

Adam Smith's Natural Prices, the Gravitation Metaphor, and the Purposes of Nature

David Andrews, Department of Economics, State University of New York at Oswego, USA
david.andrews@oswego.edu

Abstract

Adam Smith's 'natural price' has long been interpreted as a 'normal price' or 'centre of gravitation price' based on the famous gravitation metaphor of the *Wealth of Nations* I.vii, natural in the sense that it is the price that would result if competition were truly free, unobstructed by monopoly or government regulation, and could also therefore be called normal price, appealing to a sense of natural opposed to that which is produced artificially.

This essay has three purposes. First I criticise this interpretation of Smith's gravitation metaphor. For Smith, it is not a Newtonian metaphor for the attractive character of natural price, but rather an Aristotelian metaphor for the pattern of movement of market prices, in which natural price serves merely as a reference point.

Second I present an interpretation of Smith's natural price based on his understanding of nature, in the context of his assertions that the goals of nature are the self-preservation of individuals and the propagation of species, goals humans pursue with divided labour under bonds of mutual dependence, facilitated by exchange and hence prices. The natural price of a commodity is the price that supports nature's goals by providing for the maintenance of those who participate in production and supply in a manner that is just sufficient for these activities to continue indefinitely.

Third I highlight the similarity between natural prices construed in this way and the prices of Piero Sraffa's *Production of Commodities by Means of Commodities*.

Keywords: Adam Smith, Piero Sraffa, natural price, normal price, nature, gravitation

Introduction

At least since Alfred and Mary Paley Marshall's *The Economics of Industry* (1879), Adam Smith's 'natural price' has been interpreted as a 'normal price' or 'centre of gravitation price' based on the famous gravitation metaphor of Chapter 7 of Book One of the *Wealth of Nations*: 'The Normal Price, or as Adam Smith says, "the natural price is as it were the central price to which the prices of all commodities are continually gravitating. Different accidents may sometimes keep them suspended a good deal above it, and sometimes force them down even somewhat below it. But whatever may be the obstacles which hinder them from settling in this center of repose and continuance, they are constantly tending towards it"' (Marshall and Marshall 1879: 77; citing Smith *WN* I.vii.15).

The Marshalls took the gravitation metaphor to mean that natural price is natural in the sense that it is the price that would result if competition were truly free, unobstructed by monopoly or government regulation, and could also therefore be called normal price, appealing to a sense of natural opposed to that which is produced artificially.

A similar interpretation has been adopted by a number of more recent writers on classical political economy who argue, along with Marshall, that the centre of gravitation mechanism plays a crucial role in Smith's theory of natural price, writers including Pierangelo Garegnani, Geoffrey Harcourt, Ian Steedman, John Eatwell, Murray Milgate, Tony Aspromourgos, Heinz Kurz and Neri Salvadori.

'As we all know, [theorists including Adam Smith] understood the long-period position as the "centre" towards which the competitive economy would gravitate in the given long-period conditions' (Garegnani 1976: 27).

'The classical authors did not consider the "normal" values of the variables as purely ideal or theoretical; they saw them rather as "centres of gravitation", or "attractors", of actual or market values' (Kurz and Salvadori 1998: 3).

'Natural prices are the competitive "centre of gravitation" for fluctuations of market (i.e. actual) prices. By creating these categories Smith defined what the theory of value, the core of any analysis of a market economy, was to be about' (Eatwell and Milgate 1999: 83).

'With regard to commodity prices, the centerpiece of Smith's approach is a dynamic process: the converging or "gravitating" of market prices toward natural prices via competition' (Aspromourgos 2010: 65-6).

'Ever since the Physiocrats and Adam Smith, political economists have wrestled with the relationship between observable market prices [and] underlying natural prices ... Central to this analysis has been the concept of a centre of gravitation ... Common to them all is the concept of a central attractor' (Harcourt and Kriesler 2012: 9).¹

Despite substantial differences regarding the theory of value, Marshall shares with these scholars the idea that Smith's natural price is to be understood in terms of the economic process Smith illustrated with the gravitation metaphor. On this shared understanding, natural price is natural first and foremost because it is the price which is the outcome toward which market prices tend to move if they are neither obstructed nor restrained: 'whatever the differences between the two kinds of theory [that of the classical writers and that of Marshall] what concerns us here is only to point out that the notion of "long-period positions" as "centres" of gravitation was fundamentally the same in the two cases' (Garegnani 1976: 29).

This essay has three purposes, the first of which is to criticise the common interpretation of Smith's gravitation metaphor. Smith uses it, not in a Newtonian sense to represent the attractive character of natural price, but rather in an Empedoclean or Aristotelian sense to illustrate the pattern of movement of market prices, a pattern for which natural price serves merely as a reference point.²

A second purpose is to present an alternative interpretation of Smith's natural price based on his understanding of nature. Smith asserts that the goals of nature are the self-preservation of individuals and the propagation of species, goals humans pursue with divided labour under bonds of mutual dependence, facilitated by exchange and hence prices. The

¹ Aspromourgos (2010) provides the most comprehensive discussion of Smith's use of nature and the meaning of natural price.

² Empedocles was the first to formulate the four elements theory, but Aristotle is responsible for its mature form.

natural price of a commodity is the price that supports nature's goals by providing for the maintenance of those who participate in production and supply in a manner that is just sufficient for these activities to continue indefinitely.³

The third purpose of this essay is to highlight the similarity between natural prices construed in this way and the prices of Piero Sraffa's *Production of Commodities by Means of Commodities: Prelude to a Critique of Economic Theory*. Although Sraffa moves beyond Smith in a number of ways, he begins from similar assumptions, taking as given a society with divided labour, addresses the same problem of mutual dependence among members of such a society, and reaches similar conclusions, invoking exchange and prices.

This essay proceeds as follows. The first section examines the context in which Smith's gravitation metaphor appears in order to show that it was intended as an assertion about the movement of market prices rather than one about the meaning of natural price. Section Two explores the gravitation metaphor in detail to show that what Smith described is gravity in the ancient rather than the modern sense, implying that movement results from the inclination of market price rather than from any property of natural price. The third section focuses attention on Smith's understanding of nature, arguing that, according to Smith's Aristotelian usage, 'natural' refers to the reproduction of species, including the human species. Based on this discussion, Section Four presents an interpretation of the sense in which natural prices are said to be natural in Smith. Section Five turns to the prices of Sraffa's *Production of Commodities by Means of Commodities*, focusing on his discussion of the term natural price.

1. Gravitation in the Context of *Wealth of Nations* I.vii

Book I, Chapter VII of the *Wealth of Nations*, 'Of the Natural and Market Price of Commodities,' opens by postulating a society in which income is distributed among wages, profits and rents, in a manner with enough stability to justify the description of the rates of payments as 'ordinary': 'There is in every society or neighbourhood an ordinary or average rate both of wages and profit in every different employment of labour and stock' [and also rent] (WN I.vii.1). Smith defined these stable rates as the natural rates: 'These ordinary or average rates may be called the natural rates of wages, profit, and rent, at the time and place in which they commonly prevail' (WN I.vii.3).⁴ Smith takes as given, that is, that the object of study is a stably ongoing society with a division of labour that distributes income according to ownership of land, labour and capital.

Smith defined 'natural price' on the basis of these postulated rates of income distribution: 'When the price of any commodity is neither more nor less than what is sufficient to pay the rent of the land, the wages of the labour, and the profits of the stock employed in

³ A natural price understood in this way may be the normal price, or it may not, but the term 'normal price' fails to capture the full meaning of Smith's 'natural price' because it does not reflect this purposive generative movement of Smith's nature. If a substitute for Smith's natural price is needed, 'reproduction price,' 'necessary price' or 'continuation price' would be superior to 'normal price' or 'ordinary price,' both of which for Smith could only apply to market prices.

⁴ Although Smith called these prices natural he acknowledged that they are not purely natural in the sense of being necessary for physical reproduction, but have also a conventional element through the conventionality of wages. He argued that the natural rate of wages would tend to be that which is sufficient for the self-preservation of individuals, 'the lowest which is consistent with common humanity' (WN I.viii.16; also I.viii.28), but he made clear that this did not mean the minimum necessary for biological survival, distinguishing between a component of the wage that is absolutely necessary for physical survival, and a societal component which varied across different countries: 'By necessities I understand, not only the commodities which are indispensably necessary for the support of life, but whatever the custom of the country renders it indecent for creditable people, even of the lowest order, to be without' (WN V.ii.k.3). Smith says that these 'may be called' the natural rates, even though he acknowledged that, strictly speaking, the natural rate of wages was not natural.

raising, preparing, and bringing it to market, according to their natural rates, the commodity is then sold for what may be called its natural price' (I.vii.4).

Smith continued with two points about natural price, explaining first that the natural price is 'precisely ... what it is worth, or ... what [a commodity] really costs the person who brings it to market' (I.viii.5) and second that it 'is not always the lowest at which a dealer may sometimes sell his goods, it is the lowest at which he is likely to sell them for any considerable time' (I.vii.6). We will return to these points because they constitute Smith's explanation of natural price, but our concern here is with the gravitation mechanism, so it is only necessary to note that neither point Smith makes here about natural price involves any reference to any property of attraction or to market prices.

Only after having explained natural price does Smith introduce market price, defined as the 'actual price at which any commodity is commonly sold' (I.vii.7) and 'regulated by the proportion between the quantity which is actually brought to market, and the demand of those who are willing to pay the natural price of the commodity' (I.vii.8).

Smith next explained how this proportion expressing relative shortages and surpluses drives the movements of market prices, the former leading to increases in market prices, the latter to decreases. On this basis Smith explained how the 'quantity of every commodity brought to market naturally suits itself to the effectual demand,' a surplus leading to a fall in price and a reduction in the quantity brought, a shortage leading to an increase (I.vii.9-14).

It is at this point that Smith introduces the gravitation metaphor: 'The natural price, therefore, is, as it were, the central price, to which the prices of all commodities are continually gravitating. Different accidents may sometimes keep them suspended a good deal above it, and sometimes force them down even somewhat below it. But whatever may be the obstacles which hinder them from settling in this center of repose and continuance, they are constantly tending towards it' (I.vii.15).

The word 'therefore' directly links the claim to the previous discussion in which shortages and surpluses are eliminated through movements of prices, so the gravitation metaphor represents a summary of those movements. The natural price, described in terms only of its location as the 'central price,' serves as a reference point, as a metaphorical place, in terms of which Smith describes the movement of market prices. This involves no claim about properties of natural price, in particular, no claim that it has any power to attract market prices.

Smith goes on to discuss 'occasional and temporary fluctuations' in market prices and then systematic obstructions: 'particular accidents, sometimes natural causes, and sometimes particular regulations of police, may, in many commodities, keep up the market price, for a long time together, a good deal above the natural price' (I.vii.20).

Smith continues by setting deviations of market prices from natural prices aside: 'This is all that I think necessary to be observed at present concerning the deviations, whether occasional or permanent, of the market price of commodities from the natural price' (I.vii.32). He does this because both the random fluctuations as well as the more systematic obstructions make no contribution to the ongoing functioning of the economic system and are therefore logically independent of natural price. David Ricardo stated the same point more forcefully and directly:

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. (1817: 91-2; emphasis added)

Ricardo does not deny that deviations of market price from natural price occur, but rather claims that such deviations are independent of the determination of natural prices and based on conditions independent of the principles that regulate natural prices. Such deviations are, therefore, of no theoretical interest. In setting them aside, Smith and Ricardo treat market prices as equal to natural prices for their theoretical purposes.

Once deviations of market price from natural price are excluded, the process of adjustment Smith illustrated with the gravitation metaphor loses its *raison d'être* and is also excluded. The gravitation metaphor arises only in connection with these deviations of market price from natural price. The metaphor's significance and function disappear when these deviations are set aside.

The adjustment process that Smith likened to gravity, then, is separate from the determination of natural prices, describing the movements of market prices when they deviate from natural prices, movements that have no intrinsic theoretical interest. Along with the gravitation metaphor, it provides no clues as to the nature of natural price.

2. Empedoclean or Newtonian Gravitation?⁵

The idea of natural price as a 'normal price,' 'centre of gravity' or 'central attractor' involves interpreting Smith's gravity in a Newtonian sense as an attractive force between bodies: 'The power of attraction which, according to the [Newtonian] theory of gravity, each body possesses, is in proportion to the quantity of matter contained in that body' (*Astronomy* IV.75). Smith, however, was closely familiar with another understanding of gravity, the ancient view associated with the theory of the four elements, in its original form due to Empedocles.

Smith expressed his great admiration for Newton in his essay known as the 'History of Astronomy': 'The superior genius and sagacity of Sir Isaac Newton . . . made the most happy, and, we may now say, the greatest and most admirable improvement that was ever made in philosophy, when he discovered, that he could join together the movements of the Planets by so familiar a principle of connection, which completely removed all the difficulties the imagination had hitherto felt in attending to them' (*Astronomy* IV.67). But here we are concerned with a metaphor, so this is not a question of in which theory Smith had more confidence.

It has been noted by several writers that the sense in which Smith used gravity in explicating his famous metaphor is not quite Newtonian.⁶ Referring to the gravitation metaphor, I. Bernard Cohen claims that Smith was Newtonian, but only imperfectly and incompletely, that what Smith 'took from Newton's physics was perfectly correct *up to a point*, it was merely incomplete. . . . Often cited as an instance of Smith's alleged Newtonianism, this

⁵ The question of Newton's influence on Smith is beyond the scope of this essay. See Redman (1993) and Montes (2003, 2006)

⁶ Cf. Schliesser (2005: 40-1).

use of gravity is an illustration of imperfect replication.'

The problem, according to Cohen, is that 'Smith did not take account of one of the features of Newtonian gravitation,' namely, 'its property of acting mutually between all pairs of gravitating bodies, so that there is always an equal and opposite force.' According to Smith's metaphor market prices gravitate toward natural prices. If Smith were to replicate Newton's gravity correctly and completely, market prices would also exert a mutual gravitational pull on natural price: 'a complete homology with Newtonian physics would require that the natural price must also gravitate toward all other prices' (Cohen 1994: 65-66).⁷

I argue that the sense of gravity in Smith's metaphor is not just imperfectly Newtonian, but pre-modern, involving not a force of attraction drawing prices toward one another, but an inclination on the part of the market prices toward a central point of rest, a sense Smith described in his essay on *Ancient Physics*. According to the theory of the four elements, each element earth, water, air and fire, had 'a particular region allotted to it,' a 'place of rest, to which it naturally tended, by its motion, either up or down, in a straight line, and where, when it had arrived, it naturally ceased to move'. The levity of air and fire gave them a tendency to move outward away from the centre, while the 'natural motion' of water and earth, due to their gravity, 'was downwards, in a strait line to the center'. Once an element arrived in its allotted place, 'each of them tended to a state of eternal repose and inaction'.

Consider once more the relevant passage in this light: 'The natural price, therefore, is, as it were, the central price, to which the prices of all commodities are continually gravitating. Different accidents may sometimes keep them suspended a good deal above it, and sometimes force them down even somewhat below it. But whatever may be the obstacles which hinder them from settling in this center of repose and continuance, they are constantly tending towards it.'

There are three clear indications in the passage that this gravity is Empedoclean or Aristotelian rather than Newtonian. First, Smith's language indicates that the movement is the result of an inclination of the market prices, which are gravitating, tending to move as though they possessed gravity. There is no suggestion of Newtonian gravity as a mutually attractive force pulling two bodies together. Second, as with Empedocles, the direction those things with gravity tend to move is in a straight line toward a central point. Newtonian gravity pulls bodies in the direction of other bodies, lacking the notion of a centre or central point altogether. Third, the gravitation of market prices directs them toward achievement of a place 'of repose and continuance,' also an idea central to the ancient account of gravity but completely foreign to the Newtonian one.

The gravitation metaphor, then, reflects the movements of market prices but without contributing anything to the definition of natural price, just as the centre of the earth, according to the ancient theory, serves as the place of repose for those things with gravity without telling us anything about the centre of the earth in itself.

In order to understand Smith's natural price, then, it is necessary to turn away from the gravitation metaphor and to examine Smith's definition of natural price. It will be useful, however, to first consider what Smith understood in his use of nature and natural.

⁷ Sinha, commenting on this paper, suggests that the failure of Smith's natural prices and market prices to display Newtonian attraction is due the implicit assumption by Smith of constant returns to scale in each industry, but Sraffa (1926) has shown that the classical theory excludes the possibility of such a functional relationship between cost of production and quantity produced within an isolated industry.

3. Adam Smith and the Purposes of Nature

Smith wrote repeatedly that the primary purposes of nature are the self-preservation of individuals and the propagation of species: 'Thus self-preservation, and the propagation of the species, are the great ends which Nature seems to have proposed in the formation of all animals' (*TMS* II.i.5.9: 77); 'In every part of the universe we observe means adjusted with the nicest artifice to the ends which they are intended to produce; and in the mechanism of a plant, or animal body, admire how every thing is contrived for advancing the two great purposes of nature, the support of the individual, and the propagation of the species' (*TMS* II.ii.3.5: 87). Since the self-preservation of individuals is a means to the propagation of the species, the former is subsumed under the latter and thus Smith also referred to the single purpose of nature as reproduction: '[Nature's] great purpose, the *continuance and propagation* of each species' (*ED* 23: 571).⁸

In this sense, nature, in pursuing its goal, is the cause of a certain systematic activity oriented toward continuation of the various kinds of natural bodies. This is a teleological sense in that the activity of which nature is the cause is directed at the achievement of goals or purposes.

This is not original, but strongly suggestive of Aristotle, who took the same view, joining the goals of self-preservation and reproduction as the primary intentions of nature and the primary focus of the activities of living beings: 'The life of animals, then, may be divided into two acts – procreation and feeding; for on these two acts all their interests and life concentrate' (*History of Animals* 589a 2-4). As Aristotle scholar Mariska Leunissen writes: 'The nutritive capacity is . . . the ultimate principle of life and the one capacity that is common to all living beings.' Aristotle defines it as the capacity for both reproducing and using food, which are the 'most natural functions' among living beings. (2010: 63). Similarly, philosopher Martha Nussbaum writes: 'This capacity – to maintain functional states through self-nutrition and to propagate them through reproduction – is the mark that set off the living from the lifeless' (1986: 76). In this sense Aristotle says that the nutritive capacity is the 'nature' of plants and animals: 'the nutritive soul . . . is also the generative soul, and this is the nature of every organism, existing in all animals and plants' (*Generation of Animals* 740b9-741a5).

Smith and Aristotle both believed that human beings were distinctive among animals for a number of reasons, but neither exempted humans from the overall goals of nature. According to Smith's *Lectures on Jurisprudence*, 'Food, cloaths, and lodging are all the wants of any animal whatever' (LJB.207: 487) including humanity, as he also identified these same things necessary for self-preservation as 'three great wants of mankind' (LJA vi.24: 340) and as 'our three humble necessities' (LJB.209: 488).

Like Aristotle, Smith suggested that satisfying these needs was a primary activity of human enterprise, although he recognised that while these are, in a sense, natural necessities, they are not merely natural necessities: 'The whole industry of human life is employed not in procuring the supply of our three humble necessities, food, cloaths, and lodging, but in procuring the conveniences of it according to the nicety and [and] delicacy of our taste' (LJB.209: 488).

The pursuit of these necessities forms the basis for the activities of society more broadly: 'in a certain view of things all the arts, the sciences, law and government, wisdom, and even virtue itself tend all to this one thing, the providing meat, drink, rayment, and lodging for men' (LJA vi.20: 338). Money bears the same purpose: 'The intention of money as an

⁸ Smith also suggested that happiness was the purpose of human beings. The position, shared by Aristotle, does not contradict Smith's claims that nature's goals are self-preservation and reproduction, any more than it did Aristotle's. Self-preservation and reproduction are minimal conditions for all life, but different species have different and distinctive capacities beyond this.

instrument of commerce is to circulate goods necessary for men, and food, cloaths, and lodging' (LJA vi.127: 377).

In drawing this comparison between Smith's use of nature with respect to prices and Aristotle's understanding of nature, I should emphasise that I am not suggesting that Smith followed Aristotle's writings on economics, for example, on household management, exchange or chrematistics.⁹

Aristotle discussed at great length the nourishment and reproduction of non-human animals. Smith's discussion of human reproduction represents an extension of Aristotle's approach to the human species. This does not closely follow what Aristotle wrote about human economy, but it follows a direction that can be found in his other writings.

4. Natural Prices and the Purposes of Nature

Despite the similarity between humans and other animals as self-maintaining organisms, Smith emphasised the uniqueness of the human mode of meeting nature's purposes, of preserving one's self, which, unlike other animals, involves communication and cooperation. Smith asserts that adult non-human animals 'live intirely independent of others' unable to use the skills in combination with others: 'The swiftness of the greyhound, the strength and sagacity of the mastiff, and the docility of the sheep dog, as they do not occasion a division of work, no way ease the labour of the species. Each works for himself.'

Humans, on the other hand, possessed of language and the ability to cooperate, can work together by dividing labour and specialising. They are thus able to 'ease the labour of the species' or the group. Although born with few physical advantages compared with other animals, only humans are able to develop specialised skills in various fields of endeavour that are complementary to each other.

The division of labour, according to Smith, allows humans to be massively more productive than other animals, but it also creates a problem. Those who acquire and practice specialised skills are dependent on others for their subsistence (aside from use of what one produces one's self), so an advanced division of labour creates a situation of extreme mutual dependence. Thus, for Smith, as for Aristotle, people are inherently social, brought together by their need for each other: 'man ... can subsist only in society' (*TMS* II.ii.3.1).

Nature did not, according to Smith, leave it up to human beings to discover a means to manage this mutual dependence, but implanted within people an inclination to ('truck, barter' and) exchange which, Smith famously argues, is an effective means of gaining the cooperation of others under such circumstances and overcoming the problem of dependence:

'Man continually standing in need of the assistance of others, must fall upon some means to procure their help. This he does not merely by coaxing and courting; he does not expect it unless he can turn it to your advantage or make it appear to be so. Mere love is not sufficient for it, till he applies in some way to your self-love. A bargain does this in the easiest manner' (LJA vi.45: 347-8; cf. *WN* I.ii.2).

Exchange therefore arises by nature and solves a problem created by nature in such a way as to allow for the realisation of nature's purpose, the survival of the human species. As the terms of exchange, prices are similarly connected to nature, playing a corresponding role in the accomplishment of nature's ends. From this perspective, the natural prices would be

⁹ On Aristotle's economic writings, see Crespo (2006, 2008a, 2008b, 2008c).

those that precisely fit nature's goals for humans, their survival, and this, I suggest, is what we find in the *Wealth of Nations*.

As noted above, Smith defined natural price in the *Wealth of Nations* as 'neither more nor less than what is sufficient to pay the rent of the land, the wages of the labour, and the profits of the stock employed in raising, preparing, and bringing it to market, according to their natural rates' (I.vii.4). Natural price equals the cost of production, but Smith's explanation shows that the significance of natural price extends beyond simply being the cost of production to contributing to the continuation of production.

Smith made two related points in explanation of his natural price. First, the natural price represents the value of a commodity from the perspective of the person who supplies the market and therefore includes profit: 'The commodity is then sold precisely for what it is worth, or for what it really costs the person who brings it to market'. Smith does not say explicitly why the perspective of the supplier should be privileged here, why the real cost to the person who supplies the commodity is what it is worth in a general sense, as opposed, for example, to what a commodity is worth according to the producer or the consumer, but the answer can be inferred from Smith's second explanatory comment: 'Though the price, therefore, which leaves him this profit, is not always the lowest at which a dealer may sometimes sell his goods, it is the lowest at which he is likely to sell them for any considerable time; at least where there is perfect liberty, or where he may change his trade as often as he pleases.'

The natural price is the lowest price that makes it possible for the supply of the commodity to continue 'for any considerable time.' Although this introduces a time element into the analysis, it is not the duration of periods of time that are at stake, but the possibility of ongoing continuation based on the revenue provided by the natural price: 'The natural price... is the lowest which can be taken, not upon every occasion, indeed, but for any considerable time together... the lowest which the sellers can commonly afford to take, and at the same time continue their business' (WN I.vii.27). This element of continuation ties natural price to the purposes of nature.

The perspective of the person supplying the commodity to the market is relevant, then, because that is the person whose role it is to continue supplying the market. Natural price is the price that is just sufficient to actuate the person with the capacity to allow business – production, supply and exchange – to continue in an ongoing, self-sustaining way.

We see the roots of this idea in Smith's *Lectures on Jurisprudence*, where the natural price is similarly tied to the division of labour and reproduction as the price that supports the continuation of business by incentivising the relevant specialised labour, as that price which 'is necessary to induce one to apply to a particular business,' sufficient not only to maintain the specialised labourer but also to compensate the costs of acquiring the specialised skills: 'Thus one would not become a hackneywriter unless he had a prospect of maintaining himself and recompensing the expense of education.'

While the maintenance of the labourer is crucial, the natural price must be sufficient not only to maintain the labourer, but to support continuing business activities, including the ongoing acquisition and practice of the specialised skills: 'Maintenance is the first thing necessary to be afforded by every business. But if this trade gives no more than bare maintenance this will not induce any one to enter into it. I perhaps having by some accident fallen into some strange out-of-the-way business, may by dint of application make a miserable lively hood of it, but if this be all, the trade will end in me.'¹⁰

¹⁰ Smith likewise emphasised that natural wages must be sufficient not only for the self-preservation of the individual labourer, but also for the propagation of the species: 'They must even upon most occasions be somewhat more; otherwise it would be impossible for him to bring up a family, and the race of such workmen could not last beyond the first generation' (*Wealth of Nations* I.viii.15).

Again, the natural price is the lowest price that will allow the business to continue indefinitely. It is not necessary that the business actually continue indefinitely or even for a long period of time in fact because for Smith natural price is the theoretical condition that must be satisfied for continuation regardless of whether the market price is greater, lower or equal to it.¹¹ If the condition is minimally satisfied, then the business is able to continue, if not, it will not.

Although natural price is equal to the cost of production, it is not simply the historical expense involved in the production that is at stake here, but the revenue that will be sufficient to continue the supply of commodities to the market, to keep commodities in motion, to continue the business. The revenue constituted by natural price is important not just because it is sufficient to pay the producer of the commodity that has been sold, but because it allows the process to go on. The natural price in both the *Lectures on Jurisprudence* and *Wealth of Nations* promotes the goals of nature, continuation of production, the self-maintenance of individuals and the reproduction of the system as a whole. The natural price, in both cases, is the price that fulfils the conditions necessary for ongoing production and hence allow for the survival of human beings and the propagation of the human species.

5. Natural Price and *Production of Commodities*

Piero Sraffa repeatedly called attention to the 'connection' between his book *Production of Commodities* and 'the theories of the old classical economists,' describing his own 'standpoint' as 'that of the old classical economists from Adam Smith to Ricardo' (1960: v) and suggesting that the classical term 'natural price' would be a suitable label for the prices of his own models.

The similarities between Smith's natural price and Sraffa's prices can be seen in Sraffa's discussion of price concepts and terms, but it will be necessary to trace Sraffa's path to get to that discussion.

As with Adam Smith's discussion of natural price, Sraffa began *Production of Commodities* by postulating a society that continues to exist stably over time because it produces enough output, with a division of labour supported by exchange among mutually dependent producers: 'Let us consider an extremely simple society which produces just enough to maintain itself. Commodities are produced by separate industries and are exchanged for one another at a market held after the harvest' (1960: 3).¹²

Sraffa begins then, as does Smith's discussion of natural price, by taking a living, producing economic society with division of labour as given and asking how this society continues to survive as a stable unified entity. On the basis of just a few simple assumptions – that commodities are produced in single product industries with no surplus and exchanged with a single price for each commodity – Sraffa demonstrates that the problem can, as Smith suggested, be solved through exchange: 'There is a unique set of exchange-values which if adopted by the market restores the original distribution of the products and makes it

¹¹ In later lectures, Smith added compensation for risk to the list of expenses that natural price must cover if ongoing production is to be sustained: 'A man then has the natural price of his labour when it is sufficient to maintain him during the time of labour, to defray the expense of education, and to compensate the risk of not living long enough and of not succeeding in the business. When a man has this, there is sufficient encouragement to the labourer and the commodity will be cultivated in proportion to the demand' (LJB.227: 495-6).

¹² Sraffa does not address money, which plays no role in *Production of Commodities*, but it is not explicitly excluded either. Money might be used to facilitate exchange within the market held after the harvest, but Sraffa did not specify any of the institutional details through which that exchange is carried out, except in vague terms a market after the harvest.

possible for the process to be repeated; such values spring directly from the methods of production' (1960: 3).

Sraffa's claim that the values 'spring directly from the methods of production' has often been taken to mean that prices are determined solely by technology, for example, 'relative prices depend on the conditions of production' (Woods 1990: 16, 31), because each equation represents a production process. This formulation, however, conceals the role of the condition of reproduction, which does not appear as a variable in any of the equations, but is the condition for the solution of the equations. The requirement of reproduction drives the solution of the equations in a manner analogous to the way that the equilibrium condition drives the solution of supply and demand equations. The magnitudes of the prices will depend on technology, but they are prices with a purpose, that is, to facilitate reproduction.

As in Smith, the division of labour and the dependence that it creates plays a crucial role throughout *Production of Commodities* – reproduction requires exchange among distinct industries as each requires inputs from others. This contrasts sharply with Marshall's assumption that the forces that determine prices can be isolated in supply and demand functions peculiar to a given industry.

Sraffa's next model, of production with a surplus and a corresponding uniform rate of profit, follows the same principles. Sraffa then introduced the well-known distinction between basic and nonbasics, between those commodities that play a role in the determination of the system of prices and those that do not, on the basis of whether they enter, directly or indirectly, into the production of every other commodity. The prices of basic commodities play a role in the determination of the system of prices as a whole while the prices of non-basics do not:

'These products have no part in the determination of the system. Their role is purely passive. If an invention were to reduce by half the quantity of each of the means of production which are required to produce a unit of a [non-basic] commodity of this type, the commodity itself would be halved in price, but there would be no further consequences; the price-relations of the other products and the rate of profits would remain unaffected. But if such a change occurred in the production of a commodity of the opposite type [basic], which does enter the means of production, all prices would be affected and the rate of profits would be changed' (1960: 8).

Sraffa's discussion of natural price immediately follows the introduction of the distinction between basic and non-basic commodities. Up to that point, Sraffa described the exchange ratios of his system as prices and values, but then suggested that it 'might be thought more appropriate' that 'costs of production' be used instead. The question concerns the conceptual relationship between prices and costs of production and the meaning of the terms. It might be suggested that the mathematical structure is more important than what the variables are called. Mathematically, prices equal costs of production, the values depending on the equations and not at all on their names. But this was not the view of Sraffa for whom the point was terminological and theoretical rather than mathematical.

Sraffa claimed that the term 'cost of production' is an appropriate description of the prices of nonbasic commodities because they simply reflect their costs of production and nothing beyond: 'their exchange ratio is merely a reflection of what must be paid for the means of production, labour and profits in order to produce them – there is no mutual dependence'.

The situation of a basic commodity, however, is different in that its price is not only equal to what was paid to produce it, but also has 'another aspect to be considered' in its role in the reproduction of the system as a whole: its 'exchange ratio depends as much on the use that is made of it in the production of other basic commodities as on the extent to which those commodities enter its own production' (1960: 9).

For this reason, Sraffa argues, to label the prices of his model 'costs of production' would be misleading except with respect to nonbasics. A broader term is needed, that is, one that captures the fact that the price of a basic commodity is equal to its costs of production, but also captures the fact that it is determined by its role in the reproduction and continuation of the overall system: 'a less one-sided description than cost of production therefore seems to be required'.

For the sake of brevity, Sraffa does not use Smith's natural price, but according to Sraffa, natural price does capture this aspect of the prices of basics: 'Such classical terms as "necessary price", "natural price", or "price of production" would meet the case' (1960: 9).

In Sraffa's view, that is, 'natural price' as used by Smith does not share the one-sidedness of 'cost of production' and captures the other aspect, 'the use that is made of' a commodity, its participation in the reproduction of the system as a whole.

Although Sraffa develops the point much further than Smith does, this notion of basicness as something equal to costs of production but moving beyond to include participation in the determination of the system as a whole parallels what I have argued about Smith's definition and explanation of natural price – that it is equal to the costs of production, but also that it is important for reasons that do not merely look backward at production but forward to use of the revenue to continue business in a self-maintaining way.

In this way Sraffa develops a price concept close to Smith's concept of natural price, without any mention of market prices or the adjustment process Smith compared to gravitation, consistent with Ricardo's claim that deviations of market prices from natural prices are of no theoretical interest. In excluding market prices, then, Sraffa followed the examples set by Smith and Ricardo.

Conclusion

Sraffa and Smith begin from the same place and ask the same question. Both begin with a given economic system characterised by a division of labour that exists and continues to exist through time. That such a society exists is evidence that it maintains and reproduces itself, in the sense that any thing that actually exists, as Aristotle pointed out, must be in a constant state of continuing its existence by maintaining itself and reproducing itself through time – otherwise it would have ceased to exist. The question to be directed at any such existent, according to Aristotle's approach, is how, in what manner, it manages to carry out this activity of ongoing existence. The answer to this question corresponds to the nature and content of animal life.

Both Smith and Sraffa answer that exchange plays the key role with the price system providing the conditions for continuing reproduction and the ongoing survival of the human species. Those prices, that are just sufficient to provide for ongoing production, supply and exchange, may, therefore, be called natural prices because they support the purposes of nature. These prices, independent of the deviation of market prices from natural price and the gravitation-like adjustment process, are equal to costs of production, but involve something more than simply cost of production. They contribute to the feeding, reproduction, and continuation of humanity.

Acknowledgements

I gratefully acknowledge comments on the paper made in the *Economic Thought* Open Peer Discussion Forum by Leonidas Montes, Maria Elton and Ajit Sinha.

References

Aristotle. 1942. *Aristotle: Generation of Animals*. Translated by A. L. Peck. Cambridge, Harvard UP.

Aristotle. 1878. *Aristotle's History of animals. In ten books*. Translated by R. Cresswell. London: G. Bell.

Aspromourgos, T. 2009. *The science of wealth: Adam Smith and the framing of political economy*. London: Routledge.

Cohen, I. B. 1994. 'Newton and the social sciences, with special reference to economics, or, the case of the missing paradigm,' in Philip Mirowski, *Natural Images in Economic Thought: 'Markets Read in Tooth and Claw'*. Cambridge: CUP. 55-90

Crespo, R. F., 2006. 'The Ontology of the "Economic": an Aristotelian Analysis', *Cambridge Journal of Economics*, 30.5.767-781.

Crespo, R. F., 2008a, 'Aristotle's Science of Economics', in Samuel Gregg and Ian Harper (eds.), *Christian Morality and Market Economies: Theological and Philosophical Perspectives*, Edward Elgar, 13-24.

Crespo, R. F. 2008b. "'The 'Economic' According to Aristotle: Ethical, Political and Epistemological Implications', *Foundations of Science*, 13.3-4.281-294.

Crespo, R. F. 2008c. 'Aristotle', in Irene van Staveren and Jan Peil (eds.), *Elgar Handbook of Economics and Ethics*, Cheltenham and Northampton, 14-20.

Eatwell, J. and M. Milgate. 1999 'Some deficiencies in Walrasian intertemporal general equilibrium,' in Gary Mongiovi, and Fabio Petri. *Value, Distribution and Capital*. Routledge. 82-93

Garegnani, Pierangelo. [1976] 2003. 'On a Change in the Notion of Equilibrium in Recent Work on Value and Distribution: A Comment on Samuelson.' In *The Legacy of Piero Sraffa*. Volume 2, edited by Heinz D. Kurz and Neri Salvadori, 451–471.

Harcourt, G.C. and P. Kriesler, 2012. Introduction (To *Handbook of Post-Keynesian Economics*, Oxford University Press: USA). UNSW Australian School of Business Research Paper No. 2012-33.

Kurz, H. and N. Salvadori, 1998. *Understanding 'Classical' Economics: Studies in long-period theory*. London: Routledge.

Leunissen, M. 2010. *Explanation and Teleology in Aristotle's Science of Nature*. Cambridge: Cambridge UP.

Marshall, Alfred, and Mary Paley Marshall. 1879. *The Economics of Industry*. London: Macmillan.

Montes, L. 2003. 'Smith and Newton: some methodological issues concerning general economic equilibrium theory', *Cambridge Journal of Economics*, 27.5.723-47.

Montes, L. 2006. 'On Smith's Newtonianism and general equilibrium theory,' in L. Montes and E. Schliesser eds. *New Voices on Adam Smith*, Routledge, 247-70.

Nussbaum, M. C. 1986. *Aristotle's De Motu Animalium*. Princeton: Princeton UP.

Redman, D.A. 1993. 'Adam Smith and Isaac Newton,' *Scottish Journal of Political Economy*, 40.2.210-230.

Ricardo, David. 1966. *The Works and Correspondence of David Ricardo*, Volume I *On the Principles of Political Economy and Taxation*. Edited by Piero Sraffa. Cambridge University Press.

Schliesser, Eric. 2005. 'Some Principles of Adam Smith's Newtonian Methods in the Wealth of Nations: In Memoriam: I. Bernard Cohen.' In *Research in the History of Economic Thought and Methodology: A Research Annual*, edited by Warren J. Samuels, Jeff E. Biddle, and Ross B. Emmett, 33–74, vol. 23-A.

Smith, A. [1759] 1976. *The Theory of Moral Sentiments*. Oxford: Clarendon Press. (TMS)

Smith, A. [1762] 1978. *Lectures on Jurisprudence*. Oxford: Clarendon Press. (LJ)

Smith, A. [1776] 1976. *An Inquiry into the Nature and Causes of the Wealth of Nations*. Oxford: Clarendon Press. (WN)

Smith, A. [1795] 1980. On the Principles that Lead and Direct Philosophical Enquiries, illustrated by the History of Astronomy (HA); by the History of the Ancient Physics (AP); by the History of the Ancient Logics and Metaphysics. In *Essays on Philosophical Subjects*. Oxford: Oxford UP.

Sraffa, Piero. 1926. 'The Laws of Returns under Competitive Conditions', *Economic Journal*, 36.44.535-550.

Sraffa, Piero. 1960. *Production of Commodities by Means of Commodities; Prelude to a Critique of Economic Theory*. Cambridge University Press.

Woods, J. E. 1990. *The Production of Commodities: An Introduction to Sraffa*. Atlantic Highlands, NJ: Humanities Press International.

SUGGESTED CITATION:

Andrews, D. (2014) 'Adam Smith's Natural Prices, the Gravitation Metaphor, and the Purposes of Nature'. *Economic Thought*, 3.1, pp. 42-55. <http://www.worldeconomicsassociation.org/files/journals/economicthought/WEA-ET-3-1-Andrews.pdf>