covering economic growth and the "quality" of life, encompassing life expectancy, literacy rates, and poverty rates.[1] However, there can be no lasting and permanent improvement in economic development without sustained and high growth rates of per capita real *GDP* and *GNI*. Critical variables driving such growth rates are investments in physical, human, and intellectual capital, and payments on foreign debt.[2]

This volume consists of twelve chapters, covers both closed and open economies, and discusses the neoclassical theory of economic adjustment and growth and its econometric testing, as well as its practice in a country case study (The Philippines). It provides theoretical and practical support to the International Monetary Fund (IMF) approach to economic stabilization.

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*Written by Delano S. Villanueva.

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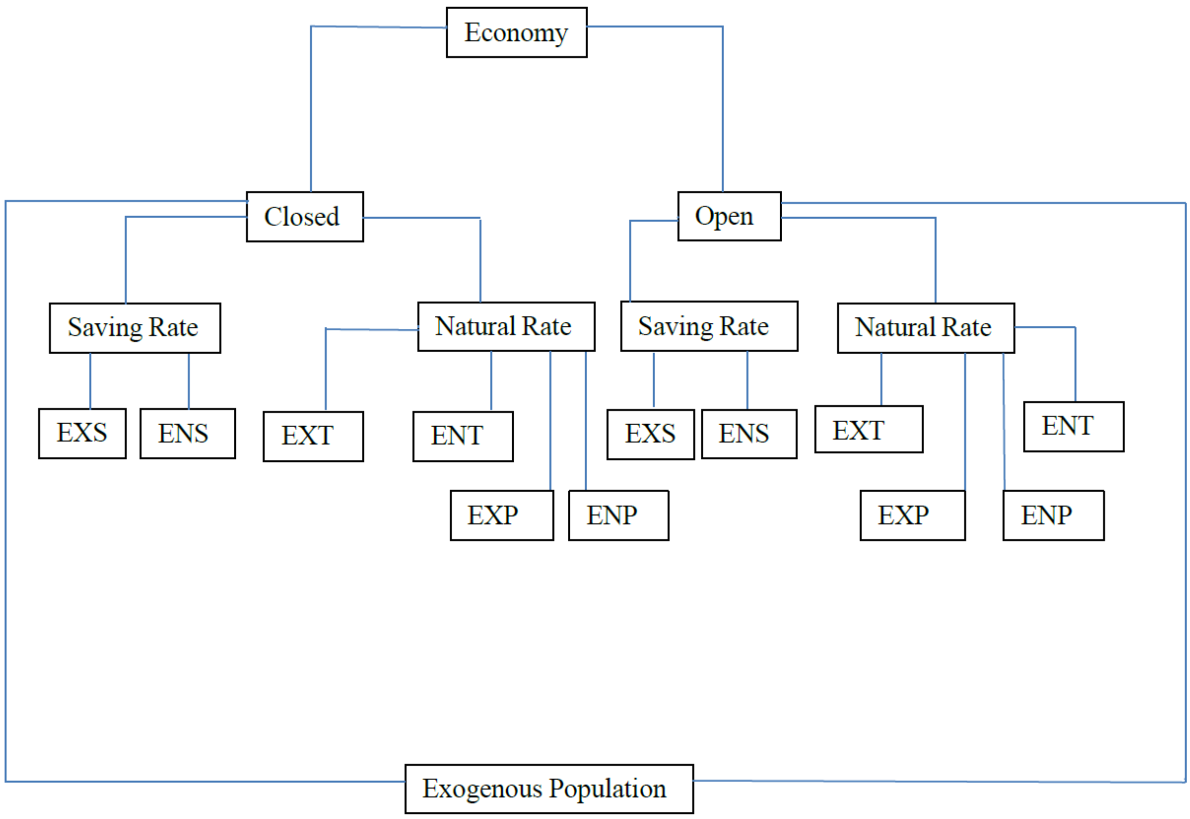
[1] One popular metric is the UN Human Development Index (HDI), comprising three elements: (1) life expectancy; (2) educational attainment; and (3) per capita real *GNI.*

[2] Including principal and interest payments, net of principal and interest received. Also included are profits and dividends repatriated by foreign owners of domestic companies, net of profits and dividends received.

Box 1 is a chart classifying models according to whether they refer to a closed or open economy, or whether the saving rate, technical change, or labor participation, respectively, is exogenous or endogenous. Box 2 places each growth model in the classificatory format of Box 1.[3]

Box 1. Aggregate Growth Models

EXS = Exogenous Saving;
ENS = Endogenous Saving;
EXT = Exogenous Technical Change;
ENT = Endogenous Technical Change;
EXP = Exogenous Labor Participation;
ENP = Endogenous Labor Participation



[3] Notes to Box 2 contain definitions of the three levels and related terminologies of Box 1. All models, except one, assume exogenous labor participation. The only growth model with endogenous labor participation is the closed-economy model of Villanueva (2020, **Chapter 3**), with exogenous saving rate and exogenous technical change à la Solow (1956)-Swan (1956) (**Chapter 1**).

Box 2. Aggregate Growth Models: Summary Features

C = Closed, **O** = Open, **EXS** = Exogenous Saving, **ENS** = Endogenous Saving,
EXT = Exogenous Natural Rate *via* Exogenous Technical Change,
ENT = Endogenous Natural Rate *via* Endogenous Technical Change,
EXP = Exogenous Natural Rate *via* Exogenous Labor Participation,
ENP = Endogenous Natural Rate *via* Endogenous Labor Participation,
L (effective labor) = APN,

A = technology or productivity multiplier (index number),
P = labor participation ($0 < P \leq 1$),
N = population,
$\frac{\dot{L}}{L} = \frac{\dot{A}}{A} + \frac{\dot{P}}{P} + \frac{\dot{N}}{N}$ = natural rate, $\frac{\dot{N}}{N}$ = exogenous population growth rate.

Various Growth Models	C	O	EXS	ENS	EXT	ENT	EXP	ENP
Ramsey (1928)	✓			✓	✓		✓	
Harrod (1939)	✓		✓		✓		✓	
Domar (1946)	✓		✓		✓		✓	
Solow (1956)	✓		✓		✓		✓	
Swan (1956)	✓		✓		✓		✓	
Arrow (1962)	✓		✓		✓		✓	
Cass (1965)	✓			✓	✓		✓	
Koopmans (1965)	✓			✓	✓		✓	
Phelps (1966)	✓		✓		✓		✓	
Conlisk (1967)	✓		✓			✓	✓	
Romer (1986)	✓			✓		✓	✓	
Lucas (1988)	✓			✓		✓	✓	
Romer (1990)	✓			✓		✓	✓	
Grossman & Helpman (1991)	✓			✓		✓	✓	
Rivera-Batiz & Romer (1991)	✓			✓		✓	✓	
Rebelo (1991)	✓		✓		✓		✓	
Mankiw, Romer & Weil (1992)	✓		✓		✓		✓	
Barro & Sala-i-Martin (1992)	✓		✓		✓		✓	
Knight, Loayza & Villanueva (1993)	✓		✓		✓		✓	
Villanueva (1994)	✓		✓			✓	✓	
Barro & Sala-i-Martin (1995)	✓			✓		✓	✓	
Aghion & Howitt (1997)	✓			✓		✓	✓	
Villanueva (1997)		✓	✓			✓	✓	
Villanueva & Mariano (2007)		✓	✓			✓	✓	
Villanueva (2008)		✓	✓			✓	✓	
Villanueva (2020)	✓		✓		✓			✓
Villanueva (2021)	✓		✓			✓	✓	
Villanueva & Mariano (2021)		✓		✓		✓	✓	
Villanueva (2022)	✓		✓			✓	✓	

Economic Adjustment and Growth: Theory and Practice

Contents

The narrative on theory begins with the closed economy models of Harrod (1939) and Domar (1946), henceforth H-D, and Solow (1956) and Swan (1956), henceforth S-S. The critical difference between the H-D and the S-S models is the behavior of the *warranted rate* (saving- investment as a ratio to the capital stock, or capital growth). The H-D model assumes that the warranted rate is an exogenously fixed constant (constant saving-income ratio divided by constant capital-output ratio minus constant depreciation rate). With the *natural rate* (labor growth) fixed at a constant rate of exogenous Harrod-neutral technical change plus a constant rate of exogenous working population growth, the H-D model has a "knife-edge" dilemma–only by accident does the constant warranted rate match the constant natural rate to achieve full employment on a balanced and stable growth path.

The S-S model provides an elegant solution to the H-D "knife-edge" problem. **Chapter 1** reviews the S-S model's standard neoclassical assumptions and simple structure. With a single homogeneous good produced by a well-behaved neoclassical production that is subject to diminishing returns to capital and labor separately and constant returns jointly, the warranted rate is a negative function of the capital-labor ratio. Along with wage-price flexibility in perfect markets, this ensures the attainment of a full-employment equilibrium growth path that equates the endogenously determined warranted rate to the exogenously fixed natural rate (Hacche, 1979).

The S-S model is a closed economy with an exogenously fixed saving rate and exogenous technical change. The Ramsey (1928), Cass (1965), and Koopmans (1965), henceforth R-C-K, model is a closed economy with an optimally derived saving rate, and exogenous technical change. The Arrow (1962) model is a closed economy that links learning by doing to either the growth rate of the capital stock or to the capital-labor ratio, making technical change potentially endogenous. The S-S and Arrow models are followed by the closed-economy, fixed saving rate, endogenous technical change model of Conlisk (1967), a neglected first attempt at making labor-augmenting technical change (a component of the natural rate) a positive function of the capital-labor ratio. The Conlisk model makes both warranted and natural rates adjust toward equality, leading to an endogenously determined equilibrium growth of per capita income. A variant of the Conlisk model is Villanueva (1994).[4]

During the 1980s and 1990s, S-S was under attack by the new endogenous growth models (discussed below), alleging that it failed to explain observed differences in per capita income across countries. By augmenting the S-S model to include human capital and using a cross-sectional approach, Mankiw, Romer and Weil (1992, or M-R-W) found that the S-S model's predictions were indeed consistent with the empirical evidence.

Chapter 2 extends the M-R-W model in two directions: First, a panel of time-series, cross-sectional data is used to determine the significance of country-specific effects assumed away in the cross-sectional approach used by M-R-W, Barro and Sala-i-Martin (1992), and nearly all other studies. In order to exploit the additional information contained in these panel data, the econometric analysis is extended by applying an estimation procedure outlined by Chamberlain (1982, 1983).[5] Second, labor-augmenting technical change is influenced by two factors: outward-oriented trade policies and the stock of public infrastructure. The empirical results support the view that both country-specific and time-varying factors such as human capital, public investment and outward-oriented trade policies exert positive and significant influence on growth.

Enter the closed-economy, optimally derived saving rate, endogenous technical change models of Romer (1986, 1990), Lucas (1988), Grossman and Helpman (1990, 1991), Rivera-Batiz and Romer (1991), Barro and Sala-i-Martin (1995), and Aghion and Howitt (1997). These new endogenous growth models conclude that the economy's long-run output can grow at least as fast as, or faster than the capital stock, and public policies on saving and investment affect long-run economic growth. In the AK model (Rebelo, 1991), output grows at the same rate as capital stock K, equal to sA, where s (larger than the saving rate of the S-S model by the amount of investment in human capital) is the fraction of income saved and invested, and A is a technological constant.[6] In the R&D models of Romer (1986), Grossman and Helpman (1991), Barro and Sala-i-Martin (1995), and Aghion and Howitt (1997), firms operate in imperfectly

[4] Villanueva's reference to the Conlisk model is acknowledged by Agénor (2004, footnote 4, p. 466).

[5] **Chapter 2** uses a panel data approach to estimate an augmented S-S model covering 98 countries (22 industrial and 76 developing) over the period 1960-85, taken from the Penn World Tables in Summers and Heston (1991).

[6] The AK model has no transitional growth dynamics. Output growth always equals the steady state level, sA.

competitive markets and undertake R&D investments that yield increasing returns, which are ultimately the source of long-run per capita income growth.[7] On the other hand, the closed-economy, exogenous saving rate, endogenous technical change models of Conlisk (1967) and Villanueva (1994), and the open-economy, endogenous saving rate, endogenous technical change models of Villanueva and Mariano (2007, 2021) were developed under the neoclassical model assumptions of diminishing returns to capital and labor separately and constant returns jointly, operating in perfectly competitive markets with complete wage- price flexibility. Villanueva (1994) and Villanueva and Mariano (2021) are modified versions of the Arrow (1962) learning by doing model, wherein experience on the job raises labor productivity.[8] The equilibrium properties of the new endogenous growth models and of the exogenous saving rate, endogenous technical change models of Conlisk (1967) and Villanueva (1994, 2021) are similar.[9]

As Box 2 shows, all growth models assume exogenous labor participation. In light of robust econometric results on the determinants of labor participation in 36 advanced economies reported by Grigoli et al. (2018) and independently by CBO (2018), **Chapter 3** modifies the S-S model by introducing endogenous labor participation that responds to the real wage, among other factors, and thus to the ratio of capital to effective labor, making the natural rate fully flexible, much like what the S-S model does for the warranted rate. By allowing a fully adjusting natural rate, both warranted and natural rates adjust to changes in the capital-labor ratio. Thus, the positive growth effects of the saving rate hold in the transition to and in the steady state (a generalization of the S-S model).[10]

Chapter 4 presents a closed-economy, neoclassical growth (henceforth, DV) model with two reproducible inputs: physical capital stock and combined stock of human and intellectual capital. In flow terms, these correspond to Solow's (1991) physical, human and intellectual investments. The production process is subject to diminishing returns to capital in perfect markets, in sharp contrast to endogenous growth models that assume increasing returns to capital in imperfect markets. The DV model's predictions are similar to those of new endogenous growth models emphasizing R&D investments. What is different is that the new endogenous growth

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[7] On increasing returns, Solow (1991, p. 12) comments: "As I have emphasized, the key assumptions all seem to require that some economic activity be exempt from diminishing returns. That is hard enough to test for a single industry or process, and even then might not settle the relevant question." Conlisk (1967) argues that increasing returns to capital yield explosive growth.

[8] Agénor (2004, pp. 466-471) refers to the 1994 Villanueva (**Chapter 6**) model as "An extension of Arrow's (1962) learning by doing model...(wherein) the productivity of workers increases when the relative availability of capital goods (for instance, the stock of high-performance computers) rises," leading to enhanced long-run growth effects of saving and investment rates.

[9] Lucas (1988) specifies effective labor $L = uhN$, where h is the skill level, u is the fraction of non-leisure time devoted to current production. The uh variable is T in Villanueva (1994, **Chapter 6**), defined as labor productivity multiplier or technical-change multiplier, and $uhN = K_h$ in Villanueva (2021, **Chapter 4**), defined as combined human and intellectual capital.

[10] **Chapter 1** shows that, in the steady state, the S-S model yields an endogenously determined *level* of per capita income and an exogenously determined *growth rate* of per capita income.

models assume increasing returns to capital—incompatible with balanced growth—and imperfect markets, while the DV model assumes diminishing returns to capital and perfect markets (standard neoclassical assumptions). The DV model's transitional dynamics is consistent with the empirical findings reported in Chapter 2. The DV model concludes that a high saving rate raises both transitional and steady state growth rates of output through increases in physical, human, and intellectual investments that augment labor productivity—a key extension of the S-S model. Additionally, the DV model derives an optimal rule for choosing the saving rate that maximizes consumer welfare.

Chapter 5 discusses a simple growth model with a financial sector and endogenous technical change. In a two-class growth model of Pasinetti (1962), there is no financial intermediary that mobilizes bank deposits loaned out to the capitalist class for physical investment. The absence of a capital market also precludes workers from buying capitalists' new issues of stocks and bonds to finance investment.[11] Thus, the equilibrium rate of return to capital is independent of the saving rate of the working class—what Samuelson and Modigliani (1966) referred to as the Pasinetti paradox. In this chapter's modified Pasinetti model with endogenous growth, the equilibrium rate of return to capital is shown to be a function of all structural parameters, including both saving rates of the capitalist and working classes. Additionally, the modified model explains the recessionary dynamics of the 2007-08 global and regional financial crises.

The next five chapters examine the roles of fiscal, monetary, trade, and external debt management policies in the short run and long-run behavior of per capita income growth. **Chapter 6** analyses the effects of fiscal policies on economic growth and speed of adjustment. It postulates that learning through experience raises labor productivity with three major consequences. First, the equilibrium growth rate of per capita income becomes endogenous and is influenced by government policies. Second, the speed of adjustment to equilibrium per capita income growth increases, and enhanced learning further reduces adjustment time. Third, the optimal net rate of return to capital is higher than the sum of the exogenous rates of technical change and working population growth, or alternatively the optimal saving rate is only a fraction of capital's income share because of endogenous growth and the induced learning associated with increases in the capital stock. Simulation results confirm the model's faster speed of adjustment, and cross-country regression analysis finds that a large part of divergent growth patterns is related to the extent of economic openness, depth of human development and quality of fiscal policies, particularly growth of real

[11] There are, of course, studies linking finance to output growth. For example, the Atje-Jovanovic (1993) model uses an augmented M-R-W (Mankiw, Romer and Weil, 1992) growth format, introducing finance in the form of a stock market as the third input in the aggregate production function, additional to capital and labor. In a more conventional manner, the model of **Chapter 5** views the banking sector as an intermediary that mobilizes workers' deposits on-lent to the capitalists for investments in the capital stock, thus retaining the S-S model's traditional two-input (capital and labor) aggregate production function.

expenditures on education and health and avoidance of high fiscal deficits as ratio to *GDP*.[12]

Chapter 7 is an open economy model that modifies and extends the modern macroeconomic model of economic fluctuations presented in the macroeconomics textbook by Hall and Taylor (1997), and links it formally to the S-S model (reviewed in Chapter 1). The integrated model answers the question of whether monetary policy matters for long-run growth, arguing that both levels *and* growth rates of potential output and real *GDP* change in economically sensible ways when monetary policy changes. The effects of monetary policy on stabilization and growth are analyzed and simulated.

Chapter 8 discusses the role of outward-oriented trade policies, particularly export policies, in the behavior of per capita output growth. Because of the central role of exports in the absorption of modern technology, and the interdependence of investment, technical change and the size of the export sector, a successful growth-oriented strategy should begin with exporting manufactured goods in early stages of economic development. Trade policies should avoid high protective tariffs because they result in an inefficient industrial sector, prevent the adoption of modern techniques, and stunt factor productivity. In this regard, a crucial policy instrument is a competitive, market-determined exchange rate, complemented by low, non-discriminatory tariffs and elimination of non-tariff import barriers.

Chapter 9 explores the joint dynamics of external debt, capital accumulation, and growth.

Reliance on foreign saving has limits, particularly in the current global environment of rising interest rates and risk spreads. The optimal domestic saving rate is derived and estimated using Phelps' (1966) *Golden Rule* maximization criterion. On the balanced growth path, if consumption per unit of effective labor (or any monotonically increasing function of it) is taken as a measure of the social welfare of society, the domestic saving rate that maximizes consumption per unit of effective labor is chosen. Consistent with this optimal outcome is a sustainable ratio of net external debt to total output.[13] Using parameters for the Philippines to calibrate the model, the growth model's steady state solution is characterized by a constant capital-effective labor ratio, an optimal domestic saving rate, and a unique external debt-capital ratio. The latter ratio interacts with long-run growth and domestic adjustment, and is determined jointly with other macroeconomic variables, including a country's set of structural parameters. A weakness of the above growth model is its unrealistically high estimate of the optimal saving rate associated with a lack of micro-

[12] See **Chapter 2** for panel data evidence.

[13] For research on the sustainability of external debt using various statistical procedures, see Manasse and Schimmelpfenning (2003), Reinhart *et al.* (2003), Kraay and Nehru (2004), Patillo *et al.* (2004), and Manasse and Roubini (2005). For an excellent survey, see Kraay and Nehru (2004).

foundation, a criticism leveled by Lui (2007).

In response to Lui (2007), **Chapter 10** incorporates consumer preferences explicitly in the optimization process, and presents an open-economy, optimally derived saving rate, and endogenous technical change growth model. More importantly, it incorporates a modified Arrow (1962) learning-by-doing feature. Imports of capital goods with embodied advanced technology allow learning by doing to raise labor productivity and long-run growth. An RCK optimal control setup derives sustainable ratios of foreign debt to *GDP* and saving rates that maximize the discounted stream of intertemporal consumption. The model generates a feasible range of optimal domestic saving rates corresponding to an estimated range of intertemporal substitution elasticities.[14]

Chapter 11 reviews the IMF approach to economic adjustment and sums up the analysis of economic adjustment and growth covered in previous chapters. Following an external current account deficit, and in response to tight fiscal and monetary policies, the open economy model of

Chapter 7 clearly shows a short-term improvement and eventual balance in the external current account. In the medium- and long-term, the supply side effects are favorable owing to investment accelerating in response to expected inflation successfully anchored to a stable low rate. The resulting larger capital stock with embodied advanced technology enhances labor productivity via learning by doing. The higher potential output matches the larger aggregate demand. Similarly, the higher investment rate (warranted rate) matches the larger natural rate, strengthening the growth impact ignored in traditional macroeconomics. The IMF approach to economic adjustment and growth (Mussa and Savastano, 1999) is consistent with this chapter's summing up.

Using cross-country and panel data, the narrative on growth empirics includes, besides Knight et al. (**Chapter 2**), studies by Conlisk (1967), Otani and Villanueva (1990), Villanueva (**Chapter 6**), and Barro and Sala-i-Martin (1995). Specific country studies of developing and emerging market economies include, among others, Villanueva and Mariano (**Chapters 9** and **10**).

Guided by the principles covered in **Chapters 1-11**, **Chapter 12** narrates the evolution of a successful strategy of adjustment and growth practiced by an emerging market economy that had shown stellar pre-COVID19 pandemic growth performance, low and stable inflation, and a sustainable external current account position.

[14] Recall Lui's (2007) comment that the high domestic saving rate estimated by Villanueva and Mariano (**Chapter 9**) owes to the failure to consider the elasticity of intertemporal substitution in the optimization process inherent in the Phelps (1966) Golden Rule criterion.

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