CHAPTER 6

Political economy: value and labour

[Note: This text is taken from *Classical Econophysics*, by Paul Cockshott, Allin Cottrell, Greg Michaelson, Ian Wright and Victor Yakovenko (London and New York: Routledge, 2009), where it appears as pages 113–136.]

This chapter plays a bridging role. In the previous chapters of this Part we have presented what one might call a philosophical history of technology. We have discussed technologies from the steam engine to the electronic digital computer, but not from a purely technical point of view: we sought to bring out the connections between the technologies themselves and their scientific underpinnings and consequences, as well as their social motivations and effects. And in particular we sought to show that a wide range of seemingly disparate socio-economic and technical phenomena can be unified by taking the perspective of the science of information. In the next Part we focus on theoretical analysis of the economy. The present chapter lays the groundwork for understanding the economic debates to which the following chapters contribute. It follows the historical approach, devoting particular attention to the classical political economists (hence cashing out part of the meaning of the 'Classical' of our title). One thrust of our argument will be that the ideas of the classicals are much more helpful then one might think, from opening a modern economics textbook.

6.1 Smith and Watt

Chapter 1 discussed the development of the physical concept of work by James Watt. It is probably no coincidence that Watt's colleague at the University of Glasgow, Adam Smith, was in the same period developing what would later be called the labour theory of value. We say 'probably' no coincidence because although we gather that Smith and Watt were friends and discussed intellectual matters together,[1] we don't know if there was any direct connection between Watt's development of the concept of work and Smith's conception of labour as the basis of value; this remains an intriguing speculation. Certainly Watt's work and Smith's labour are not the same thing – we have pointed this out above – yet the abstraction is similar. As Smith remarks, 'The greater part of people ... understand better what is meant by a quantity of a particular commodity than by a quantity of labour. The one is a plain palpable object; the other an abstract notion, which, though it can be made sufficiently intelligible, is not altogether so natural and obvious' (Smith, 1974: 134–5).

The 'abstract notion' of labour employed by Smith is not entirely new with him. His friend David Hume had written that 'every thing in the world is purchased by labour' in his *Political Discourses* of 1752 and John Locke had hinted at a labour theory of value in the chapter on property in his *Of Civil Government*. But these earlier statements were undeveloped and Smith was in a sense striking out on his own, since he was writing against the background of a 'natural law' tradition in which value was analysed in terms of 'utility and scarcity' (Hutchinson, 1988) and not, as Smith would have it, in terms of labour.[2]

Smith began his career as a moral philosopher, particularly concerned with the analysis of human sympathy, but he later turned his attention to political economy and of course his magnum opus was *An Enquiry into the*

[1] 'Watt's workshop was a favourite resort of Smith's during his residence at Glasgow College, for Watt's conversation, young though he was, was fresh and original, and had great attractions for the stronger spirits about him' (Rae, 1965: 74).

[2] The natural law approach stemmed from the work of the German jurist Samuel Pufendorf. Gershom Carmichael, also a Professor at Glasgow, produced an edition of Pufendorf's *De officio hominis et civis* which was very influential in Scottish intellectual circles.

Nature and Causes of the Wealth of Nations (1776). The opening sentence of this work announces a perspective in which labour plays a central role:

> The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes, and which consist always either in the immediate produce of that labour, or in what is purchased with that produce from other nations. (Smith, 1974: 104)

Smith is interested in the proportion this 'produce' bears to 'the number of those who are to consume it' (or real Gross Domestic Product per capita, as we might say today), and he remarks that

> this proportion must in every nation be regulated by two different circumstances; first, by the skill, dexterity, and judgment with which its labour is generally applied; and, secondly, by the proportion between the number of those who are employed in useful labour, and that of those who are not so employed. (Smith, 1974: 104)

We can think of this as the identity

$$\frac{\text{output}}{\text{population}} \equiv \frac{\text{output}}{\text{worker}} \times \frac{\text{workers}}{\text{population}}$$

where output per worker, or labour productivity, is governed by Smith's 'skill, dexterity, and judgment'.

The first three chapters of *The Wealth of Nations* are given over to a discussion of the division of labour, which Smith sees as the key to increasing labour productivity. We have already alluded to this in chapters 3 and 5. In a society where the division of labour has taken hold, individual producers do not produce their own subsistence; they produce a surplus, over their own requirements, of their own product, and rely upon others for articles they require but do not themselves produce. Smith takes for granted that the developed form of this interdependency is *commodity production* (the term is actually Marx's). That is, individual producers confront each other as independent property owners, and produce their respective goods as commodities, products destined for exchange via a market. In this respect Smith's argument is lacking in generality (as Marx would point out): commodity exchange via the market is one way – historically a very important way, to be sure – of organizing an economy based on a complex division of labour, but it is not the only way. The alternative is that the division of labour is planned, and that the goods produced by the specialized workers are *transferred* to their consumers rather than purchased by the consumers. This is the model followed in the division of labour within a peasant household or, on a larger scale, in the planned industrial economy that existed in the Soviet Union from the late 1920s till the late 1980s.

At any rate, talk of commodity exchange as a concomitant of the division of labour leads Smith to money in chapter IV of *The Wealth of Nations*, and thence to value. The term 'value', as applied to goods and services, has various meanings or shades of meaning. When we talk of a commodity's being 'good value' or 'value for money' we mean that it has a favourable ratio of useful or desirable qualities to price. This corresponds to the first pole of the opposition Smith established, between 'value in use' (or use value) and 'value in exchange' (or exchange value).

> The word value, it is to be observed, has two different meanings, and sometimes expresses the utility of some particular object, and sometimes the power of purchasing other goods which the possession of that object conveys. The one may be called 'value in use'; the other, 'value in exchange'. The things which have the greatest value in use have frequently little or no value in exchange; and, on the contrary, those which have the greatest value in exchange have frequently little or no value in use. Nothing is more useful than water: but it will purchase scarce anything; scarce anything can be had in exchange for it. A diamond, on the contrary, has scarce any value in use; but a very great quantity of other goods may frequently be had in exchange for it.(Smith, 1974: 131–2)

In light of subsequent developments in modern economics, it is worth noting that for Smith (and for the classical political economists in general) 'value in use' seems to be understood as an objective category. Smith is perfectly confident in saying that water is highly useful and diamonds have little value in use; there is no suggestion that this could be a matter of 'individual tastes and preferences'. Even when objective, in the sense of being independent of individual tastes, value in use can depend on the situation. Which has the greater value in use, a hammer or a screwdriver? It's not a matter of opinion, but it depends on the task in hand. By contrast, modern economics has replaced the term 'value in use' by 'utility', and has cast utility not as a matter of the objective usefulness of goods but as a matter of the subjective 'psychic satisfaction' an individual derives from consumption of the good. This rather strange analysis would seem to apply best (if at all) to the highly refined

luxury products of an advanced culture. Which has the greater utility, a novel by Charles Dickens or one by Jane Austen? A bottle of California Chardonnay or a Chablis? Here the satisfaction obtained by the individual is all we have to go on.

Although classical 'value in use' is not a subjective matter, it is clearly relative to the state of technology. We can infer from Smith's dismissal of diamonds as having 'scarce any value in use', if we didn't know it already, that diamond-tipped drills were not in use for oil exploration in Smith's day.

Anyway, having made the distinction between use value and exchange value, Smith proceeds to concentrate on the latter. He sets himself three problems.

> In order to investigate the principles which regulate the exchangeable value of commodities, I shall endeavour to show:
>
> First, what is the real measure of this exchangeable value; or, wherein consists the real price of all commodities.
>
> Secondly, what are the different parts of which this real price is composed or made up.
>
> And, lastly, what are the different circumstances which sometimes raise some or all of these different parts of price above, and sometimes sink them below their natural or ordinary rate; or, what are the causes which sometimes hinder the market price, that is, the actual price of commodities, from coinciding exactly with what may be called their natural price. (Smith, 1974: 132)

In understanding these questions it is important to be clear on terminology. Smith's first question concerns the 'measure' of exchangeable value: he wants to know how exchange value is best measured or expressed. This is quite distinct from the question of the *determination* of exchange value. Well, actually 'determination' can mean two things. It *can* mean measurement, as in 'How would you determine the height of that tree?' (By triangulation, perhaps.) Or it can mean causation: in this sense the height of the tree is determined by its genetic material (Is is a dogwood or a redwood?) and its environment (How much sunlight and water were available to it?). When we use the phrase 'determination of value' below we take it strictly in the second sense, to refer to the causal processes governing the exchange value of commodities.

Smith's second question (What are the different parts of which real price is made up?) relates to the determination of value, but note that he seems to prejudge the issue, taking for granted that exchange value is determined by an adding up of component parts. His third question introduces the important concept of 'natural price': this is the price that is just sufficient to call forth a supply of the product that meets the demand for it. In Smith's view natural price constitutes the 'centre of gravitation' of actual, day-to-day market prices. To update Smith's Newtonian metaphor using the language of modern dynamics we might talk of natural price as an *attractor* for market price. We shall have more to say about this below.

6.2 Labour commanded as a measure of value

The title of Smith's Chapter V – 'Of the Real and Nominal Price of Commodities, or their Price in Labour, and their Price in Money' – tells us where he's headed on his first question. He is emphatic that the 'real' price of commodities must be measured by 'labour commanded'.

> Labour was the first price, the original purchase-money that was paid for all things. It was not by gold or by silver, but by labour, that all the wealth of the world was originally purchased; and its value, to those who possess it, and who want to exchange it for some new productions, is precisely equal to the quantity of labour which it can enable them to purchase or command. (Smith, 1974: 133)

In the day-to-day operations of a market economy it is 'natural' to express the exchange value of goods in terms of money: the money one would have to hand over to acquire the good, or that one could realize by selling it. But Smith argues this measure is superficial and potentially misleading. Superficial, because it does not take into account the point that the 'real price of everything, what everything really costs to the man who wants to acquire it, is the toil and trouble of acquiring it.' Potentially misleading, because money is not constant in its own value over time. A better measure of the exchangeable value of a commodity is the quantity of labour which it enables its possessor to 'purchase or command'. Smith's particular formulation of labour commanded is appropriate to an age when people (of a certain class, of course) were accustomed to hiring servants. Thus if I own a commodity with a market value of one guinea (twenty-one shillings), and if the labour of a servant can be had for one shilling per day, then with the money obtained by selling the commodity I can command the

labour of a servant for three weeks. For the modern reader an alternative version of Smith's calculation may seem more natural: the 'labour commanded' by a commodity represents the time you would have to work (say, at the average wage) in order to buy the commodity. In both cases – Smith's version and the modern one – the calculation of labour commanded is the price of the item divided by some measure of the wage, usually an average.

This is a good comparative measure of the cost of goods to a working consumer at widely separated points in time, or across nations at a point in time if the exchange rates of national currencies are a questionable guide to the respective purchasing power of the currencies in their home economies. Thus for instance a new Ford Model A car (4-door model) cost $570 in 1928, while a new Ford Escort 4-door cost about $11,000 in 2000. Is the Escort in 2000 really almost 20 times as costly as the 1928 model? Not in any meaningful sense. The average hourly wage for manufacturing workers was $0.56 in 1928, and $14.50 in 2000. If we take a working month to be 160 hours, this means that the labour commanded by the Model A in 1928 was 6.3 months, while the labour commanded by the Escort in 2000 was 4.7 months: in real terms, the Escort is cheaper than the Model A.[3]

Notice that the labour time required to produce a good and the labour it commands in exchange are not the same thing. Say a basic car in the USA today commands five months' labour at the average wage. What can we say about the labour time required to *produce* a car? Well, suppose that were also five months; in that case the average worker could work five months to obtain a commodity that embodies five months' labour. That is, his wage over the period would equal the value of the output he produces over the same period. But this means that the workers' wages would exhaust the value of the product – there would be nothing left over for profit. If the profit margin on car production is positive, it must be that wages per month are less than the exchange-value produced per month, or in other words the labour-time required to make the car is less than the labour-time it commands. If the car commands five months' labour, it might take, say, three worker-months to produce. Further, the factors making for changes in the labour required to produce a commodity, and those making for change in the labour it commands, are not the same. A change in the wage rate will alter the amount of labour commanded by any commodity of given price, while it is changes in technology, not wages, that produce changes in the labour time required to produce things.

We have explicated Smith's idea that 'labour commanded' is the best measure of value, but was he right? His successor in the line of classical political economy, David Ricardo, disagreed. Ricardo accepted Smith's point that plain money-price is not a good measure since money is variable in its own value, but he turned that argument against Smith: wages are variable too.

Writing in the early nineteenth century, Ricardo took it for granted that the wage was basically a subsistence wage, and as such was primarily governed by the price of food, 'corn' in particular. So suppose something happens that lowers the price of corn relative to other commodities; the wage will be pushed down too. If the prices of other commodities remain relatively stable, then on Smith's measure 'real prices' (in terms of labour commanded) have risen. According to Ricardo this is specious: it's wages (and corn) that have fallen, not prices that have risen.

This objection on Ricardo's part is bound up with a quest that absorbed a great deal of his intellectual energy, namely the search for an 'invariable standard of value': when A rises relative to B, how can we tell whether it is 'really' A that has risen or B that has fallen? Many later economists have suspected that this is a will-o'-the-wisp. At any rate, it seems that Smith would probably have stuck to his guns: if I have to work more hours to purchase a unit of commodity X than before, then X has become more expensive in real terms, regardless of how the change came about.

One's sympathies may be pulled either way in this debate. But it's worth noting that subsequent writers who have taken seriously the problem of measurement have tended to gravitate to Smith's solution.[4] Keynes, in his *General Theory of Employment, Interest and Money* (1936) grappled with the measurement issue and concluded that the only measures he could be confident in were sums of money and hours of labour time; he worked in terms of the 'wage-unit', deflating money-prices by the average wage. Farjoun and Machover, in

[3] The data in this paragraph were collected from The Bureau of Labor Statistics and *Collectibles Corner* for August 27, 1999, at www.krause.com.

[4] Many economists are happy to take the numbers as given, and gaily go ahead with crunching them.

their *Laws of Chaos* (1983), similarly operationalize their concept of 'specific price' (that is, price per hour of labour-time embodied in the product) by using the ratio of money-price to the average wage in the numerator.

Ricardo's objection has some force, but its force is reduced by the changes in the economy since his day. Wages are no longer strictly subsistence wages, and they are no longer so dependent on the price of any particular commodity: the 'corn'-based counter-example to Smith's idea is no longer plausible.

6.3 Labour time and the determination of value

Having argued that labour commanded is the best measure of value, Smith turns in Chapter VI of *The Wealth of Nations* to 'the Component Parts of the Price of Commodities'.

> In that early and rude state of society which precedes both the accumulation of stock and the appropriation of land, the proportion between the quantities of labour necessary for acquiring different objects seems to be the only circumstance which can afford any rule for exchanging them for one another. If among a nation of hunters, for example, it usually costs twice the labour to kill a beaver which it does to kill a deer, one beaver should naturally exchange for or be worth two deer. It is natural that what is usually the produce of two days' or two hours' labour, should be worth double of what is usually the produce of one day's or one hour's labour. (Smith, 1974: 150)

Here we have it – the idea that the labour time required to produce a given product governs or determines the exchange value of the product. There is, Smith says, a 'natural' proportionality between required labour time and exchange value. He proceeds to qualify this idea, saying that labour which is harder, or requires more skill, will count for more than simple labour. More importantly, he implicitly qualifies the idea with his opening clause, confining it to an 'early and rude state of society'. We'll turn to Smith's qualifications shortly but first, at the risk of belabouring the obvious, we'll ask why he put forward the basic idea in the first place.

One possibility is the notion that 'fair's fair' – the goods on one side of a barter transaction 'ought to' embody the same number of hours of labour-time as the goods on the other side. But it's unlikely that this is what Smith had in mind.[5] More likely, he was thinking in terms of self-interested calculation. If I'm in possession of a beaver which 'usually' costs $2h$ hours to kill and I'm contemplating exchanging this for deer that 'usually' cost h hours apiece, then I'm not interested in exchange unless I can get at least two deer per beaver; otherwise I could do better by hunting deer myself. The possessor of the deer is thinking symmetrically, and is willing to part with the deer only if two deer will fetch at least one beaver. In each case the question is: How am I doing in exchange versus proceeding on my own account? And the upshot is that exchange will take place only if both parties are willing, which requires that, as Smith says, one beaver should exchange for two deer.

The presupposition here – implied in Smith's 'usually' – is twofold: the individual hunters are of roughly equal productivity, and they're aware of that fact. An interesting question arises if the hunters are somewhat specialized (one can kill beaver more effectively and one is better at hunting deer). Then, it seems, a wedge may open up: there's an overlap between (a) the exchange ratio below which hunter A reckons he's better off going it alone and (b) the exchange ratio above which hunter B favours autarky. In other words, there's a range of exchange ratios at which they'd both find trade advantageous, so where does the ratio settle? This sort of analysis was beyond Smith, but it was the basis of Ricardo's theory of comparative advantage. Ricardo concluded that such a wedge could indeed appear in international trade, due to the limited mobility of both labour and capital across national boundaries, in which case exchange ratios were not fully determined by labour-time embodied, and could vary over a certain range.

Holding Ricardo off for a moment, let's return to Smith. He had said that the labour time required to produce a commodity affords the only plausible rule that might govern the ratio in which it commonly exchanges against other commodities. But he had restricted this proposition to the 'early and rude' state of society. Why?

Reading further, it seems that, for Smith, the distribution of the product of labour is the key factor. In the early and rude state, 'the whole produce of labour belongs to the labourer; and the quantity of labour commonly employed in acquiring or producing any commodity is the only circumstance which can regulate' its exchange value. By contrast, in a developed market economy, where 'stock [i.e. capital] has accumulated in the hands of particular persons', we have a state where

[5] Unlikely, because elsewhere in *The Wealth of Nations* Smith is quite explicit in saying that considerations of fairness have little purchase in economic affairs.

> the whole produce of labour does not always belong to the labourer. He must in most cases share it with the owner of the stock which employs him. Neither is the quantity of labour commonly employed in acquiring or producing any commodity, the only circumstance which can regulate the quantity which it ought commonly to purchase, command, or exchange for. An additional quantity, it is evident, must be due for the profits of the stock which advanced the wages and furnished the materials of that labour. (Smith, 1974: 152)

The profits of stock, says Smith, constitute a second 'component part' of price, over and above the wages of labour. He then goes on to say that the rent due to the landlord constitutes a third component part of price. Exchange value can no longer be based on labour alone.

Smith has got into a muddle here. He seems to have persuaded himself that if the prices of commodities remained proportional to the labour time required to produce them then profit would be ruled out. But this doesn't follow at all. In a capitalist economy the exchange values of commodities cannot, in general, equal the *wages paid* in their production, else there would be no profit. But the propositions (a) that prices are proportional to the labour time required to produce things, and (b) that prices are equal to the wages paid in the production of things, are quite distinct: neither one implies the other.

Smith seems closer to getting it right when he writes, 'The value which the workmen add to the materials ... resolves itself ... into two parts, of which the one pays their wages, the other the profits of their employer' (Smith, 1974: 151). That is, one can think of the value of a commodity as being determined by the labour time required to produce it, and then, as a distinct question, consider the 'resolution' or decomposition of this value into wages and profit. This was the position taken by David Ricardo, the first writer after Smith to make real progress in political economy.

6.4 Ricardo: clarity achieved

The labour theory of value (LTV) – that is, the idea that, to a first approximation, the value in exchange of commodities is in proportion to the labour time required for their production – is first clearly and unequivocally expressed by Ricardo. As we have said, he cut through Adam Smith's confusion on this point, rescuing the LTV from its confinement to a prehistoric world of independent hunters. The LTV is given pride of place in Ricardo's *Principles of Political Economy and Taxation*; the opening words of Chapter 1 are

> The value of a commodity, or the quantity of any other commodity for which it will exchange, depends on the relative quantity of labour which is necessary for its production, and not on the greater or less compensation which is paid for that labour. (Ricardo, 1951: 11)

We will examine three questions in relation to Ricardo's LTV: What is the proper domain of this theory? How does Ricardo justify it? How does the theory handle profit and rent?

On the first question, Ricardo clearly demarcates the commodities whose value is governed by the LTV, namely those that are *reproducible via the application of labour*. If we're talking about bottles of Chateau Latour Pauillac 1996[6] or paintings by Matisse the LTV is of no help. The prices of such items are unrelated to the labour-time that went into making them, and depend jointly on their scarcity and how badly rich people want to own them. But such commodities are the exception.

> These commodities, however, form a very small part of the mass of commodities daily exchanged in the market. By far the greatest part of those goods which are the objects of desire, are procured by labour; and they may be multiplied, not in one country alone, but in many, almost without any assignable limit, if we are disposed to bestow the labour necessary to obtain them. (Ricardo, 1951: 12)

This statement in itself takes us onto the second issue, Ricardo's justification of the theory. He talks of commodities which 'may be multiplied... almost without any assignable limit, if we are disposed to bestow the labour necessary to obtain them'. This must be taken to the letter: ultimately, *only* labour is required to produce such things. Of course, tools and materials may be (usually are) needed, but these in turn can be resolved into the labour time required to produce them. Ricardo takes the example of cotton stockings.

> First, there is the labour necessary to cultivate the land on which the raw cotton is grown; secondly, the labour of conveying the cotton to the country where the stockings are to be manufactured, which includes a portion of the labour bestowed in building the ship in which it is conveyed, and which is charged in the freight of the goods; thirdly, the labour of the spinner and weaver; fourthly, a portion of the labour of the engineer, smith, and carpenter, who erected the buildings and machinery, by the help of which they are made; fifthly,

[6] Bargain price on the Internet as of this writing: $1799.99 apiece.

> the labour of the retail dealer, and of many others, whom it is unnecessary further to particularize. (Ricardo, 1951: 25)

In this light Ricardo seems to be thinking: what else other than labour *could* account for the value of commodities?

Let's pause on this for a moment. One possible objection would be, what about the natural resources involved? Surely human labour doesn't produce stockings from nothing. Parallel to Ricardo's catalogue of the particular sorts of labour required to produce the stockings, one might think of the soil in which the cotton grows, the sunlight and rain that sustain its growth, the wind that powers the ship, and so on. Yes, of course, but Ricardo's thinking is that these resources come free, and so don't contribute to the economic cost of the stockings. (But if the cotton needs artificial irrigation, then the labour time required to arrange that has to be reckoned in.)

A second and deeper question is, how is Ricardo able simply to add up the various sorts of labour he mentions? Clearly he is following Smith in thinking of 'labour in the abstract', such that one can add the labour of the farmer, the seaman, the shipwright, the spinner and so on without any conceptual difficulty. But what licenses this? If we were like the bees, wolves or horses of chapter 1 this wouldn't work. Imagine a humanity composed of sub-species, some of whom were only capable of spinning, some only of seafaring, and so on. Then adding up hours of 'human labour' would be no more meaningful that adding up hours of operation of the Large Hadron Collider and of an electric toaster. But in fact we are the 'Universal Robots' of chapter 5. A normal human being is capable of performing a huge variety of tasks. In many cases this involves training, but we can treat this in the spirit of Ricardo's analysis by resolving the cost of training into the labour time it takes (work on the part of the student or apprentice and the teacher).

In sum Ricardo is saying, not only is labour required for the production of every commodity but in a real sense human labour is the only true cost. The amount we can have of any given commodity is ultimately governed by the amount of labour time we're willing to put into making it, directly and indirectly. And he's confident that this basic information will come through in exchange ratios. Why does an iPod cost 30 times as much as a pizza? According to Ricardo, the only rational explanation is that the iPod takes about 30 times as much labour to produce. Of course, like Smith before him and Marx after him, Ricardo was well aware that a host of contingent, 'accidental' factors can drive the prices of commodities up or down relative to their 'centres of gravitation'. What he's claiming to theorize is that 'centre', or 'natural price'.

6.4.1 Ricardo on profit and rent

We noted earlier that Ricardo objected to Smith's 'component parts' or 'adding up' theory of value. The motivation for Smith's theory was the observation that the price of any given commodity has to afford not just wages for the workers but also profit for the capitalist and rent for the landlord. Ricardo recognizes this, but he conceptualizes it differently. In brief,

(1) price (accidental factors aside) is determined by the labour time required to produce the commodity, as we've said.
(2) The wage is determined by forces of supply and demand in the labour market. Along with the hours of direct labour performed, this fixes the share of price going to wages.
(3) The share of price going as rent is determined by a specific mechanism which we'll describe below; and
(4) profit is a 'residual', whatever is left over. All being well, from the capitalist's point of view, this will be positive but there's nothing to stop it being zero or negative (costs exceed price and the capitalist makes a loss).

So Ricardo has a 'breaking down theory' not an 'adding up theory'. We'll deal with two additional issues here: first, the promised explanation of how rent is determined; and second, a significant – but, according to Ricardo, quantitatively minor – qualification to the LTV that is demanded by the careful analysis of profitability.

Ricardo's theory of rent is couched in terms of the economy of his day (corn growing figures largely) but is in fact very general. Let's start out with an economy that is supporting a relatively small population. The corn required to feed that population can be grown on the best, most fertile land, and is therefore quite cheap. Now the population grows. To produce more corn we must bring less fertile land into cultivation.[7] Then, Ricardo

[7] Or we could farm the best land more intensively (applying more fertilizer and so on). Ricardo's theory handles this case just fine but the exposition is simpler if we imagine less good land being used.

Digression 6.1 Rent and Nature's Bounty

Adam Smith had said that in agriculture 'nature labours along with man', and that rent 'may be considered as the produce of those powers of nature, the use of which the landlord lends to the farmer.' It represents 'the work of nature which remains, after deducting or compensating every thing which can be regarded as the work of man.' Ricardo turned this on its head. Rent does not reflect nature's bounty but rather her stinginess: 'In proportion as she becomes niggardly in her gifts, she exacts a greater price for her work.' (Ricardo, 1951: 76)

If there were a limitless supply of top quality corn-growing land, corn land would command no rent. If all the world's oil-fields were as productive as the Saudi ones, there would be no oil rent.

says, we'll run into 'diminishing returns': the labour required to produce the last bushel of corn will increase, and the price will have to rise. But what if I'm still farming the best land, and therefore producing corn at a cost substantially below the new price? Then I get a sort of bonus: there's only one price for corn – the new, higher price – and I get to sell my cheap corn at that price. This bonus Ricardo calls 'rent'. If I'm a tenant farmer, my landlord can cream it off by raising my rent, in the ordinary contractual sense of the word. If I'm farming my own land the rent is no less real, it just flows to me.

The most striking example of Ricardian rent on a world scale today is the revenue enjoyed by the Middle Eastern oil producers. The world oil price (gyrations apart) has to cover the cost of production in the less productive oil-fields (e.g. in the USA). The cost of production in Saudi Arabia, for example, is very much less than that and the Saudis (or some of them) reap the benefit in massive oil-rents.[8]

In relation to Ricardo's theory of value, the key point is that rent, in the economic sense, is not a magnitude 'determined in advance' that governs the prices of commodities, it's a consequence of differential production costs (see also Digression 6.1).

Now to profits once more. We said that Ricardo conceives of profit as a residual. Nonetheless, he has the idea that 'in equilibrium' (not a term he used, but it captures his thought) the rate of profit in different industries or trades should be the same (after adjusting for differential riskiness and other possible complications). Smith and Marx had the same thought. If the rate of profit were not the same across industries then capitalists have an incentive to get out of low-profit industry X and into high-profit industry Y, which would shift the prices of X and Y, meaning that we're not in equilibrium.

The question then is this: is a single rate of profit across all industries compatible with the labour theory of value as stated above? And the answer is, in general, no, for a relatively subtle reason. Ricardo expressed it in terms of the 'durability of the instruments of production'. Suppose, he said, that industry X requires a bigger investment in long-lasting means of production (e.g. fixed capital) than industry Y. To keep things simple, let's assume that the products of both X and Y require 100 hours of labour time per unit (total, direct plus indirect), so that the simple LTV would predict they'd have same value. The trouble is that if prices conformed to the strict LTV, X wouldn't be as profitable as Y. Since X employs more durable capital, the time-phasing of the 100 hours of labour that go into its product must differ from that of Y. Specifically, more of the labour must be carried out 'earlier', relative to the time when the product is finally sold. So the capitalists in X are out of pocket earlier. If they're to get the same rate of return (per cent per annum) on their outlay as the Y capitalists, the return on their earlier investment must be compounded, or in other words their price must be higher than the LTV predicts.

Ricardo had no access to statistics on the degree to which fixed capital is used in different industries, but he could observe the economy around him. His judgment was that this 'modification' to the LTV was far from being fatal to the theory. As we'll see below, some of his followers took a different view.

6.5 Marx's contribution

We have commented on various aspects of Marx's theories in several other chapters. Here we are concerned specifically with his contribution to the development of the labour theory of value that he 'inherited' from Ricardo.

[8] It is easy to find statistics on the market price of oil, not so easy to find figures for its cost of production. But studies by the International Energy Agency cited on the Internet put the cost of production in Saudi Arabia at about 2 or 3 dollars per barrel.

One aspect is worthy of mention here, but will be taken up in chapter 11. That is, Marx argued that although Ricardo had given a largely correct account of the theory as it applied in a capitalist economy, he hadn't stopped to ask why the products of labour take the form of commodities in the first place, and why the labour time required to produce them manifests itself in the form of exchange value. This is the issue of the 'form of value'.

In this chapter we confine ourselves to two points: Marx's distinction between labour and labour-power, and his development of Ricardo's 'modification' of the labour theory of value due to the differential 'durability of the instruments of production' in different industries.

6.5.1 Labour and labour-power

Let us start with Ricardo on wages:

> Labour, like all other things which are purchased and sold, and which may be increased or diminished in quantity, has its natural and its market price. The natural price of labour is that price which is necessary to enable the labourers, one with another, to subsist and to perpetuate their race, without either increase or diminution. (Ricardo, 1951: 93)

This looks reasonable enough, but wait: the labour theory of value said that the natural price of each commodity depends on the labour time it embodies. Here the commodity we're talking about is labour itself. It seems as if we *ought* to say that the wage is governed by the labour time embodied in labour – but what is that supposed to mean? We could say it's identically 1, or it's not defined, neither of which seem helpful. So how is Ricardo able to give a sensible answer – is he somehow being inconsistent?

In explicating Marx's answer, it will be helpful first to make a terminological point. We have spoken of exchange value and use value: what shall we mean by the term *value*, without any qualifier? In Marx's *Capital* this is used as a term of art, denoting the sum of the direct and indirect labour time required to produce a commodity. (The question of the labour theory of value is then: to what extent or under what conditions do prices reflect or correspond to values?) We will use this terminology below, although we'll sometimes write *labour-values* for Marx's values if there's any ambiguity.

That said, Marx's claim is that the expression 'the value of labour' is not meaningful. What Ricardo is really talking about above is, in Marx's terms, the value of *labour-power* – that is, the worker's *capacity to work*. Labour is not a commodity that could be bought and sold at a point in time, it's an *activity*. The wage is not the 'price of labour' but the rental-price of labour-power. In the wage transaction the worker binds over to the capitalist his capacity to work for some definite period. The capitalist then sets the worker to work, but how much labour he actually gets depends on how hard his overseer presses, how fast the line runs, how rebellious the worker is. Unlike 'the value of labour', the value of labour-power is a valid concept and it comes down, pretty much, to what Ricardo said: it's the labour time that is required to maintain and reproduce the worker's capacity for working, in other words the labour time embodied in the goods the workers need to maintain themselves and their families.

Marx's distinction was a useful clarification of previous classical usage, which in effect amounted to a play on the word 'labour'. At the same time it opened the door for his concept of exploitation. Marx asked, where does profit come from? This can seem very puzzling if we think in terms of exchange of commodities, ruled by the LTV. In any given transaction, goods that contain x amount of labour exchange against other goods that also contain x amount (in general via the mediation of money, of course), so how can a capitalist come out ahead? Even if the reciprocity of the LTV is broken, that doesn't seem to help. If in a given trade goods embodying $x + h$ hours exchange against goods containing $x - h$ hours then one party has gained at the other's expense, but what needs explaining is the existence of net profit on a macroeconomic scale.

The answer, Marx said, lies in the special commodity labour-power. The worker sells to the capitalist labour-power which embodies (let's say) 5 hours; that is, the value of the worker's means of subsistence amounts to 5 hours per day. But once he gets through the factory gates or the office door, he finds that the working day is 8 hours. The worker therefore performs 3 hours of 'surplus labour' per day and this is manifest in 3 hours' worth of surplus value accruing to the capitalist. Marx calls the labour time workers spend in reproducing the value of their wages the 'necessary labour time', and he calls the ratio of surplus labour time to necessary labour time the *rate of surplus value*. In the example just given the rate of surplus value is $3/5 = 0.6$.

Marx's theoretical accomplishment here was to explain how profit could arise, while maintaining in strong form the assumption that all commodities exchange in line with the labour time they embody. It was also, of course, an ideological accomplishment, providing intellectual ammunition to the workers' movement. Prior to Marx the 'Ricardian socialists' had arrived at something like Marx's notion of exploitation – it was, after all, implicit in Ricardo – but Marx gave it coherent and forceful expression.

6.5.2 The transformation problem

Recall Ricardo's point that if the 'durability of the instruments of production' differs across industries, the strict LTV is incompatible with all industries' earning the same rate of profit. Marx took up this point in somewhat different terms; we need to introduce a few more items of Marx's terminology at this point.

Smith and Ricardo had talked of fixed and circulating capital ('fixed' referring, for example, to buildings and machinery, and 'circulating' to raw materials and work in progress). Marx retained this distinction but added a second, between *variable* and *constant* capital. Variable capital is what the capitalist lays out in wages. It is called 'variable' not because wages are variable (though they may be) but because there is a systematic variation (increment) between the value of wages and the value produced by the workers who receive those wages – this flows from the analysis of exploitation mentioned above. All the rest of capital, fixed or circulating, is constant capital – constant because there's no systematic increment. All the capitalist can hope for, on average, is that the elements of his constant capital will *retain* their value over time. However, these 'elements of constant capital' will change their shape: materials that stood in stockpiles leave the factory worked up into the final product, machinery and buildings gradually depreciate. Depreciation is conceived not as a *destruction* of value, but rather a passing-on. If you will, the labour time previously stored up in the machine gradually 'leaches out' into the product. When the machine is worn out its value has passed fully into the product.

One more term: the capital in any given industry divides into constant and variable, and the ratio of the two will differ across industries. Marx calls the ratio of constant capital to variable capital the *organic composition of capital*. Thus a high organic-composition industry is one in which a relatively small workforce uses a lot of valuable machinery, or processes a lot of valuable materials.

We are now ready to express Ricardo's problem in Marx's terms. Consider two industries, X and Y, the organic compositions of whose capitals are 1:1 and 3:1 respectively. Suppose that the rate of surplus value is the same in both industries, say 0.6 as in the example above.[9] And suppose the total capital advanced in each industry is 1000 per year. Then we get the situation shown in Table 6.1 (never mind the 'Aggregate' row, we'll come back to that later). In industry X, the total capital breaks down into 500 constant and 500 variable; in industry Y, 750 and 250. S denotes surplus value and V denotes variable capital, so S/V is the (common) rate of surplus value, which we apply to each industry's variable capital to give the figure in the S column. The rate of profit, r, is measured as the ratio of the surplus to the total capital advanced. Industry X shows a rate of profit twice as high as Y.

Industry	Total $C+V$	Capital: Constant C	Variable V	S/V	S	$S/(C+V)=r$	Value of output $C+V+S$
X	1000	500	500	0.6	300	$\frac{300}{1000}=30\%$	1300
Y	1000	750	250	0.6	150	$\frac{150}{1000}=15\%$	1150
Aggregate	2000	1250	750	0.6	450	$\frac{450}{2000}=22.5\%$	2450

Table 6.1 – Differing organic composition generates differing profit rates

The rate of profit we have calculated for each industry in Table 6.1 is what we may call the 'value rate of profit': all magnitudes are assumed to be denominated in hours of labour time. The rate of profit observed by any real firm is, however, the money- or price-rate. To calculate it, we'd have to replace the figures in the table

[9] Marx thought there would be forces tending to equalize the rate of surplus value across industries. Recall that this rate is the ratio (value of wages) to (value added by the workers). If wages are equal and the intensity of labour is equal in two industries, then those industries will have the same rate of surplus value – even though the value of gross output per worker might be quite different due to different employment of constant capital.

with the corresponding figures in price terms: for C the aggregate price of the non-labour inputs, for V the monetary wage-bill and for S the monetary surplus of sales revenue over costs. However, according to the LTV this should not make much difference, since prices $\approx$ values.

So there's a fork: either we maintain the LTV and conclude that industries with substantially differing organic composition of capital realize substantially different rates of profit, or we maintain the proposition than ('in equilibrium') all industries earn the same rate of profit and conclude that the LTV is incorrect.

A little background: this issue, which came to be known as the transformation problem, is addressed by Marx in Volume III of *Capital*. In Volume I, in which Marx presents his basic analysis of capitalist production, the LTV had been taken for granted. Nonetheless, Marx is willing to accept that the LTV is not strictly correct, and, like Ricardo, he believes that the rate of profit should be equalized across industries. But he insists that his analysis of exploitation is correct, which he takes to mean that (a) the aggregate price of output equals the aggregate value of output and (b) the aggregate profit equals the aggregate surplus value.

It was clearly incumbent upon Marx to explain how this could be worked out, and he took a first step in this direction. Consider the 'Aggregate' row of Table 6.1, where we have added up the figures for the two industries. The aggregate rate of profit (in value terms) is 22.5 per cent. If we were to apply this to the outlays of 1000 for each industry, we'd conclude that the aggregate price of each industry's output should be $1000 \times 1.225 = 1225$, as opposed to the labour-value figures of 1300 for X and 1150 for Y. So far, so good: each industry earns 22.5 per cent and Marx's two conditions hold: aggregate value = aggregate price = 2450, and aggregate surplus value = aggregate profit = 450. One can take this perspective: surplus value is *produced* industry by industry, but when it comes to share-out time, each participates on a *pro rata* basis (once again, 'in equilibrium'). Each industry gets a share of the total surplus value proportional to capital advanced.

We want a term for the prices that will do the job that Marx indicates, and he coined one: *prices of production*. These are the prices that give each industry or sector an equal rate of profit on capital advanced. They are hypothetical, because everyone knows that every industry does not earn the same rate of profit in any finite chunk of historical time, but they are in a sense 'nearer to reality' than labour-values if we assume with Marx and Ricardo that there exists a strong *tendency* for the rate of profit to become equalized.

We said above that Marx had taken 'a first step' in the direction of computing prices of production. What more did he have to do? The difficulty is that the calculations based on the 'Aggregate' row of Table 6.1 still assume that the value figures for the *inputs* to production are usable 'as is': each industry advances 1000. Consider the C figures: as given, these represent the aggregate *value* of the non-labour inputs for each industry. But since Marx's first 'transformation' step has shifted prices away from what the LTV would predict, it seems that we should go back and re-visit the inputs: it may be that if we re-evaluate the elements of constant capital in price terms the resulting figures do not agree with the 500 and 750 given for C in industry X and Y respectively.

To do this properly we would need not just a toy table with two industries but a tableau of the economy as a whole. Then we could take the 'transformed' prices of the outputs and feed them back into the system as the prices of inputs. In computational terms, what is called for is an iterative algorithm:

(1) $i = 0$; compute the first approximation to prices of production just as Marx did, but on an economy-wide scale.

(2) Take the round-i prices of production and use them to re-evaluate the inputs to production, and so re-evaluate the capital advanced by each industry.

(3) Re-evaluate the output prices as per Marx, but on the basis of the new numbers for capital advanced; $i \leftarrow i + 1$.

(4) Have the computed prices changed appreciably from the last round to this one? If so, go to step 2; if not, stop.

Savvy readers will notice that what we have given above appears to be a somewhat cumbersome way of describing a result that could be presented more compactly using the notation of linear algebra. Even savvier readers will appreciate that the iterative procedure we have outlined is in fact how one would best go about the calculation for a large input–output table using a computer.

The trouble for Marx's project is that if you carry out the calculation specified above – that is, iterate until you have essentially the same prices on the input and the output side – you will find that, in the general case, both of Marx's invariance conditions (total price = total value and total profit = total surplus value) are *not* preserved. This was shown by Ladislaus von Bortkiewicz in an article published in 1907 that went unnoticed

Digression 6.2 Interpreting Marx

Few readers will be surprised to learn that the view we present of Marx's 'transformation problem' is not accepted by all Marx scholars. The Temporal Single-System (TSS) school, in particular, would reject both our account and that of von Bortkiewicz as distortions of Marx. The key point is how one interprets Marx's conception of value. We have claimed that for Marx, value means the sum total of the labour time directly and indirectly required to produce a given commodity. We take this to be essentially the same as what Ricardo had in mind, and we take it be a quantity which is determined by technological factors (taking technology in a broad sense to include the social organization of labour). On the TSS view, Marx meant by 'value' the sum of (a) the *direct* labour time required to produce the commodity and (b) the labour-time equivalent of the monetary value of the non-labour inputs. Component (b) is calculated by multiplying the price of the non-labour inputs by a conversion factor that is the reciprocal of the so-called MELT (Monetary Equivalent of Labour Time), which in turn is calculated using the economy-wide ratio of monetary value-added to hours worked over some given period. On this interpretation of value one can argue that Marx's one-step 'transformation' was OK in itself, and doesn't need the sort of iterative completion we indicated.

We recognize that the writings of any theorist as original and fecund as Marx must be open to multiple interpretations, but in our view the TSS interpretation of Marx's *value* is forced and untenable. For the other side of the argument see, e.g., Kliman (2007).

at first but won him posthumous fame. The system has a degree of freedom which allows one to impose one of Marx's invariance conditions as a normalization, but not, in general, both of them.

Marx must be credited with giving a clearer and more explicit statement of the transformation problem than Ricardo. He should also be credited with intellectual honesty since the problem was clearly inconvenient to him. Nonetheless, in a sense, Marx was hoist by his own petard on this issue. Nothing forced him to insist on his two invariance conditions, but having done so he was then open to the charge of inconsistency (but see digression 6.2). One could easily get the impression that the validity of the LTV hinged on whether Marx had got his transformation calculations right, which is far from the truth.

6.6 Two challenges to the labour theory of value

In this chapter we have taken the labour theory of value seriously. But you won't find this theory discussed in current textbooks of economics. What happened? Over the century and a half since Marx's *Capital* was published the LTV has been subject to two major attacks. In the last quarter of the nineteenth century it was challenged by economists of what came to be known as the neoclassical school, who claimed that the correct approach to value was via the concepts of utility and scarcity,[10] not labour time. The success of this school in side-lining the LTV was partly due to the political acceptability of their theory. After Marx (if not already before), the LTV was linked with concepts such as exploitation, class struggle and communism. The neoclassicals calmed things down: value was all about individuals making choices, trade-offs, in face of (inevitably) limited resources. In the second half of the twentieth century another attack was mounted, this time by economists who saw themselves as building on Ricardo's approach, yet argued that labour time was otiose – a useless detour – in a neo-Ricardian theory of value. We'll consider these challenges in turn.

6.6.1 Utility and the marginalist theory of value

The anti-classical, marginalist theory of value is particularly associated with the names of W. S. Jevons, Carl Menger and Léon Walras, who mounted their attack in the early 1870s.[11] But the spirit of their objection to Ricardo had been expressed pithily by Richard Whately in 1832: 'It is not that pearls fetch a high price *because* men have dived for them; but on the contrary, men dive for them because they fetch a high price.' (And they fetch a high price because people find them very desirable, a matter of subjective preference or 'utility'.) This,

[10] Thus reverting to the 'natural law' tradition which Adam Smith had quietly but firmly rejected in *The Wealth of Nations* (see section 6.1 above).

[11] 'Anti-classical' and 'attack' are the right words. Jevons, for example, spoke of the 'mazy and preposterous assumptions of the Ricardian School' (Jevons, 1871).

in a nutshell, is the subjective argument against the LTV. At first glance it seems to have some force. It's true that simply spending a lot of time in producing something does not make it valuable – not if nobody wants it. And it's also true that when people expend time and energy and put themselves in danger pearl-diving, it's because they know that pearls will bring a good price. But think about it a little more. What if pearls washed up on the beach and could be gathered as easily as sea-shells? They would not command anything like their current price, regardless of how 'highly valued' they are as ornaments. (In fact, of course, while pearls would remain just as pretty they would lose their social cachet: duchesses and their emulators want to be seen wearing something *expensive* – something that other people had to spend a lot of time making – not just something pretty.)

Ricardo put it very clearly: the *precondition* for a commodity's having value is that it is an object of demand, but given that it's demanded, the magnitude of its value depends on the labour required to produce it. The quantity that people want of (reproducible) commodity X doesn't matter, provided they want it at all. Quantity supplied will adjust to match demand, and once the adjustment is complete prices will be (approximately) proportional to labour times. Neither does it matter what people are *willing to pay* for X. The market will be in equilibrium when demand equals supply at a price in line with labour content. If you're not willing to pay that much, you don't get any. If you'd be willing to pay a lot more you are in luck, you don't have to. In the limiting case where nobody is willing to pay a price for X that corresponds to its labour content, X doesn't get produced.[12]

On the Ricardian view consumer demand may be important in its own right but it plays little role in the theory of value. Shifts in demand cause market prices to diverge from their 'centres of gravitation' for a while but those 'centres' are unaffected. The factors that drive prices up or down on a long-term basis are those that produce a change in the required labour time, most likely either changes in technology or depletion of natural resources.

The crude version of the subjective theory of value – in which value seems to depend entirely on consumers' tastes and preferences – played an important polemical role, but it's not what you find in today's textbooks. The textbooks contain the theory devised by Alfred Marshall, the great English compromiser, who found a way to 'reconcile' Ricardo and his critics.[13]

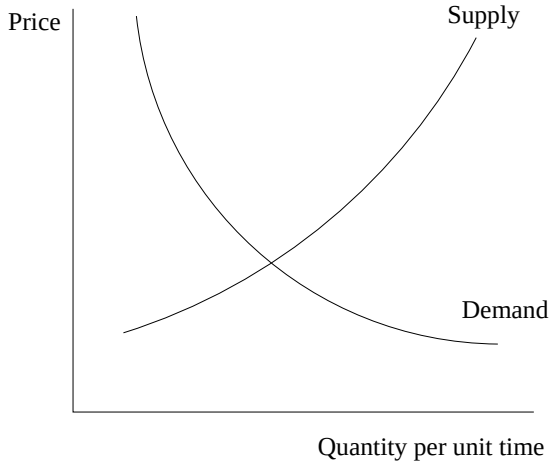

Figure 6.1 – The celebrated Marshallian supply–demand cross

As anyone who has taken a course in economics knows, this is the apparatus of the supply curve and the demand curve (Figure 6.1). The demand curve represents the quantity of commodity X that consumers are willing to buy, per unit time, at various possible prices. It slopes downward due to 'diminishing marginal utility': the n^{th} unit of good X consumed per week (say) is subjectively less valuable than unit $n-1$. The

[12] For example, as of this writing, star-gazing vacations on the moon. But that may come.

[13] Marshall's *Principles of Economics* (1890) was hugely influential and went through eight editions in his lifetime, the last published in 1920. Marshall was also responsible for establishing economics as an academic discipline, founding the Economics Tripos at Cambridge in 1903.

supply curve represents the quantity firms are willing to supply, again at each possible price. It slopes upward due to increasing marginal cost: to produce more, firms have to take on more labour and work their production facilities more intensively, giving rise to an increase in the cost of each extra unit produced; for this to be worthwhile, the price must be higher. Market equilibrium requires that the quantity consumers are interested in buying coincides with the quantity firms are interested in supplying: price is determined where supply and demand cross.

Marshall's supply–demand cross obviously has its uses but from a theoretical point of view it is unsatisfying. The question has been switched. Ricardo (and Smith, and Marx) wanted to know what determines the 'natural price' of commodities, the attractor for market prices. Their focus was both long-run and *systemic*: the virtue of the LTV was that it gave an explanation of exchange-value based on a cause outside of, and underlying, the circle of mutually-determining money prices and costs. Marshall shifted the focus to the short run, and to a *microeconomic* approach. To explain the price of commodity X you need to know the supply curves of the firms producing X. And to construct those supply curves you need to know the prices of the inputs used by the firms. Prices determine prices. Well, yes, in a sense they do, but something important in the way of scientific insight has been lost.

Ricardo's labour time gets a look-in, in the Marshallian apparatus, via the supply curve. If a commodity embodies a great deal of labour time then the wage-bill for producing that commodity is high, and the supply curve will sit relatively high on the price axis, hence intersecting the demand curve at a high level. But the wage-bill appears as just one money cost among others; the idea all costs can be resolved into labour time is submerged. In addition, with the Marshallian cross it appears that you can't determine price without knowing demand. That is because the supply curve slopes upward. And that was due to increasing marginal cost. But this, Ricardo would say, is a short-run phenomenon. Diminishing returns to the application of labour (the basis of increasing marginal cost) is something that Ricardo expected to see in *agriculture*, due to the limited supply of the most fertile land (see the discussion of rent in section 6.4.1 above), but not in manufacturing. If we want more of commodity X, in the long run, we not only apply more direct labour but also scale up the production facilities accordingly (hence, more indirect labour). Once we're done there's no reason to expect that the labour time *per unit* of the product will be higher than before. So here's what you can do to get the Ricardian theory back out of Marshall's cross:

- Draw the (long-run) supply curve as horizontal. Then demand determines the quantity consumed but not price.
- Argue that the vertical location of the horizontal supply curve depends on the sum of the direct and indirect labour time required.

To be 'fair' to neoclassical economics, we should point out that while the Marshallian cross is the staple of undergraduate textbooks, it's not what is taught in graduate school. There, in the theory of general equilibrium, transitive preference orderings confront convex production sets (Debreu, 1959). The critique that prices are explained by prices does not apply. But the critique that we're lacking a key level of explanation does apply. Why does a laptop computer cost 50 times as much as a pizza? Here are three answers:

(1) The laptop requires 50 times as much labour to produce (Ricardo).
(2) The configuration of supply and demand is such that the curves intersect at the observed respective prices (Marshall).
(3) These are the prices that appear in the solution vector to the equations of general equilibrium, assuming that a solution exists – and also that the solution is unique, unless you'd prefer an explanation of why a pizza costs 50 times as much as a laptop (Debreu).

If the first answer is even approximately true, it gives an important insight that is totally missing from the others.

6.6.2 Sraffa and the redundancy of labour values

Both Ricardo and Marx started out from the labour theory of value. The LTV appears in pride of place at the start of their respective expositions and is taken for granted in their discussions of a wide range of economic phenomena. Nonetheless, they both recognized that this theory is incompatible with an equal rate of profit across industries that have (in Marx's terminology) unequal organic compositions of capital. Both spoke of a

necessary 'modification'. Marx conceived of a set of 'prices of production' that would yield a uniform rate of profit, and referred to these as modified values.

Briefly, the 'redundancy' critique of the labour theory of value goes like this: if your basic idea is that 'natural prices' ought to be such as to give a uniform rate of profit, there's no need to take labour-values as a starting point. The LTV just gets in the way of the correct solution. Paul Samuelson expressed this in his 'erase-and-replace' critique of Marx. What's the correct way of carrying out the 'transformation' from values to prices of production? It's easy, you erase values and replace them with prices of production (Samuelson, 1972: ch. 153).

In the background to Samuelson's article (which was one shot in a debate that raged in the economics journals in the 1970s) was Piero Sraffa's brilliant mathematical reconstruction of Ricardian theory (Sraffa, 1960), the founding document of the neo-Ricardian school. Sraffa showed that you could write down a set of equations that defined prices of production for each industry provided you had the following information.

- The matrix of 'technical coefficients' indicating how much of each industry's product is needed as input for each other industry.
- The vector of direct labour coefficients indicating how much direct or current labour is needed per unit of the product in each industry.
- Either a given real wage-rate or a given rate of profit. (Whichever of these variables is not given will be part of the solution.)

Labour-values are the sum of the direct and indirect labour required to produce each commodity. To calculate labour-values you need the first two sorts of information mentioned above but not the third. Given the way the calculations work out – specifically, the compounding effect due to a positive rate of profit – there is in general no mathematical function that takes you from labour values to prices of production. In other words, there exists a basic information set from which we can calculate *either* labour-values or prices of production, but if we want prices of production there's no sense in going *via* labour values; in fact, in general it can't be done.

One further point demands attention. In general, prices of production differ from values – but how much do they differ? The divergence comes from the theoretical postulate of a uniform rate of profit on capitals of differing organic composition. This divergence will be greater (a) the greater is the overall rate of profit and (b) the more uneven is the distribution of organic composition. To put it the other way round, if the overall rate of profit were zero and/or if every industry had the same organic composition, prices of production would be the same as values.

This suggests that if the rate of profit is 'moderate' and the organic composition of capital is not too widely scattered around its average, labour-values will be approximately 'right'. In a practical sense that sounds positive for the LTV. In a strictly theoretical sense, however, the LTV is downgraded. It's a 'special case'. The 'correct' theory is that of prices of production and the LTV may give an acceptable approximation under certain conditions. Under other conditions the LTV may give wildly 'wrong' results. Or so it seems.

6.7 The probabilistic response

There's nothing wrong with Sraffa's or Samuelson's mathematics, yet we do not accept the 'redundancy' critique of the labour theory of value. Our reasons flow from two sorts of investigations that have been carried out since the early 1980s: on the one hand, the theoretical account of the capitalist economy as a disorderly system with very large degrees of freedom, initiated by Farjoun and Machover (1983); and on the other, empirical work on labour-values and prices of production stemming from Shaikh (1984).

These issues are taken up in chapters 7 and 10; here we anticipate, enumerating some of the most relevant points without argument.

(1) Not only is the rate of profit not uniform – everyone knows that – but neither is it uniform 'in equilibrium'. For a random variable such as the rate of profit the appropriate equilibrium concept is that of *statistical equilibrium* (chapter 7). The dispersion of profit rates around their average is roughly stable over time (while individual firms and industries bump around, changing their places in the distribution).

(2) Many studies show a close correlation between market price of output and labour-value across industries. Ricardo's intuition that the LTV gives a good approximation was correct.

(3) Further, several studies show a negative or inverse correlation between profit rates and organic composition of capital across industries – precisely the result that Ricardo and Marx thought they had to avoid, leading to their 'modifications' to the basic LTV.

(4) As an empirical matter, labour-values and prices of production seem to be roughly equally good as predictors of market prices. It's not the case that prices of production are 'right' and labour-values the poor cousin.

This is all very exciting from a scientific point of view. We posed above the simple-minded but revealing question for any theory of value: why does a laptop cost 50 times as much as a pizza? (Or vary the example to taste.) We expressed our dissatisfaction with the neoclassical answer, but the Sraffian answer is really no better – it has to be some generalized verbiage along the lines of, 'This price ratio is such as to give pizza bakers and laptop makers the social average rate of profit, given the input–output matrix and the vector of direct labour requirements.' The answer given by the labour theory of value, however, is, as economists like to say, a 'testable hypothesis'. Not only that, but the theory is an engine capable of giving rise to a series of further testable hypotheses – and that (in large measure) is how science advances.

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