Chapter

5

Economic Growth and Government

Understanding the causes of the wealth and poverty of nations is 'the grand object of all enquiries in Political Economy'.

Thomas Malthus, letter to David Ricardo

The Causes of Economic Growth ♦ Optimal and Efficient Economic Growth ♦ Markets and Economic Growth ♦ Government and Economic Growth

Globally, there are great differences in living standards. What causes these differences? Why have North American economies grown faster than the European ones or East Asian economies grown faster than Latin American ones? Are resource endowments, markets or governments responsible? Answering such questions has long been a central concern of economics. And, as we will see, government has a major role to play.

In this chapter we examine the causes of economic growth and the policy implications. Of course, economic growth depends on efficient use of resources, as discussed in Chapter 3. However, that discussion took technology and the supply of capital and labour as given in any period. Formally, it assumed a given production possibility frontier. Economic growth is about expanding output principally by improving productivity in various ways, including technological advances and increasing capital inputs.

We should note that the welfare objective is usually to increase GDP per capita, not simply to increase GDP as population grows. Some other important caveats should be noted. High growth rates may not enhance overall welfare if it entails large sacrifices in current standards of living, significant inequalities in society or long-term degradation of the environment.

The chapter starts by examining the main causes of economic growth. The second section discusses optimal and efficient rates of economic growth. The third and fourth sections examine the roles of markets and government respectively in creating economic growth.

The Causes of Economic Growth

Economic output depends on the supply of factors of production and their productivity. An aggregate production function links output to inputs. Thus, a country's aggregate production function can be expressed generally as:

$$Y = A f(K, L, N) \tag{5.1}$$

where Y is the total output of the economy, K is the stock of physical capital, L is labour units, N is natural resources and A is a measure of productivity or technology (also known as multi-

factor productivity). As technology improves, the value of A increases and more output is produced from a given combination of inputs.

In this general formulation, capital and labour are treated as standard (homogeneous) units. Technical innovation is a catch-all variable that allows both for improvements in the ways in which inputs are used and for improvements in labour skills (human capital) and capital productivity. However, labour can be estimated in skilled labour unit equivalents, which allows for the acquisition of workforce skills by investment in human capital.[1]

Equation 5.1 relates the level of output to the levels of inputs and technology. Economic growth depends on changes in inputs and technology. Growth models focus especially on changes in capital, labour and technology. Natural resources are generally regarded as fixed or, alternatively, as a function of capital investment and technology. The quantum of resources is also very hard to measure. Accordingly, natural resources are omitted from most growth models.

In a competitive economy in which factors of production are paid the value of their marginal product, Equation 5.1 can be transformed into a specific growth accounting equation.

$$\Delta Y/Y = [(1-\theta) \times \Delta L/L] + (\theta \times \Delta K/K) + \Delta A/A \qquad (5.2)$$

where Δ represents the change in the respective variable, thus $\Delta Y/Y$ is the change in output, $\Delta L/L$ is the change in labour and so on. $(1-\theta)$ and θ are weights equal to the proportion of total output (GDP) received by labour and owners of capital respectively. To see how this works, suppose that labour and capital's share of GDP are 0.75 and 0.25 respectively and that, over a year, labour grows by 1.0 per cent, capital by 2.0 per cent and productivity by 1.5 per cent. It follows that GDP would grow by $(0.75 \times 1.0) + (0.25 \times 2.0) + 1.5 = 2.75$ per cent in a year. Box 5.1 shows a common production function of this nature.

Economists traditionally viewed investment in physical capital as the main determinant of economic growth, especially of growth per capita. Investment was in turn regarded as depending mainly on savings. Changes in technology were regarded as determined exogenously. In so far as technical progress was explained, it was embodied in new investment and depended also on savings.[2]

Box 5.1 The generalised Cobb–Douglas production function

The generalised Cobb–Douglas production function is a practical and commonly used aggregate production function. This is expressed as a power function:

$$Y_t = Ae^{rt}K_t^{a_1}L_t^{a_2} \qquad (5.3)$$

where Y, K and L are as described in the text, e equals 2.718, A, r, a_1 and a_2 are constants, and t refers to the year. Given data for Y, K and L, the values of the constants can be estimated.

Assuming constant returns to scale, which is often observed, the a_i exponents sum to one ($a_1 + a_2 = 1$). This means that if K and L are both multiplied by λ, then output will be multiplied by λ. Typically, a_1 is about 0.25 and a_2 is about 0.75.

This implies diminishing returns to extra inputs of capital or labour, holding the other input and technical progress constant. The effects of diminishing returns are avoided by simultaneously increasing the other input or by technical progress.

Equation 5.3 can be converted to a growth equation as follows:

$$\dot{Y} = r + a_1\dot{K} + a_2\dot{L} \qquad (5.4)$$

where a dot over a variable represents change per unit of time and r is the rate of technical progress. The rate of growth of output is the weighted sum of the rates of input growth plus r. If $r > 0$, growth can occur without any growth in inputs. This is known as disembodied technical progress.

[1] For excellent discussions of growth models, see Jones (2002) or Aghion and Howitt (2009).
[2] This traditional view is sometimes formalised in the neo-classical or Solow–Swan model

Table 5.1 Output growth (%) attributable to capital, labour and productivity, 1960–89

Source of growth	*North America*[a]	*Europe*[b]
Capital stock per capita	39	43
Capital quality	7	6
Labour hours per capita	13	-16
Labour quality	17	10
Productivity	24	57
Total output	100	100

(a) Average for United States and Canada.

(b) Average for France, Germany, Italy and United Kingdom.

Source: Dougherty and Jorgenson (1996).

However, econometric studies have found that changes in capital and labour explain only a small part of economic growth. A large part is explained by the residual element (technical progress). For example, Aghion and Howitt (2009) estimated that changes in total factor productivity accounted for two-thirds of the growth of OECD economies between 1960 and 2000, leaving one-third unexplained.

Some growth accounting models now include estimates of the quality of physical capital and labour as well as the quantity. Table 5.1 shows estimated contributions of the quantity and quality of capital and labour, and residual productivity growth, to the growth of GDP in North America and Europe between 1960 and 1989. According to these estimates, changes in the stocks of capital and labour inclusive of quality changes explained 76 per cent of economic growth in North America but only 43 per cent of growth in the four large European countries (where labour hours fell significantly), with residual productivity explaining the balance in both cases. Almost certainly, in this century, the extraordinary digital technological advances are responsible for a large part of recent economic growth.

Thus, there remain large unexplained productivity changes broadly associated with changes in technology. Recent discussions suggest several possible drivers of productivity growth: a competitive economy open to international trade, investment in human capital through education, government support for innovation, a democratic and inclusive system of government which protects property rights and a culture of trust (sometimes described as social capital). We examine below the roles of these various drivers of economic growth.

Economic growth factors

Natural resources (natural capital). The contribution of natural resources to growth is complex. Some resources are finite and non-renewable and decline with exploitation. However, resources may be discovered or economic ways to exploit previously uneconomic resources may be found. Other resources are renewable and their productivity may depend on how they are managed. Also, environmental assets depend on the management of wastes. While the quantity of wastes usually rises with GDP, management usually improves so that the impact of growth on environmental quality may be negative or positive. Thus, it may not be clear at any point in time whether the effective supply of natural capital is rising or falling. Moreover, if the supply is rising, this is generally the result of capital investment or technical innovation. Partly because of these conceptual and measurement difficulties, natural capital generally gets less attention than other forms of capital in the economic growth literature.

This was not always the case. In the 19th century, economists such as Malthus and Jevons were deeply concerned about the impact of population pressures on scarce natural resources,

notably on agriculture and coal resources. At the start of the 20th century, ten of the 12 largest companies in the United States were resource-based.[3]

However, commodity prices fell through most of the 20th century. The major growth industries such as microelectronics, biotechnology, telecommunications, machine tools and robots, and computers depended more on human capital than on natural resources. To-day, the top seven most highly valued stocks on the US stock market are technology companies.

However, in this century the emergence of China and India as economic powers, with relatively few natural resources for their size of populations, has greatly increased the demand for resources and commodity prices rose to hundred-year highs. In Australia, investment in energy and mineral resources became major sources of economic growth.

On the other hand, soil degradation and shortage of water are constraints on growth. Globally there are deep concerns about the impacts of climate warming on resources. Overall, resources are likely to continue to be major factors in economic growth. Protection of natural capital will enhance long-run economic growth.

Physical capital. This has four main components: private fixed capital (plant, equipment and commercial property), residential investment, inventories and public capital investment. Of these, private fixed investment and public capital investment, including many elements of economic infrastructure, are the most important determinants of economic growth. The latter is of course under government control. What are the main drivers of private fixed capital?

Private investment was explained traditionally by a country's propensity to save. East Asian countries were cited as examples of cultures that encouraged saving and hence investment. But investment depends on domestic savings only in a closed economy. Most economies have been open for a long time. Between 1870 and 1929, savings were a far higher proportion of GDP in the UK than in the United States, but investment was higher in the United States, funded largely by British savings. Investment opportunities were greater in the United States because scale effects encouraged the manufacture of specialised machinery, standardised goods and interchangeable parts, and the low price of materials relative to labour encouraged the use of machinery.

Today, there is a world capital market. Foreign capital may cost more than local capital to allow for regulation and exchange rate risks. Thus, local savings are still important, but they are not a major constraint on development. Investment depends on the relationship between the marginal return on capital and the borrowing rate. Investors must be able to obtain an acceptable after-tax return on capital, with due allowance for risks. Government factors that influence the return on capital include provision of reliable economic infrastructure, access to markets, competitive tax rates, security of property and freedom from regulatory risk. Government may also encourage private investment by subsidies for research and development (R&D) or by tax breaks for capital investment. However, the Productivity Commission (2007) found R&D subsidies create limited additional investment.

Labour and human capital. As we have observed, an increase in labour may increase GDP but result in a fall in GDP per capita. On the other hand, an increase in foreign labour may raise average GDP per capita but reduce GDP per capita for existing residents. A critical factor here, though not the only factor, is the role of human capital.

Human capital refers to "the stock of knowledge, skills and abilities that determine the labour productivity of an individual", (Black et al., 2013). This is significantly determined by the education and training in society. As discussed in Chapter 12, many studies find high returns to investment in education and training, with an extra year of schooling raising wages by about 10 per cent. However, as noted there, these results should be viewed with care as

[3] Thurow (1996) p. 66.

some of the estimated gains may reflect unmeasured ability or non-education inputs. Studies of international rates of economic growth also strongly support the role of education in growth. Barro (1997) estimated that an extra year of male upper-level schooling raised the average growth rate in 100 countries by 1.2 percentage points per year. The OECD (2001a) concluded that, for OECD countries as a whole, "each extra year of full-time education (corresponding to a rise in human capital by about 10 per cent) is associated with an increase in output per capita of about 6 per cent". Hanushek and Woessmann (2010) estimated that, in OECD countries, school improvements falling within observed existing performance levels could raise GDP by between $90 and $275 trillion over 80 years to 2090.

Institutional capital. This refers to the capacity of a country's institutions to create the conditions for economic growth. Two critical conditions are necessary to encourage innovations, entrepreneurial activity and investment in the application of technology.

One is a secure and lawful environment, including established property rights, rule certainty and tax stability. Lawlessness, crime and violence, along with an unpredictable judiciary, are major impediments to economic growth. Drawing on the results of a survey of 3600 firms in 69 countries, the World Bank (1997) concluded that a sound and secure institutional capacity is a major determinant of investment and economic growth. Aghion *et al.* (2008) found a significant correlation between economic growth and democracy. In their very readable book, Acemoglu and Robinson (2013) describe how government institutions, including the rule of law and property rights, dramatically affect economic outcomes across countries.

The second critical condition is competitive and open markets. While we discuss below arguments for and against market competition as an incubator of innovation, we find that, overall, competitive markets are much more innovative than monopolistic or protected markets. Trade openness encourages specialisation, increases market size and opportunities for scale economies, technology transfers and knowledge spillovers. American citizens have long benefited from economies of scale and low prices of the large free trade area of the United States. By contrast the populations of South American countries suffered from the small markets and high prices in their closed economies.

Social capital. Whereas institutional capacity is about rules and systems, social capital is about social norms and relationships and especially about the amount of trust and cooperation in society. Fukuyama (1999) defines social capital as 'an instantiated set of informal values or norms shared among members of a group that permits them to cooperate with one another'. Putnam (2000) defines the concept as 'social networks and the norms of reciprocity and trustworthiness that arise from them'.

Bowles and Gintis (2002) argue social capital reduces transaction costs that impede markets, allows informal institutions for credit and finance, encourages recognition of the social costs of private actions, encourages effective political participation and gives credibility to policy announcements of government. A high level of trust allows governments to reduce the amount of regulations and encourages citizens to invest over longer terms. The role of the mafia in crippling economic development in Southern Italy for centuries is a classic example of the destructive impacts of poor social capital.

Aghion and Howitt (2009, pp. 422–425) provide an excellent summary of the empirical issues in testing these hypotheses and of recent empirical studies. A prime issue is how to measure social capital. This is typically done by measures of club membership or by surveys that report the amount of trust that citizens have in each other. Then, if economic growth is correlated with this measure of social capital, there is the issue of causality. Does trust create economic growth or does growth create trust? The econometric response to this is to try to find an instrument that is correlated with trust, for example genetic resemblance, that cannot be a function of economic growth. OECD (2001a) reviewed several studies and found that

social capital tends to reduce poverty and anti-social behaviour, improve health and increase longevity. Aghion and Howitt (2009) also cite several studies showing a relationship between economic growth and trust in the society, but few have shown the nature of the causality. Guiso *et al.* (2005) is cited as one of the few that suggest trust is a positive factor for growth.

If social capital is important, what determines the amount of it in a society? History and culture are important. So is education. Secondary education allows people to participate fully in society, increases employability and reduces anti-social behaviour (see Chapter 12). As Glaeser *et al.* (2001) observed, many individuals invest in membership of social networks because they see the economic as well as social benefits.

Government also has a major role. An inclusive and compassionate government can significantly enhance social capital. On the other hand, social capital declines with social polarisation, discrimination, inequality, an absence of social security and arbitrary government actions.

Optimal and Efficient Economic Growth

The optimal rate of economic growth is the rate that maximises the welfare of citizens over time. This is rarely the highest achievable growth rate. The Soviet Union under Stalin in the 1930s and the People's Republic of China under Mao Tse-Tung in the 1950s and 1960s tried to increase economic growth by shifting resources into capital formation and away from rural production. Millions starved in the process.

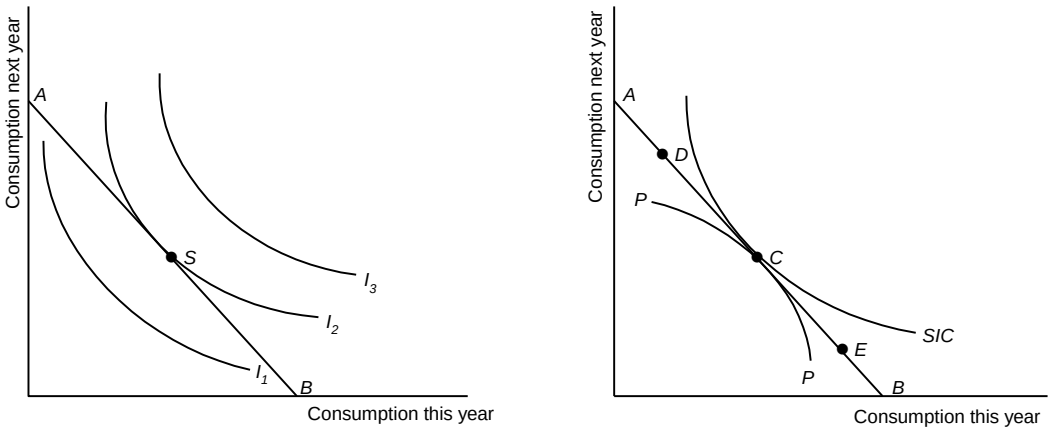
Although productivity improvements may provide some painless economic growth, growth in future consumption generally requires some sacrifice of present consumption (unless capital is wholly externally financed). Economic growth may also be maximised in a low tax and benefit environment that rewards the successful but leaves behind the less productive. And it may be maximised in the short run by ruthless exploitation of natural resources. To determine an optimal rate of economic growth we need a social welfare function that weights consumption across generations.

We focus here on the more modest objective of achieving an efficient rate of economic growth. Drawing on the concept of Pareto efficiency, the rate of economic growth is efficient when resources cannot be reallocated across time periods to make one person better off without making someone else worse off. The analysis of efficiency over time is similar to the analysis of efficiency at a point in time. In both cases, the necessary conditions for overall efficiency are: efficient consumption, efficient production, and product mix efficiency.

Consumption efficiency. In Figure 5.1a overleaf the line *AB* shows the consumption available to an individual, Amy, in two periods. The slope of *AB* is the marginal rate at which consumption in one period can be exchanged for consumption in the next. The slope equals $-(1 + r)$ where r is the real return on savings. Suppose that r equals 5 per cent: if Amy forgoes \$100 of consumption in the first period, she can obtain \$105 of consumption in the second one.

The indifference curves (I_i) show combinations of consumption in the two periods between which Amy is indifferent. These curves are usually convex because the lower the level of consumption in any period, the greater the compensation required for a further sacrifice of consumption in that period. The slope of the indifference curve at any point shows the marginal rate at which Amy is willing to exchange consumption now for consumption later.

To maximise her utility, Amy aims for the highest feasible indifference curve. She achieves this by borrowing or lending so that the marginal rate at which she is willing to exchange present for future consumption equals the rate of exchange between present and future consumption in the market (point *S*). At any other point on the *AB* line she could increase her utility by changing her consumption pattern. The same principle applies to all consumers.



(a) An individual's inter-temporal choice

(b) Efficient economy-wide output and consumption

Figure 5.1 Efficient inter-temporal markets

Although individual budget lines vary with income, in a competitive market there is a market-set rate of exchange between present and future consumption and the slope of all such budget lines equals this exchange rate $-(1+r)$. This implies the condition for inter-temporal consumption efficiency—*the marginal rate of substitution between future and present consumption (MRS) of all individuals* $= -(1 + r)$ *and is the same for all individuals*.

Production efficiency. In Figure 5.1b the curve *PP* shows the combinations of consumer goods that an economy can produce in each period. Firms can increase output of consumer goods in period 2 by producing more capital goods and less consumer goods in period 1. The slope of the *PP* curve reflects the marginal rate at which present goods can be transformed into future goods. With declining returns to capital applied to fixed resources, the *PP* curve is concave. Firms invest so long as the return on investment is sufficient to pay for the investment. The marginal rate at which firms use resources to transform current goods into future goods (MRT) must equal the price of transformation, the market rate of interest. Faced with a real interest *rate r, all firms maximise the present value of their profits by choosing a level of output, such that MRT* $= -(1 + r)$.

Overall inter-temporal efficiency requires that the *marginal rate of substitution of future for present consumption must equal the marginal rate of transformation of present into future goods* with both equal to $-(1 + r)$. This is also illustrated in Figure 5.1b. The indifference curve here represents a notional social indifference curve (SIC) between present and future consumption. At the margin, SIC must be tangent to *AB* (because MRS is equal for all individuals). The point *C* is a Pareto-efficient outcome. At *C*, the marginal rate at which present goods can be transformed into future goods equals the marginal rate at which all consumers are willing to exchange future for present consumption. The desired savings by households are just sufficient to finance the desired borrowing by firms. Individuals borrow to equate their MRS between period 1 and 2 to $-(1 + r)$. At point *D*, there would be too little consumption this year; at point *E*, there would be too little consumption next year.

Conclusion. This analysis shows the necessary conditions for efficiency over time. However, it does not consider inter-generational or equity issues more generally or environmental outcomes. Nor does it explain what determines the key drivers of economic growth: capital investment and technical innovation. We also need to discuss whether markets or government produce efficient and equitable economic growth. We turn to these issues below.

Markets and Economic Growth

In this section we examine first how markets establish the quantity of physical capital stock and its price (the rate of interest). We then discuss the drivers of innovation. Finally, we discuss whether markets produce an efficient rate of economic growth.

The quantity and price of physical capital

The amount of capital stock in a country is a function of the demand for, and supply of, capital. Investment, a flow variable, refers to the change in the capital stock. The rate of interest is the price of capital.

Figure 5.2a shows how the quantity and price of capital (the rate of interest payable for capital) are determined in a closed economy. The demand for capital curve slopes downward because firms can profitably employ more capital when the price is low. The locus of the curve depends on profit opportunities and technology. The supply of capital curve represents the savings decisions of households. At higher interest rates, each dollar of consumption deferred yields more consumption in the following period. Thus, households are usually willing to save more at higher interest rates.[4] The locus of the supply curve is a function, *inter alia*, of household incomes. In period 1, the demand for capital and the supply of savings are in equilibrium at quantity K_1 and interest rate r_1. If the supply of saving increases in period 2 (with no shift in demand), there is a new equilibrium quantity of capital stock K_2 at a lower rate of interest r_2. Capital investment is the difference between K_2 and K_1 plus any investment required to offset depreciation of K_1 stock.

Figure 5.2b includes international savings. For small open economies, such as Australia, an elastic supply of international funds is available at the international lending rate allowing for local exchange rate and other risks (r_F). Thus, the supply of international capital lowers the rate of interest from r_D to r_F. The total capital stock rises from K_{D1} to K_F. However, capital stock financed from local savings falls from K_{D1} to K_{D2}. The fall in the price of capital provides a benefit to firms equal to area $r_D ADr_F$.

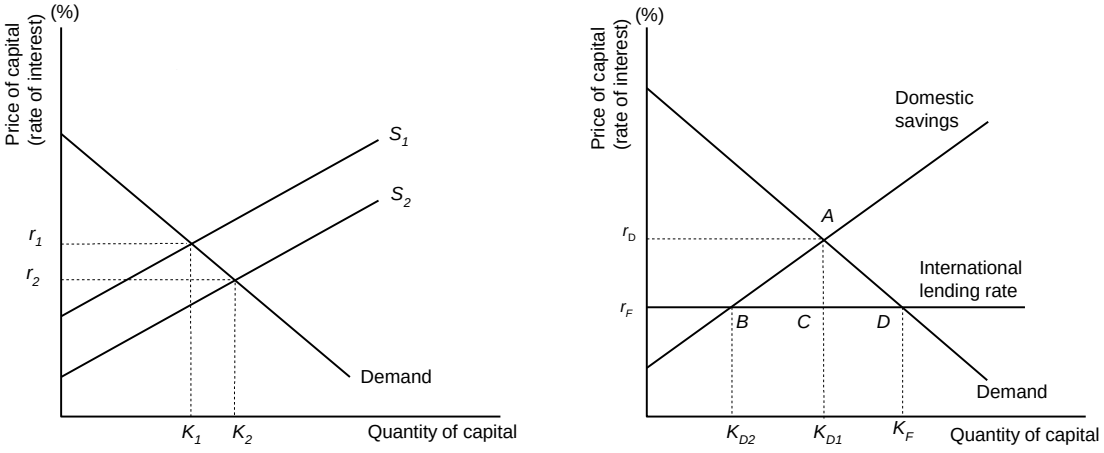


Figure 5.2 Quantity and price of capital (the rate of interest)

[4] This statement is based on the substitution effect of higher interest rates. High interest rates also have income effects. For given savings, higher interest rates increase income in the next period. This may have the reverse effect of discouraging saving.

On the other hand, domestic savers lose a surplus equal to area $r_D ABr_F$. The net efficiency gain to the local economy is area ABD.[5] For small economies the rate at which international capital can be attracted to a country is often a more important determinant of capital investment than the level of domestic savings.

Markets and innovation

The capitalist system is remarkably good at creating innovation. In competitive markets, prices constantly transmit new information about consumer demands and new incentives to producers. Competition pushes resources from low productivity or value activities to higher ones. Unlike in the static model, technology is not a given. Firms face continuous change and continually seek innovation in the form of new products or processes. Under competition, innovation is mandatory for survival of the firm. Competitive firms create new products, improved quality and product differentiation. Also, new technology is likely spread faster under capitalism than under other systems because innovators have an incentive to commercialise their knowledge in some way. Entrepreneurs bring the new concepts and processes into use.

A key feature of the innovative process is 'creative destruction'—a term first employed by Schumpeter (1943). Creative destruction refers to the entry and exit of firms into markets. Quality-improving innovations lead to new products displacing existing products and new firms replacing old ones. Schumpeter's concept of competitiveness has several features of the competitive model (many participants, low barriers to entry and limited long-run excess profits). However in Schumpeter's world, most products are differentiated and production techniques are rarely identical. Indeed, imperfectly competitive markets are an inevitable result of technical innovations. As Schumpeter (1943) observed:

> Entrepreneurial profits are the prizes offered by capitalist society to the successful innovator … The introduction of new methods of production and new commodities is hardly conceivable with perfect and perfectly prompt competition from the start. And this means that the bulk of what we call economic progress is incompatible with it. As a matter of fact, perfect competition is and always has been temporarily suspended whenever anything new is being introduced … even in otherwise perfectly competitive conditions.[6]

Porter (1990) also argued strongly for the role of innovation in creating economic growth. Firms must possess a competitive advantage in the form of lower costs or differentiated and preferred products. To achieve this advantage, an economy must continually upgrade capabilities and technology. In Porter's words, national competitive advantage:

> grows out of the capacity of a nation's firms to improve and innovate relentlessly … A nation's firms must relentlessly improve productivity in existing industries by raising product quality, adding desirable features, improving product technology, or boosting production efficiency … At the same time, an upgrading economy is one which has the capability of competing successfully in entirely new and sophisticated industries.[7]

However, in some contrast to Schumpeter, Porter stressed the importance of competitive product markets to innovation: 'among the strongest empirical findings from our research is the association between vigorous domestic rivalry and the creation and persistence of competitive advantage in an industry'.[8] Domestic rivalry stimulates new rivals through spin-

---

[5] To translate investment into economic growth, suppose that net investment (gross investment less depreciation) is 15 per cent of GDP and that the average real rate of return on capital is 12 per cent. With a constant labour supply, GDP would grow by 1.8 per cent per annum.

[6] Schumpeter (1943) pp. 104, 107.

[7] Porter (1990) p. 621.

[8] *Ibid*., p. 117.

offs, creates and attracts factors, upgrades home demand, encourages and rewards related industries. As examples of successes of the competitive market model, Porter cited the pharmaceutical industry in Switzerland, chemicals in Germany, computers and software in the United States and electronics in Japan. It might be added that arguably, Australia's most competitive domestic industry—the sports industry—is also one of its most successful international businesses. On the other hand, industry cartels reduce productivity and international market share. Examples are the Swiss watch industry, the German camera industry and the Australian coastal shipping and steel industries.

Research summarised by Aghion and Howitt (2009, Chapter 12) generally supported the case for product market competition, for example Nickell (1996). However, the results depend on the circumstances with better results in more technically advanced sectors. Aghion, Blundell *et al*. (2006) estimated the impact of industry entry rates on total firm productivity using panel data with 32 000 annual observations of firms in 166 different four-digit industries from 1980 to 1993 in the United Kingdom. They found that high entry rates increase the productivity of firms near the technology frontier but had little or negative impact on productivity of firms further from the frontier. Aghion, Burgess *et al*. (2006) report on the effects of de-licensing entry in India based on an annual panel of 24 000 observations in 85 industries over 18 years. They found that de-licensing increased the dispersion of output but did not actually increase entry.

In summary, competition is a strong force for innovation, investment and economic growth. Sustained productivity increases depend on the competitiveness of the economy. The incentives range from entrepreneurial profits to sheer survival. Protected monopolies are generally less creative than more competitive industries. But the competition that creates economic growth is not perfect competition. Although some rewards for innovation can be viewed as economic payments to entrepreneurs for time, ingenuity and risk, successful innovation often produces supernormal profits and an imperfectly competitive market.

These findings have some significant policy implications. Government may have to provide some protection for innovation by way of patents. However, generally, it should not only police anti-competitive behaviour among incumbent firms, it should also actively ensure that there are minimal barriers to entry and exit. And as Aghion and Howitt (2009) observe, complementary policies should help labour and capital move from laggard sectors to advanced sectors. In addition, they observe, as do most economists, that policies of supporting 'champion' firms to lead national innovation are unlikely to be successful.

Do markets produce efficient economic growth?

So competitive markets (though not perfectly competitive markets) drive growth, but do they produce an efficient rate of economic growth? It can be shown that perfectly competitive markets would achieve the three key conditions (consumption, production and overall economic efficiency) necessary for a Pareto-efficient inter-temporal allocation of resources just as they would for an efficient static allocation of resources. Where there are perfectly competitive markets for all goods, including future goods, individuals can borrow or lend at the inter-temporal price (the interest rate) and no firm or individual has independent power over any price. All agents face the same set of prices, including the same interest rate. To maximise utility, all consumers substitute marginal future consumption for present consumption at the unique relative price provided by the interest rate. To maximise profits, all firms use resources to invest in future output up to the point at which the marginal rate of return equals this same rate of interest. Because households and firms make their marginal inter-temporal decisions (for consumption and production) in accordance with the same relative price of present and future goods, the marginal rate of substitution of future for present consumption equals the marginal rate of transformation of present into future goods.

Market failures. However, all the market failures that occur in a one-period world occur in a multi-period world. Indeed, some failures are more significant in a long-run world. Firms under-invest in goods with substantial positive externalities. Thus, they tend to under-invest in areas of economic infrastructure such as power, water, transport and telecommunication networks. Firms are also likely to over-exploit common property resources and to create pollution and other negative externalities, thus reducing the productivity of natural resources.

Another important long-run market failure is under-investment in human capital and technology. Firms under-invest when investment produces benefits to third parties, which is typically the case with education and training. Baumol (2002) estimates that on average less than 20 per cent of the total economic benefit of innovations accrues to those who invest in making them happen. The rest of the benefit spills over to the society at large. Public investment in knowledge is particularly important because of the non-rival nature of knowledge (Dowrick, 2003). Protecting new ideas by patents creates monopoly powers for the holders and constrains the use of a non-rival good that can be used as an input to generate further knowledge and products.

We have also observed that innovation requires some product differentiation and produces supernormal profits. These innovations create imperfectly competitive markets. The optimal degree of departure from perfect competition is a difficult policy issue. Baumol (2002) argues that oligopoly is the industrial structure that best fosters productive innovation. On the other hand, Porter (1990) and Aghion and Howitt (2009) contend, with significant evidence, that innovation is maximised in a competitive industrial structure.

A classic inter-temporal issue is whether people make well-informed and efficient savings decisions. Pigou (1920) traditionally and behavioural economists Diamond and Vartiainen (2007) recently have conjectured that many individuals are short-sighted, undervalue future consumption and save too little. This would raise interest rates and reduce capital formation and economic growth. On the other hand, many people save as a precaution against adverse events, not just to optimise inter-temporal consumption. Precautionary saving lowers interest rates and raises investment and economic growth. Which distortion has the larger impact on savings and flow-on consequences for economic growth is hard to tell.[9]

In summary, in competitive markets firms innovate and invest in new products so long as the rate of return satisfies savers. In principle, there is equilibrium in the capital market as investors and savers make all desired trades. This would produce an efficient rate of economic growth. However, the supernormal profits and imperfect competition that result from innovation may lead to inefficiency in the allocation of resources. More importantly, all the market failures that occur in the static model also occur over time. In addition, firms under-invest in economic infrastructure and education, which are basic drivers of economic growth. Further, in the absence of regulations markets would almost certainly over-exploit natural resources.

Government and Economic Growth

We now discuss how government can contribute to the main forms of capital that, along with technical innovation, drive economic growth. We also consider how government may adversely impact on growth. Finally we examine empirical studies of the relationship between growth and government.

Institutional capital, the provision of a safe and lawful trading environment and open and competitive economies, is pre-eminently the responsibility of government. As we have seen

[9] Another concern is that market interest rates reflect the views of current participants in the market and not the interests of future generations. This may lead to higher interest rates and encourage current consumption of resources at the expense of future consumption.

so dramatically in recent years, confidence in the security of the financial sector is crucial to the mobilisation of savings and the efficient deployment of scarce capital resources. Economies need a national financial system and prudential supervision that will ensure the safety and soundness of financial institutions, while also allowing for competition and new entrants into the market. In addition, an open and competitive trading environment and liberal trade, capital markets and investment regimes are essential for economic growth. But markets are not automatically competitive. As Porter (1990, p.62) observed, 'Few roles of government are more important to the upgrading of an economy than ensuring vigorous domestic rivalry'.

Investment in **physical capital** in the form of economic infrastructure (such as energy and water supply, transport and communication facilities) is another major responsibility of government. As we have observed, firms under-supply such goods or, if they provide them, may try to create monopolies or exploit market power in one or other way. Note, however, that government responsibility for the provision of economic infrastructure does not necessarily imply public ownership of infrastructure enterprises. As we see in Chapters 18 and 19, public infrastructure can be supplied in many ways.

Some economists, for example Thurow (1996), argue that the provision of public infrastructure is strongly correlated with private productivity growth in many countries, and that this is an additional argument for government involvement. However, despite many macroeconometric studies of the possible external productivity benefits of public infrastructure, the size of these benefits remains questionable.[10] Cost–benefit analysis remains the best method for evaluating optimal investment in infrastructure.

Government also has a major role to play in the development and maintenance of **human capital** through education and health services. Public investment in education is required because markets undersupply education for three main reasons—the public good/positive externality nature of education, capital market imperfections and inequities in market provision. However private agents also gain substantially from investing in education, so the public gain needs to be identified (see Chapter 12). Some publicly financed health services are also required to ensure the basic health and fitness of the workforce.

In addition, firms under-invest in research and development because they cannot capture all the positive spin-offs from research findings. Also, technical knowledge has some non-rival features of a public good. Its use by one agent does not preclude its use by another agent, although this may reduce its profitability. Thus there is a strong public interest in research and development. Granting private property rights (patents) in discoveries is needed to encourage research. Also, governments may invest directly in research and development or subsidise privately funded research and development. These expenditures have produced large benefits in agriculture and telecommunications.[11] However determining the optimal amount of public funding of research is extremely difficult given the uncertainties of the outcomes.

Government must also protect **natural capital**. An economy may increase output in the short run while depleting its natural resources. However, standard national income accounts do not record depreciation of natural resources. In the long run, depletion of natural resources

[10] Using macroeconomic time series data, Aschauer (1989) estimated that the elasticity of GDP with respect to public investment was about 0.4 in the United States, which implied a very high rate of return to public investment. Others, for example the World Bank (1994a), have questioned the methodology used and the results gained. Lau and Sin (1997) estimate that the elasticity is about a quarter of Aschauer's estimate, but conclude that the externality benefits from investment in public infrastructure are positive. The practical conclusion is that the supply of economic infrastructure should be determined by microeconomic (cost–benefit) studies rather than by macroeconomic assumptions.

[11] In the 19th century, governments built the world's first telegraph lines. Recently, the US Department of Defense largely funded the Internet for the first 20 years of its life. Also in recent times, publicly funded research contributed greatly to increases in agricultural productivity, especially in less developed economies.

may reduce living standards. Given market failures in environmental resource use, efficient use of environmental resources is a major function of government (see Chapter 13).

Finally, government must maintain **social capital** through provision of social security services, basic health and education services and an income transfer system that reduces social inequalities. It also has a cultural leadership role. An inclusive and tolerant government supports social capital; a divisive and intolerant government can destroy it.

Government actions that reduce economic growth

Government can also reduce economic growth. Obviously, it may fail to perform efficiently the functions just described. Also, government expenditure, taxes or public policies may be inefficient. Government may allocate too few, or too many, resources to public goods. Government regulation of trade and industry, anti-competitive policies, output and price controls and other regulations may undermine investment and innovation. And more fundamentally, an extractive and corrupt government undermines private trade and investment (Acemoglu and Robinson, 2013). Here we highlight four issues.

The first issue is potentially excessive public expenditure. Public expenditure on goods and services nearly always crowds out some private expenditure either by direct competition for resources or via a reallocation of expenditure from the private to the public sphere. This is true of tax-financed or deficit-financed expenditure. Government borrowing tends to raise interest rates. This reduces private investment unless there is a strong multiplier effect of public expenditure. Saunders and Klau (1985) reviewed several econometric models and concluded that, although public expenditure generally stimulates the economy in the short run, borrowing usually crowds out some private investment. However, if the public projects are efficient (obtain high social rates of return), the crowding out of some private expenditure is **not** necessarily inefficient.

Second is the related issue of taxation. Taxation generally reduces the supply of capital and labour. In so doing, it often creates economic (deadweight) losses (see Chapter 27). From an economic growth perspective, taxation of income may discourage entrepreneurship, savings and investment, and labour supply. Taxation of capital and labour reduces the net return to capital and labour respectively and encourages factors of production to move from heavily taxed sectors to less heavily taxed (and less productive) sectors, including leisure.[12]

The third issue is income transfers. High personal benefits, for example for unemployment, disability and retirement, may reduce the labour supply. Following a wide-ranging survey of the impacts of benefits in Australia, Gruen (1982) concluded that 'an improvement in welfare benefit provisions can have fairly substantial effects both on the number claiming benefits and on the economic behaviour of potential claimants'.

Fourth, government is often a relatively inefficient producer of goods and services (see Chapters 16 and 18). The reasons include the lower level of competition, weaker incentives for efficient allocation of capital, greater operational constraints (e.g. audit responsibilities and wage controls) and slow responses to market changes.

However, an important caveat is in order. Many government policies or actions that decrease growth of GDP may on balance enhance social welfare. This is especially the case for some income redistribution policies. This is another version of the efficiency–equity trade-off that is pervasive in public economics.

[12] These generalisations must be treated cautiously because the income effects of taxes may offset the substitution effects and cause labour to work longer hours (see Chapter 26)!

Economic growth and government: evidence

There are many kinds of evidence on the relationship between economic growth and government. Much is relatively casual. For example, some observers contrast the high growth rates of East Asian countries with the slower rates of African countries and attribute this, among other factors, to the smaller role of government in East Asia. On the other hand, Stiglitz (1996) observes that governments have played a major role in some success stories and cites Japan and South Korea.

More formally, the World Bank (1997) drew its conclusions on the importance of institutional capacity from a wide-ranging survey of businesses operating in 69 countries. Porter (1990) likewise drew his conclusions about markets and economic growth from survey data. In Chapters 16 and 18, we report on various studies of the efficiency or otherwise of government as a provider of services. Aghion and Howitt (2009) report on industry-wide studies of the factors determining total factor productivity. Such sources can provide important insights into the economic growth and the role of government.

However, the dominant form of analysis has been cross-country econometric studies of the determinants of economic growth. These studies typically attempt to explain differences in the average rate of growth in GDP per capita in a large number of countries over a sample period using cross-sectional regression analysis. The independent variables may include government expenditure or tax revenue, the openness of the economy, levels of education, investment as a percentage of GDP, and geographic and even religious variables.

Sachs and Warner (1997) is an example of such a study. As shown in Table 5.2. Sachs and Warner found that 11 variables explained 84 per cent of the variance of growth per capita in 83 countries between 1965 and 1990. All variables have a plausible sign and are significant, or nearly so, at the 95 per cent level of significance (the *t*-statistic is greater than 1.95).

In relation to government, Sachs and Warner found that economic growth was correlated positively with openness of the economy to trade, government saving (current revenues less current expenditures) and an index of institutional quality (an average of sub-indexes for the rule of law, bureaucratic quality, corruption and the like).[13]

Table 5.2 Cross-country model of economic growth per capita 1965–1990[a]

Independent variable	*Estimated oefficient*	*t-statistic*
LnGDP per economically active person in 1965	–1.5	(–6.5)
Share of years open, 1965–90	10.9	(3.7)
GDP in 1965 times share of years open	–1.1	(–3.0)
Growth of economically active population – population growth	0.7	(1.9)
Central government budget balance (saving) 1970–90	0.11	(5.2)
Institutional quality index (1980)	0.32	(3.8)
Tropics	–0.8	(–3.0)
Landlocked	–0.6	(–2.3)
Share of natural-resource exports in GDP, 1970	–3.9	(–4.0)
Life expectancy	0.3	(2.8)
Life expectancy squared	–0.0026	(–2.3)
Adjusted R^2	0.84	

(a) Based on 83 countries with a mean growth of 0.33 per capita.

Source: Sachs and Warner (1997).

[13] The data for these indices were drawn from the *International Country Risk Guide*.

Sachs and Warner also found evidence for the conditional convergence theory of growth—holding constant other factors, such as government policy and investment, less developed countries grow faster than more developed ones. On the other hand, growth was lower in tropical countries (with poor soils and poor health), in landlocked countries (with low trade) and in resource-based economies. Curiously, the authors do not explain why they excluded two variables that they earlier found to be significantly correlated with economic growth. Sachs and Warner (1995) reported that economic growth was correlated positively with the share of total investment in GDP and negatively with the share of government consumption.

This kind of analysis requires careful interpretation, especially when an independent variable may be determined jointly with the dependent variable. Examples are the two-way relationships between economic growth and investment or between growth and human capital. A correlation does not prove that investment or human capital causes economic growth. The causal relationship might be in the reverse direction. Alternatively, both correlated factors may be caused by a third variable.[14] Another problem is multicollinearity — a correlation among explanatory variables. For example, high rates of investment tend to be correlated with education and openness. If independent variables are correlated, the precision of the estimated coefficients is reduced. If they are omitted, the model may be specified imperfectly and an estimated coefficient may pick up some of the impact of the omitted variables.

Other statistical problems include the sample set (which countries and years to include), the measurement of some variables such as openness, functional form because some relationships may be non-linear, parameter variability and limited degrees of freedom due to the small number of observations relative to potential explanatory variables. For example, analysing economic growth in 100 countries from 1960 to 1990, Krueger and Lindahl (2001) found that education and human capital stocks are an important factor in economic growth. However, this finding was driven mainly by the role of education in less developed countries. In their analysis, the relationship between education and economic growth was less clear in OECD countries. Aghion and Howitt (2009) found that the role of education depends on the stock of human capital and the proximity of the economy to the technological frontier. Primary and secondary education is important for countries that can import technology. Investment in higher education is important for countries close to the technological frontier.

Table 5.3 summarises the results of other cross-country growth studies with a focus on the role of government. Durlauf *et al.* (2005) provide a comprehensive list of such studies.

For the reasons just cited, conclusions must be drawn cautiously. However, the following conclusions appear valid:

1. There is general support for the theory of conditional convergence. However, when low-income countries do not achieve the necessary conditions (adequate physical and human capital) for economic growth, they fail to converge on higher-income countries.
2. Economic growth is usually positively associated with the quality of local institutions, the rule of law, open economies and the share of output allocated to investment generally and to investment in education (human capital improvement) specifically.
3. There is some evidence that economic growth is inversely related to the shares of government consumption expenditure and taxation in GDP, but the evidence is not conclusive. Microeconomic studies of the impacts of taxation on investment and labour supply provide stronger evidence of the negative impact of government on economic output (Temple, 1999).

[14] Technically, the simultaneous problem can be resolved if we can find exogenous variables to use as instruments. However, there are few such variables in cross-country data sets.

Table 5.3 Selected studies of growth rates of per capita income and role of government

Study	*Sample*	*Main results for the role of government*
Barro (1991)	98 countries, 1960–85	Growth positively related to initial human capital and measures of political stability. Inversely related to initial per capita GDP, proxy for market distortions, share of government consumption in GDP
Dowrick (1992)	Sample of OECD countries, 1960–85	Output growth is inversely related to the share of personal income tax in GDP
Engen and Skinner (1992)	107 countries, 1970–85	An increase of 2.5 percentage points in the share of tax reduced long-term output by 0.18 percentage points
Tanzi and Schuknecht (1995)	OECD and newly industrialised countries, 1975–90	Economies with low increases in public spending have lower unemployment, are more innovative (have more patents), and have smaller black economies
Cashin (1995)	23 developed countries, 1971–88	Productive public spending, including public investment and transfer payments that raise private investment, increases economic growth. Distortionary taxes that reduce the marginal return to private capital dampen economic growth
Dowrick (1996)	116 countries, 1950–90	Economic growth is positively related to government consumption up to a level of around 12 per cent of GDP and negatively related at levels above about 18 per cent of GDP
Sala-I-Martin (1997)	About 100 countries, 1960–90	Growth is positively correlated with the rule of law, the openness of the economy and the degree of capitalism. No measure of government spending was found to affect growth in a significant way
Barro (1997)	100 countries, 1960–90	Growth is related positively to schooling, rule of law, a democracy index, life expectancy and terms of trade. It is related negatively to initial GDP, fertility rates and public consumption expenditure

Box 5.2 Economic growth and government in Australia

Over the last 60 years the Australian economy has experienced relatively high growth rates. From 1960 to 1974, GDP grew at a high average rate of nearly 5 per cent per annum. Over the next 20 years to the mid-1990s, the average rate of growth fell to around 3 per cent per annum. Since the mid-1990s, the growth rate has averaged over 3 per cent per annum. The economy was not significantly affected by the Asian meltdown in 1998, the slowdown in OECD economies around the turn of the century or the global financial crisis which started in 2007. These generally high rates of growth reflect, among other factors, a rich resource endowment, high immigration and a high level of institutional capital.

In the 1960s, general government expenditure was below 30 per cent of GDP. It rose to around 35 per cent of GDP in the early 1970s and has fluctuated around this level since then. Some critics argue that this reduced growth rates in the late 1970's and 1980's, However, by OECD standards, government expenditure is modest (Chapter 2). Recent growth rates have been achieved without a significant decline in government expenditure as a proportion of GDP.

Starting in the early 1980s, the Australian economy has been substantially deregulated. Major features were the floating of the exchange rate in 1983, large-scale privatisation programs and the introduction of national competition policy in 1996 (see Chapter 14). Several reports by the Productivity Commission have argued plausibly that high growth rates since the mid-1990s are attributable to the more competitive environment.

In recent years, economic growth has been greatly facilitated by the extraordinary rates of growth in East Asia, most notably in China, and by related growth in the resources, education and tourism sectors.

The role of government in this has been more as facilitator than driver. Australia is seen as having stable institutions, laws and property rights which encourage private capital investment. Public investment in education and health provide a capable and healthy productive workforce. On the other hand, there is a view that government should have invested more on public infrastructure.

Conclusions

The major factors that enhance economic growth are sound legal and financial structures that encourage capital investment, a high level of human capital and its corollary investment in education (and in health), bountiful natural resources and its corollary preservation of the environment, a domestically competitive economy and an open economy with liberalised trade. There is also some evidence that democracy and a high level of social capital enhance economic growth.

Markets are a prime source of capital investment and innovation. However, government has the major responsibility for ensuring that these key conditions for economic growth are achieved. But government must also be mindful of other social objectives, notably creating and maintaining a socially just society and a sustainable economy in the long run.

Summary

- Economic growth depends principally on investment in physical and human capital and on innovation. Private investment and innovation depend on sound legal and financial structures and an open and competitive economy that encourages trade and entry into, and exit from, industries.
- The rate of economic growth is efficient when the rate at which consumers want to substitute future for present goods equals the rate at which the economy can transform present into future goods.
- However, this concept of efficiency is limited because innovation is taken as given.
- Competitive markets are a dynamic force for investment and innovation. However, the process of innovation creates supernormal profits and the risk of imperfect competition.
- Also, private firms may under-invest in public goods, including economic infrastructure, technology and education. They may also over-exploit resources.
- Government has an important role in providing the institutional, social and human capital necessary for economic growth. Government functions include providing a safe and lawful environment, ensuring markets work fairly, promoting domestic competition and international trade, addressing market failures, and protecting natural capital and investment in economic infrastructure, education, science and technology, and the health of the population.
- Government may also slow down economic growth though high government expenditure and taxes. Poor regulation may restrict competition, stifle innovation and add to industry costs. Growth is usually lower in highly regulated economies, in closed economies and in countries that fail to protect private property.
- However, government also has other social objectives, notably creating and maintaining a socially just society and a sustainable economy in the long run which may involve a trade-off with short-term economic growth.

Questions

1. Can a country have a high level of income and a low rate of economic growth or vice versa? If so, give examples and explain why.
2. What are the technical economic conditions necessary for an efficient rate of economic growth? What are the limitations of this concept?
3. Is an efficient rate of economic growth always the same as an optimal rate of economic growth? Are high rates of economic growth always better than low rates?
4. Do high levels of domestic savings create high rates of economic growth?
5. What kinds of markets contribute most to economic growth? What is the evidence? What policy conclusions can be drawn?
6. What role does government have in facilitating economic growth?
7. How may government have an adverse effect on economic growth?
8. Does higher government expenditure increase both economic output and growth?
9. Do lower interest rates increase growth by increasing investment?
10. Given that investment is a function of profit, does a tax on profit reduce investment and economic growth?
11. What problems arise in trying to estimate the effect of government activity on economic growth from econometric cross-country studies of economic growth?

Further Reading

Acemoglu, D. and Robinson, A. (2013), *Why Nations Fail: The Origins of Power, Prosperity and Poverty*, Random House.

Aghion, P. and Howitt, P. (2009) *The Economics of Growth*, MIT Press, Cambridge, MA.

Bouis, R., Duval, R. and Murtin, F. (2011) *The Policy and Institutional Drivers of Economic Growth across OECD and Non-OECD Economies: New Evidence from Growth Regressions*, OECD Economics Department Working Papers, No. 843, OECD, Paris.

Durlauf, S.N., Johnson, P.A. and Temple, J.R.W. (2005) 'Growth Econometrics', in *Handbook of Economic Growth*, P. Aghion and S.N Durlauf, (eds), Elsevier, Amsterdam, pp. 555–677.

Hindriks, J. and Myles, G.D. (2006) *Intermediate Public Economics*, Chapters 19 and 21, MIT Press, Cambridge, MA.

Jones, C.I. (2002) *Introduction to Economic Growth*, Chapters 1, 2 and 10, W.W. Norton, New York.

Productivity Commission (2016), *Increasing Australia's Future Prosperity*, Discussion Paper, Canberra.

Productivity Commission (2017), *Shifting the Dial, 5 Year Productivity Review*, Report No. 84, Canberra.

Rogers, M. (2003) 'A survey of economic growth', *Economic Record*, 79, 112–135.

Sachs, J.D. and Warner, A. (1997) 'Fundamental sources of long-run growth', *American Economic Association, Papers and Proceedings*, 97, 184–188.