What Is Supply-and-Demand? Rationalizing the Marshallian Cross, 1838–1890

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This study takes its bearings from the proposition that the supply-and-demand apparatus of the 'Marshallian cross' is an unsatisfactory and implausible representation of actual supply and demand forces, which are better characterized in the manner of the classical economists. From that point of departure it then enquires into how and why that representation nevertheless arose in the period from 1838 to 1890, notwithstanding its lack of robustness as economic theory – via consideration of the economics of four key contributors prior to Marshall. The investigation confirms that there is no plausible basis for a general presumption in favour of the conventional rising supply function – other than the marginal productivity theory of factor pricing, which is itself unsatisfactory. There are multiple reasons for the rise of the apparatus of supply-and-demand functions, notwithstanding its intrinsic implausibility.

1. INTRODUCTION

Fundamental to conventional economics for much of the last 100 years is a concept of 'equilibrium' price as the unique price which ensures or supports a balance between planned market supply and planned market demand, with planned supply and demand conceived of, respectively, as a positive function and a negative function of 'the' market price. (Hereafter, explicit reference to 'planned' magnitudes can be left aside, and supply-and-demand is referred to as 'SAD' for short.) Hence arises the ubiquitous diagrammatic representation: the intersecting SAD curves of the partial equilibrium 'Marshallian cross' – although the earliest instance of such a diagram is due to Antoine-Augustin Cournot rather than Alfred Marshall.[1] In the first instance, this apparatus of SAD functions is applied to consumer goods in particular, but it is also conceived of as applicable to 'factors of production' – and its ubiquity is evident in the pervasive presence of the diagram in many other contexts as well. The price equilibrium associated with the apparatus of course also entails simultaneous determination of an equilibrium quantity transacted.

This study takes its bearings from the proposition, argued in sections 2 and 3, that the conventional SAD functions – the standard, once-intersecting SAD curves of the partial equilibrium cross – are an unsatisfactory and implausible representation of actual SAD forces in a decentralized economy. Those forces are better characterized in the manner they were by the classical economists, from William Petty to Karl Marx. But if conventional SAD functions and the associated SAD-cross diagrammatic representation are not robust economic theory, what enabled this construction to be rationalized in the course of its development in the nineteenth century, such that it subsequently gained very wide support in twentieth-century economics? Indeed that representation of SAD became so widely accepted that it came almost to be regarded as mere common sense that any economic fool would know and accept. The following sections 4 and 5, respectively, examine the rationalizations upon which that SAD apparatus was proposed by four key contributors to its development prior to Marshall (1890), and consider why it gained acceptance. The investigation confirms that there is no plausible basis for a general presumption in favour of the conventional rising supply function – other than the marginal productivity theory of factor pricing, which is itself unsatisfactory. There are multiple reasons

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[1] See Cournot (1838; Figure 6 in the set of diagrams accompanying the book, with 101–04), Cournot (1897: 90–92), and Humphrey (2010: 29–32) – the latter also indicating the contributions to SAD geometry, prior to Marshall (1879), of Karl Heinrich Rau, Jules Dupuit, Hans von Mangoldt and Fleeming Jenkin.

for the rise of the apparatus of SAD functions, notwithstanding its intrinsic implausibility. The concluding section offers a reaffirmation of the classical conception of SAD.

2. RISING SUPPLY-PRICE

The conventional upward-sloping market supply curve for a commodity shows a positive relationship between market 'supply-price' and the profit-maximizing aggregate quantity of output supplied to the market. Supply-price here refers to the market price, assumed singular, just sufficient for any given quantity of aggregate supply to be forthcoming – the minimum price that will induce that market output. Such a rising supply curve or supply function – 'rising supply-price' for short – describes a situation in which, under competitive conditions, higher and higher supply-price is required in order for increased market supply to be forthcoming, or higher and higher market supply brings about increasing supply-price. Within the marginalist framework of *perfect* competition, profit maximization entails the supply-price being equated with the marginal cost of output (hereafter, 'MC'). Hence, rationalizing rising supply-price (hereafter, 'RSP') reduces to justifying rising MC of aggregate market supply. At the SAD market-clearing equilibrium, supply-price must also equal average or unit cost, which in turn incorporates equilibrium remunerations of the contributing factors of production (including rate of return on capital) – those remunerations, in a marginalist framework, themselves being determined by SAD equilibria.[2]

In contemplating what grounds there might be for a general presumption of rising MC, we put aside diminishing returns associated with short-period fixity of one or more of the reproducible inputs employed by firms (and, for the moment, put aside scarce natural resources). In traditional marginalist language, we are interested in the more general conditions associated with 'long-period' or long-run supply functions. In that framework, marginalist theory commonly assumes constant returns to scale in production. Indeed, it cannot easily proceed *without* that assumption – at least in the neighbourhood of equilibrium – since marginal productivity (hereafter, 'MP') factor pricing will not exhaust (and just exhaust) output, except under conditions of constant returns. But such constant physical returns nevertheless are associated with rising MC, even with fully variable factor proportions. In fact, it is the MP theory of factor pricing which generates rising MC. With the overall economic system's equilibrium supposed as entailing full utilization of resources, expansion in the supply of any particular commodity can only occur via bidding factors away from other uses, thereby placing upward pressure on the prices of factors used relatively intensively in the production of that commodity (i.e., relative to factor proportions in the rest of the economy), and so upward pressure on its cost of production relative to other commodities (Garegnani 1983; Opocher and Steedman 2008: 260–63).

It is worth emphasizing this result, that constant returns do not necessarily generate constant unit cost and MC. If one models Piero Sraffa's reconstruction of the classical approach to price theory, imposing the restrictions of constant returns and no scarce natural resources, then constancy of unit costs and supply-prices does result (Kurz and Salvadori 1995: 94–163). What is generating constant supply-prices is *the combination* of constant returns and the characteristic classical supposition of a distributive variable determined exogenously with respect to prices – typically, the real wage; but in a modern context, an exogenous general rate of profit or rate of interest can generate the same result. (The non-substitution theorem reveals the same logic (Salvadori 1987).) The RSP with constant returns

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[2] Note also that, whatever can be said about disequilibrium and stability with respect to the supposed unique SAD equilibrium price, the recourse to a singular price in defining each point on the supply curve (and also each point on the demand curve) presumes already that the 'law of one price' has prevailed, even in the absence of market-clearing. This entails the supposition (generally tacit) of a competitive disequilibrium process that has ensured convergence of all market transactions to the same price, *even when market supply and demand are unequal* (compare Aspromourgos 2009: 70–72, 83–5). One may conclude that points on the SAD curves away from the equilibrium are purely notional.

that is generated in the marginalist framework, due to the supposition of the MP theory of distribution, is a confirmation of the critical role of the theory of distribution in the determination of commodity supply-prices.

To illustrate a little further, consider a standard partial equilibrium representation of firm and industry long-period competitive equilibrium along marginalist lines. The supply side of the industry consists of identical firms with U-shaped long-run unit cost curves. The equilibrium outcome entails each firm producing the scale of output associated with the minimum point on the unit cost curve, unit cost therefore equalling MC, and equalling price when SAD are in balance (for perfect competition, this firm scale being supposed a very small fraction of aggregate market supply). The industry output will be given by the level of demand at that price, associated with a conventional market demand curve. The ratio of industry output to optimal firm output will determine the number of firms in the industry. This may be called a situation of merely *quasi*-constant returns, due to the fact that this ratio need not be a strictly whole number – a second-order complication that may be left aside (see Aspromourgos 2009: 91–4).

Why then should not exogenous shifts of the demand curve – say, an exogenous increase in demand – once equilibrium is restored, merely lead to an increase in the number of firms in the industry (each producing at the same, unchanged minimum unit cost), with no change in equilibrium price, so that the industry supply curve is perfectly elastic? Such an industry supply curve would be a repudiation of the characteristic interaction of SAD functions or curves that is supposed to be the essence of the marginalist approach to price theory. The answer, already given, is the role of MP factor pricing – from the partial equilibrium standpoint, traditionally characterized as a pecuniary external diseconomy. With expansion of output supply, upward pressure on the prices of factors used relatively intensively in the industry causes the firms' unit cost curves to shift upwards (with an increase in the number of firms, but all producing the same, unchanged optimal firm output as previously). Hence the new, higher equilibrium industry output will be associated with a higher supply-price and equilibrium price, capturing the impact on MC of rising factor prices as industry supply and the associated factor demands expand. It is *the absence of the MP theory* that is the key to the different results in the classical framework.

Hence insofar as one has robust grounds for rejecting the MP theory of factor pricing – which we assert to be so, without argument here[3] – there is no systematic basis for RSP in such a relation between factor demands and factor prices. But having thereby abandoned the marginalist framework, one is not in a position to defend the supposition of constant or quasi-constant returns to scale on the mere basis that it is a necessary condition for a theory of distribution that one has now rejected. With regard to variable physical returns to scale, decreasing returns internal to the firm can be eliminated by construction: profit-maximizing firms will avoid or eliminate any such increasing-cost production configurations, as being of suboptimal scale. (In the limit, the optimal plant size or production configuration might involve output of one unit, with or without multiple plants.) On the other hand, increasing returns (internal to the firm) at high levels of output, relative to the market demand forthcoming at competitive supply-price – whatever complications they might introduce with respect to the nature of competition and the character of supply behaviour – of course will provide no basis for RSP. (There is likewise no basis for RSP in any increasing returns external to the firm.) This leaves just one systematic potential source of RSP: the use of scarce natural resources in consumption or production.

Upward pressure on unit costs can thereby result via a variety of possible, qualitatively distinct forms of natural resource constraint, most notably, the following. *i*) There can be unambiguous increase in the physical inputs required to extract a natural resource and ready it for use – either as a consumption good or input to production – as the total quantity extracted increases. This could apply to either non-renewable or renewable natural resources. (Ambiguous changes in the physical inputs required can also increase unit cost, depending upon the configuration of input prices.) *ii*) Somewhat similar but distinct is the paradigmatic Ricardian case of production requiring use of land that is limited in quantity

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[3] See Garegnani (1990), Kurz and Salvadori (1995: 427–67), Petri (2004; 2016) and Ciccone *et al.* (2011: 13–198).

and quality, relative to the demand for the outputs producible with land, thereby leading to the possibilities of extensive and intensive diminishing returns to labour and capital employed. *Iii*) Then there is the case of strictly non-renewable natural resources of finite stock, whose prices may thereby be a positive function of the demand for them. With the economy as a whole entailing input-output interdependencies in production, changes in natural resource costs and commodity prices arising from these possibilities will generate also (unpredictable) changes in the prices of all commodities in which these resources or commodities are directly or indirectly employed as inputs (including feedbacks to the costs of natural resources extraction and the prices of the commodities that directly use scarce natural resource inputs). All this is much more complex and indeterminate than the simple idea of RSP. In any case, this range of possibilities does not provide a *general* presumption in favour of RSP. Rather, it indicates that such possibilities can arise in particular cases, where an industry makes significant use of a natural resource, and increased use of the resource by that industry has a significant impact on its price (via that industry's use being a significant proportion of the resource's total demand and production).[4]

3. THE DEMAND SIDE

Whether or not the conventional commodity market demand function is a plausible or robust construction in itself, it is worth first emphasizing that in the absence of RSP, the demand curve is deprived of any role with respect to determining equilibrium competitive prices. To that extent, if one is satisfied that a general theoretical presumption in favour of RSP can be dismissed, then the status of the demand curve becomes more or less irrelevant. At least as a first approximation, one may then say that prices are determined on 'the supply side' (and quantities can be determined along Keynesian lines, an issue we leave aside here). That phrase is used advisedly because the supposition of unit cost and supply-price constant with respect to output variations does not justify a 'cost-plus' (mark-up on cost) theory of prices: Sraffa's 1960 system shows that, in general, costs and prices are interdependent (Steedman 1992). And the irrelevance of demand curves is not equivalent to supposing that demand *as such* is irrelevant to price theory; most notably, because of the various possibilities that arise with variable returns. In any case, notwithstanding the considerable irrelevance of demand curves in the absence of RSP, how plausible is the demand function in itself?

   It is a mistake (and a trick commonly perpetrated on unsuspecting undergraduates) to suppose that its plausibility is synonymous with the plausibility of substitutability in consumption. The latter is by no means sufficient for construction of the former. The demand function requires prior or simultaneous determination of consumers' incomes and hence, the rates of remuneration, employment levels and distribution of ownership of the factors of production that generate those incomes – as well as, in general, the determination of all relative commodity prices (Garegnani 1983: 309–10; 2002: 249–50). The existence of substitutability in consumption may be common sense (although there is complementarity in consumption as well); but the perhaps innocent-looking partial equilibrium demand curve, so far from being common sense, must rely upon at least substantial elements of the complex and highly contestable apparatus of general equilibrium theory (including

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[4] Further to these issues, see Kurz and Salvadori (1995: 15–18, 28–33, 277–311, 357–74, 414–21). Sraffa's (1925; 1926; 1960) contributions greatly inform the analysis. See also Viner (1931), Robinson (1941), Newman (1987), Panico and Salvadori (1994), Opocher and Steedman (2008), and Freni and Salvadori (2013). Opocher and Steedman (2015) provides a rigorous treatment, under very general conditions, of optimal firm choices and associated industry outcomes, revealing multiple shortcomings of partial equilibrium and otherwise conventional SAD reasoning. Keeping in mind that RSP must properly be conceived of in *real* terms, whether supply-price is rising or falling with output can turn, arbitrarily, upon mere choice of numéraire (when a change initiated in one industry entails changes in multiple prices). The book draws on a large body of the authors' earlier research published in journals; pp. 168–95 in particular connect the analysis to the historical development of relevant theory from Marshall forward.

full employment of the factors of production). And then further, there are the Sonnenschein-Mantel-Debreu theorems generated in the framework of the post-War, general equilibrium research programme, which demonstrate that – even with individuals' behaviour conforming to all the standard postulates of conventional choice theory – market demand functions with the typical properties of individual demand functions can only be generated under very restrictive conditions (see, e.g., Kirman 2006; Rizvi 2006).

The critique of MP theory to which we earlier appealed is independent of the validity or otherwise of the human psychology posited in marginalist theory, which provides foundations for the conventional SAD apparatus. But that psychology is in any case also contestable.[5] The structure of the theory requires that individuals' preferences are autonomous with respect to the economic processes they engage in, and that each individual's preferences (and perception of her own well-being) are autonomous also with respect to the preferences (and perception of well-being) of all other individuals. Such beings seem more like gods than humans (Aspromourgos 2009: 261–3). The fundamental building block of the theory is the individual agent as constrained optimizer of his outcomes with respect to such preferences. Individuals are supposed as capable of calculating, and as also choosing, the most efficient means for maximum satisfaction of their given preferences. But the economic activities individuals engage in (production, consumption and so on) commonly change them, and thereby, their preferences (and perceptions of well-being); and interdependence of individuals' preferences (and of well-being, in individuals' perception) is an obvious feature of so social an animal as the human species.

The supposition of autonomous preferences (and perhaps also a supposition of *stability* of preferences) may be satisfactory for the purposes of specific and particular pieces of economic analysis; but it is extremely implausible for a general theory of economic society. Nor is it compelling that individuals always pursue maximum satisfaction of their preferences; people regularly do things they would prefer not to do (and abstain from doing things they would prefer to do). More generally, individuals' choices can instead be based, for example, on rules of thumb, satisficing behaviour, habit, custom, social norms, imitation (although for completeness, one would then need to explain how the imitated make their choices), ethical principles, or asking the gods (or their spokespersons) to decide. If there are limits to individuals' capacity to calculate optimal choices, then other methods or rules for making choices become not merely possible, but necessary. Even to the extent that individuals' perceptions of pleasure and pain govern their behaviour, pleasure and pain are surely more complexly interrelated and intertwined than the crude notion of them as mere opposites (e.g., in relation to the role of work in individuals' lives).

It may be added here that in all the previous discussion the terms 'curve' and 'function' have been used more or less interchangeably. But they can involve significantly different conceptions. In particular, there is an asymmetry between the supply side and the demand side: when the former is expressed in terms of curves or functions that represent observable, measurable phenomena (costs and supply-prices, derivative from production methods and some or other rate(s) of factor remuneration), and the latter, in terms of curves or functions in part derivative from unobservable supposed phenomena. (Of course, in the marginalist framework the observable rates of remuneration are themselves understood to be a function of unobservable psychological phenomena.) The partial equilibrium demand curve can be *merely* a curve, in the sense that it is merely an arbitrarily drawn line in quantity-price space, about which nothing is definite or known, except that it is negatively sloped with a positive intercept. Even if one considers instead the demand function expressed in some rigorous algebraic or geometric form, whether in a partial equilibrium or general equilibrium framework, it lacks known general properties or definite quantitative content (Garegnani 1983: 311–12; 2002: 244–5). To that extent, supply-price equations are functions in a more substantial sense than any form of demand curve or function ever could be.

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[5] Although it is not wise to argue too much about these subjective phenomena since, like God, they are unobservable, so that disputation about them can go on forever.

4. THE RISE OF SUPPLY-AND-DEMAND, 1838–1890

If the conventional Marshallian cross is unsatisfactory as a general representation of SAD, then it is natural to ask how and why it appeared plausible – if indeed it did – to those who first developed analysis in terms of SAD functions in the half-century prior to Marshall (1890). Here we consider four key pre-Marshallian contributors in particular: Cournot, Dupuit, Mangoldt, and Jenkin, as well as Marshall.

With regard to the demand side, Cournot simply posits 'annual demand' for a commodity as 'ordinarily' a negative function of its price[6] – adding merely that 'the form of this function' depends on 'the kind of utility of the article, on the nature of the services it can render or the enjoyments it can procure, on the habits and customs of the people, on the average wealth, and on the scale on which wealth is distributed'. There is no marginal utility concept. He goes on to defend the usefulness of recourse to this 'law of demand', notwithstanding its algebraic indeterminacy due to these causes being 'capable of neither enumeration nor measurement'. The function is also assumed 'continuous', on the supposition of there being a large number of heterogeneous consumers (Cournot 1897: 46–50; also 134, 139–41). On the supply side, '[total] cost of production' is made a function of the annual quantity produced and sold.[7] MC is made explicit and assumed nonnegative for all output levels, but allowed to be either a positive or negative function of quantity produced, and in some cases, constant or zero with respect output variations (Cournot 1897: 57–61).

Cournot's Figure 6 seminal SAD diagram is introduced in the context of an analysis of 'unlimited competition', characterized as conditions under which the number of producers is so considerable that the output of no individual producer can influence price – conditions 'realized, in the social economy, for a multitude of products, and, among them, for the most important products'. Profit maximization then entails all producers equating MC with market-clearing price. As a necessary condition for competition so understood, it is supposed that every producer's MC is a positive function of its output, since – under marginal-cost pricing – falling MC is inconsistent with total revenue covering total cost (Cournot 1897: 90–92; compare 44). (The possible case of constant MC appears to be ignored here, perhaps because this would require all producers to have identical cost structures.) The positively-sloped supply curve of Cournot's Figure 6 is then a representation of the aggregate of the producers' outputs at each possible price, mapped against a representation of the demand function rationalized earlier (pages 44–50) and diagrammatically represented also in Figure 1, introduced at page 53. Cournot's *x, y* axes are the reverse of the later convention – representing prices and quantities respectively, rather than quantities and prices.

To sum up, it is not clear that his rising market supply curve is regarded by Cournot as the normal or most common situation in economic life, rather than merely a logical consequence of a necessary condition (rising MC) of his particular conception of 'unlimited competition' – a conception very different from the classical notion of competition (see section 6). On the other hand, there is his comment that unlimited competition applies to 'a multitude of products, and … the most important products'; but then earlier, rising MC is said to be universal in agriculture and mining, while manufacture is regarded as 'generally' exhibiting decreasing MC, 'from better organization of the work, from discounts on the price of raw materials for large purchases, and finally from the reduction of … *general expense* [i.e., fixed costs presumably]' (Cournot 1897: 59–60, 90). Nevertheless, 'beyond

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[6] But inappropriately identifying demand so understood with 'sales'; i.e., demand actually realized. He explicitly allows as an exception, what later come to be called snob effects (Cournot 1897: 46).

[7] The costs explicitly mentioned in Cournot's example are 'materials and labour', 'the value of the raw materials, the wages or profits of the agents who cooperate in making and marketing it, and the interest on the capital necessary'. Later, transport costs in particular are detailed as: 'the price of necessaries and the wages of the agents by whom the transportation is mechanically carried on, … insurance premiums, and the profits of the merchant, who ought to obtain in his business the interest on the capital employed and a proper return for his industry' (Cournot 1897: 57–8, 117; see also 128, 157–8).

certain limits', even in manufacture MC may begin to rise, due to 'higher prices for raw materials and labour' (Cournot 1897: 60).

This is to posit a rather ad hoc pecuniary externality to justify rising MC, and a supposition which also does not address the consequences if the raw materials or labour are employed across more than one industry (so that whether or not MC rises can depend upon the numeraire; recall note 4 above). Nowhere is it suggested that rising MC is in any way attributable to expansion of a particular industry being in the context of full employment of the economic system's aggregate available resources; nor is there anything resembling MP factor pricing (*not* to be identified with the appeal to higher input prices quoted immediately above). The lack in Cournot of robust grounds for the idea of the conventional SAD cross, and recourse (on the supply side in particular) to merely ad hoc suppositions, invites the conjecture that the image of the intersecting curves might somehow have exercised a kind of a priori attraction; that the image of the cross was embraced, and *then* rationales were sought for it (more on this in section 5). Furthermore, with regard to *any* analysis that bases rising unit cost and MC on something akin to pecuniary diseconomies, external or internal, even if it is plausible to suppose that unit cost of the industry and the firms within it must eventually rise, at *some* scale of production, this by itself says nothing about the proportion between the scale of the firm, and the level of total market demand at prices in the neighbourhood of unit cost, at that scale. That is to say, the supposition of scale diseconomies is consistent with both what we have earlier called quasi-constant costs and an optimal plant size small relative to market demand (section 2), *and* consistent with just one plant or a very small number of plants being the optimal number for the industry.

Although Dupuit is commonly included in accounts of the rise of marginalism, he cannot really be characterized as having a SAD theory of prices. The focus of Dupuit (1952; 1962 – translations of Dupuit 1844 and 1849 respectively) is the evaluation of public works and the pricing of the associated services. In the course of this he outlines, as a general principle, the notion of a utility-based commodity demand curve, with total demand a negative function of price. This is conceived of in terms different classes of potential consumers attaching different utility to a commodity, depending upon their incomes, but also each individual attaching a different utility to a commodity at different levels of total consumption of the commodity, fairly clearly indicating in the latter case, total utility increasing at a decreasing rate (Dupuit 1952: 85–7).[8] Nevertheless it is the class-based explanation which is emphasized in rationalizing the 'laws' of demand (103). In the mathematical appendix the price-demand relation is called 'the curve of consumption', and presented diagrammatically, with prices on the *x*-axis (106, 108); Dupuit (1962: 7, 12, 31) speaks of 'the law of consumption'. In fact, he has there 'three consumption laws', the second of which – that change in demand with respect to price increases in absolute magnitude as price falls – also relies on class-based explanation: 'The reason is that as the product becomes cheaper it comes within the reach of more and more populous classes of society' (1962: 8).

Dupuit has much less to say with regard to the supply side. In an illustration of consumer net utility (roughly equivalent to Marshall's consumer surplus) market price is assumed to be 'more or less equivalent to the [presumably unit] costs of production' (Dupuit 1952: 90). In a further arithmetical example, it is taken for granted, in passing, that a reduction in unit cost (due to an innovation) will lead to price falling by the same magnitude (93). Similarly: 'often … when the cost of production of an article falls, competition causes the price of the same commodity produced by a different method to

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[8] Dupuit claims this notion of utility is shared by Adam Smith (87). But it is clear that for Smith use-value is heterogeneous, purposive and objective – the use-value of a hat is for covering the head, the use-value of a chair is for sitting, and so on – essentially the same as Aristotle's conception (Aspromourgos 2009: 119–25). Indeed, the quotation from J.R. McCulloch that Dupuit appeals to as justification for his interpretation of Smith indicates precisely this: 'the capacity of bread, for example, to appease hunger, or of water to quench thirst'. (Dupuit's accusation that the Physiocrats equated utility with cost of production (90n) is equally unfounded.) Dupuit provides no citation whatsoever for his McCulloch quotation; but the editors of the translation indicate its location in McCulloch's edition of Smith (1776). They cite the 1853 edition (which of course, Dupuit could not have used); but the relevant text is already in the first, 1828 edition (vol. 4: 83–4).

fall to the same level, as it does also for similar commodities' (98). In an analysis of the consequences for utility of a cost reduction from an improvement in production methods, it is implied that unit cost is constant with respect to the level of output (107, with Figure 2). Unit cost is never given any systematic connection to quantity supplied. Hence, if by SAD theory one means prices determined by the simultaneous interplay of SAD functions, then Dupuit is not a SAD theorist. Indeed, to the extent that he is treating unit costs and associated competitive prices as given independent of scale, the balancing of SAD in Dupuit's framework entails utility of the 'marginal consumers' (our term) adapting to independently given prices, so that utility does not in any way enter into competitive price determination.[9]

Mangoldt (1962 – a translation of Mangoldt 1863, book III, chapter 3, part 1: 46–73) takes its point of departure from SAD curves with higher price 'generally' associated with 'a contraction of demand and an expansion in supply' – represented diagrammatically (with prices on the y-axis). The price at which SAD are equalized is characterized as 'the natural price, or the centre of gravity of price'. Competition also is said to entail the law of one price and a tendency towards proportionality between the prices and production costs of different commodities. The rationale for 'the demand curve' is 'expected utility' relative to price, with shifts of the function attributed to population change, 'evolution of needs', increasing knowledge of 'the useful qualities of things', shifting perceptions of 'use value', changes in real incomes – and 'the distribution of wealth' (Mangoldt 1962: 32–5).

As a 'general rule', the supply side is said to be governed by 'expected price' relative to 'production cost' (35–6) – cost being also characterized as 'the sacrifice entailed' by production (33, 35, 57). Somewhat implicitly, 'the supply curve' is then treated as mapping unit cost of production, with the possibilities of constant unit cost, strictly inelastic supply, and both falling and rising unit cost, all allowed for (36–7; compare 55–6). But after representing falling unit cost ('economies of large-scale production') in Figure 7 (37), all the subsequent SAD diagrams, and almost all the economic analysis, exclude the possibility.[10] A distinction is drawn between cost changes that affect *all* units produced and cost changes that apply 'solely to the additional supply', so that a concept of MC (but not the term), and MC diverging from average cost, enter the picture explicitly (36; also 40–41) – which can be construed as echoing a Ricardian conception of natural scarcity. Intensive diminishing returns in agriculture are also discussed (59). While ultimately, all commodities have a strict 'supply limit', 'it may be so far off as to be irrelevant in practice' (36). With constant unit cost, 'natural price' is 'determined by … production cost'; with inelastic supply, there will be a 'scarcity price or a monopoly price', determined by suppliers' seeking to maximize profits (38–9). Between those 'two extremes', there are the rising and falling costs possibilities. This analysis might seem to give equal weight to all four of the supply-curve possibilities; but recall that price rising with increased supply was characterized as 'generally' the case (32); and subsequently, it is asserted that 'supply normally … [is] expanding with rising prices' (50); and recall also that Mangoldt's SAD diagrams, with the one exception, all exhibit RSP (although in the joint production and common-input-use exercises noted immediately below, the rising supply curves are not genuine supply curves).

Mangoldt goes on analyse – in a two-commodity framework, algebraically and with numerical illustrations – certain forms of interdependence of prices, via interdependence of demands (complementarity and substitutability), joint production and common use of the same input (41–50; for a formal clarification of some of this, see Schneider 1960: 384–92). The latter case of two commodities produced with a common input is potentially the most interesting (48–50); but the assumptions employed are so artificial as to render the exercise unimportant for the rationalization

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[9] For an interpretation of Dupuit's economics as a whole, and in its larger intellectual context, see Mosca (1998).
[10] There is, however, a brief comment on falling unit cost in relation to differences in unit cost across different producers of the same commodity (40–41); and the issue is further raised in relation to multiple equilibria (50–51).

of supply curves. There is also discussion of possible multiple equilibria, due to negatively-sloped supply curves or positively-sloped demand curves (50–51), and stability of equilibrium (51).[11]

In his major essay on SAD, Jenkin (1887b [1870]: 76–8) begins by simply positing, without justification, a commodity 'supply curve' and 'demand curve', such that the quantity 'holders' are 'willing to sell', 'at a given time in a given market', is a positive function of price; and the quantity buyers will purchase is a negative function of price. The term 'function' is used; and as with Cournot and Dupuit, in the diagrammatic representations (the first, at p. 77), prices and quantities are on the x-axis and y-axis respectively. Jenkin posits a 'law' of SAD as 'the market price' being that which equates SAD so understood, an outcome attributed to 'competition'. The SAD curves are described as 'unknown'; and the equilibrium price as 'theoretical'.[12] Following some comparative static analysis and discussion of disequilibrium, Jenkin (1887b [1870]: 87–9) then argues that the notion of a market price that balances SAD provides 'little help, or no help, in determining what the price of any object will be in the long run'. For producible commodities whose quantity can be varied, the 'average demand curve may vary to an indeterminate extent, but the average supply curve will be found in the long run to depend simply on the cost of production' – including in this cost, 'a fair profit'. This leads to Jenkin's further law, which enables estimation of 'the probable price of any article, as well as the probable quantity': '*In the long run, the price … is chiefly determined by the cost of its production, and the quantity manufactured is chiefly determined by the demand at that price*' (original emphasis).

The 'average' supply curve, 'over a number of years, depends on the cost of production alone' (whereas day-to-day supply-side behaviour depends upon suppliers' expectations concerning demand conditions). Unit cost of production in turn is treated as a positive function of quantity produced: the impact of quantity on cost can be slight ('articles which, at a given price, can be produced in almost unlimited quantities'); but for '[m]ost supply curves … cost of production will gradually increase with the quantity produced, owing to the limitation of labour, of capital, and of raw material'; 'a higher price is generally required to tempt more capital and more labour into the given walk [i.e., the industry under consideration]' (Jenkin 1887b [1870]: 89–92). This line of argument is subject to the same criticism as was applied above to Cournot, with the qualification that in the explanatory text accompanying Figure 12 (p. 90), there is *perhaps* a hint of a utility/disutility calculus lying behind factor supply: 'including in … cost of production, sufficient profit to labour and capital to *induce* the production' (emphasis added). This is all the justification offered here for rising remunerations and input cost as an industry's output expands.[13] Jenkin (1887a [1871–2]: 110–12) rationalizes RSP along the same lines, as the normal case, on the basis that rising price is required to cover an increasing 'interest on capital' and 'remuneration for skilled superintendence' as an industry expands. Again, if these remunerations increase also for capital and superintendence labour beyond the industry under consideration, then the impact on relative supply-prices becomes unclear. Whether impacts of expanding industry scale on remunerations within the industry might also influence remunerations in other industries is not addressed – notwithstanding that the analysis is supposed to apply to long-run and (in some sense) competitive conditions, under which a tendency to uniformity of factor remunerations across industries might be expected.

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[11] For an overview of Mangoldt's economics as a whole, although with a tendency to overgenerous interpretation, see Hennings (1980), which also evidences that in some respects Mangoldt's economics is a hybrid of classical elements and incipient marginalist theory.

[12] Jenkin (1887c [1868]): 15–19: also provides an exposition of SAD, without diagrams, but including an algebraic formulation of the functions. There is a further, slight algebraic formulation in Jenkin (1887a [1871–2]: 107–08), but interestingly, Jenkin puts the algebra aside: 'There is, however, little or no advantage in adopting this algebraic form, because we cannot suppose that in any instance $\varphi(x)$ or $\varphi_1(x)$ [the SAD functions] will be any tolerably simple function'. Commenting on William Stanley Jevons, Jenkin observes: 'utility, as he defines it, admits of no practical measurement' (109–10).

[13] There is no reference to physical returns, except for one sentence (p. 92), accompanied by a diagram (Figure 13 at p. 91), which is a peculiar attempt at characterizing increasing returns to scale – by a supply curve for low outputs levels and a different, lower supply curve for high output levels, but both curves rising with output. There is also no discussion of firm versus industry (a comment also applicable to Mangoldt).

One may add, as an alternative possibility, that the capacity of a single industry's demands for capital and superintendence labour to influence general rates of return on capital and superintendence labour that is widely employed across the economy as a whole (not just in the industry under consideration) may be doubted, and so, any impact on costs also may be doubted. The 'bare [unit] cost of production' – evidently intending cost net of profits and management remuneration – is also asserted to increase with quantity, without any explicit justification here, although the accompanying diagram implies that the effect is slight; and the analysis confirms that Jenkin's supply curve maps average cost. There is little more about the demand side: some discussion of differences in demand responsiveness to price but no explicit rationale for the negative slope, presumably because it is taken to be self-evident. Further on, demand is connected with 'utility', 'the causes' of which, are 'too numerous for classification' (Jenkin 1887b [1870]: 90, 98); but a connection, of some kind, between demand and 'utility' (understood in *some* sense or other) has a history long predating the idea of marginal utility. The SAD apparatus is affirmed to apply to labour as well, and in fact, the remainder of the essay is devoted to that application (Jenkin 1887b [1870]: 93–106; 1887c [1868]: 7–28 is an analysis along similar lines). Whatever the merits and defects of that analysis, it is not a marginal-disutility/marginal-productivity theory.

We turn finally to consider Marshall's own analysis, most particularly, his earliest printed (if not exactly published) SAD constructions. With the slight exception of Marshall (1873; reprinted in Whitaker 1975: vol. 2, 284–5), these are in Marshall (1879),[14] the first diagram of intersecting SAD curves being introduced in the 'Domestic Values' text (p. 4; Figure 20) – with quantities and prices now represented on the *x*-axis and *y*-axis respectively.[15, 16] A continuously negatively-sloped demand curve is there simply treated as axiomatic, without any explicit justification (3–4). (But factors determining demand are subsequently detailed at pp. 15, 19, with a marginal utility analysis then applied to explain individual and market demand at pp. 20–25.) This demand curve is mapped in all the subsequent twelve diagrams, save one (Figures 21–31, with Figure 22 the exception). With regard to the supply side, '[t]he law which governs the shape of this curve is not so simple as the corresponding law for the Demand curve' (5). In the first instance a continuously positively-sloped curve for the industry is posited, as mapped in Figure 20 (5); but subsequently, the possibility, particularly in manufacture, of the supply curve involving both falling and rising segments is allowed; the contending forces mentioned are 'economies in … production' and 'increasing expense … in obtaining additional supplies

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[14] For the background and context for this work, see Whitaker (1975: vol. 1, 57–66, vol. 2, 3–7, 111–17, 181–6), Groenewegen (1995: 153–79). All our page references are to the 'Domestic Values' text, which is separately paginated from the 'Foreign Trade' text. Humphrey (2010: 30) cites '*The Pure Theory of Foreign Trade*, … fig. 22a' for Marshall's SAD diagram, but this is actually the second of four diagrams in which Marshall maps the demand curve against a continuously positively-sloped supply curve; and all of these figures are connected with the 'Domestic Values' text, not the 'Foreign Trade' text.

[15] This is in contrast to the diagrams of Cournot, Dupuit and Jenkin, but in agreement with those of Rau and Mangoldt. If either of the latter influenced Marshall in this respect, it was Rau (Streissler 1990: 57; Groenewegen 1995: 153–4; Rau 1847: 578–80). As Groenewegen indicates, Rau (1847) is the edition possessed by Marshall. From the 1841 4th edition forward, Rau's book included an appendix presenting a SAD-cross diagram (Hennings 1979: 9; the appendix is translated in Hennings 1979: 16–17). Rau supposes both supply as a fixed quantity and the possibility of supply as a positive function of price – the latter, with only very slight rationalization. In the book appendix he simply conjectures '[i]f supply increases with higher prices …', the only further comment on the issue being: '[i]f on the other hand [i.e., not fixed supply] the expectation of a higher price were to increase supply, …' (Hennings 1979: 16–17). In a separate document of 1841 he merely comments: 'There are commodities whose production can easily be increased in a very short time. If then the price rises, the supply will increase' (also translated in Hennings 1979: 13–15). Hennings (1979: 5–6) makes a convincing case for Rau's probably having been unaware of Cournot's SAD diagram of three years earlier.

[16] Groenewegen (1995: 140) notes: 'By 1879 … the essentials of his system were complete'. The 1879 analysis is also prefigured in an unpublished Marshall essay, including SAD diagrams, probably written at the beginning of the 1870s (Whitaker 1975: vol. 1, 119–59; acutely analysed in Bharadwaj 1978) – and forms of the SAD apparatus are to be found as well in other pre-1890 Marshall writings published by Whitaker.

of ... raw material or … labour' (5–6; determinants of costs and supply are further discussed at 15–19, 29–30).

In general the supply curve is said to represent 'the price[s] which will just cover the expenses of producing and bringing into the market' the various possible quantities of output; 'the price[s] per unit at which' those quantities 'can be remuneratively produced and brought into the market' (5). Marshall goes on to defend the idea that economies of scale *can be* (but may not be) external to the firm, while a function of the size of the relevant particular industry (7–10) – a preliminary statement of the idea that Sraffa will attack forty-six years later – and then analyses equilibrium, multiple equilibria and stability of equilibria (10–14). The multiple equilibria are not necessarily fatal for the SAD curves apparatus, since if, as quantity increases, eventually RSP prevails, then the last SAD intersection will be a conventional Marshallian cross. SAD intersections involving negatively-sloped supply curve segments can be stable also, depending upon the relative SAD slopes and the character of disequilibrium dynamics (11–12).

The same SAD logic is sketched in Marshall and Marshall (1879), book II, but without SAD diagrams and geometry. In the first edition of the *Principles*, the Marshallian cross diagram first appears in book V, chapter V, section 3 (Marshall 1890: 423n). In the final, 8th edition, the first SAD diagram is in a footnote to book V, chapter III, section 6 (Marshall 1949 [1920]: 288n; Figure 19). There are forty-one diagrams in the book as a whole, all in footnotes (plus four in the Mathematical Appendix), of which nineteen are commodity SAD diagrams of one kind or another – and half of the rest are commodity demand *or* commodity supply diagrams. The relevant supply concept for the cross in the *Principles* is long-period, normal supply-price under competitive conditions (1949 [1920]: 314–15, 334, 412). RSP is there ultimately attributable to increasing employment of factors – in the face of less than perfectly elastic factor supplies – requiring higher factor remunerations, with the inelasticity due to rising marginal disutility.

5. WHY THE RISE OF THE CROSS?

The question as to why the apparatus of SAD functions arose would be uninteresting if the answer were simply that – on some rational basis or other – the Marshallian cross is sound science. What gives the question interest is the *absence* of plausible grounds for a general presumption of RSP, and hence, for the conventional cross. But the possible answers to the question are more difficult to compellingly demonstrate than the inadequacy of the theoretical justifications for the cross, so that our argument here is more tentative and conjectural. There are multiple dimensions involved and the evidence for answers involves large, complex and subtle issues. Six distinct factors are offered here, as seeming likely to have been in play.

Before detailing those factors, a certain logic to the intellectual development of the cross may be noted. Sraffa (1998: 325; also 354–5) makes the point that the idea of a general, systematic relation between quantity produced and unit cost was not entertained by the classical economists, adding the acute observation that it was in pursuit of the idea of a supposed symmetry of SAD forces that the idea arose: 'only *after* the studies of marginal utility had called attention to the relationship between price and quantity (consumed), did there emerge by analogy the symmetrical conception of a connection between cost and quantity produced'.[17] Hence one may conceive of a two-step process to the development of the cross: *i*) 'utility', in some sense or other (whether or not expressed as marginal utility) is understood as rationalizing a systematic, inverse price-demand relation, as a more or less robust parameter for price theory; *ii*) the idea of equilibrium prices as determined by SAD, in some sense, is embraced. Once the demand curve is accepted, *some* kind of supply curve is required in order

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[17] Sraffa also subsequently makes the related (and well-taken) point: 'is it not very strange that two such heterogeneous things as human nature and industrial technology should bring about results so similar [i.e., diminishing marginal utility, diminishing returns]?' (Sraffa 1998: 332).

to complete the second step. In the first instance the supply-side curve or function can be vertical, horizontal, positively- or negatively-sloped (as we see in Mangoldt and Marshall); but there must be a definite price-supply relation. Then, the attempt to make the positively-sloped supply curve the norm is a further step. As we have seen, the pioneers considered here, including Marshall, illustrate the difficulty of providing a compelling case for RSP as the normal situation – and evidence some self-awareness of that.

The notion of a price-quantity demand relation creates the imperative for a price-quantity supply relation, if a SAD equilibrium price theory is to be effected. And without RSP in particular, the demand curve becomes uninteresting (at least with respect to price theory), as was observed in section 3 above. It was also noted there that the critique of MP theory associated with Sraffa (note 3) is independent of the validity or otherwise of the psychology posited in marginalist theory. Suppose, merely for the sake of a thought experiment, that the prices of consumable commodities are determined along the lines of Sraffa's classical approach – with a given distributive variable and constant-returns production methods simultaneously determining unit costs and equilibrium prices, independent of output levels. One nevertheless could still posit the individual consumer as utility-maximizer, with diminishing marginal utilities and so on (leaving aside the issue of cardinal versus ordinal utility). In the absence of the marginalist supply-side construction, this could still allow the conclusion that prices tend to equality with marginal utilities, but with marginal utilities adapting to prices, the latter being determined independently of demand, utility and so on. This confirms that the marginalist demand side without the marginalist supply side is vacuous.

We turn now to the six explanatory factors.

a) Influence of Earlier and Other Inchoate SAD Theories

The development of rather vague SAD theories of price by some prominent writers earlier in the nineteenth century almost certainly gave impetus to the later development of theories in terms of SAD curves or functions. Palumbo (2015) provides a valuable diagnosis of attempts at SAD approaches to the determination of normal or equilibrium prices – but not in terms of functions – by James Maitland (Lord Lauderdale), Jean-Baptiste Say and Robert Malthus. (For somewhat later, one may add John Stuart Mill, a considerable influence upon Marshall (Groenewegen 1993; 1995: 154–79).) Indeed, as Palumbo (2015: 106) also notes, something like this is to be found more than a century earlier still, in the economic writings of John Locke. In the case of both Say and Malthus, there is some attempt to extend this inchoate SAD theory to the pricing of production inputs, and of labour in particular (Palumbo 2015: 107–08, 110–11).

It may be added however, that to go beyond what may be called the mere *common-sense law of markets* – the notion that an imbalance between quantity supplied and quantity demanded tends to cause a *change* in price – in order to determine a definite *level* of market price, the balance of quantity supplied and 'demand' must entail that the latter refers, not to a quantity of output, but to a quantity of *expenditure* on output. This then enables expenditure divided by quantity supplied to 'determine' an (average) actual market price. (It will only be a *uniform* actual market price if all transactions occur at the same price.) But depending on how one may construe the expenditure magnitude (e.g., in terms of ex ante versus ex post magnitudes), this can reduce to nothing more than a tautology (Aspromourgos 2009: 101–31, especially 103–07).

b) The Pleasure-Pain Calculus

The rise of utilitarianism and the associated notion of a pleasure-pain calculus as the regulator of actual human behaviour[18] provided an intellectual environment highly favourable to embrace of the

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[18] This is quite distinct from the application of such a calculus as an ethical principle.

SAD cross, understood as an expression of that calculus. This is so even if the notion that marginal-utility-based explanations of consumption demand are derivative from, or sanctioned by, the utilitarianism of Jeremy Bentham or J.S. Mill is misguided.[19] It was indicated above (p. **11** [**section 5, 2nd intro para**]), that once a systematic price-quantity relation is posited on the demand side, a SAD approach to price theory demands a systematic price-quantity relation on the supply side. The pleasure-pain psychology gives expression to a deeper symmetry: the demand function as an expression of diminishing marginal utility of consumption and the rising supply function as an expression of increasing marginal disutility of production (i.e., from employment of factors of production). Hence arises the 'Robinson Crusoe' parable – much appealed to in the rise of marginalism (White 1987) – of the isolated individual who employs her (painful) labour to produce (pleasurable) consumption, with an optimal solution maximizing net pleasure, where the rising marginal disutility of producing consumption is just offset by the declining marginal utility of the consumption (extended also to intertemporal production and consumption). Thus the 'primitive', so to speak, of the SAD apparatus is in the psychological constitution of the hypothesized individual agent.

'Parable' is the right term for this train of thought, since it becomes an *attempted* analogy from a supposed psychology of the individual, to the organization of a decentralized mass economic society of many individuals or agents (including firms), in terms of the SAD apparatus universally applied to commodities and factors of production. This simple reductionist psychology is the ultimate, irreducible (that is to say, virtually axiomatic) basis of the conventional SAD cross – the kernel of the entire edifice.[20] But I earlier suggested (note 5) that it is unwise to contest too much about merely psychological postulates, since they concern unobservables. If the rationalization of the conventional SAD apparatus reduces to a psychology of disutility and utility, is it not then, to that extent, incapable of compelling disproof (or proof)? The point to be emphasized in relation to this is that the vindication of the SAD apparatus, for a decentralized mass social economy, requires that the psychology can find expression in 'well-behaved' MP factor pricing (and associated determination of factor employments). To be plausible, along with upward-sloping factor supply functions, this requires a general presumption in favour of downward-sloping factor demand functions. The latter can be analysed in terms of the observable phenomena of rates of real wages and profits, production methods, profit-maximizing capital-labour ratios and so on. If, as was earlier asserted (section 2), the MP theory fails, then this suffices to demolish a general presumption of RSP, without need to disprove the psychology.

c) The Rise of Individualistic Liberalism

It may be tentatively conjectured that more generally, the rise of liberalism in the nineteenth century, to the extent that it was associated with a notion of the individual as a kind of autonomous agent, probably provided also a broader intellectual, moral and cultural 'atmosphere' in which the methodological individualism of the new marginalist theory appeared attractive. Such individualistic liberalism could encourage the notion of the individual as the appropriate fundamental building block of social theory. (In the framework of the marginalist theory the autonomy of the individual will eventually take the strong form of the exogeneity of the individual's preferences (see section 3 above).) Such liberalism may be connected with, but is distinct from, the pleasure-pain psychology. The latter involves an even more particular kind of individualism (for a radical contrast, consider

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[19] See Roncaglia (1999: 107), on Jevons. Statements that exchange-value depends upon 'utility' can amount to nothing more than that use-value – whether or not supposed reducible to some homogeneous substance or quality; compare note 8 above) – is merely a *prerequisite* for exchange-value (Roncaglia 1999: 109 gives the example of Bentham himself). This is an idea entirely consistent with the classical approach to price theory (e.g., Ricardo 1951 [1817]: 11).

[20] The pleasure-pain calculus is also much elaborated by Hermann Heinrich Gossen (1854; 1983), but without any apparatus of SAD functions, and with only slight consideration of production. There is no RSP notion. Gossen (1983: 106, 114–15, 170, 252–3, 255, 281, 298) also applies his theory of the supposed beneficial socio-economic outcomes of the operation of the calculus (including distributional outcomes) to repudiation of socialism.

Friedrich Nietzsche's individualism). But the rise of individualism in broader forms could provide also a congenial environment. Coming from the standpoint that the individual is the point of departure for social theory, it is not surprising that the primary focus of the early builders of marginalism was on demand and exchange: it is more plausible to theorize consumption demand in terms of the individual agent than it is to theorize production in such terms – although consumption *is* a social activity as well. Of course, repudiation of the SAD apparatus does not entail rejection of economic or political liberalism.

d) 'Physics Envy'

A motivation of economic writers to invest economic theory with a credibility similar to physics can be understood to have also encouraged the rise of marginalism. A striking example is Francis Edgeworth's notion of economics as social mechanics ('Mécanique Sociale'), supposedly paralleling or analogous to mechanics, especially celestial mechanics, in physics (Edgeworth 1881: 9–13). Mirowski (1989) is the most salient contribution to this line of interpretation. This is not merely about the use of formal methods; in particular, not merely about recourse to mathematics. After all, the classical approach to price theory could be, and eventually was, given explicit mathematical expression (see section 5.e immediately below). It appears more about the substantive idea of economic equilibrium as an expression of utility maximization understood as a balance of opposing forces – maximization via the balance of disutility and utility at the margin; and so, the balance of commodity supplies and commodity demands and, eventually in fully-fledged marginalism, also of the parallel opposing forces of supplies and demands with respect to factors of production.

e) Theoretical Problems of the Classical Approach

The theoretical difficulty in which the classical approach to price theory ended up in the economics of David Ricardo and Marx undoubtedly contributed to its abandonment, depriving the discipline of a plausible alternative to a SAD approach to equilibrium prices and the associated rise of marginalism. First and foremost, this difficulty concerned the need to reconcile the classical approach to the theory of distribution with the logic of competitive prices (in particular, the alignment of prices with unit costs of production, including uniform net rates of profit on capital). The labour theory of value was the rock upon which the classical ship risked perishing. Eventually, some brilliant and mathematically sophisticated contributors were able to point to a solution, enabling the classical approach to distribution to be reaffirmed, consistent with competitive prices, and without need for recourse to the labour theory. One may mention in particular, prior to Sraffa, Vladimir Dmitriev, Ladislaus von Bortkiewicz and Georg von Charasoff.

f) An Ideological Dimension

Finally, there is the role of ideological motivation. The link between classical economics and the so-called 'Ricardian socialists', as well as the connection to Marxism, promoted a conservative reaction – at a mundane level, to justify rejection of higher wages; and more fundamentally, to provide an economic rationale for 'pure' profits (i.e., profits net of risk premia). Hence this ideological dimension doesn't pertain primarily to the *commodity* cross; it is most pertinent to the attempted parallel and symmetric application of the SAD apparatus to distribution – to determination of equilibrium rates of wages and profits.[21] Appeals to the supposed 'laws' of SAD to attack labour unionism and its demands are evident in a number of nineteenth-century literatures. The 'wages fund' doctrine, as a peculiar

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[21] It is symmetric in the sense that the factor demand functions are supposed to be simultaneously determined by the same singular factor substitution mechanism in response to relative factor price changes; and also that the wage and profit rates are both conceived of as necessary supply-prices to bring forth the equilibrium quantities of the two factors of production.

form of SAD theory, was deployed as an ideological weapon (Stirati 1994: 51–2, 111–12, 177–84). The application of the pleasure-pain calculus to saving and capital accumulation – the notion of abstinence from present consumption, or 'waiting', as painful – is where ideology particularly comes into play. Such motivation also could exploit the theoretical problems of the classical approach indicated immediately above, to further the appeal of the rising marginalist theory (e.g., Carl Menger on Marx; see also Campus 1987).

   The psychologizing of cost in the marginalist framework, in supposing a certain symmetry between painful labour provision and painful capital provision, thereby placed the profits of capital on the same functional footing as the wages of labour. This is in contradistinction to the classical approach, with its objective notion of cost, wherein the (socially) necessary consumption of labour is an objective cost of production, while net profits arise from the surplus product of the economic system. The symmetric psychologizing of cost – 'the efforts and abstinences' of 'labourers and capitalists' – is affirmed already at the beginning of Marshall (1879: 2, which quotes also, along similar lines, from an 1876 Marshall article), and is clear as well of course in Marshall's *Principles* (e.g., 1949 [1920]: 116–17, 282, 294). It may be added that even if the marginalist treatment of functional distribution were valid, marginalism cannot justify *personal* distribution, which would require also a justification for the distribution of the ownership of labour and capital resources (something the theory cannot possibly provide). But it can rationalize profitability of capital, however high, and real wages however low, as functionally necessary or expedient for equilibration of factor supplies and demands. It may be noted as well that the theory can still serve an ideological function even when advocates of the theory have no ideological intent (possibly involving also ideology as self-deception).

6. CONCLUSION: THE CROSS VERSUS CLASSICAL SUPPLY-AND-DEMAND

It was observed in section 1 above that the conventional apparatus of SAD functions, in the form of the Marshallian cross, eventually came almost to be regarded as common sense. Subsequently, in sections 2 and 3, it was argued that a general presumption in favour of RSP lacks a robust basis and that even by itself, the conventional demand function is by no means self-evident common sense. The historical inquiry in section 4 confirms the conclusion that a general presumption of RSP stands or falls with the validity or otherwise of the MP theory of distribution. It is the notion of imbalances between quantity supplied and quantity demanded – quantities not functions – causing price *changes*, which is common sense, and which we indeed earlier referred to as the common-sense law of markets. This becomes the basis for a treatment of disequilibrium price behaviour in classical economics, once combined with something that is *not* common sense: a theory of competitive normal or equilibrium prices (Aspromourgos 2009: 105–06; see also Steedman 1998).

   SAD quantity imbalances and the resulting market prices are disciplined by the force of competition and associated 'natural' or normal prices, with the latter determined, not by SAD, but by reference to production conditions and an element of functional distribution that is independent of commodity prices – whereas in the marginalist framework, forms of SAD are applied to explaining both equilibrium prices and disequilibrium price behaviour. Hence the following comment, which makes perfect sense in the classical framework, appears mystifying or nonsensical from the marginalist standpoint:

   Mr. Malthus appears to understand, by his short phrase, '*the principle* of demand and supply' something different from what I should, as a reader of Smith only, have understood it to mean: I should have said, it meant that principle, which tends to bring the respective prices of things into

such a state as will equalize, as nearly as is possible, the profits, &c., obtained in the production of each. But that principle does not then determine, what that state is.[22]

The classical normal prices are the prices that enable the reproduction of a decentralized economic system, consistent with an element of predetermined distribution. Rather than the subjective psychology of the individual as the fundamental and irreducible building block of price theory, the classical point of departure is the objective structure of production, together with a distributive variable determined by wider political, social and economic factors (Garegnani 1984 or 1987; Kurz and Salvadori 1995).

Whatever theoretical approach one wishes to employ, the primary formal expression of a situation in which competition has fully produced its effects is, and must be, an alignment of prices and pecuniary costs, including with the latter, the competitive general rate of profit. Behind pecuniary costs, in the classical approach, cost is ultimately constituted by the quantities of the inputs used up in the production of the gross outputs or social surplus of the economic system (Kurz 2006). In marginalism, cost is ultimately constituted by the subjective sacrifice of disutility from factor employment, equated at the margin with the gain of utility from consumption. Factors of production are understood to be remunerated in accordance with their contribution, at the margin, to the production of utility-generating consumption goods; that is to say, they are priced in line with their indirect marginal utilities, so to speak. In this (failed) theoretical construction there is no classical surplus – in the sense of a net product available for free disposal – to be found. Under competitive conditions, all remunerations to all factors of production are 'necessary' pecuniary costs (at the margin), in the sense that they are functional to inducing factor supplies and ensuring the equilibration of the system (Aspromourgos 2011: 355–6).

It is a striking fact that Adam Smith never, not even once, uses the phrase 'supply and demand' (or 'demand and supply'), but speaks of 'supplying the demand' (and similar) – which carry a quite different, non-symmetric connotation.[23] The relative activeness attributed to the supply side in this phrase is first and foremost (but not only) about capital mobility in pursuit of the highest rate of return, responding to deviations between actual and normal profit rates, due to deviations between actual market prices and competitive prices. This points to the classical conception of 'free' competition – a considerably less restrictive notion than the latter-day 'perfect' competition – focussed on freedom of entry and exit in response to profitability.[24] This notion of competition, and therefore also the associated price theory, entail a form of economic rationality, but of a minimal and objectively grounded kind, compared with the rationality entailed by marginalism. That modest rationality required by classical price theory finds expression in the law of one price: if the same commodity is on offer (in demand) at two different prices, consumers (suppliers) will prefer the lower (higher) price; if capital or any other singular production input is being employed at two different rates of

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[22] Anonymous (1821: 76–7). The author is probably Henry Brougham (O'Brien and Darnell 1982: 83–107). Marx more than once makes similar comments: 'If demand and supply balance, the oscillation of prices ceases, all other conditions remaining the same. But then demand and supply also cease to explain anything' (Marx 1967, vol. 1 [1867]: 538; also vol. 3 [1894]: 189).

[23] Aspromourgos (2009: 77–8). On the origins of the phrase, see Aspromourgos (2009: 83, 295), which refers also to Groenewegen (1973; 1987) and Thweatt (1983).

[24] For a deep analysis of the difference between the two notions of competition, see Salvadori and Signorino (2013). It may be added that in the absence of free competition, persistent spreads between net profit rates in different activities also play a role in price formation, but these spreads themselves are not likely to be independent of the competitive general profit rate (Aspromourgos 2013: 18–19). In any case, a determination of prices along classical lines is still perfectly possible with differential profit rates, so long as the set of spreads as well as the competitive rate of return can be taken as given. And the theory of competitive prices is really the necessary foundation for also theorizing such systems of non-competitive prices, insofar as the latter are associated with rates of profit above the competitive general rate of return; that is to say, conceived of as a *deviation from* the competitive system.

remuneration, suppliers (demanders) of capital or other inputs will prefer the higher (lower) remuneration – these behaviours pushing prices and remunerations towards uniformity.

In all this, there is no need for autonomous individual preferences or 'utility' (cardinal or ordinal). Partly following Salvadori (1995: 163), we may conclude that the role of preferences or utility is not comparable to that of cost of production because the former are evanescent, unobservable, perhaps unstable, whereas the latter is tangible, observable and generally persistent.[25] So one can say that the role of demand is indefinite, unpredictable and unsystematic (although under conditions of rapid technological change, the existence of a definite classical normal supply-price can also be compromised). In a letter of 11 July 1971, Sraffa comments:

> You say 'I don't see how demand can be said to have no influence on … prices, unless constant returns …'. I take it that the drama is enacted on Marshall's stage where the claimants for influence are utility and cost of production. Now utility has made little progress (since the 1870s) towards acquiring a tangible existence and survives in textbooks at the purely subjective level. On the other hand, cost of production has successfully survived Marshall's attempt to reduce it to an equally evanescent nature under the name of 'disutility', and is still kicking in the form of hours of labour, tons of raw materials, etc. This, rather than the relative slope of the two curves, is why it seems to me that the 'influence' of the two things on price is not comparable. (quoted in Asimakopulos 1990: 342; also in Salvadori 1995: 154)

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[25] This is the ultimate justification for excluding demand from an influence upon prices – by recourse to constant returns to scale and constant unit cost (with respect to scale) as a legitimate first-approximation assumption, or assumption of convenience – in many areas of economic theorizing and modelling, although of course, not in *all* areas.

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