Many people despise wealth, but few know how to give it away.

Francois de La Rochefoucauld

What's the quickest way to become a millionaire? Borrow fivers off everyone you meet.

Richard Branson

7.1 Overview

Borrowing and lending is a fundamental act of economic life. Each of the main economic players identified in the circular flow diagram of Chapter 2—households and firms of the private sector, the government, and the rest of the world—have their own reasons to borrow and lend. In doing so, they shift income and spending between the present and the future. Borrowing brings future income forward to be spent today. Lending or, more generally, saving, defers the use of current income to some later date.

Borrowing and lending decisions are motivated by expectations about the future. Those who reasonably expect their incomes to grow will want to borrow and raise their standards of living now instead of waiting. In contrast, the lucky winner of a lottery will probably save a large fraction of the prize, because it is unlikely to occur again. Firms' investment decisions, which means adding capacity for future production, are a gamble on future demand. Not the present, not the past, but expectations of the future exert the greatest influence on firms' investment decisions.

The shifting of spending over time can be seen as an intertemporal trade. One could think of a lender as a seller of money today, and the borrower as a buyer. Like any trading activity, there must be both a price linking the present and the future and each actor must face a budget constraint. Indeed, because people are impatient, time has a price. This price is determined by the interest rate. An **intertemporal budget constraint** requires that liabilities be repaid someday, while accumulated assets will eventually be spent.

The intertemporal budget constraint provides a powerful framework for understanding many fundamental aspects of macroeconomics. Because the future is unbounded, it can be rather overwhelming to think about it. This chapter adopts two simplifications. First, we reduce the course of time to just two periods, called today and tomorrow, the present and the indefinite future. Second, we will continue to employ Robinson Crusoe, already introduced in Chapter 5, as a parable for consumer, producer, and his own government, all at once. These steps will make abstract and complex considerations a bit easier to handle.

7.2 Thinking About the Future

7.2.1 The Future Has a Price

Anything of value must have a price. This includes money and goods delivered at future dates. In fact, markets exist for the sole purpose of pricing future deliveries of commodities. These are the stock markets like Euronext or New York Mercantile Exchange (NYMEX), exchange markets or specialized commodity markets. Such markets exist in many countries, both developed and emerging. Their common feature is to place a value on future 'things' like company shares, loan repayments, steel deliveries or foreign currency. They price the future.

Microeconomic principles can be readily used to understand how the future is priced. There is a parallel between *intertemporal* consumption choices (between present and future goods) and *intratemporal* consumption choices (among goods at a particular point in time). When we choose between consuming now or in the future, we effectively decide whether to save or to borrow. As rational households plan spending over time, they take into account their future incomes and needs, and balance these against the interest rate at which they can borrow or save. Similarly, firms need to forecast the profitability of plant and equipment in which they invest. They need a benchmark for that profitability—what could they or their owners have otherwise done with their money? They compare the profit, or return, from those projects with that available from lending their money at some available interest rate, which represents either the cost of funds or, if funds are available, the best alternative use for them.

7.2.2 The Rational Expectations Hypothesis

Expectations about the future are crucial to all this. But how exactly do firms and households form their expectations? Do they get it right or wrong? In this book, we will generally take the modern view that economic agents' forecasts are right *on average*. This is the **rational expectations hypothesis**.

The rational expectations hypothesis does not mean that households and firms never make mistakes, or that they always forecast the future perfectly. It is simply a way to apply the rationality principle to the way economic agents think about the future—we assume that they do not make *systematic* errors. Clearly, alternative assumptions about expectations are possible. In fact, laboratory experiments on human subjects show that we all get sidetracked, sometimes, often responding to emotions rather than to cold calculation. These experiments also show that we have limited ability to process mentally all the information that we have, or should have. So why do we adopt the rational expectations hypothesis? For three reasons:

- First, because there are so many ways of being irrational that there is no simple alternative.[1]
- Second, standard economic theory is based on the hypothesis that agents 'optimize' in the sense that they behave rationally—that they take the best possible decisions in a logically consistent way. If agents are rational in planning their consumption, work, and production, then they should be rational when thinking about the future.
- Third, even if most people are not fully rational all the time, it is unlikely that they are repeatedly and systematically wrong. If they are, they must suffer continuous losses. Isn't it natural to expect them to take steps to avoid such errors in the future?

There is an even better and subtler justification for rational expectations. We are ultimately interested in how prices, interest rates, incomes, and spending interact on the market place. It is often enough that a few well-informed agents behave rationally to drive the markets. If trade unions act on behalf of their members, it suffices that their expectations will be correct on average. In financial markets, all that is required is that a number of professional traders are well informed and have sufficient resources at their disposal. If they perceive that prices are too low compared with their valuation, they will buy, forcing prices upwards. If prices are too high, they will sell. Less well-informed customers end up accepting the market prices because they know that it could be dangerous to disregard them.[2]

As a short cut, this book will frequently use a simplified version of rational expectations known as perfect foresight. Perfect foresight simply assumes that people know everything that will happen in the future. The difference with rational expectations is that we ignore uncertainty. Perfect foresight can be thought of as an exploration of what the world would be like if the future was in fact perfectly known. Of course, no one thinks that this is realistic but, as with rational expectations, if surprises are sometimes good and sometimes bad, perfect foresight is a reasonable starting point.

[1] Some alternatives to rational expectations are presented formally in the WebAppendix to this chapter.

[2] This point highlights an important tension between rationality of individual behaviour and aggregate outcome. We will see in Chapter 14 that financial markets can be susceptible to problems when too many people blindly believe the signal thought to be contained in prices.

7.2.3 The Parable of Robinson Crusoe

This chapter sets up the intertemporal budget constraint facing households, firms, the government, and the nation as a whole. We return to Robinson Crusoe as our representative household, already familiar to us from Chapter 5. As we deal with the infinite future, it is convenient to collapse time into two periods, 'today' and 'tomorrow', where tomorrow is a metaphor for the future. And beyond tomorrow? Crusoe is rescued and will no longer need to concern himself with the economics of his island!

7.3 The Household's Intertemporal Budget Constraint

7.3.1 Consumption and Intertemporal Trade

Let's start by imagining that Crusoe's island does not even have coconut trees. Rather, the coconuts simply wash up on the beach. The number of coconuts that he (rationally) expects to have today and tomorrow is his exogenous **endowment**. This endowment includes both present and future resources. Using subscripts to denote the relevant period in which they become available, we can represent his endowment of Y_1 coconuts today and Y_2 coconuts tomorrow by point A in Figure 7.1.

Until Robinson learns how to plant coconuts, he has no choice but to consume what nature gives him. Since coconuts cannot be carried over to the next period, Crusoe's consumption is also given by point A. This is the **autarky** point. A household or a country operates in autarky when it does not trade and consumes its endowment.

If we bend the story a little and allow for neighbouring islands inhabited by other economic agents, trade is possible. Because Crusoe's coconuts are just as good as his neighbours', we might not expect to observe any trade between them. Yet Crusoe may well be interested in **intertemporal trade**, or exchanging resources across time. He might lend his neighbours some coconuts today, if he expects to find only a few tomorrow, or if he prefers to consume more tomorrow. On the contrary, if today's 'harvest' is abnormally low or if Crusoe is impatient, he could borrow coconuts now and repay later when times are better.

The rest of the chapter will explore borrowing and lending, and the role of financial markets. As a way of moving away from autarky, borrowing and lending is just like selling or buying goods and services. Yet banking and financial markets suffer from reputation problems, and the recent financial and credit crisis hasn't made matters better. Box 7.1 explores these reservations and possible reasons for them.

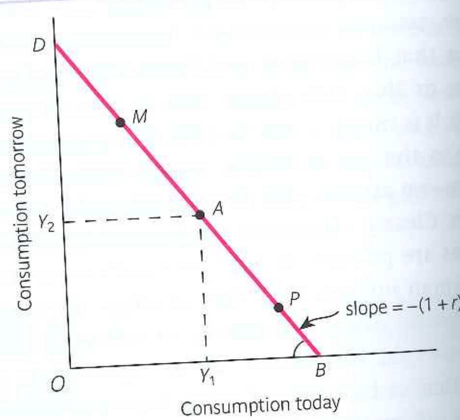

Fig. 7.1 Endowment, Wealth, and Consumption

Resources available today and tomorrow—the endowment—determine wealth and available consumption choices along the budget line *BD*. In the figure, the same level of wealth (*OB*) is attainable by a professional athlete (point *P*) or a university student (point *M*).

Box 7.1 Neither a Borrower nor a Lender Be: The Economics and the Sociology of Credit

In a well-known scene from Shakespeare's *Hamlet*, Polonius gives his son Laertes some parting advice: 'Neither a borrower, nor a lender be: For loan oft loses both itself and friend, and borrowing dulls the edge of husbandry.' In other famous plays, such as *The Merchant of Venice*, Shakespeare gives lenders a pretty tough time. Is it morally wrong to borrow (or to lend)? And what is wrong with charging interest, if borrower and lender freely agree to it? Although the economic arguments against autarky are convincing, many important religions of the world—including Islam, Christianity, and Judaism—have banned lending at a positive interest rate at one time or another in their histories. Why the ambivalence?

Perhaps it is because lenders have an unconditional claim on the resources of individual borrowers in an inherently risky world. If the fortunes of a borrower go south, those of the lender do not—that is, unless the borrower declares bankruptcy. Perhaps it is because borrowers appear to be in a poor bargaining position, often seeking credit when all else has failed. Perhaps it is because individuals are frustrated when their bank won't give them the loan they think they deserve, because the credit officer deems them 'too risky', which they feel is insulting. And the market has ways of dealing with individual risks which are distasteful to many. One is charging higher interest rates, which appears opportunistic since the 'risky' poor people pay more than the 'safe' rich. Stories abound in the USA and the UK of indebted families with credit card debt paying interest rates of 30% and more. Then there is loan-sharking, illegal and possibly violent enforcement mechanisms, and 'payday loans', which amount to selling one's own wage packet in advance at effective annual interest rates sometimes in excess of 600%.

And yet, borrowing and lending is as natural as breathing. Even when lending at interest is prohibited as in many Islamic countries, the market finds ways around the ban, for example declaring loans to be 'equity stakes' which participate in profits and losses of the enterprise. The American economist Irving Fisher wrote in 1930 that:

> Prohibiting loan contracts cannot prevent interest taking. To forbid the particular form of sale called a loan contract would leave possible other forms of sale, and the mere act of valuation of every property right involves an implicit rate of interest. ... Indeed, as long as buying and selling of any kind were permitted, the virtual effect of lending and borrowing would be retained. (Fisher 1930: 116.)

In the end, the fundamental truth is that the market for loans exists because there are gains from trade: different degrees of patience, different wants, different opportunities, and different information.

7.3.2 The Real Interest Rate

Crusoe and his neighbours must agree on the terms of repayment: how much should he pay (or receive) tomorrow for one coconut borrowed (lent) today? These terms are the **real interest rate**, which we denote by r and will treat as given or exogenous; 'real' because Crusoe and his neighbours do not use money. Borrowing 100 coconuts will require paying back $100(1 + r)$ tomorrow—the principal of 100 plus interest payments of $100r$. If the real interest rate is 3%, or 0.03, interest payments will be 3 coconuts. Another, equivalent way of thinking of this transaction is that Crusoe agrees to sell $100(1 + r)$ coconuts tomorrow for the price of 100 today. Similarly, if Crusoe takes the other role and lends 100 coconuts today, he will receive $100(1 + r)$ coconuts tomorrow; to buy $100(1 + r)$ coconuts tomorrow he must save 100 coconuts today. The relevant intertemporal trade involves swapping $1/(1 + r)$ coconuts today for each coconut tomorrow. We can say that a coconut tomorrow is worth $1/(1 + r)$ coconuts today.[3]

The price of tomorrow's consumption in terms of today's, $1/(1 + r)$, is called an **intertemporal price**. As the real interest rate r is positive, $1/(1 + r)$ is less than 1, which means that goods tomorrow are cheaper—or less valuable—than goods today. The real interest rate measures the cost of waiting. Valuing future goods in terms of goods today (here, dividing by the interest

[3] As a simplifying assumption, we have assumed that the interest rate is the same, whether one is borrowing or lending. The world is more complicated, but the logic is unchanged, when we consider different rates of interest for borrowers and lenders. Section 7.5 provides more details.

Box 7.2 Discounting and Bond Prices

Discounting is used in economics and finance to value future incomes or expenditures in terms of income today. It is frequently used to put a value on financial assets and debts. It asks: What is the amount of money required today, given an interest rate, to generate some payment or payments in the future? By valuing a coconut tomorrow only as worth $1/(1 + r)$ coconuts today, Robinson Crusoe has successfully applied discounting to a practical problem.

Let us apply discounting to a financial problem, and consider a simple bond that pays €100 in one year's time. (This type of bond is called a *pure discount* bond.) If the interest rate given by the market is 5%, what is the value of this bond today? It is the amount that, if invested now, yields €100 next year. If that amount is B, then it must be true that $B(1 + 0.05) = 100$, so $B = 1/(1.05) =$ €97.24. Similarly, the value of a two-year discount bond is given by $B = 100/(1 + 0.05)^2 =$ €90.70. The further into the future the payout is, the more heavily any amount is discounted, and the lower the discount bond price is.

Conversely, given discount rate r, the present value of a stream of payments a_t over n years, $t = 1, \ldots, n$ has present value given by

$$\frac{a_1}{1+r} + \frac{a_2}{(1+r)^2} + \frac{a_3}{(1+r)^3} + \ldots + \frac{a_n}{(1+r)^n}$$

Now consider the case of a consol, a bond that promises to pay a fixed amount a forever. Is it possible to put a price on that income stream, even though the payments are infinite? As long as the interest rate is strictly positive, the answer is yes! The price of a consol C which pays a each period is simply the present discounted value of its payments:

$$C = \frac{a}{1+r} + \frac{a}{(1+r)^2} + \frac{a}{(1+r)^3} + \ldots + \frac{a}{(1+r)^n} + \ldots$$

$$= \frac{a}{1+r}\left[1 + \frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \ldots\right]$$

$$= \frac{a}{1+r}\left[\frac{1}{1-\frac{1}{1+r}}\right] = \frac{a}{r},$$

where we have applied the formula for a sum of a geometric series to the term in brackets. The price of a consol is inversely related to the interest rate. Other bonds have a finite maturity so the formula is more complicated, but the general principle survives that higher real interest rates imply lower bond prices.

factor, 1 plus the real interest rate) is called **discounting**. Discounting is a very important concept in macroeconomics which is worth studying carefully. It helps explain the inverse relationship between bond prices and interest rates, as well as the fact that surprising changes in market interest rates often move stock prices in the opposite direction. It explains why borrowers—including governments—love to postpone repayment of loans, and why lenders resist such attempts with vigour. Box 7.2 presents the important concept of discounting more generally.

Intertemporal trade allows Crusoe to choose combinations of consumption today and tomorrow which are different from his autarky point. These combinations are represented by the line BD in Figure 7.1. This line must go through his endowment point A, since he can always choose not to trade at all.

At point B Crusoe would forgo consumption tomorrow completely. In that case he would borrow fully against his future endowment Y_2, receive $Y_2/(1 + r)$ coconuts, and consume $Y_1 + Y_2/(1 + r)$ coconuts today. At point D he would fast today and lend all his current endowment Y_1 in order to consume $Y_1(1 + r) + Y_2$ coconuts tomorrow. The line BD represents all the possibilities open to Crusoe, in between the extremes just described. It is called the **budget line**. The budget line is the simplest representation of the intertemporal budget constraint. Its slope[4] is given by $-(1 + r)$. If the rate of interest increases, the budget line becomes steeper. For a given amount of saving today, more will be available tomorrow.

[4] The slope of the budget constraint is negative and is given by −1 times the ratio OD/OB. From the text we know that $OD/OB = [Y_1(1 + r) + Y_2]/[Y_1 + Y_2/(1 + r)] = 1 + r$.

7.3.3 Wealth and Present Discounted Values

If Crusoe's income 'from nature' in the first period is Y_1 and he consumes C_1 in the same period, his saving is $Y_1 - C_1$. If $Y_1 - C_1$ is positive, Crusoe is lending; if $Y_1 - C_1$ is negative, he is borrowing. In the second period, his maximal consumption C_2 will equal the sum of income Y_2 and $(1 + r)(Y_1 - C_1)$, i.e. the interest and principal on his savings from period 1. If saving was negative in the first period, this means paying back principal plus interest. The budget line can be represented formally as:

$$C_2 = Y_2 + (Y_1 - C_1)(1 + r). \tag{7.1}$$

This fully describes Crusoe's intertemporal budget constraint. Dividing both sides by $(1 + r)$ and rearranging,

$$\underbrace{C_1 + \frac{C_2}{1+r}}_{\text{present value of consumption}} = \underbrace{Y_1 + \frac{Y_2}{1+r}}_{\text{present value of income}} = \underbrace{\Omega}_{\text{wealth derived from income}} \tag{7.2}$$

The left-hand side is the **present discounted value** of consumption. It is the sum of today's and tomorrow's consumption valued in terms of goods today. The right-hand side is equal to the present discounted value of income (his endowment). It is the maximum consumption that Crusoe could enjoy today, given his resources today and tomorrow, and is represented by point B in Figure 7.1. Put differently, OB is the present discounted value of Crusoe's total endowment. In fact, it represents his wealth, which we denote by the symbol Ω.

Lending and borrowing enable individuals with the same total wealth but with very different income profiles to enjoy the same menu of possible consumption over both periods. It doesn't matter whether Crusoe is a university student with low current and high future income, as represented by point M in Figure 7.1, or a professional athlete with high current and low future income (point P). As long as these points are on the same budget constraint, the present discounted value of income is the same and intertemporal trade allows income to be shifted across time by borrowing and lending.

Now suppose Crusoe had initial tradable wealth B_1 (an initial cache of coconuts). His wealth will increase by this amount and the budget constraint will be modified as follows:[5]

$$\underbrace{C_1 + \frac{C_2}{1+r}}_{\text{present value of consumption}} = \underbrace{Y_1 + \frac{Y_2}{1+r} + B_1}_{\text{total wealth}}. \tag{7.3}$$

If $B_1 > 0$, Crusoe can consume more in both periods. But B_1 could be negative, if Crusoe began his existence with debt. In that case, he will have to consume less (in present value terms) in order to repay the debt and interest. In general, total wealth Ω is the sum of inherited wealth or debt B_1 and of the present value of income: $\Omega = Y_1 + \frac{Y_2}{1+r} + B_1$. This is shown in Figure 7.2, where the inherited wealth or debt is added to the present value of income. At a given real interest rate, it implies shifting the budget line BD to $B'D'$ (if wealth increases) or $B''D''$ (if it decreases).

7.4 The Firm and the Private Sector's Intertemporal Budget Constraint

7.4.1 Firms and the Investment Decision

Crusoe's income has been exogenous until now. In reality, income mostly comes from planned activities. As we saw in Chapter 3, production requires that resources are diverted from consumption and used to acquire productive capital. Crusoe could plant coconuts today which would grow into trees bearing coconuts tomorrow. Naturally, once planted, a coconut cannot be consumed: it is useful only for its future production. The use of valuable resources to produce more goods later

[5] This is obtained by noting that today's available resources are $Y_1 + B_1$ so that (5.2) is changed to $C_2 = Y_2 + (B_1 + Y_1 - C_1)(1 + r)$.

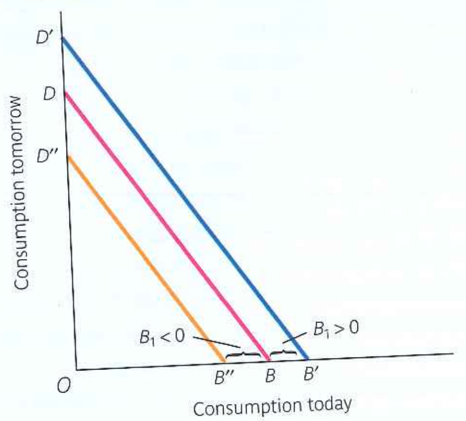

Fig. 7.2 Inheriting Wealth or Indebtedness

When wealth $B_1 > 0$ is inherited, the budget line shifts from BD to $B'D'$. Debt $B_1 < 0$ shifts the budget line to $B''D''$. The lines are parallel because the real interest rate is assumed unchanged.

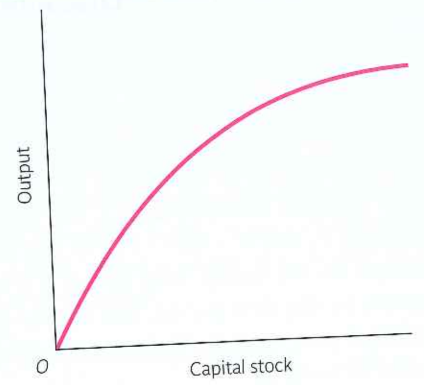

Fig. 7.3 The Production Function

As more input is added, output increases, but at a decreasing rate. This is the principle of declining marginal productivity.

is called **investment** or **fixed capital formation**. Many goods produced in modern economies are designed solely to make future production possible, and have no consumption value at all.

The notion of investment was already explored in Chapters 3 and 4 in the discussion of long-term economic growth. The investment decision also has a fundamentally intertemporal aspect. Firms decide to accumulate capital when it is sensible, i.e. profitable to do so, and profitability depends on expected future outcomes. In order to finance their investments, firms can either obtain resources in the capital market (stock exchanges, bond markets, or banks) or use their own funds (retained earnings). The discussion of this and the next chapter deviates from the growth model in Chapters 3 and 4. In those chapters, capital was accumulated as the result of available savings, which was assumed to be an exogenous fraction of national income. In what follows, investment and savings will be described as conscious choices of firms and households.

7.4.2 The Production Function

The investment decision depends upon the amount of output that can be produced with the available equipment (the number of coconuts to be obtained from a tree). The **production function** $F(K)$ captures this relationship between capital input and output and is depicted in Figure 7.3. It can be thought of as a special case of the production function of Chapter 3, in which labour input is exogenous.[6] The shape of the curve implies that, as more capital is accumulated, the additional or marginal yield declines. That marginal output decreases when input increases is the same principle of **diminishing marginal productivity** that we encountered in Chapters 3 and 5.[7]

7.4.3 The Cost of Investment

Starting with no capital stock (assuming no coconut trees on the island at the outset), today's investment represents the total stock of capital available for production tomorrow. (Box 7.3 considers the more realistic case when previously accumulated capital already exists.) Crusoe understands that he can either invest K in productive equipment, or lend K in the capital market. In the first case, he will receive output $F(K)$ tomorrow. In the second case, he will receive $(1 + r)K$ tomorrow. The real interest rate measures

[6] In Chapter 3, labour supply was also treated as exogenous. If we set $L = 1$, and $Y = F(K, L)$, as in Chapter 3, then $Y = F(K, 1)$.

[7] The reason behind this principle is that, given the existing amount of labour used to man the equipment (here, Crusoe's time), adding new equipment is less and less effective in raising output.

Box 7.3 Gross Investment, Depreciation, and the Capital Stock

When previously accumulated capital already exists in the amount K_1, the situation in the next period is more complicated. The stock of capital may differ in the future from the previously accumulated stock in two ways. First, new capital I_1 may be invested. Second, depreciation—wear, tear, and obsolescence—may remove some of the value of the old capital stock. It is a proportion δ of the capital stock. The new capital stock is:

$$\underbrace{K_2}_{\text{new capital stock}} = \underbrace{K_1}_{\text{old capital}} + \underbrace{I_1}_{\text{gross investment}} - \underbrace{\delta K_1}_{\text{depreciation}}$$

The realized change in the capital stock, $\Delta K = K_2 - K_1$, is therefore equal to $I_1 - \delta K_1$, the difference between gross investment and depreciation of previously accumulated capital. For the capital stock to grow, new investment spending must exceed depreciation.

the **opportunity cost** of the resources used in investment. Because of the option of lending at rate r, the investment in this case must yield at least $1 + r$ to be worth undertaking.[8]

Figure 7.4 shows the opportunity cost of invested capital K as the ray OR from the origin, which is given by $(1 + r)K$. As long as the resulting output exceeds the cost, the technology is sufficiently productive and investment is worthwhile. At point A, investment just covers its cost. There is no economic profit possible. To the right of A, investment uses up more resources than it produces. Positive economic profits occur only to the left of A.

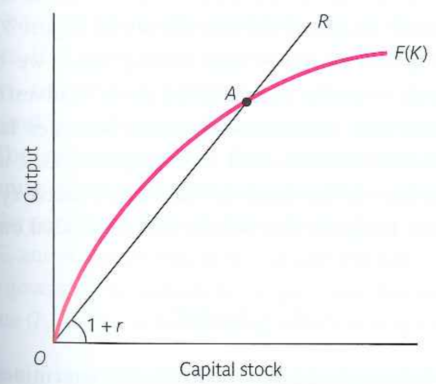

Fig. 7.4 Productive Technology

The cost of borrowing to finance investment is given by OR. As long as output exceeds the cost of borrowing, the technology is productive and the producer makes profit. Beyond A, she makes losses.

The interest rate r is obviously crucial for the valuation of investments. For example, if the rate of interest were to increase, the OR line would rotate upwards to the left, moving point A to the left and reducing the volume of investment that has any positive value at all. Capital must be more productive—and therefore lower—to make up for higher borrowing costs.

Another approach, that will prove useful later, is to ask what is the net return V from investing K—what Crusoe gets from planting K coconuts as an irrecoverable expense. The net return is simply the difference between the present value of output tomorrow and investment today:[9]

$$V = \frac{F(K)}{1+r} - K. \quad (7.4)$$

Note again that to compare goods available tomorrow with goods available today, we must price the former in terms of the latter, i.e. we discount the former by applying the intertemporal price $1/(1 + r)$.

An investment project is economically justifiable only if it has a positive present value. In terms of (7.4), that means $V > 0$ or if $F(K) > K(1 + r)$. Figure 7.5 illustrates a case when the technology is not productive enough given the real interest rate. In that case it

[8] Alternatively, Crusoe could borrow coconuts for investment purposes. The interest rate then is literally the cost of this debt-funded investment. This is discussed in the WebAppendix.

[9] By assumption the trees are assumed not to have resale value; they die after the second period. If they didn't, one would need to add back the resale value of the depreciated trees in the second period, which would increase the value of the investment activity. This modification is described in detail in Chapter 8.

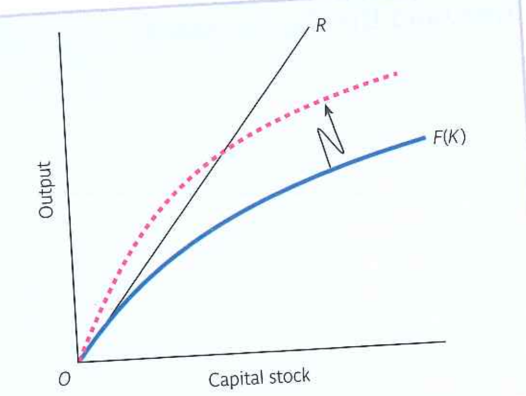

Fig. 7.5 Unproductive Technology

Given the interest rate, no firm will operate with the production function shown in the figure. A technological innovation which shifts the production function upwards can make an unproductive technology productive again.

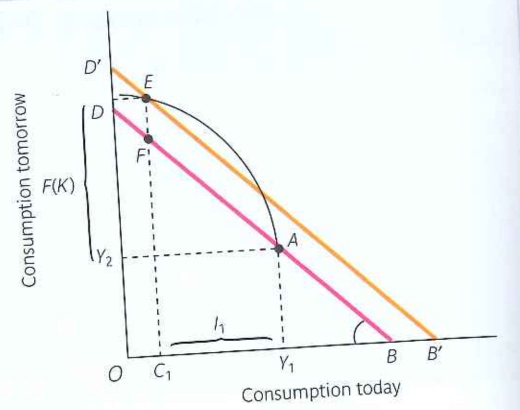

Fig. 7.6 Investment Increases Wealth

Investing I_1 (which becomes K_2) in a productive technology allows a household to increase its wealth over and above that corresponding to the initial endowment *A*. Here wealth increases by *BB'* as *FE* additional goods become available in the second period.

does not pay to invest anything at all: it is more profitable simply to lend at the rate *r*. It would require either an improvement in technology (the production function schedule shifts upwards as in Figure 7.5) or a decline in the interest rate (the ray *OR* rotates downwards) for some investment to be worthwhile.

7.4.4 The Intertemporal Budget Constraint of the Consolidated Private Sector

The budget constraint of Section 7.3 took endowments as given by nature as on Crusoe's island. Once investment and production are taken into account, income tomorrow is no longer simply given by nature. The budget constraint now depends on the amount that is invested and on its profitability. As long as the investment project has positive present value, investment increases wealth. Figure 7.6 shows how this happens. Starting from point *A*, Crusoe can save either by lending, or by investing an amount I_1 up to a maximum of his endowment Y_1. In the later case, Crusoe's saving are equal to investment, which is equal to the capital stock for tomorrow's output production (remember: the island is barren upon his arrival, so initial capital $K_1 = 0$). This is the difference between today's endowment Y_1 and consumption C_1:

$$K_2 = I_1 = Y_1 - C_1. \tag{7.5}$$

The more he invests—the more we move to the left in Figure 7.6—the larger will be tomorrow's production. This is why the production function *AE* is now the mirror image of the one shown in Figure 7.4: as consumption declines and saving rises, we move leftwards from the endowment point *A*, investment increases and tomorrow's output becomes larger. Tomorrow's income—and consumption as it is the last period—is the sum of the endowment Y_2 (the coconuts lying on the beach) and produced output $F(K_2)$:

$$C_2 = Y_2 + F(K_2). \tag{7.6}$$

The intertemporal budget constraint determines the present value of consumption $C_1 + C_2/(1 + r)$ as equal to total wealth Ω. Recognizing that $C_1 = Y_1 - I_1$ is given by (7.5) and C_2 given by (7.6), the intertemporal budget constraint can be rewritten as:

$$\underbrace{C_1 + \frac{C_2}{1+r}}_{\text{present value of consumption}} = \underbrace{\Omega}_{\text{total wealth}} = \underbrace{\left[Y_1 + \frac{Y_2}{1+r}\right]}_{\text{wealth from income}} + \underbrace{V.}_{\text{value of the firm}} \tag{7.7}$$

Wealth now consists of two parts.[10] The first part is the present discounted value of the endowment as before in (7.2). The second part is the increase in wealth represented by *V*, the net value of the investment activity, as in (7.4). In Figure 7.6 the outcome of investment I_1 is shown as point *E*. Note that *E* lies above the initial budget line. This is because the production technology is productive at the rate of interest *r*. The distance *OB* still represents the present value of the endowment. But now, for a choice of investment I_1 that brings Crusoe to point *E*, new total wealth is the distance *OB'*. Since the value of future output is discounted at the same rate *r*, the new budget line is parallel to *BD*. The distance *BB'* represents the net present value of the investment project.[11]

In the parable, Crusoe stands for the private sector as a whole, which consists of individuals and the firms they own. Firms ultimately belong to their shareholders, and the net return from investment raises their wealth. If shareholders anticipate that a firm will become more profitable in the future—because of a technological advance, as represented by the shift in Figure 7.5—then net expected returns rise and they are richer. This wealth gain takes the form of an increase in the value of the firm. In the real world, this would be reflected as an increase in the firm's value in the stock market.[12]

7.5 Public and Private Budget Constraints

7.5.1 The Public Budget Constraint

There was no government on Robinson Crusoe's island. In the real world, there is a public sector, which collects taxes, purchases goods and services, and makes transfers to households. Yet the government is little different from other economic agents. It can borrow, but is expected to repay its debt with interest; if it lends it will expect to be repaid by its debtors. Consider a government, which spends G_1 today and G_2 tomorrow, and raises net taxes T_1 and T_2.[13] The government has debt outstanding at the beginning of the period in the amount D_1. This debt must be serviced (interest must be paid) at interest rate *rG*, and must be repaid in the last period.

The government spends $(G_1 + r_G D_1)$ and has net tax revenue (T_1) today. It is running a deficit if spending exceeds revenue, that is if $G_1 + r_G D_1 - T_1 > 0$. Like anyone who spends more than they earn, the government must borrow to finance that deficit. Total borrowing requirement can be broken down into two parts: (1) the **primary deficit** $(G_1 - T_1)$, the amount by which non-interest expenditures exceed revenues, and (2) interest payments $(r_G D_1)$. While a solvent government cannot avoid making interest payments which are due, the primary deficit can be chosen by changing either spending or net taxes.

In the second and last period, the government must repay its obligations in full. This means that tomorrow's primary surplus $(T_2 - G_2)$ must be sufficient to repay today's deficit $(G_1 - T_1)$ plus interest on

[10] To see this, write wealth as the present discounted value of net income and rearrange using $V = \frac{F(K_2)}{1+r} - I_1$, which yields $\Omega = \left[Y_1 + \frac{Y_2}{1+r}\right] + \left[\frac{F(K_2)}{1+r} - I_1\right] = \left[Y_1 + \frac{Y_2}{1+r}\right] + V.$

[11] A subtle, but important point: This valuation of the firm is independent of whether Crusoe finances the investment himself out of savings (or 'retained earnings' in the language of business) or whether he *borrows* funds to finance it (and discounts the project returns using the same interest rate). In this benchmark case it doesn't matter. This result is known as the Modigliani-Miller Theorem, and is discussed in the WebAppendix to this chapter.

[12] Because the production function lies above the new budget line *B'D'*, total wealth could be increased by investing a little bit less than I_1. Chapter 8 shows that, when Crusoe strives to do the best he can—behaves optimally—he will invest to push out his new budget line as far as possible, i.e. he maximizes the value of his total wealth.

[13] Note that *G* represents government purchases of goods and services. It is not the same as total government spending or outlays, which include transfer payments. In our notation, transfer payments are deducted from taxes to give net taxes *T*. Although interest payments are treated like transfers in the national income and product accounts, they are such a central component of the intertemporal budget constraint that we will always distinguish them from other transfers throughout this book.

that deficit $r_G(G_1 - T_1)$, but also the inherited debt from the past D_1, *plus* interest $r_G D_1$:

$$T_2 - G_2 = (1 + r_G)(G_1 - T_1) + D_1 + r_G D_1 = (1 + r_G)(D_1 + G_1 - T_1). \tag{7.8}$$

This is the government budget constraint, which can be rearranged as

$$D_1 = (T_1 - G_1) + \frac{T_2 - G_2}{1 + r_G} = \left[T_1 + \frac{T_2}{1 + r_G}\right] - \left[G_1 + \frac{G_2}{1 + r_G}\right] \tag{7.9}$$

public debt = present value of primary budget surpluses.

For the government to obey its intertemporal budget constraint, the sum of the present value of primary budget surpluses is equal to initial outstanding debt. This also means that the present value of government income must be sufficient to cover the present value of purchases plus the initial debt. The government budget constraint is illustrated in Figure 7.7 for the case of no initial debt or assets ($D_1 = 0$). The budget line has slope $-(1 + r_G)$ and passes through the origin.

The two-period parable contains a strong message: Governments with debt and deficits *today* must run primary surpluses *tomorrow*; similarly, governments with a comfortable fiscal position today can let go (a little) in the future. Yet do governments really obey their budget constraints? The European debt

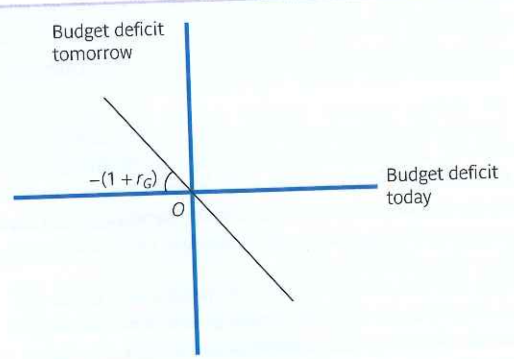

Fig. 7.7 The Government Budget Line

A deficit today must be matched by a budget surplus tomorrow, or vice versa, if the government is to obey its intertemporal budget constraint.

crisis–Box 7.4 discusses its genesis–has given many reason to doubt it. In fact, some governments throughout history have been faced with budget problems, sometimes resulting in spectacular defaults, or repudiation of past debts. Yet an error commonly made by politicians and the general public is to look only at the current year's deficit as a measure of the government's solvency. Especially when the economy is growing robustly, tax revenues can be expected to grow over time as well, thus easing some of the burden.[14] For that reason, it is always a good idea to measure expenditures and tax revenues relative to GDP. Still, in order to avoid defaults, today's primary deficits require primary surpluses later, and conversely. Given spending plans, lower taxes today are followed by higher taxes tomorrow. Alternatively, for a given path of taxes, more spending today requires spending cuts tomorrow. How long does 'today' last before a government is hit 'tomorrow' by the budget constraint?

Figure 7.8 shows that governments do generally obey their budget constraints. It shows the evolution of primary budget balances for four countries over time, relative to the size of the economy measured by the GDP. Some countries (the UK) show a succession of primary deficits and surpluses. In other cases (Ireland, Italy, the USA) deficits have been sustained over many years, yet eventually the primary budgets were corrected, sometimes moving into spectacular surpluses. The financial crisis of 2007–8 has led to sudden relapses in Ireland, the UK and the US. The case of Ireland is unusual (note that the scale is not the same for all four countries). In 2010, the government had to scramble to save its collapsing banks. With a deficit of some 30% of GDP, the Irish government itself went into crisis and had to be bailed out by the other Eurozone countries with assistance from the International Monetary Fund. Italy, on the other hand, managed to keep its budget roughly balanced. Yet it went into crisis when markets took a dim view of several decades of large deficit and smaller surpluses that left a legacy of a public debt of some 110% of GDP. These examples show how sudden unexpected spending needs or long strings of

[14] The implications of economic growth for government budget constraints and stabilization policy will be explored in detail in Chapter 17.

Box 7.4 The European Debt Crisis

Many people were surprised by the sudden market panic on the Greek government debt which arose in the spring of 2010 and seemed to spread to other Eurozone countries. At the time of this book's writing (January 2012), several euro area countries are under severe budgetary stress, meaning that economic analysts doubt that they will be economically or politically able to meet their budget constraints. This judgment reflects and is also driven by 'current market conditions'—meaning those high current interest rates that the market demands for fresh lending.

History is littered with government defaults, frequently accompanied by sharp political upheavals: the turbulent years of the French Revolution, the October 1917 revolution in Russia, the end of the Weimar Republic in 1933, Castro's revolution in Cuba.[15] In most cases, however, defaults are just the end of a long period of debt accumulation, reflecting a long string of budget deficits which don't seem to reflect any budget constraint at all. This was true of much of Latin America in the 1980s, Russia in 1998, Argentina in 2001, and Iceland in 2008. It could be coming closer to home, to the euro area.

The history of government finance shows that default is a subjective concept.[16] Technically, it occurs when the borrower country has failed to service its debt, meaning that it has missed a payment due—even by a day! Yet financial markets, which finance most of the deficits, can be enormously patient or excessively optimistic. It is always possible to arrange a short-term 'bridge' loan, even on short notice, for a few years time, if there is a high chance that the loan will be repaid. In the end, it is not really possible to know with certainty whether a government is meeting its budget constraint at any point in time. In reality, the intertemporal borrowing constraint features public spending and tax revenue streams that extend into the infinite future. If there are lenders out there with strong nerves and enough patience, current deficits associated with a temporary decline in tax revenues in a recession can be overlooked. This is why the current situation—which will be examined in more detail throughout the rest of the book—is so disturbing. The financial markets, right or wrong, seemed to have lost hope in 2010.

insufficient surpluses can stretch the intertemporal budget constraint to its limits.

7.5.2 The Consolidated Public and Private Budget Constraint

Both households and firms–which are owned by households–ultimately have to pay the taxes. They cannot ignore the public sector budget constraint. Much as they must include the budget constraints of the forms that they own, households must also see through the public sector financing veil. In this section we follow this logic and integrate the private and public budget constraints to face intriguing and important consequences.

For simplicity, we ignore the existence of firms and set initial government debt to zero. The private and public intertemporal constraints are, side-by-side as follows:

$$C_1 + \frac{C_2}{1 + r} = Y_1 - T_1 + \frac{Y_2 - T_2}{1 + r}, \tag{7.10}$$

$$G_1 + \frac{G_2}{1 + r_G} = T_1 + \frac{T_2}{1 + r_G}. \tag{7.11}$$

In the first budget constraint, the private citizens pay the taxes, while in the second, the government receives them. Note that we do not assume that the government and the private sector face the same interest rates when they engage in borrowing or lending activities. Traditionally, the private sector is considered as less safe than the public sector but the crisis may be changing this presumption. The government sector borrows and lends at rate r_G, while

[15] The public debt should be distinguished from the external debt, although in some instances the public debt is held by foreigners and represents the bulk of the external debt. This chapter assumes that the public debt is held by domestic residents.

[16] We will have much more to say about this in Chapter 17, which looks more carefully at government deficits, debt, and the role of the central bank.

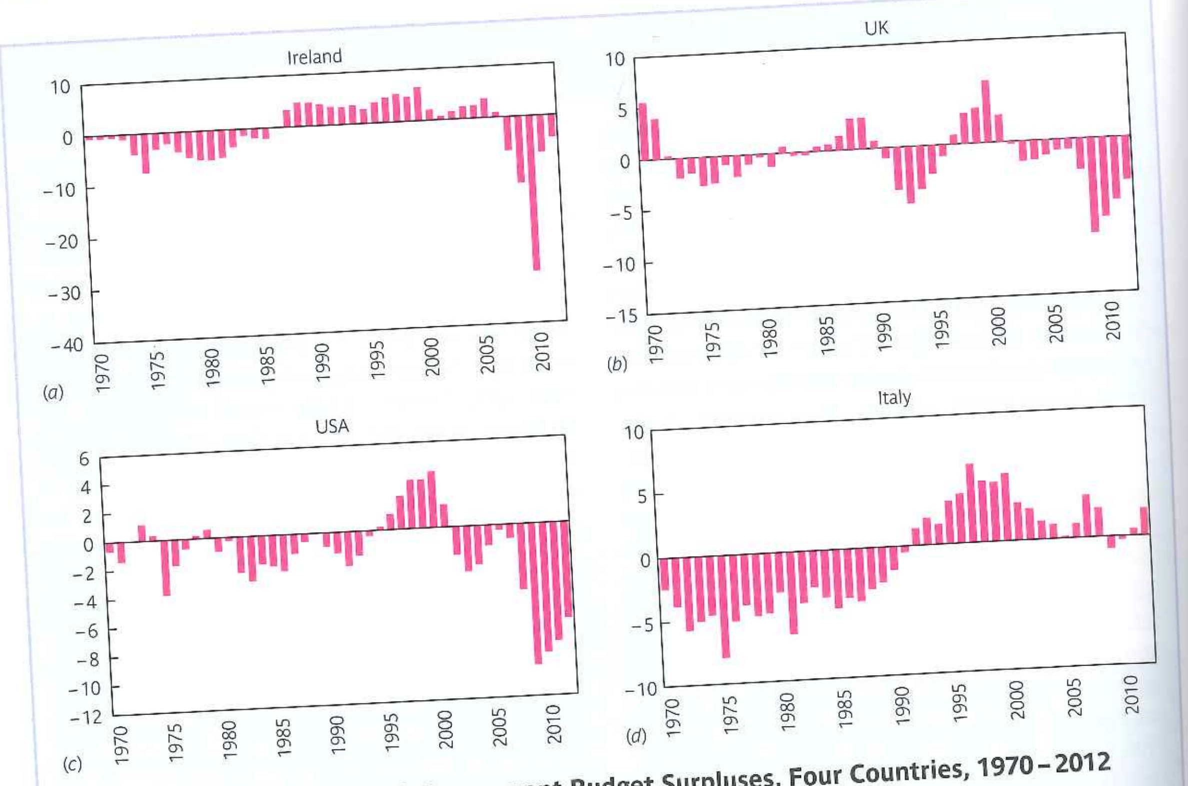

Fig. 7.8 Primary Consolidated Government Budget Surpluses, Four Countries, 1970–2012

Over time, primary budget balances must add up, in present-value terms, to initial public debt. Some governments, like the UK, have maintained primary budget balances on average over many years. Those that have allowed deficits to cumulate into large indebtedness will eventually have to run surpluses, as has been the case in Ireland, Italy, and the USA.

Source: OECD, National Accounts.

the private sector borrows and lends at rate r. Combining the private and public budget constraints yields the consolidated budget constraint[17]

(7.12)

$$\underbrace{C_1 + \frac{C_2}{1+r}}_{\text{present value of consumption}} = \underbrace{(Y_1 - G_1) + \frac{Y_2 - G_2}{1+r}}_{\text{present value of private resources net of government spending}} + \underbrace{\left[\frac{r - r_G}{1+r}\right](G_1 - T_1)}_{\text{present value of the government's financing advantage.}}$$

[17] To derive this result, multiply both sides of (7.11) by $(1 + r_G)/(1 + r)$, and rewrite as

$$G_1 + \frac{G_2}{1+r} + \frac{r_G - r}{1+r}G_1 = T_1 + \frac{T_2}{1+r} + \frac{r_G - r}{1+r}T_1.$$

or

$$T_1 + \frac{T_2}{1+r} = G_1 + \frac{G_2}{1+r} + \frac{r_G - r}{1+r}(G_1 - T_1).$$

Substitution of this last expression into (7.10) yields (7.12).

A comparison of the consolidated budget constraint (7.12) with the private constraint (7.10) shows that both link private consumption to private income—remember that to simplify, we ignored inherited debts or assets. Before consolidation, private income is the present value of net of taxes incomes over both periods. Equation (7.12) shows that after consolidation, private income includes two parts. First, the present value of incomes net of public spending, not taxes. This means that households can only consume the output that the government has not taken for itself. As long as the government respects its budget constraint, its spending will be paid for by taxes, now or in the future, and it does not seem to matter when!

Yet it does matter. The second part of private income reflects the difference between the interest rates at which the government and the private sector can borrow. If, as is normally the case, the government can borrow more cheaply than the private sector, $r > r_G$, this part is positive: the more the government borrows, the better off the private sector is. In order to understand this surprising result, consider the case when the government reduces taxes today and raises them tomorrow to meet its budget constraint. This means that it will have to borrow today at rate r_G and pay back tomorrow. The private sector will pay less taxes today but more tomorrow; it makes sense for the private sector to save the correspond amount, at interest rate r. The private sector benefits from this operation because it earns r on its saving and will have to pay more taxes to cover the public borrowing at the lower interest rate r_G. In effect, the government borrows on behalf of the private sector, allowing the private sector to save at a higher rate than it borrows indirectly. Of course, it is also true that if the government borrows on *worse* terms than its citizens, it can *reduce* net wealth of its citizens. Furthermore, is r greater than or less than r_G?

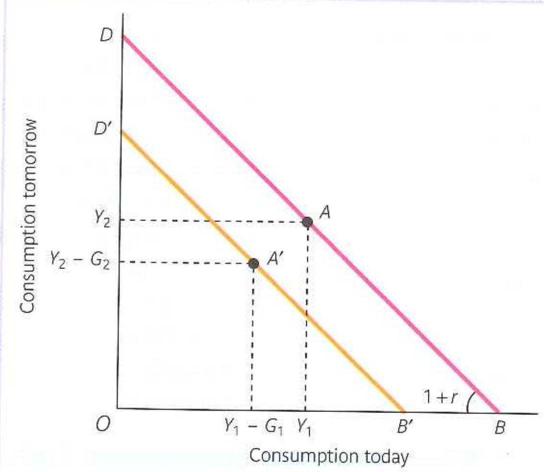

Fig. 7.9 Ricardian Equivalence

The government's spending and taxing activities reduce private wealth. Given government purchases, the precise scheduling of taxes does not matter.

7.5.3 The Ricardian Equivalence Proposition

The story gets even more interesting. Suppose for the moment, that the interest rates of the private sector and the government are exactly equal, so $r = r_G$. In that case, the consolidated budget constraint (7.12) collapses to

(7.13)
$$C_1 + \frac{C_2}{1+r} = (Y_1 - G_1) + \frac{Y_2 - G_2}{1+r}.$$

This looks very much like the private sector budget constraint (7.10), except that now it does not matter at all when taxes are levied. Once the government has 'helped itself' to G_1 and G_2 of output, the private sector will take the rest whenever it wishes in the form of C_1 and C_2, borrowing or lending as needed. In fact, the private sector has fully internalized the public sector's budget constraint. The hypothesis that the private sector fully internalizes the public sector's budget constraint is known as the **Ricardian equivalence proposition**.[18] In Figure 7.9, point A represents Crusoe's endowment measured before taxes. Once public spending is taken into account as in (7.12), the private endowment is represented by point A'. The government reduces Crusoe's private wealth by an amount represented by the distance BB', which is either the present value of taxes or the present value of public spending—the two are equal because of the government budget constraint. As long as the public and private sectors borrow and lend at the same rate ($r = r_G$), these intertemporal shifts are equivalent and the public borrowing can be matched one for one by private saving along the same private budget line.

The Ricardian equivalence proposition can be stated in a number of different ways. The first is that total national spending—the sum of private and public spending on goods and services—cannot exceed the country's wealth. The country can borrow or lend abroad, but it must respect its (national) budget constraint.[19] The second is that private sector wealth—which can be spent on private consumption—is the difference between the present value of production or income on the one hand and public purchases of goods and services on the other. The implication is that the pattern of taxation over time

[18] Named after English economist David Ricardo (1772–1823), who first formulated this idea, only to dismiss it as unlikely. The idea has been revived and championed by Harvard economist Robert Barro.

[19] This can be readily shown by rewriting (7.13) as

$$(C_1 + G_1) + \frac{C_2 + G_2}{1+r} = Y_1 + \frac{Y_2}{1+r}.$$

has no effect on private wealth. What matters in the end is public spending, which represents resources taken away from the private sector. Finally, Ricardian equivalence means that its citizens do not treat government debt as net wealth. Government's indebtedness does not appear as part of private wealth on the right-hand side of (7.13). The private sector sees through the veil of government. It recognizes that the government's promises to pay the principal and interest on public debt are matched by taxes levied to service the debt, today or tomorrow. Public bonds are an asset to households, which is exactly offset by the present value of their future tax liabilities.

7.5.4 When Ricardian Equivalence Fails

For obvious reasons, the Ricardian equivalence result is highly controversial. It means that the path of taxes is irrelevant for the behaviour of the private sector. It implies that public borrowing and the resulting stock of government debt do not, on net, contribute to the wealth position of households. Holding constant the path of government purchases of goods and services, budget deficits do not matter! This controversial Ricardian equivalence result requires a number of assumptions, and this section reviews them critically. In the end, the result of this discussion is that budget deficits probably do matter, and that at least some fraction of public debt is regarded by the private sector as wealth.[20]

Different interest rates

A central assumption behind the Ricardian equivalence result is that the government and the private sector face the same interest rate. Is that realistic? It has long been taken for granted that, in any country, governments borrow at the lowest interest rate. The reasoning is that the government is considered a less risky borrower than most private businesses or individuals because governments can always tax to pay back their debts while private agents may find themselves unable to reimburse some loans. In the developed countries, the difference between the rates at which a government borrows and those that apply to firms in good standing has traditionally been of some 1–2% more for businesses, and much more for households. Table 7.1 shows that this still holds for the UK, US, and the Eurozone as a whole, but it is definitely not the case for individual countries.

This was a nearly universal observation before the crisis hit the Eurozone. Figure 7.10 shows that when the crisis started to unfold in 2009, the Italian government borrowing privilege has gradually eroded. By late 2010, Italian firms with solid credit ratings were paying interest rates on debt that were considerably lower than those demanded of the government. While government and private interest rates are taken as given for the purposes of the analysis, they are in fact endogeonous and depend on a number of factors. Box 7.4 already hinted that the reason for increases in government interest rates could be a perceived increased risk of default. Chapters 14 and especially Chapter 17 will make this case more clearly. In any case, when $r_G > r$ the government should be wary of running deficits, since according to the logic of the budget constraint, they are hurting, not helping their citizens; in this case deficits reduce, not increase, their net wealth!

Table 7.1 Interest Rates for Government and Corporate Bonds, 30 December 2011 (% per annum)

	10-year government bond	10-year corporate bonds A-rated	10-year corporate bonds BBB-rated
United Kingdom	1.96	6.13	n.a.
United States	1.89	4.38	4.78
Euro area	4.11	5.04	7.03

Source: Macrobond.

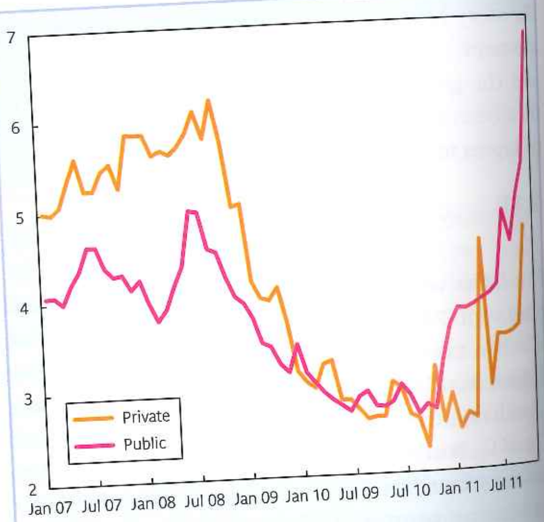

Fig. 7.10 Public and Private Borrowing Rates in Italy, 2007–2011

The rates refer to loans of 1- to 5-year maturity for the private sector and of 5-year maturity for the government. The reversal of the traditional hierarchy in 2010 was a potent signal that Italy was entering into a public debt crisis situation.

Source: ECB and Banca d'Italia.

[20] Other potential failures of the Ricardian equivalence proposition are related to the behaviour of agents under uncertainty, and go beyond the scope of this book.

Mortal or new citizens

Another objection is that Ricardian equivalence must fail because citizens are not all alike when they face the taxman: some pay a lot more taxes than others. So the burden of public debt service is not equally borne by all citizens. Similarly, some hold government debt, and some don't. Yet, this does not imply that the aggregate household sector can escape the implications of equations (7.11) and (7.13). In the *aggregate* some pay more than average, others pay less and, as a first approximation, it does not matter.[21]

On the other hand, citizens are certainly mortal. If they are not alive in period 2, they have little reason to care about the implication of the intertemporal budget constraint of the government. Of course, no one knows whether they will be alive next period but there is always a possibility, unfortunately, that the answer will be negative. Collectively, the private sector currently alive may factor in only a fraction of *all* future tax liabilities. In that case, government debt represents private wealth as we realize that we will not be alive next period and therefore we will not pay taxes to cover the public debt. To those who will not be alive, holding the current debt represents wealth. In a similar vein, new agents—immigrants, perhaps—who enter at some future date will pay taxes to reimburse the public debt issued before they arrived. This too breaks the link between the budget constraint of the presently living generations and future government revenues.

Restrictions on borrowing

Many households cannot borrow as much as future expected income would justify, sometimes they cannot borrow at all. They may be unable to convince lenders—typically banks—of their creditworthiness. For their part, lenders only possess incomplete information on the creditworthiness of borrowers when they apply for credit. In addition, future incomes are never really certain, so lending to households is risky. Borrowing rates exceed lending rates to compensate for this risk.[22] In the worst case, no lending is extended and individuals are said to be credit rationed. The case of credit rationing is represented in Figure 7.11. With a net private endowment represented by point *A*, the agent can only move along her budget line on the segment *AD*. The segment *AB* is not attainable through private borrowing. This means that the consolidated budget constraint—and Ricardian equivalence—is irrelevant for that agent. For instance, consider the case where the government runs a deficit today, so that $T_1 < G_1$, borrowing at rate r_G which we assume equal to r for simplicity. The agent may now reach point A' and could consume $Y_1 - T_1$, which is larger than $Y_1 - G_1$. She benefits when the government does the borrowing that she cannot do.

Most often, individuals face higher and rising costs of borrowing. Lending institutions frequently demand higher interest rates from individuals to compensate for additional risk. The situation is similar to the case studied in the previous section and is also illustrated in Figure 7.11. When lending, the constrained agent can move along *AD*, but for borrowing she moves along *AB'*. The budget line is now kinked at the endowment point. In this case, public debt contributes to citizens' wealth, and the time profile of taxes affects the private sector budget constraint. At

[21] It is true that poor people do not save and spend all of their income, while rich people only spend a fraction of what they earn. Taking from the rich to give to the poor does raise spending. Yet, the effect is typically very small, hence the 'first approximation' conclusion.

[22] More details on the rates of return paid on risky assets is provided in Chapter 14.

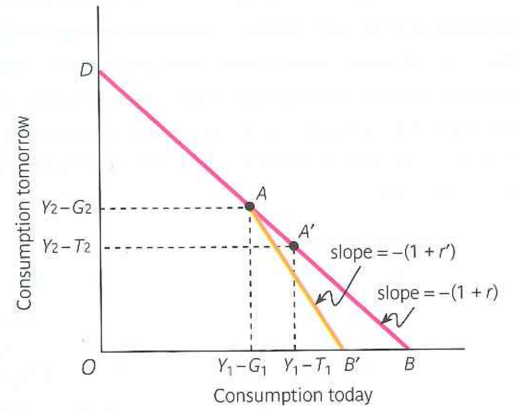

Fig. 7.11 Borrowing Constraints

When the household cannot borrow at all, its budget line is restricted to the segment *AD*, because it cannot consume today more than what is left of the endowment after public spending ($Y_1 - G_1$). If the government reduces taxes and borrows instead (here, from abroad), the household's borrowing line extends to the segment *A'D*. When borrowing constraints take the form of a higher private borrowing rate *r'*, the budget line is the kinked line *B'AD*. A budget deficit at *A'* at a lower interest rate $r = r_G$ relaxes the private household's budget constraint.

point *A'* the constrained citizen is better off than any point along *AB'*. Once again, when the government borrows on behalf of its citizens, it increases the wealth of those who cannot borrow on those terms.

Distortionary taxation and unemployed resources

Another important reason why the Ricardian equivalence can fail is that people change their behaviour in response to taxes. Most taxes are said to be distortionary. For example, taxation on labour income or wages may lead some to work less, and this will reduce output. In the parable of Crusoe, the endowments of coconuts are exogenous, so increasing taxes on them does not affect their supply. In the real world, taxes can reduce wealth because they reduce output. This is especially important in the presence of unemployment. If a tax cut increases the level of economic activity and generates additional income, then the associated fiscal deficit will be associated with higher wealth.

Evidence

Given the long list of qualifications, it would seem quite unlikely that Ricardian equivalence could ever hold in practice. Yet, it receives some empirical backing, especially when the public budget moves by large amounts that are clearly perceptible to the private sector, possibly signalling important policy shifts.

At a very fundamental level, it is unlikely that the private sector would completely disregard what the government is up to. One piece of evidence that supports the Ricardian equivalence is presented in Figure 7.12. Using the case of the UK, the figure shows that changes in the government primary budget balance are partly mirrored by household savings: when the government borrows more, that is when it runs a bigger deficit or smaller surplus, households save more as if they were putting money aside to face future tax liabilities. More formal studies, using advanced statistical techniques, indeed

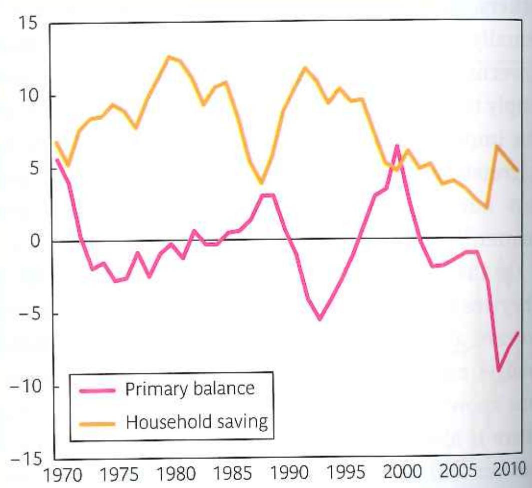

Fig. 7.12 Ricardian Equivalence in the UK, 1970–2011

The figure plots the primary budget balance of the British government (in per cent of GDP) and the household saving rate, the proportion (in per cent) of disposable income that is saved. Remarkably, the two curves tend to move systematically in opposite directions, although not always and not exactly. This suggests that British households are partly Ricardian.

Source: Economic Outlook, OECD.

suggest that households save about half of tax cuts and increases. Ricardian equivalence is thus '50% true'—although this is a dramatic oversimplification but worth keeping in mind.

7.6 The Current Account and the Budget Constraint of the Nation

7.6.1 The Primary Current Account

The consolidation of the budget constraints of the private and public sectors can be thought of as the intertemporal budget constraint of the nation as a whole. In Chapter 2 we saw that national net saving vis-à-vis the rest of the world occurs through the current account. Like the public sector budget surplus, it can be decomposed into a **primary current account** and net investment income:

$$\text{current account surplus } (CA) = \text{primary current account surplus } (PCA) + \text{net investment income } (rF), \tag{7.14}$$

where *F* represents the country's net asset position (sometimes called net investment position) vis-à-vis the rest of the world, and *r*, as before, is the real interest rate paid on *F*. Net investment income is positive when the country holds more assets than liabilities ($F > 0$), or negative in the case of an indebted country ($F < 0$).[23]

It was a lesson from Chapter 2 that the consolidation of the public and private intertemporal budget constraints can be expressed in terms of primary current accounts. In the two-period framework, the budget constraint of the nation requires that the present value of a country's primary current account surpluses be no less than the value of international assets in the first period:

$$\underbrace{PCA_1 + \frac{PCA_2}{1+r}}_{\text{present value of current and future primary accounts}} \geq \underbrace{-F_1.}_{\text{existing net external debt}} \tag{7.15}$$

[23] In Chapter 2, it was noted that when writing (2.8) as $Y - A = CA$, Y is properly measured by the GNI. Equation (7.14) shows that if Y is the GDP, we have $Y - A = PCA$.

If a country has net wealth at the beginning of period 1 (F_1 is positive), it can draw on it to run future current account deficits. If there is external debt (F_1 is negative), the present value of current accounts must be positive, by an amount sufficient to repay the external debt plus interest. Box 7.5 presents the net external position for a few countries.

The implication for the country as a whole is the same as for the private and public sector. A primary current account deficit in the first period ($PCA_1 < 0$) must be repaid by primary current surpluses (in present value) in the second unless there exist previously accumulated assets ($F_1 > 0$). Symmetrically, surpluses in the first period enable a nation to spend more than it produces in the future. It would seem wasteful for a country not to do this; otherwise it is literally giving away resources for claims on the rest of the world, which it will never use. For that reason, it seems likely that the countries of the world with large surpluses today will eventually get wise and start using these surpluses to improve the standards of living of its citizens.

7.6.2 Enforcement of International Credit Contracts and Sovereign Borrowing

If a country fails to satisfy its budget constraint, eventually it will face a tough situation. Many of the crises of the 1990s can be traced back to growing fears that some countries were not going to meet their budget constraints. But ultimately international borrowers have more or less honoured their obligations. Research shows that despite spectacular exceptions, international borrowers more often than not actually repay their debts in present value terms.