Value and Price[1]

Introduction: basic concepts

Transactions in which an individual, household, firm, government, or other economic entity ('the buyer') purchases something (usually with money) from another economic entity ('the seller') are widespread and familiar events in many societies. Economic theory describes the exchanged 'thing' or 'item' variously as a 'good', an 'asset', or a 'commodity'. The term 'good' emphasizes the usefulness of the thing exchanged to the buyer or some ultimate purchaser of the item in a chain of transactions. The term 'asset' emphasizes the fact that the seller owns and controls the item, and has the legal right to transfer ownership to the buyer. The term 'commodity' has a narrower sense of a good produced with the intention of selling it in a system of production organized through exchange.

'Price' is the commonly used term for the amount of money exchanged in such a transaction for the item. By extension, the term 'price' is often used to describe a standing offer to make such transactions, whether there is an actual transaction or not. In the rarer case of barter transactions, in which one non-money item is exchanged for another, the ratio in which the items are exchanged is often described as the 'relative price'. Economic arguments that abstract from the mediation of money in exchange are often couched in terms of relative prices.

[1] We are grateful to Heinz-Dieter Kurz and Roberto Veneziani for helpful comments on an earlier draft. All errors remain our own.

Price derives through Middle English and Old French from the Latin *pretium*, which translates as both price and value; value derives also through Middle English and Old French from the Latin *valere*, meaning 'be strong, be worth'. The dictionary definition of value (omitting senses deriving from ethics, and applications to people) is a rich one with a number of meanings:

> '**I**. 1. That amount of some commodity, medium of exchange, etc., which is considered to be an equivalent for something else; a fair or adequate equivalent or return. 2. The material or monetary worth of a thing; the amount at which it may be estimated in terms of some medium of exchange or other standard of a like nature. 3. The equivalent (in material worth) of a specified sum or amount. The extent or amount of a specified standard or measure of length, quantity, etc. **II** The relative status of a thing, or the estimate in which it is held, according to its real or supposed worth, usefulness or importance.' (Little et al. 1973, p. 2449)

That of price is narrower:

> '**I**. Money, or the like, paid for something. The money (or other equivalent) for which anything is bought or sold; the rate at which this is done or proposed… Payment of money in purchase of something.
>
> **II**. Value, worth (obsolete, archaic)' (Little et al. 1973, p. 1667)

In the light of these definitions and usages, it is not surprising that in political economy the relation between value and price is contested and prone to confusion. The term 'value' in both ordinary and technical economic language is used in a bewildering array of senses, including as a synonym for ‘price’, as the ‘value’ of a collection of items calculated by multiplying the quantity of each by a corresponding price, in particular as ‘value-added’, the value of a collection of produced items net of the costs of the non-labour inputs required to produce them, as the relation between the underlying quality or usefulness of the item and the price (‘good’ or ‘bad value for money’), as the general social usefulness of the item, and, by the classical political economists such as Adam Smith and David Ricardo and their critic Karl Marx, in the sense of the quantity of labour time necessary to produce a commodity. This last, more technical, sense of the term ‘value’ will be the main focus of our discussion.

Broadly speaking, in classical economics value is a substance of something; it is expressed in money as a price, and being a substance, some ‘productive’ activities produce it and other ‘unproductive’ activities use it up. This chapter elaborates the development of this perspective.

The economy as an organic mechanism

In European medieval society, all economic and social relationships were interpreted through the prism of Christian theology and Aristotelian ‘natural law’. These relationships were regarded as both ‘natural’ and divinely inspired, and were regulated by the Church. People’s horizons were local (and rural), with trade and commerce limited by time (market day) and place (marketplace). Where there was trade, transactions were supposed to take place at ‘just prices’, sufficient to compensate sellers for costs of acquisition and transport and to allow them to maintain their customary status, but no higher or lower.

Gradually, over some centuries, this society of custom and tradition disintegrated. The forces of disintegration were various (for example, the commutation of feudal services for a monetary rent, technological progress in agriculture and the expansion of trade), and their effects were to widen the sphere and scope of monetary transactions. This process tended to break down the religious bonds of society, encouraging the growth of individualism in order to take advantage of the opportunities offered by the growth of markets for material advancement. The development of early forms of capitalism, based on individual pursuit of monetary gain, accelerated these tendencies. However, the growth of individualism posed a problem: if society was not held together by divine providence, by what, if anything, was it held together?

Hobbes' answer, written in the mid-seventeenth century against the background of the English Civil War, was that society was held together by a 'social contract', whereby the people transfer some of their rights to a strong central authority in order to guarantee their protection. Otherwise, in the natural state of mankind characterized by no strong central authority, war will ensure that

> 'there is no place for industry; because the fruit thereof is uncertain: and consequently no culture of the earth; no navigation, nor use of the commodities that may be imported by sea; no commodious building; no instruments of moving, and removing, such things as require much force; no knowledge of the

> face of the earth; no account of time; no arts; no letters; no society; and which is worst of all, continual fear, and danger of violent death; and the life of man, solitary, poor, nasty, brutish, and short.' (Hobbes [1651] ch. XIII, paragraph 9.)

What leads to war is the human instinct of acquisitiveness, greed or selfishness expressed through mutual competition[2], and what holds society together in the face of such human nature, averting anarchy, is the politics of a social contract.

In the early eighteenth century the emphasis changed when Mandeville (in his *Fable of the Bees*, in a variety of editions between 1714 and 1732) argued that 'vice' rather than 'virtue' was the foundation of prosperity. By 'virtue' he meant cooperative behaviour in conscious pursuit of the good of others, in contrast to 'vice', which was the selfish pursuit of greed. This latter, if wisely channelled by skilful politicians, would generate public benefits. In contrast to the Hobbesian view that human nature was vicious and could only lead to anarchy unless politically controlled, Mandeville proposed that the greed of human nature, provided it was politically guided, constituted the fabric of social intercourse and progress. It was then a short intellectual step, after another 50 years, for Adam Smith to advocate the removal of political guidance and to focus on the benefits of a laissez-faire state to the operation of an invisible hand.

Political philosophers and nascent 'political economists' in this period gave a great deal of attention to the problem of understanding how decentralized pursuit of self-interest

[2] 'So that in the nature of man, we find three principal causes of quarrel. First, competition; secondly, diffidence; thirdly, glory.
The first maketh men invade for gain; the second, for safety; and the third, for reputation.' (Hobbes [1651] ch. XIII, paragraphs 6 and 7).

might lead to organized and socially beneficial outcomes. In particular, political economic discourse of this period evolved the idea that self-regulating standards were latent in the competitive hurly-burly of the market place. Behind the constantly fluctuating market prices at which commodities actually exchanged lay ‘natural prices’ or ‘values’ to which market prices were tethered and around which they ‘gravitated’. To the degree that these natural prices represented socially beneficial guides to allocation of resources (such as land, other non-labour inputs, and labour), this process of competitive gravitation would act as an ‘invisible hand’ in regulating social production.

The idea that order emerges from spontaneity was a powerful ‘grand narrative’ that was not confined to political economy. But Smith’s intuition that the innumerable actions of competing individuals in pursuit of self-interest could generate something other than chaotic anarchy set an intellectual agenda that remains contemporary. Since trading activity in decentralized markets appeared to characterize the process of the invisible hand, it threw a particular focus on what was brought to the market, what was taken from the market, and the prices at which these trades took place. It was therefore critical to give an account of the forces influencing both market prices and natural prices, which poses the questions a theory of value has to answer.

Value and price in Smith

Smith’s invisible hand is a metaphor for how prices organize a complex social division of labour. Within the factory, the division of labour is completely planned, and its purpose is to increase labour productivity. For Smith this occurred for three reasons. Specialization of tasks increased dexterity and reduced the time otherwise needed to move between tasks; these two reasons are more or less specific to handicraft production. Thirdly, and historically overwhelmingly the most important, the division of labour was extended and productivity increased through the use of specialized machinery. But outside the factory it is a different story. Rather than planned and hierarchically organized, the division of labour is (in principle) completely unplanned and spontaneous, emerging as the outcome of profit-seeking producers responding to price fluctuations, and limited only by the extent of the market. Thus Adam Smith famously wrote,

> '… man has almost constant occasion for the help of his brethren, and it is in vain for him to expect it from their benevolence only. He will be more likely to prevail if he can interest their self-love in his favour, and show them that it is for their advantage to do for him what he requires of them. Whoever offers to another a bargain of any kind, proposes to do this. Give me that which I want, and you shall have this which you want, is the meaning of every such offer; and it is in this manner that we obtain from one another the far greater part of those good offices which we stand in need of. It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest. We address ourselves, not to their humanity, but to their self-love, and never talk to them of our own necessities, but of their advantages.' (Smith 2008, WN, I.ii.2.)

As well as depending upon what Smith called 'a certain propensity in human nature … to truck, barter and exchange one thing for another' (Smith 2008, WN, I.ii.1), this market determination depended upon mobility of inputs. Since the accumulation of wealth depended upon the labour productivity increases brought about by the division of labour (restricted only by the overall size of the market), it seemed obvious then to relate the price of a product to the labour performed in its production. Certainly if a production process required labour alone, such as hunting deer and beaver on common land with no produced implements, then deer and beaver would exchange in a ratio measuring the relative times spent in hunting each. For if they did not, labour would reallocate itself to the more profitable activity in terms of labour time expended. So labour mobility is an important presupposition of a theory of value.

Although the industrial revolution was in its early stages during Adam Smith's lifetime, in most major sectors of production labour had come to be organized along capitalist lines, in which direct producers did not own the means of production, but sold their capacity to labour (in Marx's terms, 'labour-power') to a capitalist, who did own means of production, in exchange for a wage. The capitalist's *profit* per time period, for example a year, is $\Pi = R - C - W$, where R is the sales revenue per year, C is the cost of other purchased inputs per year, and W is the wage payment per year, all in money units. If the capitalist in pursuit of profit on average ties up money, or 'capital' worth K, the *profit rate* is $r = \frac{\Pi}{K}$, a pure number per unit of time like an interest rate.[3] Smith and the other classical political economists argued that because the motivation of capitalist producers

[3] In classical economics, 'capital' generally refers to the total money sum invested by the capitalist, irrespective of what inputs it is used to purchase. In economics today the term 'capital' has a generally narrower reference, meaning either the sum of money invested in non-labour means of production or the physical inputs so purchased, depending on the context.

was the expansion of their wealth, they would tend to seek out sectors of production with the highest profit rate, withdrawing capital (and with it labour) from sectors with lower than average profit rates and moving capital (and labour) to sectors with higher than average profit rates.

Smith thus argued that a crucial feature of capitalist society was the mobility of capital. For he supposed that the long run level of price was determined through competition among capitalists by whatever level would generally equalize the rate of profit across all activities. This he called the 'natural price', contrasting it with the day-to-day fluctuations of the 'market price' caused by all sorts of ephemeral and contingent factors. For Smith, the problem of the theory of value was to explain what determined the natural prices of commodities. In his 'early and rude state of society which precedes both the accumulation of stock and the appropriation of land' (Smith 2008, WN, I.vi.1), natural prices were determined primarily by labour hours required for the production of each commodity. When means of production are appropriated (through the accumulation of 'stock', which is Smith's technical term for the non-labour means of production) the determination of natural prices is also influenced by the mobility of capital in search of higher profit rates.

However, once the organization of the hunting process took a capitalist form, with the capitalist hiring hunters and supplying them with hunting implements, Smith's simple labour theory of value became problematic. This is because the revenues from production have to cover more than wages: the capitalist requires a return on his capital, which is invested in both labour and non-labour inputs, in the form of profit, and the landlord requires a return on his ownership of land in the form of rent. Faced with the need to include rent, wages, and profit in his account, Smith abandoned his labour embodied theory for an adding-up theory of value based on the idea of explaining the natural price of commodities by adding up labour costs, land costs, and capital costs at natural wage, rent, and profit levels. This then required an independent determination of natural wage, rent and profit levels.

Smith did have some idea of a subsistence wage, and that wage determination was affected by employers ('masters') being fewer in number than the workers they hired, more able to hold out longer in disputes, and more favoured by institutions and politics. He also had some idea that profits and rents were deductions from the product of labour, but he had no systematic theoretical account of any inverse relationships between distributive variables. But Smith did not have any systematic account of the independent determination of natural levels of rent, wages and profit, and, without these, his adding-up theory remained enmeshed in circularity.

While he did not manage to work out a natural price interpretation of rent, wages and profit, Smith was very clear that differences between market price and natural price called forth quantity adjustments in an arbitrage process, and that this process was endless. Smith thus had an account of market price fluctuations around levels determined by natural prices, for the invisible hand process was one of continual adjustment (towards an equalized rate of profit) combined with continual displacement (as technology and demand evolved). Natural price was in effect the value substance underpinning market price, but once Smith had abandoned his embodied labour theory of value, he had no satisfactory theory of natural price levels.

Smith is therefore the father of modern economics in at least two ways. First, while he did not invent it but built on his predecessors, he had a clear vision of a decentralized market economy as an organic self-organized system that produced a roughly orderly and comprehensible result rather than chaotic anarchy. When an individual pursues private profit,

> 'he is … led by an invisible hand to promote an end which was no part of his intention. … By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.' (Smith 2008, WN, IV.ii.9.)

Second, his two theories of price were the ancestral foundations of all subsequent theories of price. Contemporary neoclassical economics traces its genealogy back to Smith's adding-up theory, while Smith's immediate successors focused on developing his embodied labour theory of value, both holding to the presumptions of labour and capital mobility.

Value and price in Ricardo

Smith had supposed that when producers could freely shift from one line of commodity production to another, natural prices would tend to adjust to equalize the 'whole of the advantages and disadvantages of the different employments of labour' in the production of commodities (Smith 2008, WN, I.x.1). If the main component of the ‘advantages and disadvantages’ is the labour time required to produce commodities, natural prices will tend to be proportional to required labour times. Ricardo generalized this conception to an economy in which ‘stock’ had been accumulated, so that prices were determined by the sum of the labour actually performed (direct or living labour) and the labour embodied in the means of production (indirect or dead labour). Ricardo assumed that the various different types of labour (because of different skills and intensities of work) could all be reduced to a common standard unit (although he paid little attention to how this might be done). Then, measuring in this common standard, relative prices were determined by embodied labour ratios.

These relative prices were Smith’s natural prices. Thus Ricardo wrote,

> ‘In making labour the foundation of the value of commodities, and the comparative quantity of labour which is necessary to their production, the rule which determines the respective quantities of goods which shall be given in exchange for each other, we must not be supposed to deny the accidental and temporary deviations of the actual or market price of commodities from this, their primary and actual price.… In the 7th chap. of the Wealth of Nations, all that concerns this question is most ably treated. Having fully acknowledged the temporary effects which, in particular employments of capital, may be produced on the prices of commodities, as well as on the wages of labour, and the profits of stock, by accidental causes, without influencing the general price of commodities, wages or profits, since these effects are equally operative in all

> stages of society, we will leave them entirely out of our consideration, whilst we are treating of the laws which regulate natural prices, natural wages and natural profits, effects totally independent of these accidental causes. In speaking then of the exchangeable value of commodities, or the power of purchasing possessed by any one commodity, I mean always that power which it would possess, if not disturbed by any temporary or accidental cause, and which is its natural price.' (Ricardo 1951, pp. 88, 91-2.)

However, Ricardo soon discovered that simultaneously determining prices by embodied labour, and considering these prices as the 'natural prices' at which profit rates were competitively equalized, was not logically possible.

To see this, suppose a current production process has direct labour per unit of output L_1 working with means of production, and suppose these means of production were produced one period previously, and only with direct labour per unit of output L_2. So a capitalist must advance wL_2 at the beginning of the previous period, to earn $(1+r)wL_2$ at the end of that period, and must advance $wL_1+(1+r)wL_2$ at the beginning of the current period, to earn $(1+r)[wL_1+(1+r)wL_2]$ at the end of the current period. Now consider two production processes, one producing commodity *A* and the other commodity *B*. Given the simple technology, the price equations are

$$
\begin{aligned}
p_A &= (1+r)[wL_{A1}+(1+r)wL_{A2}] \\
p_B &= (1+r)[wL_{B1}+(1+r)wL_{B2}]
\end{aligned}
$$

Suppose A and B are each produced by identical quantities of embodied labour, $(L_{A1}+L_{A2})=(L_{B1}+L_{B2})$, so that they have identical values and hence natural prices. But suppose their production processes are differently divided as between direct and indirect labour. The time when the labour was embodied makes no difference to the quantity of labour embodied, which remains the same for the two commodities. But it matters a great deal to the capitalists concerned. If commodity A has more indirect labour embodied than commodity B, then the capital invested in the production of commodity A is tied up for longer than the capital invested in commodity B, and consequently the rate of profit accruing to each capitalist cannot be the same. The rate of profit on the capital invested in the production of commodity B will be higher, and this contradicts the definition of natural price as supporting an equalized rate of profit. Conversely, if the rates of profit are equalized, then the prices that bring this about cannot reflect the total labour embodied in the production of each commodity. The natural price of commodity A must be higher, and this contradicts the embodied labour theory of value.

Simple inspection of the price equations shows that the embodied labour theory of value and the equalization of the rate of profit are only compatible in two cases. The first case requires a zero profit rate (strongly reminiscent of Smith's 'early and rude state of society'). The second case requires the additional and highly special assumption that the time structure of embodiment is the same, so that $L_{A1} = L_{B1}$ and $L_{A2} = L_{B2}$, and the ratio of indirect to direct labour is the same in each production process. Whenever these ratios differ (which will normally be the case), prices at which the rate of profit is equalized cannot be formed out of the sum of direct and indirect labour. The embodied labour theory of value cannot explain natural prices because it ignores the structure of production, and natural prices depend upon the structure of production.

Ricardo never resolved this difficulty. Partly, he thought that it would not matter very much in practice, provided that differences in the structure of production were not too great (perhaps not too unreasonable an approximation in the early years of industrialization). Writing to Mill in December 1818, Ricardo contrasted his view with that of Adam Smith:

> '… it is not because capital accumulates, that exchangeable value varies, but it is in all stages of society, owing only to two causes: one the more or less labour quantity required, the other the greater or less durability of capital: - that the former is never superseded by the latter, but is only modified by it.' (Ricardo 1951, p. xxxvii.)

And writing to Malthus in October 1820, he remarked,

> 'You say that my proposition 'that with few exceptions the quantity of labour employed on commodities determines the rate at which they will exchange for each other, is not well founded' I acknowledge that it is not rigidly true, but I say that it is the nearest approximation to truth, as a rule for measuring relative value, of any I have ever heard.' (Ricardo 1951, p. xl.)

As well as acknowledging the difficulty of combining an embodied labour theory of value with the competitive equalization of the rate of profit but insisting that the incompatibility would not be large, Ricardo also tried a different approach. Since the incompatibility was produced by different structures of production, perhaps he could find some commodity with an 'average' structure of production in some sense, so that its value would be determined *only* by the total labour directly and indirectly embodied in it. It could then be used as an 'invariable standard of value', invariable that is to changes in the wage, so that distributional relations could be then analysed independently of prices. Otherwise, if the wage rate rose, the fall in the profit rate would entail effects on prices determined by the structure of production, and these in turn would alter the magnitude of the net product and hence wages and profits. Ricardo speculated that any particular commodity, such as gold, might not serve as an exact invariable standard:

> 'Neither gold then, nor any other commodity, can ever be a perfect measure of value for all things; but I have already remarked, that the effect on the relative prices of things, from a variation of profits, is comparatively slight; that by far the most important effects are produced by the varying quantities of labour required for production; and therefore, if we suppose this important cause of variation removed from the production of gold, we shall probably possess as near an approximation to a standard measure of value as can be theoretically conceived.' (Ricardo 1951, p.45.)

But this was clearly theoretically unsatisfactory, and Ricardo never found the 'average' commodity he wanted.[4]

Modern investigations based on data on average prices of commodities and their structure of production tend to support Ricardo's conjecture that differences between natural prices and embodied labour ratios are not very large (for example Shaikh 1998). Any such

[4] This turned out to be a very complicated problem. For a given technique of production, Sraffa's 'standard commodity' (Sraffa 1960) solves the analytical problem, but across different techniques no such invariable standard of value has been discovered (Kurz and Salvadori 1995, ch. 4, sections 3-5).

investigation, however, rests on some particular measure of the deviations of one relative price system from another, and empirical political economists have not reached agreement on any one method for measuring these differences.

Value and price after Ricardo: the bifurcation

Three intellectual responses were possible to the Ricardian difficulty in combining a labour theory of value with capitalist competition and the equalization of the rate of profit. The first was simply to abandon the idea that there was a competitive tendency towards the equalization of the rate of profit. Typically, this was not pursued. Not only did it appear to run counter to an evident empirical tendency; at a deeper level it ran counter to the notion of a decentralized economy that was (self-)organized by competitive behaviour rather than merely anarchic. The second was to separate the theory of value from its dependence on labour performed, a path taken by neoclassical economics after the 1870s. The third was to recast the labour theory of value, which was attempted by Marx.

Value and price in neoclassical economics

Around the 1870s, William Stanley Jevons, Carl Menger and Léon Walras all took the classical political economy Ricardian method of determining rent (as, in the case of the "extensive margin", the difference between the productivity of a given plot of land and the productivity of the worst equal-size plot in cultivation, or, more generally in the case of the "intensive margin" as the difference in the productivities of plots as more labor and complementary inputs are applied to them) and applied it to the determination of the prices of other 'factors of production' – hence the terminology '*neo*classical'.

In so doing, they developed a distinct alternative to the classical approach, in which the wage, for example, depends not on the conditions of the supply and reproduction of the labor force, but on its short-term scarcity. Instead of starting with the problem of the determination of long-period prices of production (and then considering the market price fluctuations around them), technological change and the reproduction of the economy, the neoclassical starting point was the problem of finding equilibrium prices with given stocks of input resources such as land, labour, and means of production. Rather than considering the turbulent mobility of labour and capital as in classical political economy, the neoclassical vision was based on a given state of allocation of resources, in which, for any given technology, endowments and preferences, all firms and households optimized on the basis of parametric prices and all markets cleared. Instead of contingent demand and supply fluctuations causing actual market prices to fluctuate around their long period equilibrium, in the neoclassical approach those demand and supply fluctuations are understood as being themselves the immediate determinants of equilibrium prices. Underlying demand are the choices of the utility-maximizing consumer households, but choices restricted by the equilibrium prices and incomes, and supply is in the first instance restricted to the actions of the same consumer households in selling less wanted endowments in order to purchase the household's more desired bundle of commodities. Hence the neoclassical initial focus was an exchange economy, in which the individual as consumer was sovereign. The subsequent addition of producing firms that passively choose input and output levels to minimize costs and maximize profit at equilibrium prices to the picture is something of an afterthought, requiring no fundamental change in the theory of determination of equilibrium prices (as long as technology is assumed to be characterized by non-increasing returns).

From the neoclassical point of view, the classical political economy distinctions among the categories of value, price of production, and market price are subsumed under the general category of equilibrium price. Once equilibrium prices are explained, there is no theoretical role for the concept of value in the neoclassical framework. As a result neoclassical economists tend to use the term "value" either in the sense of the value of a bundle of commodities (the sum of the quantities of each commodity in the bundle multiplied by the corresponding price), or simply as a synonym for "price".
By the 1950s, Debreu (1959) could call his study of neoclassical general equilibrium theory *The Theory of Value*, and Koopmans could define ‘value theory’ as ‘the theory of prices as guides to allocation of resources and of the relation of these prices to the technology’ (Koopmans 1957, p.148). The theory of value has no content for neoclassical economics other than as an ontology of consumer sovereignty with exogenous preferences, and the theory of price becomes an atemporal theory of market-clearing equilibrium prices.

Both internal and external critics of the neoclassical framework have noted several lacunae in the neoclassical theory of prices. If all agents are price-takers, it is not obvious how any price is ever changed. The institutions of households, firms and markets are emptied of any substantive sociological content and become purely mathematical abstractions in the form of utility and production functions. Despite heroic efforts of mathematical economists, the uniqueness and stability of a general equilibrium system of market-clearing prices cannot be assured without restrictive special assumptions. Trading at disequilibrium prices and the resulting path-dependence of final allocations has not been addressed effectively. The attempt to apply the theory of market-clearing equilibrium prices to produced means of production gives rise to paradoxes discovered by Piero Sraffa, including the phenomena of "reverse capital deepening" (a fall in the value of capital at lower profit rates), and "re-switching of techniques" (cost-minimizing firms adopting the same technique of production at high and low profit rates and a different technique for intermediate profit rates), which are incompatible with the notion that the profit rate is an index of the scarcity of capital. The attempt of neoclassical economics to circumvent these problems by generalizing the framework from atemporal equilibrium to intertemporal equilibrium have foundered on problems of incompleteness of markets, the formation of expectations, the constant introduction of novel commodities as a result of technological change and the exogeneity and stability of preferences over time.[5]

As a result, the neoclassical theory of market-clearing equilibrium resource allocation has become increasingly disconnected from economic reality. For example, in the later years of the twentieth century the existence of unemployment was attributed by many neoclassical economists to the intertemporal substitution of leisure for labour by forward-looking perfectly rational workers, a logically necessary implication of the presumption of market-clearing prices in the labour market, but a conclusion that struck many others as absurd.

[5] On these points see Kirman 2006, Foley 2010 and references cited therein.

Value and price in Marx

All theories, however abstractly formulated, have associated preconceptions, or visions, which determine what it is that the theory is supposed to explain. Often this larger vision is implicit, having to be teased out; generally it is based on a set of priors involving beliefs, a world-view, which shapes what the theory can and cannot explain. Marx’s world-view was based on his ‘historical materialism’, that purposive activity by cooperating human beings transforms the physical and social environment within which that activity occurs, and that those transformations alter the human beings themselves. ‘Cooperating’ might not be voluntary; indeed, in all of known human history following the invention of settled agriculture, it generally entailed elements of coercion. Those who owned and/or controlled the means of production necessary for realising purposive activities could compel those who did not to work *for* them rather than *with* them. Societies, that is, were class societies, and classes existed in antagonistic relations to each other.

Smith and Ricardo had talked in terms of social classes. Smith had often emphasized the role of power in determining the distribution of income as wages, rent and profits, and Ricardo had seen the interests of landowners and capitalists as opposed to one another (the protective tariffs known as the Corn Laws were a dominating theme in British politics in the first half of the nineteeth century). But Smith and Ricardo had no conception of class other than defined through their receipt of a type of income. Neither had seen the antagonistic relation between those who owned and controlled the means of production and those who did not as the overarching perspective it assumed in Marx.

How was such antagonism compatible with the notion that society was non-anarchically self-organized? In one way, Marx followed in the footsteps of Smith, although he put it in different terms.

> '… the amounts of products corresponding to the differing amounts of needs demand differing and quantitatively determined amounts of society's aggregate labour. It is **self-evident** that this *necessity* of the *distribution* of social labour in specific proportions is certainly not abolished by the *specific form* of social production; it can only change *its form of manifestation*. Natural laws cannot be abolished at all. The only thing that can change, under historically differing conditions, is the *form* in which those laws assert themselves. And the form in which this proportional distribution of labour asserts itself in a state of society in which the interconnection of social labour expresses itself as the *private exchange* of the individual products of labour, is precisely the *exchange value* of these products.' (Marx and Engels 1988, p.68, emphasis and italics in original).

But at the same time, Marx considered that there would be periodic ruptures in the social fabric. For class relations were defined in terms of property relations, and the development of technology (which he called the 'forces of production') by these class relations periodically rendered existing property relations redundant. A social revolution then occurred, overthrowing the basis of existing class relations, and establishing new ones more compatible with the forces of production. An analogy might be a landscape which appears peaceful, harmonious and at rest; and yet if this landscape rests on tectonic plates moving remorselessly against each other, then, irregularly and unpredictably, these movements result in earthquakes which violently recast the landscape. So Marx both retained the eighteenth century vision of society and its economy as a social organism, but at the same time he also transformed it into something with evolutionary and path-dependent dynamics, by changing the focus from self-seeking individuals to antagonistic classes.

This transformation presents a challenge. For while slave societies and feudal societies were characterised by explicitly coercive structures for maintaining and enforcing their class relations, this was not evident in capitalist societies. Indeed, the opposite appeared to be the case. For such societies were based on the universalization of markets,

> ‘a very Eden of the innate rights of man. It is the exclusive realm of Freedom, Equality, Property and Bentham. Freedom, because both buyer and seller of a commodity … are determined only by their own free will. They contract as free persons, who are equal before the law. Their contract is the final result in which their joint will finds a common legal expression. Equality, because each enters into relation with the other, as with a simple owner of commodities, and they exchange equivalent for equivalent. Property because each disposes only of what is his own. And Bentham because each looks only to his own advantage. The only force bringing them together, and putting them into relation with each other, is the selfishness, the gain and the private interest of each. Each pays heed

> to himself only, and no one worries about the others. And precisely for that reason … they all work together to their mutual advantage, for the common weal, and in the common interest.' (Marx 1976, p. 280)

This vision is extraordinarily powerful, indeed so powerful that the distance between it and the vision underlying contemporary economic theory more than a century later, for all its formalization, is negligible.

Marx's approach to this Eden of unfettered free markets was not to begin with the chaotic appearances of actual markets, but rather to establish a set of abstract general analytical relations (drawn from the detailed observation of real historical processes). This he called 'the method of inquiry', whose purpose was 'to appropriate the material in detail, to analyze its different forms of development and to track down their inner connection' (Marx 1976, p.102). Proof of success in this process is determined by the ability to develop these inner connections so that they can encapsulate reality 'not as the chaotic conception of a whole but as a rich totality of many determinations and relations' (Marx 1973, p. 100). This is delicate; if the concrete is understood as some manifestation of the abstract, the abstract itself has to be concretely grounded. Otherwise, theory becomes an idealist construction, creating the material world instead of being created by it.

Exchange value, value and price were Marx's organising abstractions, abstractions that were developed on the basis of their concrete reality in the universalization of commodity purchase and sale. For Marx, as for his predecessors, it was through exchange value, value and price that the 'anarchy of the market' organized the distribution of the labour resources of society. But it did this via antagonistic class relations. Marx's approach to the Eden of appearances was to develop the abstract relations of exchange value, value and price to show that capitalism's 'Freedom, Equality, Property and Bentham' were all founded on coercive class relations. In this, individuals were only treated explicitly insofar as they could be considered the 'bearers' of capitalist relations.

The commodity law of exchange

Marx, like his predecessors in political economy, distinguished 'value in use' from 'value in exchange'. Value in use, or 'use-value', derives from the qualitative properties of a product that make it desirable for someone to consume. Thus a chair, for example, has use-value because one can sit on it; by contrast, a two-legged chair has no use-value (except possibly as firewood). It is their different use-values that constitute objects as different from each other, and so objects with use-value, or use-values, are inherently heterogeneous. One way producers can meet their own needs is to consume the use-values they themselves create.

Value in exchange, or exchange-value, on the other hand, derives from the fact that when each producer has the power to exchange his or her own products for those of other producers, it is possible to acquire use-values in the marketplace by offering something equivalent in exchange. One's own produced use-value is therefore 'worth' so many units of some other use-value produced by someone else. In an economy where produced use-values are exchangeable as commodities, producers can meet their own needs by exchanging the use-values they themselves create for other use-values produced by other producers.

In a money economy exchanges of commodities are typically transacted indirectly through money: the producer of a commodity sells it for money and then uses the money to buy other commodities. A commodity is worth so many units of money, which is its price. Because units of money are homogeneous, qualitatively identical and differing only in quantity, so too are exchange-values expressed as prices. A theory of commodity exchange is simultaneously a theory of production, a theory of prices, and a theory of money.

Confining attention to objects that are produced to be exchanged, that is, to commodities, the problem of the theory of value is to explain what determines the exchange-value of a typical or representative commodity. Because any commodity can be transformed into any other through sale and purchase, regarded purely as exchange values all commodities are homogeneous, differing only in quantity.

For Marx, the homogeneity of commodities as exchange-values reflects the fact that the production of any commodity requires a certain fraction of the total labour-time of society. This labour time at any moment takes many different concrete forms, but labour has the capacity to adapt through training and practice to the requirements of various productive activities. It is fungible in a way that non-labour inputs are not. Underlying exchange-value is thus an amount of potentially homogeneous social labour-time, social labour considered only as a quantity of (standardized or 'socially necessary') hours. That labour-time is always employed in particular ways, with particular tasks required to produce particular commodities. It is this heterogeneity that produces particular use-values, and Marx called 'concrete labour' the labour involved from this perspective. That same labour considered as producing a quantity of homogeneous exchange-value expressed in terms of money, Marx called 'abstract labour'. This was then the substance of value, and was measured in units of 'socially necessary labour-time'. Exchange-value is the form in which abstract labour appears, and since prices are expressed in monetary units, money expresses abstract labour.

Consider an equation of exchange, such as x units of commodity i are worth y units of commodity g. This is only possible because both i and g require amounts of society's total labour; then the value of i is expressed in terms of g. This entails that i's value is expressed relatively in g, and g's value is the equivalent of that of i. But g is some particular use-value, so that it is this use-value that expresses the value of i. Hence the concrete labour producing g represents the abstract labour that produces i.[6] Social development selects some particular g (that has properties of homogeneity of units, portability, divisibility, storage without deterioration and so on) to act as the equivalent form of value of all other commodities, to act that is as the money-commodity. The money commodity (for example, gold) has, like other commodities, particular use-values (as a conducting medium in electronic circuits or for capping teeth in dentistry) and

[6] This inversion was part of what Marx called the 'peculiarities of the equivalent form' (Marx (1976), Ch. 1 Section 3. See also Marx (1994)). These are the foundation of his theory of ideology, which he attributed to the 'fetishism of the commodity' (Marx (1976), Ch. 1 Section 4).

acquires an additional use-value in serving as the universal equivalent form of value. With the development of a money-commodity, the exchange-value of a unit of *i* is its price (p_i^*), and its price is defined as the ratio of its natural price or value (λ_i) to the natural price or value of the money-commodity *g* (λ_g).

$$p_i^* = \frac{\lambda_i}{\lambda_g} \tag{1}$$

Equation (1) is formulated on the basis that commodities exchange as equivalents at natural prices: equivalent exchange implies that natural prices or values are proportional to social labour times required to produce commodities, with the common factor of proportionality being the inverse of the value of the money-commodity, sometimes called the Monetary Expression of Labour-Time (MELT) $m = \frac{1}{\lambda_g}$. Retaining this presumption for the present, then equation (1) applies to every commodity (and obviously therefore to every aggregate of commodities). These implications could be called the *commodity law of exchange*. In particular, the commodity law of exchange applies to labour-power and to aggregate value added. It is through these aggregates that Marx explained the mechanism of exploitation in capitalist production. Consider each in turn.

The commodity law of exchange and labour-power

The distinction between labour and *labour-power* is one of the defining characteristics of the Marxian approach. By labour-power Marx meant the capacity to work. When an individual is in possession of (sufficient) means of production, she can exercise her capacity to work, and the work then done is her labour, which eventuates in a produced use-value, to be directly consumed and/or traded for other use-values. But if an individual has to access means of production through the market, and has negligible non-labour resources with which to trade, then effectively the only asset that individual has to sell is her capacity to work, or her labour-power. In these circumstances labour-power is commoditized, with, like any other commodity, a use-value, a value and a price.[7] Its use-value is straightforward, for the purchaser of labour-power can set it to work in a production process, producing value of greater amount than the value of labour-power. This excess is called *surplus-value,* and it accrues to the purchaser of labour-power (just as the use-value of a loaf of bread accrues to its purchaser, who can consume it or throw it to the ducks, or whatever). The existence of surplus-value requires that the capitalist purchaser of labour-power can extract from the worker labour producing more value than he paid for it. Hence the value of labour-power requires careful specification.

Labour-power is a peculiar commodity, because it is a human attribute, and the (re)production of people takes place outside of capitalist relations of production, which lends some analytical complexity to the concept of the value of labour-power. By definition, the value of labour-power, like any other commodity, is the socially necessary labour-time required to produce it. Marx hypothesized that this was equivalent to the value of the subsistence wage-bundle of commodities, although he modified the Malthusian perspective with a focus on social norms. Hence, continuing the presumption

[7] Of course, logically some individuals might choose to sell non-labour inputs to purchase means of subsistence, but historically the typical case was that most individuals had nothing with which to trade except their capacity to work. The historical process that separates people from the means of production (typically a separation from land, enforced either economically, or juridically or through extra-legal violence) is called ‘primitive accumulation’ (Marx 1976, Part 8).

of equivalent exchange, and if H is the total number of hours worked, then, at the prevailing value of money, the value of labour-power (λ_{lp}) per hour of hire is the hourly wage rate (w), which in turn is spent on the (hourly) wage bundle of commodities (b/H) at prices p^*_b:

$$\frac{\lambda_{lp}}{\lambda_g} = w = \frac{\lambda_b}{\lambda_g}\frac{b}{H} = p^*{}_b\frac{b}{H} \qquad (2)$$

But it is not only equivalent exchange that underpins equation (2); it is also that people are perfectly mobile and that labour-power is fungible across all potential and actual employments. Only then could there be a uniform value of labour-power, or, equivalently, a uniform wage rate.

The importance of the distinction between labour and labour-power cannot be overemphasized. The seller of labour-power meets the purchaser in the marketplace as a juridical equal, and sellers and purchasers contract over only what is their own property. Exchanges only take place if they are mutually advantageous, and sellers and purchasers are free to walk away if this does not obtain. But sellers of labour-power are not only free to walk away from unsatisfactory contract proposals. They are also ‘free’ of possession of the means of production (and of resources through which to possess them) via the historical processes of dispossession that created a property-less working class. Thus they must strike a bargain with some (capitalist) owner of means of production or withdraw from the social division of labour altogether in circumstances in which relying on their own use-value production was tantamount to destitution and starvation. This dual freedom is summarized in the notion of perfect labour mobility: while workers are free to sell their labour-power to whomsoever they choose, they are compelled to sell it to someone in order to participate in the social division of labour. And the purchaser of labour-power is free to enjoy its use-value by consuming it, which means putting it to work in a production process, creating more value than labour-power possesses. In capitalist society, freedom in exchange, with exchange of equivalents, is the precondition of exploitation in production.

The commodity law of exchange and total value added

For Marx, following Ricardo, the value of a single commodity comprises the value embodied in the means of production with which labour works (transferred through concrete labour to the product of the production process) and the socially necessary labour-time worked by living labour. If $\boldsymbol{A}$ is a matrix of input-output coefficients, a_{ij} expressing the amount of commodity i required to produce one unit of commodity j, and $\boldsymbol{l}$ is a vector whose components l_j express the number of hours of labour required to produce one unit of commodity j, then the vector of values is

$$\boldsymbol{\lambda} = \boldsymbol{\lambda A} + \boldsymbol{l} \tag{3}$$

Under equivalent exchange at natural prices proportional to labour times required for the production of commodities, the relationship ‘price equals value divided by the value of money’ obviously holds for any aggregate of commodities. In particular, it holds for value added (*H*).

In physical terms, gross outputs ($\boldsymbol{x}$) and net outputs ($\boldsymbol{y}$) are related by

$$\boldsymbol{x} = \boldsymbol{Ax} + \boldsymbol{y} \tag{4}$$

Postmultiplying equation (3) by $\boldsymbol{x}$, premultiplying equation (4) by $\boldsymbol{\lambda}$ and subtracting yields

$$\boldsymbol{lx} = \boldsymbol{\lambda y} \tag{5}$$

where $\boldsymbol{lx} \equiv H$. Hence

$$\boldsymbol{p}^{*}\boldsymbol{y} = \frac{\boldsymbol{\lambda y}}{\lambda_g} = \frac{H}{\lambda_g} \tag{6}$$

or net output aggregated in price terms is proportional to total value added.

But equation (6) is more than a trivial proportionality relation. For the total number of hours worked in various concrete activities can also be regarded as the total potential abstract social labour of society, which expresses itself in the money price of commodities. This social abstract labour is distributed across different production processes that together produce net outputs $\boldsymbol{y}$. So prices can be thought of as the means by which this distribution is effected. Equation (6) determines prices as the bearers of social labour time, which is obvious when all prices are proportional to labour values.

If the wage is w, the profit a capitalist appropriates from the production of a unit of commodity j when commodities exchange at prices p is $\pi_j = p_j - \sum_i p_i a_{ij} - wl_j$.

Aggregating these profits, we see that

$$s = \sum_j \pi_j x_j = p(I - A)x - wlx = py - wH = (m - w)H \tag{7}$$

Thus the capitalist who employs labour-power to produce a commodity appropriates a *profit*, or *surplus-value* equal to the excess of the value added by the expenditure of labour in production over the wage paid for the labour-power. By virtue of equivalent exchange at natural prices or values proportional to the labour time required to produce commodities, total profits must be proportional to total surplus-value in terms of labour-time, and total wages to total variable capital in terms of labour-time. In this manner, aggregate profits accruing to the capitalist class are determined as the unpaid labour of the working class.

The capitalist law of exchange

On this basis of equivalent exchange, Marx analysed with considerable historical and contemporary detail how capital (any sum of money invested in order to make more money) creates surplus-value in the production process, and then how surplus-value creates capital as an accumulation process. In essence this was what now would be called a macroeconomic approach. All individual capitals are treated qualitatively as identical, differing only in quantity. Any individual capital in these terms is representative of all capitals, and Marx talked in terms of 'capital in general'. As long as his focus was on the economic categories representing class, this was sufficient for his purpose of exposing and analysing the deepest determinations.

However, it was only a first step. The freedom of markets entails competition, for each individual capital pursues the highest profit on its investment, and this entails mobility of capital in addition to the previously presumed mobility of labour. If capitals are perfectly mobile, then competition must ensure an equalized rate of profit on average over repeated production periods. Thus, in an economy where capitalists as employers allocate social labour, the principle of the equalization of the rate of profit determines natural prices, while the principle of the equalization of the advantages of production tends to equalize wages, or more generally rates of exploitation (ratios of unpaid to paid labour, because workers are still free to move from sectors where they are more exploited to sectors where they are less exploited). There is no reason to presume the equalization of the profit rate is actually achieved – rather it is a tendency, whose long run achievement is continually disrupted by empirical contingency. Marx called the prices at which the rate of profit is equalized *prices of production*: they are Smith's natural prices when capitalist employers determine the distribution of labour among branches of commodity production. Such a determination is *the capitalist law of exchange*.

Prices of production in general are different from the natural prices-proportional-to-labour-time required of equations (1), (2) and (6). For once capital-in-general is individuated into competing capitals, those competing capitals will have production processes that typically differ in technology. There will be a whole spectrum of ratios of non-labour to labour inputs, from highly mechanized almost completely automated technologies to those that are very labour-intensive. Highly automated capitals employ very little labour; very labour-intensive industries employ a lot. With perfect labour mobility enforcing a uniform rate of surplus-value, highly automated capitals produce very little new value and very labour-intensive industries a lot. Therefore the prices at which each capital would earn the same rate of profit cannot be prices-proportional-to-values. Hence capitalist exchange (except under very special analytical assumptions) *must* be non-equivalent exchange. And this entails that *value is realized at prices of production in different sectors from where it was produced*. The competition among capitalist firms that enforces the tendency for rates of profit on invested capital to be equalized effectively redistributes surplus-value among the sectors of commodity production.

In principle, this does not affect equation (6), for *in the aggregate* value added is invariant to where it is produced: the total number of hours of labour remains the same. Hence writing $\boldsymbol{p}$ for the vector of prices of production,

$$\boldsymbol{py} = \frac{H}{\lambda_g} \tag{8}$$

Equations (6) and (8) have the same interpretation: prices distribute social labour across net output. They differ in that distribution according to whether commodity exchange or capitalist exchange is considered, but for prices to be bearers of social labour time, what matters is only that there *is* a distribution. The social division of labour allocates portions of social labour to production processes, and it does this through a decentralized price mechanism. Prices, qualitatively, are always the bearers of social labour, and, quantitatively, total net output, evaluated at whatever prices are, must always equal total hours worked at the prevailing value of money.

The redistribution of surplus-value through competition also does not affect the sale of labour-power for a wage, because there is no capitalist production process of labour-power, no rate of profit earned on its production and no technology of production to consider. Hence the left-hand side of equation (2) is not affected by the difference between commodity exchange and capitalist exchange:

$$\frac{\lambda_{lp}}{\lambda_g} = w \tag{9}$$

But the wage cannot be proportional to the labour value of the wage-bundle of commodities (which means that the latter does not determine the value of labour-power under capitalist exchange), and it is also unnecessarily restrictive to presume the whole wage is always spent, so that budget constraint part of equation (2) can be dropped. Equations (8) and (9) together imply that the value of labour-power is the wage share of money value added, so that, *however prices are conceived*, profits remain the measure of unpaid labour, the rate of surplus-value is the profit-wage ratio, and capitalist exchange is founded on exploitation.

We have emphasized that, equations (8) and (9) apart, the capitalist law of exchange entails that value appears in places other than where it is produced, and that this is not contingent or accidental but systemic. This feature of Marx's account is particularly important, and its implications are under-recognized. For unequal or non-equivalent exchange implies that surplus-value is redistributed. In principle, the magnitude of these redistributions can be calculated by multiplying each capital's wage bill by the uniform rate of exploitation, and comparing the resulting surplus-value produced in each firm or sector with the actual profits accruing there. But in practice this is complicated by another factor.

For non-equivalent exchange is a more general phenomenon than just the requirements made of prices by different technological structures. Consider again the equivalent exchanges of commodity exchange and of capital in general. Once a commodity has been produced, it has to be sold, and this requires human activity. Similarly, it takes human activity to assemble labour and non-labour inputs ready to commence production. However, selling an already produced commodity changes the form in which value exists (from a commodity-form to a money-form), but it does not change its amount. Similarly, using a sum of money to purchase labour and non-labour inputs again changes the form in which value exists (from a money-form to a productive-form), but it does not change its amount. Marx called the labour that is actually value-creating 'productive labour', and the labour that alters only the form in which value exists but not its amount (typically commercial and financial labour) 'unproductive labour'. And he also called 'unproductive' the pure labour of supervision. But all of these activities must be paid for, and the only source for their payment is the production of new value. Hence a more careful specification of what labour is to count as value-creating requires a further elaboration of unequal or non-equivalent exchange.

Unequal exchange means that Marx's analysis has deep and in some dimensions very non-intuitive implications. Even very large productive capitalist firms are small relative to the whole system of capitalist production, the division of labour it creates, and the enormous resulting pool of surplus-value in the whole world capitalist economy. Thus each capitalist firm makes a negligible contribution to the pool of surplus-value through the exploitation of its own workers. The profitability of any firm rests on its ability to secure a share of the pool of surplus-value through its competitive strategy. In extreme cases, such as land rents and intellectual property royalties and rents, the appropriators of surplus-value may make no contribution at all to the pool of surplus-value through production and the direct exploitation of workers. In many cases strategies that increase a productive firm's share of the pool of surplus-value, such as cost-reduction through technical change or shifting to lower-wage labour-power, also do contribute to enlarging the global pool of surplus-value. But the contribution any particular firm makes to this pool is bound to be small compared to the effects of its competitive strategy on its share of the pool.

The resulting apparent disconnection between the realization of surplus-value in particular firms or sectors and the expenditure of productive labour in actual production leads to widespread illusions and misconceptions in understanding the capitalist economic system. The most common misconception, which Marx’s detailed analyses in Volume III of *Capital* were aimed at dispelling, is that value and surplus-value are not actually produced by the expenditure of labour at all. Victims of this misconception (which include everyone educated to look at the world through the lenses of neoclassical price theory) will be led to one or another of the fallacious theories of value anatomized in Marx's *Theories of Surplus-Value*, such as the idea that value is the ‘economic (consumer) surplus’ realized from the transfer of assets from agents who subjectively value them less to agents who subjectively value them more through exchange. From these points of view the distinction between productive and unproductive labour, which was fundamental to the classical political economists and Marx, becomes incomprehensible.

Similarly, the perennial flourishing of enthusiasms for imaginary economies based on completely automated production of goods, services such as information processing, intellectual property creation, or financial manipulations that seem to involve negligible labour expenditure rests on the same misunderstanding. The dreamers of these alternative economic universes confuse the mode of appropriation of surplus-value with the conditions of production of surplus-value. From the point of view of a software seller with a powerful monopoly of a proprietary system subject to network externalities, who can sell the same software over and over again with negligible costs of production, the pool of surplus-value does indeed seem to be limited only by the software seller’s own imagination and competitive ruthlessness. In these cases (which are more and more prominent in the contemporary globalized economy) there can be very high degrees of increasing returns to scale and diminishing average costs to the appropriation of surplus-value. But the core lesson of the theory of value of the classical political economists is that the actual source of value and surplus-value lies in the expenditure of productive labour.

‘Dual system’ interpretations of the theory of value and the ‘transformation problem’

The interpretation of Marx's theory of value we have offered in the last section is sometimes called a ‘single-system’ theory, because it emphasizes the relationship between the theoretical categories of value and price and real-world money prices. Another influential body of work on the theory of value takes a different, 'dual-system', approach, based on a system of 'values' proportional to embodied labor coefficients that coexists with the phenomenal system of money prices. These embodied labor-coefficient values are determined according to the principles we have called the commodity law of exchange, in which mobility of labour leads to natural long-period prices of commodities proportional to the labour time required to produce them. Dual-system theorists identify Marxian categories such as the value of labour-power and the rate of exploitation in terms of this underlying, but not directly observable, system of values. In the dual-system framework, the question arises as to the relation between the system of values and the system of observable prices of production. The study of this relation constitutes the 'problem of the transformation of values into prices of production' or, more compactly, 'the transformation problem'.

The discussion of the transformation problem revolves around the mathematical investigation of the relation between equation (3), which is taken as defining values proportional to embodied labor coefficients, and the representation of profit-rate equalizing prices derived from Sraffa's work:

$$p = (1+r)pA + wl \tag{10}$$

where p is a vector of relative prices and the other symbols have the meanings we have assigned already. The main difficulty encountered in the transformation problem is in reproducing the invariance claimed by Marx in chapter 10 of Volume III of *Capital* for the total value of production, variable capital, surplus value, and hence the rate of surplus value and profit rate between the value and price of production schemes. This difficulty has led theorists in this tradition either to assert a meaning to value and its significance which, because of its detachment from the prices of equation (10), is vulnerable to the charge of arbitrariness (for example Sweezy (1942)); or it has led them to abandon a labour theory of value altogether, to concentrate on the analysis and implications of equation (10) (for example, Steedman (1977)).

From the point of view of the single-system approach, it is more natural to pose these issues in terms of an 'inverse transformation problem', which takes observed prices, output, and productive labor inputs as given and seeks to recover the abstract labor time embodied in commodities produced in each line of production. One way to solve this problem is to assume that rates of exploitation of productive labour are equalized across different sectors by the mobility of labor, which determines the abstract labour time imputed to each sector of production, and identifies the redistribution of surplus value between sectors in a pattern that is consistent with the economy-wide rate of surplus value defined earlier in our discussion.

Value and price in classical economics: a summary

Smith, Ricardo and Marx all understood the economy as a decentralized social organism which was self-organized through markets and the prices they established. All three presumed labour mobility and capital mobility. For all three, the relevant prices for political economic analysis were 'natural' prices (Smith and Ricardo), or 'prices of production' (Marx), prices at which the rate of profit was equalized. None considered at any moment of time that the rate of profit was actually equalized, so that explanation of prices required a ‘long period’ approach, in which economic laws were laws of tendency.

For Smith the social division of labour was organized through the profit-seeking actions of selfish individuals. In the absence of private property in land and means of production, labour mobility implied that a labour theory of value explained natural prices. But Smith never worked out how a labour theory of value could be applied to the property relations of a capitalist economy to explain rent and profits, and he quickly abandoned it in favour of his adding-up theory.

Ricardo shared Smith’s general vision, but extended the labour theory of value to the determination of natural prices in a capitalist economy in which there was private property both in land and in other non-labour inputs. But he was unable to do this precisely, and his specification of the labour theory of value must therefore be considered incomplete.

Marx took the vision of a decentralized social organism self-organized through markets and transformed it through a focus on antagonistic class relations in production rather than the individualistic exchange relations of avaricious traders. This he achieved through the development of the distinction between labour and labour-power, which emerged out of the contrast between ‘commodity exchange’ and ‘capitalist exchange’. Commodity exchange combined with input mobility entailed an exact labour theory of value. Capitalist exchange combined with input mobility entailed a labour theory of value that was exact only in the labour market and for total value added. But this was sufficient to explain the fact of exploitation, the rate of exploitation and the overall level of profits as unpaid labour. Individual prices remained qualitatively the bearers of social labour, but quantitatively diverged from labour values because capitalist exchange entailed systemic unequal or non-equivalent exchange.

The distinctions the classical political economists discovered, and Marx elaborated, between the phenomena of market prices, the underlying regularity of natural prices, and their connection with the emergent decentralized allocation of labour time enforced by commodity production have far-reaching implications. The distinction between value and price is the window through which we can understand the inner nature of the capitalist economy, and this remains the enduring feature of the classical approach to value and price as it culminated in the work of Marx.

References

Debreu, Gerard (1959), *Theory of Value.* Cowles Foundation Monograph 17. New York: John Wiley

Foley, Duncan K. (2010), What's wrong with the fundamental existence and welfare theorems?. *Journal of Economic Behavior & Organization*,. 75(2): 115-131

Hobbes, Thomas (2010 [1651]), *Leviathan*. Online at http://ebooks.adelaide.edu.au/h/hobbes/thomas/h68l/

Kirman, Alan. (2006), “A Journey Down the Wrong Road.” (http://www.sss.ias.edu/files/papers/econpaper73.pdf)

Koopmans, Tjalling C. (1957), *Three Essays on the State of Economic Science*. New York and London: McGraw-Hill

Kurz, Heinz D. and Neri Salvadori (1995), *Theory of Production.* Cambridge: Cambridge University Press

Little, William et al. (1973), *The Shorter Oxford English Dictionary On Historical Principles*. Oxford: Oxford University Press

Mandeville Bernard (2010 [1732]), *The Fable of the Bees or Private Vices, Publick Benefits*, 2 volumes. Volume 1. With a Commentary Critical, Historical, and Explanatory by F.B. Kaye. Online at http://ebooks.adelaide.edu.au/m/mandeville/bernard/bees/complete.html

Marx, Karl (1973), *Grundrisse*. Harmondsworth: Penguin

Marx, Karl (1976 [1867]), *Capital* Volume I. Harmondsworth: Penguin

Marx, Karl (1981 [1894]), *Capital* Volume III. Harmondsworth: Penguin

Marx, Karl (1988 [1868]), Letter to Kugelman 11 July 1868, in Karl Marx and Friedrich Engels (1988), *Collected Works*, Volume 43. London: Lawrence and Wishart. Online at http://www.marxists.org/archive/marx/works/1868/letters/68_07_11.htm

Marx, Karl (1994 [1867]), *The Value Form*. In Simon Mohun (ed.) (1994), *Debates in Value Theory*, London: Macmillan

Ricardo, David (1951), *On the Principles of Political Economy and Taxation*. Volume I of *The Works and Correspondence of David Ricardo*, edited by Piero Sraffa with the collaboration of M. H. Dobb. Cambridge: Cambridge University Press

Smith, Adam (2008 [1776]), *An Inquiry into the Nature and Causes of the Wealth of Nations*. Online at http://ebooks.adelaide.edu.au/s/smith/adam/s64w/

Shaikh, Anwar (1998), 'The Empirical Strength of the Labour Theory of Value'. Ch. 15 in Riccardo Bellofiore (ed.), *Marxian Economics: A Reappraisal*, Volume 2. London: Macmillan

Sraffa, Piero (1960), *Production of Commodities By Means of Commodities*. Cambridge: Cambridge University Press

Steedman, Ian (1977), *Marx After Sraffa*. London: New Left Books

Sweezy, Paul M. (1942), *The Theory of Capitalist Development. New York: Monthly Review Press*