

# **A Review of Selected Literature in the Economics of Division of Labor from 5<sup>th</sup> Century to WWII: Part I\***

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*By means of the old, we come to know the new. ----- Confucius*

First of all, one point seems in order regarding the title: this article is not intended to be comprehensive in its coverage. Rather, it focuses on a deliberately and highly selected body of studies on the division of labor ranging from ancient Greeks to WWII as represented by those reproduced in Sun (2005a), with particular attention paid to what I believe has been relatively unknown *even* among economists of specialization. A more systematic examination, covering hundreds of studies on the division of labor by ancient Greeks, ancient Chinese, medieval Islamic scholars, medieval Latin scholasticists and Anglo-Europeans of recent centuries is found in Sun (2005b).

But what is the (commonly accepted definition of) division of labor? The one that Peter Groenewegen uses for the entry “division of labor” in *New Palgrave’s Dictionary of Economics* (1987, p.901) may be accepted by overwhelmingly most, if not all, economists: “The division of labor may be defined as the division of a process or employment into parts, each of which is carried out by a separate person.” That is, individuals cooperate, consciously or not, to undertake a divisible process or employment. As such,

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there naturally emerge two fundamental questions: Why, and how does the separation of employment among persons bear upon important economic and social consequences? In fact, the studies to be surveyed below that emerged over twenty-five centuries or so up to WWII basically centre round the above questions.

We will first of all map out the evolution of ideas about division of labor up to the classical political economy in Sections I and II. For the body of economic analysis was considerably enriched since then, with different schools/perspectives simultaneously developing and sometimes competing with one another, we will focus on three themes, explored respectively by three most influential schools that have made contributions of lasting value to the economics of the division of labor. Section III examines the idea of mutual interdependence between increasing returns to the division of labor and the extent of the market originating from Smith, substantiated by Wakefield, Mill, Marshall and culminating in Young (1928). Section IV focuses on the division of labor in society and the division of labor in manufacture, on which Marx offers important insights, foreshadowing some modern theories of the firm well into 1990s. Analyses of unfavorable sociological consequences of the division of labor are also briefly surveyed in this section. Section V examines literature on the overarching theme of the spontaneous order, which can be traced back to Mandeville and was later on elaborated by the Scottish Enlightenment men, and the Austrians especially Hayek. Indeed, the Austrians not only developed a general theory of the spontaneous order but also applied it to analyses of many issues that are concomitant with the division of labor, in particularly the origin of money and the socio-economics of dispersed knowledge. Finally, Section VI concludes.

## **I. Greek Origins, Medieval Islamic Wisdom and Schumpeter's "Great Gap" Thesis**

The idea of increasing returns to specialization is old. At the latest, ancient Greek philosophers, dated from Democritus (460BC - 370BC), had already brought it to the fore in their socio-economic discourses.<sup>1</sup> In the writings of Xenophon and Plato in particular, two most important insights of the division of labor that Adam Smith (1776) famously articulated about two millennium later, namely increasing returns to labor specialization and the division of labor being limited by the extent of the market, figured prominently. Xenophon (431 - 354 BC) clearly perceived the association of the size of the city in terms of inhabitants with the division of labor in illustrating why a larger city, compared to a smaller one, allows for greater division of occupations and thus renders products of both a finer quality and a larger quantity (Xenophon 1886, pp. 244-5). In particular, gains from the division of labor are exemplified by cooking for the king in Xenophon (ibid). Furthermore, Xenophon (1994) discussed in somewhat details the sexual division of labor within a family, a topic that was to be picked up by Thomas Hodgskin (1827) and Marxists in the 19<sup>th</sup> century and nicely integrated into a neoclassical theory of human capital in the 20<sup>th</sup> century (e.g., Becker 1985).

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<sup>1</sup> It may be fair to say that Democritus is the first among the Greeks to recognize the intrinsic connection between the division of labor and the division of resources as well as the efficiency implications of private ownership (refer to, e.g., Gordon (1975), p.4, and Landreth and Colander (1994), pp 21-35.)

Similar to Xenophon, Plato also based his theory of the emergence and development of the city on the notion of increasing returns to the division of labor. Indeed, in his celebrated *The Republic* (360BC), Plato developed, quite consciously, a theory of how a city emerges and then grows by exploiting the gains from the division of labor and saving on trading costs (Plato 1997, pp. 1008-13).<sup>2</sup> Perhaps more remarkably, in Plato's model growth of a city leads to emergence of professional merchants, *a legal system and army* among other new occupations, thus anticipating what Rosenberg (1976) refers to as "another advantage of the division of labor" in Smith's economic system. As a matter of fact, Plato's conception of social division of labor in some important aspects bears resemblance to what were to be powerfully developed by Smith among other classical economists. In a very intriguing study of the possible influence the Greek philosophers had on Smith's theory of the division of labor, Foley (1974) has gone so far as to suggest "that Smith could have gotten his original inspiration from the division of labor principle, not from the sources usually cited in this connection --- the Encyclopédie, Harris, Locke, Mun, or Mandeville – but from the ancient Greeks" (pp.221-2), notably from Plato who "provides Smith with important initial inspirations" (p.235) to Smith's theory of progressive division of labor in connection with his four-stage societal evolution. For a discussion on the fundamental difference between the two men, however, see McNulty (1975).

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<sup>2</sup> The idea of agglomeration economies originating from the division of labor still plays a key role in the urban economics literature of the 1990s based on increasing returns, which is prominently represented by the so-called New Economic Geography (see, e.g., Yang and Rice 1994, Hochman 1997, Tabuchi 1998, Fujita et al 1999 and Sun and Yang 2002).

Although it is already rightly pointed out in Plato (1997, 1010-11) that the double coincidence problem of wants between buyers and sellers in the marketplace gives rise to currency, it is Aristotle (350BC; 1921, *Politica*, Book I, Chapter 9, pp. 1257a-1257b) who offered a vivid illustration of the origin of barter money and its evolution into fiat money. Aristotle articulated the necessity of money in maintaining the network of social (inter-household) exchange of commodities. It may be worth emphasizing that Aristotle's analysis of the function of money is rooted in his focus on the trade between households in his city-state setting, rather than the genuine market exchange between a good number of sellers and buyers.<sup>3</sup>

Perhaps not surprisingly, the Greeks are not the only ones, even at their time, to observe the phenomenon of increasing returns to labor specialization. For instance, in ancient China at roughly the same time of Plato, Mencius (390BC-305BC), and a bit later on, Hsün Tsu (Xun Kuang), both argued for the necessity and significance of the social division of labor, and the division between mental labor and manual labor. (refer to, e.g., Hu 1988, pp. 65-66 and pp 167-8).

Schumpeter's (1954) "Great Gap" thesis, stating that very little if any was achieved in economic analysis during the several centuries before the rise of Latin Scholastics in the 13<sup>th</sup> century, has been challenged in recent decades by Essid (1987), Ghazanfar (2000) and Hosseini (1998) among others. It is widely known among students of medieval cultures that medieval Islam played a crucial role in the intellectual movement originating from the Greeks and eventually resulting in the rise of European Scholastics. As documented in Philip Hitti's (1970/2002) monumental volume, the

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<sup>3</sup> For a cogently presented analysis of how the philosopher significantly influenced, and was on occasions misinterpreted by, the medieval Latin Scholastics, see Gordon (1993).

“rediscovery” of Aristotlian scholarship and the renaissance of Europe would have been simply unimaginable but for the intellectual contribution by medieval Islamic scholarship which had a definitive influence on St Albert the Great and St Thomas Aquinas (and thereby on later generations of scholars including political economists, see below): when “Europe was almost totally ignorant of Greek thought and science”, the Islamic scholars during “the great epoch of translation” (mid 8<sup>th</sup> century to mid 9<sup>th</sup> century) had already got well acquainted with, and further developed, Aristotlian scholarship (2002, p. 315).

As far as the economics of the division of labor is concerned, it seems that medieval Islamic scholarship was absorbed by the Latin Scholastics, without due acknowledgement though, thereby exerting influence on Mercantilists and classical political economists including Adam Smith (see, e.g., Essid 1987 and Hosseini 1998). As is nicely demonstrated in Hosseini (1988, pp 667-673), social division of labor was discussed by Fārābi (875-50), sexual division of labor by Ibn Sīna (Avicenna 980-1037) and Tusi (1201-1274), and most prominently, a more general treatment by al-Ghazali (1058-1111), “unquestionably the greatest theologian of Islam and one of its noblest and most original thinkers” (Hitti 2002, p.431). Al-Ghazali appears to have well understood the interrelation between market exchange and the division of labor. More impressively, al-Ghazali’s theory of vertical division of labor strikingly resembles Adam Smith’s in an interesting manner. In his most important book, *Ihya Ulum al-Din* (Revivification of the Sciences of Religion), paralleling to, and constituting an influence on, St Thomas Aquinas’ *Summa Theologica* (Ghazanfar 2000, pp.863-4), al-Ghazali wrote explicitly on the division of labor,

“For a bread, for example, first the farmer prepares and cultivates the land, then the bullock and tools are needed to plough the land. Then the land is irrigated. It is cleared from weeds, then the crop is harvested and grains are cleaned and separated. Then there is milling into flour before baking. Just imagine – how many tasks are involved; and we here mention just only some. And imagine the number of people performing these various tasks, and the number of various kinds of tools, made from iron, wood, stone, etc. If one inquires, one will find that perhaps a single loaf of bread takes its final shape with the help of perhaps more than a thousand workers” (*Ihya*, 4:118; quoted in Ghazanfar and Islahi 1990, p. 390).

In further articulating the gains from, and necessary coordination in, the manufacture division of labor, al-Ghazali took needle production as an example, “even the small needle becomes useful only after passing through the hands of needle-makers about twenty-five times, each time going through a different process” (*Ihya*, 4:119; quoted in Ghazanfar and Islahi 1990, p. 390). As it happened, al-Ghazanfar’s needle example well resembles the French Encyclopédie’s “Epingle” (1750s) production (consisting of eighteen separate processes), from which Smith’s famous pin-factory story is taken (see below).

We now turn to another towering figure of Islamic thought, Ibn Khaldūn (1332-1406), whose *The Muqaddimah: An Introduction to History* (1402/1958) firmly established himself as “the greatest historical philosopher Islam produced and one of the greatest of all time” (Hitti 2002, p.568). This man is perhaps one of the most original minds in social sciences in general and in economic sciences in particular across all human civilizations. His deep insights into the socio-economic dynamics, that the driving forces of historical change come from within the present social structures, long anticipated the Scots, Karl Marx, Joseph Schumpeter and

Mancur Olson (see, e.g., Kuran 1987, pp108-110) and he has been deservedly claimed as one forerunner of a great number of European thinkers in socio-politics and historical philosophy. In the field of economics at large, his contributions have nonetheless been considerably underestimated relative to what they deserve. As demonstrated in Boulakia (1971) and Soofi (1995), Ibn Khaldūn can be well claimed in economics as a forerunner of Ricardo and Marx in labor theory of value, of Malthus in population theory, of Keynes in the theory of the expenditure multiplier, and most relevant to our purpose here, of Smith in the theory of the division of labor. Indeed, there emerges from his masterpiece *The Muqaddimah* a coherent division of labor theory of production. Anticipating Turgot (1769-70) and Smith (1776), Ibn Khaldūn (1402) starts with analysis of the prerequisite and formation of civilization in his opening sentences of chapter one in *The Muqaddimah* by emphasizing the necessity of, and gains from, the division of labor. Later on, in chapters V and VI, which are largely about what centuries later was referred to as political economy, he cogently demonstrated that the division of labor facilitated by a larger market leads to higher productivity and renders products cheaper. Effectively developing a labor theory of value, he further argued that capital has to be understood essentially as a realized value from previous labor, and that capital, as intermediate products in the linkage of vertical production, in turn enhances further labor productivity. As such, his capital theory resembles Smith, Ricardo, and more strikingly, Marx. Nonetheless, Ibn Khaldūn, not trapped in the labor theory of value, on a number of occasions, explicitly talked about both demand and supply sides in the price determination. His observation of the enormous, positive impact of production and consumption of luxury goods on the division of labor and social civilization anticipated

Mandeville and French Encyclopédists.<sup>4</sup> He also illustrated why the wage of the skilled laborer is higher in a larger city than otherwise.<sup>5</sup>

## **II. Emergence of Political Economy of the Division of Labor**

More direct precursors of Smith on doctrines of the division of labor of course are Petty, Mandeville, Hutcheson and the French Encyclopédists among others. William Petty (1671/1690, 1683; 1963, Vol. I pp.260-1 and Vol.II p.473) used the production of clothes, watches and ships as telling examples to illustrate gains from specialization of labor. Henry Martyn (the mysterious “anonymous” author of the well known pamphlet *Considerations on the East-India Trade* 1701)<sup>6</sup>, taking his cue from Petty and the brilliant mercantilist Dudley North (1691), also used examples of making cloth, ships and watches to show the productivity implication of the division of labor. Incidentally, both also touch upon the issue of specialization of machinery, while Martyn (1701) seems to be much more aware of its far-reaching consequences, especially in bringing “more order and regularity into manufactures” (1968, p.67), which is more often referred to as “standardization (of products)” in the literature nowadays. This theme was later further explored by Charles Babbage, Andrew Ure and John S. Mill among others (see below). As is widely known, Mandeville (1714-

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<sup>4</sup> See, e.g., Goldsmith (1988) for an analysis of Mandeville’s thesis on luxury consumption. On the debate between Diderot and his fellow encyclopedists on the good or bad effects of luxury goods, see, e.g., Lough (1989, pp.350-4).

<sup>5</sup> To reflect on the development of the modern literature of human capital, note that Gary Becker complains as late as the mid-1960s that “surprisingly little attention has been paid to ... the influence of market size on the incentives to invest in skills” (1964, p.52).

1729/1957) coined the very term “division of labor” and exemplified its significance by taking, once again, the instance of cloth-making.<sup>7</sup> Hutcheson (1755/1968, pp. 287-90) articulated the necessity of the division of labor and cooperation for civilized society.

The extent to which Smith’s celebrated division of labor principle was directly inspired by the French *Encyclopédie* has long been a focus of controversy. It cannot be denied after all that the three major advantages of labor specialization Smith (1776, Chapter 1) famously identified --- namely, increase in dexterity in every particular workman, saving of time in passing from one job to another, and invention of machines (technical progress) --- have figured out clearly in *Encyclopédie* (1751/1968, pp. 17-8). In particular, as to the well known example of pin-making that Smith used to illustrate the efficiency implication of the division of labor, Edwin Cannan remarked that,

“In Adam Smith’s *Lecture*, p. 164, the business is, as here, divided into eighteen operations. This number is doubtless taken from the *Encyclopédie*, tom.v (published in 1755), s.v. Épingle. The article is ascribed to M. Delaire, ‘qui décrivait la fabrication de l’épingle dans les ateliers même des ouvriers,’ p.807. In some factories the division was carried further. E. Chambers, *Cyclopaedia*, vol. ii, 2<sup>nd</sup> ed., 1738, and 4<sup>th</sup> ed., 1741, s.v., Pin., makes the number of separate operations twenty-five.” (The *Wealth of Nations*, edited by E. Cannan, Methuen, 1950, p.8, footnote 4).

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<sup>6</sup> MacLeod (1983) cogently presents an identification of the authorship of the widely read pamphlet as Henry Martyn.

<sup>7</sup> For an interesting analysis of the extent to which Mandeville might derive his division of labor principle from Plato, see pp 235-8 in Foley (1974).

As Lough (1970, p.17) rightly points out, it is an extremely tricky business to figure out what source and how much Diderot and his colleagues drew on from the English encyclopaedias, and so is the matter as to how much the English encyclopaedia in turn derived from the non-English sources. But Chambers' (1941) *Cyclopaedia* may most likely be credited as one source for the French Encyclopédia. Note, however, as mentioned above, in al-Ghazali's needle-factory example, the number of separate operations is also twenty-five, an interesting coincidence to Chambers' story. Another interesting facet of the pin-factory episode is that the French Encyclopédia's pin example, as well as the derived principle of the division of labor, finds its original source decades earlier, in the brilliant German scholar Ernst Ludwig Carl's (1682-1743) three-volume *Treatise* (1722-3), an overlooked original theorist in the history of economic thought, who seems to be well aware of the gains from labor specialization as well as the profound implication of market size for the division of labor in manufacture. Incidentally, Carl mentioned both needle and pin factories when exemplifying the effect of manufacture division of labor (Hutchison 1988, pp 160-3 and footnote 2 on p.396).

Both Ferguson (1767) and Turgot (1769-70) contain important insights into the crucial role played by the division of labor in social civilization and socio-economic development, thus giving rise to two much debated controversies over priority of the division of labor principle, namely the "Turgot-Smith myth" (termed by Edwin Cannan, see Groenewegen 1969, p.271, footnote 3) and the "Ferguson-Smith controversy". The opening chapters of Turgot (1769-70) focus on economies of the division of labor, strikingly resembling Smith's *magnum opus* published a few years later. There also exists similarity in the theoretical frameworks between the two

books. These, in addition to personal acquaintance and correspondence between the two men, give rise, naturally, to speculations and controversies over the priority of Smith (1776). We do not intend to delve into this controversy and related literature here. Interested readers may refer to, for instance, Groenewegen's (1969) nice treatment and references therein. Groenewegen's scrutiny of the two authors' writings and historical evidence of contact between the two men suggests that the charge against Smith is not well grounded despite the similarity between their books, for they appear to be inspired by the same group of scholars' writings, namely, Locke, Cantillon, Hume and Quesnay (Groenewegen 1969, p.287). As to the Ferguson-Smith controversy over the priority of the division of labor doctrine, see, e.g., Hamowy (1968), which demonstrates that Smith's charge of plagiarism against Ferguson's (1767) analysis of the division of labor can not hold. Nor does the opposite suggestion, made by Karl Marx among others, that Smith borrowed Ferguson's theory of the division of labor without giving due credit. I can only concur with Hamowy that it is Ferguson who had developed a penetrating analysis of the far-reaching *sociological* consequences of the division of labor, which afterwards, interestingly, served as a major inspiration to two fundamentally different figures: Marx and Hayek.

As Smith's celebrated economics of the division of labor is well known, we make only a few points below. Firstly, it cannot be denied that it is Smith who made the greatest contribution to the economics of the division of labor even in the light of penetrating insights of forerunners including Plato, Ibn Khaldūn and Mandeville as mentioned earlier, for only in Smith's hand was the division of labor assigned *the* central role in the system of economic analysis and did economic science *per se* emerge as a systematic scientific

enterprise under such an overarching theme. Schumpeter's (1954, p.187) oft-cited remarks contain elements of truth of particular relevance, at a certain measure of exaggeration, as to the treatment of the division of labor in Smith (1776), "there is nothing original about it, one feature must be mentioned that has not received the attention it deserves: nobody, either before or after A. Smith, ever thought of putting such a burden upon division of labor. With A. Smith, it is practically the only factor in economic progress". As is widely known among students of history of ideas in social sciences, it is often both tedious and less fruitful than one would initially expect to trace *the* original source of virtually any idea, testified by the commonsense contained in the proverb, "nothing is new under the sun". To put many old ideas into a well framed, novel scientific superstructure itself is a most important achievement and deserves the highest credit. Secondly, Smith does differ from his forerunners in an important way. The intellectual powerfulness of his mind well allows for a *coherently* and *systematically* presented scientific theory of labor specialization that contains many brilliant ideas, which perhaps were well known to a good number of his contemporaries and earlier authors, but whose importance remains to be illustrated and more fully appreciated. For instance, in Smith's theory of the division of labor, differences between individuals of different occupations, "is not upon many occasions so much the cause, as the effect of the division of labor" (1776/1976, Chapter 2, p. 28). As such, the Smithian endogenous comparative advantage sharply differs from many, including notions attributed to Plato and other Greeks, before him as well as many influential ones like the Ricardian exogenous comparative advantage as the cause of division of labor after him (Ricardo, 1817/1965). This difference, subtle as it is, has been already noticed, but perhaps more needs to be drawn on its far-

reaching implications for understanding politico-philosophy, economic development, international trade, government intervention, etc. (Cf. Houthakker 1956, McNulty 1975, Foley 1975, Yang 1994, Buchanan and Yoon 2000 and Buchanan 2005). The last point we should like to make here is that in elaborating on “old” ideas Smith realized some deep, hitherto often overlooked, connection among different aspects of potential gains from the division of labor. A case in point is his clear perception of the interdependence between the division of labor and the extent of the market, to which we shall immediately turn in the next section.

### **III. Extent of the Market, Increasing Returns and the Division of Labor: From Adam Smith to Allyn Young**

The idea that the division of labor is limited by the extent of the market, as mentioned above, has long before Smith figured in the writings of Xenophon, Plato and Ibn Khaldūn. Incidentally, the authors, as well as Smith and quite a few other classical political economists, all relate the population size, in the city in particular, to the extent to which the employment may be divided. In addition, Plato (1997, *The Republic*, pp. 1008-13), North (1691), Mandeville (1714/1729), Ferguson (1767), all have realized the importance of (foreign) trade to the division of labor in (domestic) production, and hence to economic development.

But Smith appears to be the first author to be well aware of the other side of the coin: division of labor plays a crucial role in determining the extent of the market, as revealed by Wakefield’s (1835) perusal of Smith’s (1776) *Wealth of Nations*. As a matter of fact, Wakefield (1835), drawing upon the

work of Richard Whately (1831), who insightfully saw political economy as a science of exchange and whom Wakefield highly regarded as “a profound thinker and a powerful reasoner”, considerably substantiated the theory of mutual reinforcement between the two things. His reasoning, a fairly interesting one indeed, can be summarized as the following. The division of labor is, as has been widely understood, depends on the extent of the market, that is, “the power of exchanging”. But the latter, Wakefield argues, “depends on the productiveness of labor employment which relate to the means of subsistence”, especially the productiveness of agriculture, which in turn depends on fertility of soil and climate, which are “beyond the control of man”, and labor’s skill. We are thus lead to an important proposition, “that while division of employments is limited by the extent of the market, the extent of the market is, in great measure, at least, limited by the division of employments.” (Wakefield 1835, p. 81). Wakefield nonetheless sees in no way his treatment on this issue as completion of a promising scientific inquiry. Rather, he calls for a more systematic undertaking,

“(T)he division of employments and the power of exchanging are mutually dependent means of increasing human enjoyments. At the same time, however, it must be confessed, that the power of exchanging has not been thoroughly analyzed by any writer on the subject. Of what elements that complex power is composed, and by what circumstances it is apt to be increased or diminished; these are questions which would occupy much space in a complete treatise on the principles of political economy.” (Wakefield 1835, p. 82)

It is worth noting that Wakefield seriously took issue with Smith, charging the term “division of labor”, which is taken from Mandeville and used throughout in Smith’s writings, as misleading. He submitted that it

should be referred to instead as “division of employment” or “division of operations”, which necessarily implies another important aspect of the social phenomenon of what Smith refers to as “the division of labor”: “union of labor”, or more generally yet, “cooperation”.<sup>8</sup> Remarkably, Wakefield applied his “cooperation principle” into practice in his well known social experiments in the American colony, an achievement John S. Mill (1848, Chapter VIII, pp. 116-122, esp. p. 121) admired with great passion in his further elaboration of the “cooperation principle” underlying the division of labor.

Marshall (1890) draws on biological analogies in his articulation on the “two sides of the same coin”, emphasizing, one the one hand, the increased specialization of labor skill, knowledge, machinery (“differentiation”) and, on the other, the more intimate and firm connection facilitated by markets between separate parts (“integration”) of what he famously refers to as “the industrial organism” (Book 4, Chapter VIII).<sup>9</sup>

This naturally brings us to a topic of importance to later advancement in theories of increasing returns, namely the productivity implication of such an industrial organism (especially for the particular individual firm), for which Marshall introduced the notion of “external economies” (to what Marshall

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<sup>8</sup> For a defence of the long used term “division of labor” by William S. Jevons, see Jevons (1875-6/1977), p.27. Concurring with Wakefield’s concern about, as well as his insights into, the integration due to increasingly dense market exchanging, we shall interchangeably use terms “division of labor” and “division of employment” below.

<sup>9</sup> The notion that the economic system can be seen as one part of, and hence embedded in, the social organism, or as an independently working organism, is of course an old tradition in economics, which was later on lamentably associated with social Darwinism and racism. For instance, see Michael Hutter (1994) for an informative historical survey of the German literature on the organism as a metaphor in economics. Moreover, the potential powerfulness of the organism analogy which serves as an important inspiration for Marshall’s economic analysis of the division of labor network, does not fully play out

referred to as “the representative firm” within the industry). As Sraffa (1926) cogently demonstrates with his characteristic precision, increasing returns, as originating from the division of labor in the classical political economy literature, cannot be accommodated within a Marshallian competitive framework.<sup>10</sup>

Partially in response to, and in defense of Marshall’s concept of external economies against, attacks initialized in Sraffa’s (1926), Allyn Young, in his presidential address before the section of Economic Sciences and Statistics of the British Association for the Advancement of Science at Glasgow, on Sept 10, 1928, drew heavily upon the ideas of the best known man the city has ever produced,

“I shall venture to put further stress upon two points ... The first point is that the principal economies which manifest themselves in increasing returns are the economies of capitalistic or roundabout methods of production ... largely identical with the economies of the division of labor in its most important modern forms. ... The second point is that the economies of roundabout methods, even more than the economies of other forms of the division of labor, depend upon the extent of the market — and that, of course, is why we discuss them under the head of increasing returns.” (Young, p. 530-1).

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in his economic system, due to his having to resort to the pre-Darwin mechanistic analyses of economic equilibrium (see, e.g., Limoges and Ménard 1994).

<sup>10</sup> For the heated debate initialized by Sraffa’s devastating analysis, see the “*Increasing Returns and the Representative Firm*” symposium, *The Economic Journal*, March 1930 issue. The literature emerging on this issue before the mid-1930s, as well as that after the mid-1980s due to the revival of interest in increasing returns, is too vast to permit consideration in this Introduction. But I would avail myself to mention that one way out of the incomparability of increasing returns and perfect competition is, as suggested by Stigler (1941, pp. 72-3), to discard Marshallian partial equilibrium and resort instead to a general equilibrium analysis, on which a modern treatment is found in Sun and Lio (2003).

To Young, Marshall's external economies to an individual firm arise from the whole industrial organism, that is, the network of exchanges and connections among separate parts of the division of labor. He explicitly points out that Marshall's external economies "show themselves only in changes of the organization of the industry as a whole". As such, to focus on the scale of operation by the individual firm, or even the individual industry, is misleading. The promising direction to pursue, Young contends, is to investigate the interdependence between the complicated network of *exchange* with a great number of nexus and dense linkages among them on the one hand, and on the other the progressive division of labor in *production*, which often manifests itself in roundabout methods of production in its modern forms.<sup>11</sup> He thus concludes his address as,

"(T)he division of labor depends upon the extent of the market, but the extent of the market also depends upon the division of labor. In this circumstance lies the possibility of economic progress, apart from the progress which comes as a result of the new knowledge which men are able to gain, whether in the pursuit of their economic or of their non-economic interests." (pp. 539-40)

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<sup>11</sup> Young once remarked rather plainly on the manuscript of Frank Knight's book to be published as *Risk, Uncertainty and Profit* (Houghton Mifflin, Boston, 1921), which was based on Knight's PhD thesis under the supervision of Young, "You miss the point, I fear, of Marshall's external economies. They are the economies (in general) of greater specialization and div. of labor" (Quoted from Blich 1983, p. 362).

It is interesting to notice that while Wakefield established the interdependence between the extent of the market and the division of employment by largely drawing upon the productiveness of labor employed in agriculture, Young focused on the market for intermediate products in manufacturing industries, partially due to the American's overriding of UK in manufacturing industries, a topic receiving much attention at Young's time. Another, indeed more important, reason, however, lies in his appreciation of insights contained in Marshall's industrial organism theory, which was under attack or/and being misunderstood by Sraffa and Knight among others, and which Young decisively and powerfully defended as *one important tradition older than the Marshallian economics per se*.

#### **IV. Division of Labor in Society and Division of Labor in Manufacture**

As indicated earlier, the division of labor in manufacture has on many occasions been discussed before the rise of the factory-system: e.g., the needle production in Ibn Khaldūn (1402) and Carl (1722-3), the pin production in Carl, Chambers's Cyclopedia (1741), the French Encyclopédie (1751) and Smith (1763, 1776), etc. Despite that Smith (1776) unquestionably contains many insights of enormous influence to later economic theories, especially of the division of labor, Smith did fail to grasp some important points. As criticized rightly by Dugald Stewart, Babbage, Ure, and Cannan among a few others (Cf. Cannan 1964, pp. 96-8), and

recently by Rashid (1986), Smith's treatment is rather too narrowly focused on the primitive production of the pin and its like, largely ignorant of the role played by other factors, including machinery and economic organization. Smith established convincingly the relation between the extent of the market and the division of labor exploiting the pin-factory example, which is nonetheless misleading as far as the crucial distinction between social division of labor and manufacture division of labor is concerned. The reason is fairly simple: the pin-factory model cannot be meaningfully interpreted as a theory of *social* division of labor *coordinated* by an (often complicated) network of market exchange (Cf., e.g., Buchanan 1994). Of course, as it happened, and as has been hopefully demonstrated above, inadequacy in Smith's analysis left great room for Young to considerably elaborate on such an important topic in his brilliant presidential address (1928).

Unsatisfied with, as well as inspired by, Smith's treatment of the division of labor, Babbage (1835), Ure (1835) and John Mill (1848), before Marx (1867), to whom we shall shortly devote more detailed discussion, emphasized the fundamental change in the landscape of manufacturing and industrial organizations caused by the factory-system thriving at their time, and investigated the underlying division of labor principles. Babbage pointed to fixed learning costs, in terms of "time" and "waste of material" in apprenticeship, as another important factor of increasing returns to scale, which indeed would play the central role in the literature of human capital and labor specialization represented by Rosen (1983) and Barzel and Yu (1984) in the 1980s. Babbage's major contribution, however, lies in his "new principle" of standardization in manufacturing, on which the principal forerunner of modern computer science offers a nice illustration of how the

principle can be practically applied to produce an extremely spectacular effect even in the division of *mental* labor (refer to Babbage, 1832/1989, pp. 135-40 for the fascinating story of how the French mathematician, de Prony, inspired by a random read of Adam Smith's (1776) opening chapters on the division of labor, organized the making of logarithmical and trigonometric functions based on elementary difference calculations).<sup>12</sup> Ure (1835) further argues that a definitive feature of the standardized production due to extensive employment of manufacturing machines is that the machinery supercedes skillful labors. John S. Mill (1848) highlights the organizational change and large-scale manufacturing, which allow for a greater degree of the division of labor within the factory.

Notwithstanding the above authors' important observations, it appears fair to say that the analysis on the connection and distinction between the division of labor in society and division of labor in manufacturing finds its culmination in Karl Marx (1867, Volume One, Book 1, Part 4, Chapter 14, Section 4), which provide stimulating intellectual source even to theorists of economic organizations today. Marx firstly pointed out, rightly, that the manufacture division of labor originated historically from the development in social division of labor but exerts feedback on, and indeed further promotes, the latter. Moving on to their fundamental difference, Marx wrote,

“in spite of the numerous analogies and links connecting them, the division of labor in the interior of a society, and that in the interior of a workshop, differ not only in degree, but also in kind. .... But what is it that forms the bond between the independent labors of the cattle-breeder, the tanner and the shoemaker? It is the fact that their respective products are commodities. What, on the other hand, characterizes

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<sup>12</sup> For a short bibliography and contribution to economics by Babbage, see Stigler

the division of labor in manufacture? The fact that the specialized worker produces no commodities. It is only the common product of all the specialized workers that becomes a commodity. The division of labor within society is mediated through *the purchase and sale of the products* of different branches of industry, while the connection between the various partial operations in a workshop is mediated through *the sale of the labor-power* of several workers to one capitalist, who applies it as combined labor-power. ... Division of labor within the workshop implies the undisputed authority of the capitalist over men, who are merely the members of a total mechanism which belongs to him. The division of labor within society brings into contact independent producers of commodities, who acknowledge no authority other than that of competition, of the coercion exerted by the pressure of their reciprocal interests.” (pp. 474-7; my emphasis).

For Marx, the definitive distinction between social division of labor and manufacture division of labor is rooted in mechanisms by which they are respectively coordinated. In the former, it is the decentralized market exchange of commodities, while in the latter the centralized mediation of labor allocation characterized by the employment relationship. Marx’s observation on the sale of labor (within factory) *or* commodities (in society) essentially grasps one major aspect of modern transaction cost theories of the firm. (see, e.g., Coase 1937, Pitelis 1994, Yang and Ng 1995, Holmstrom 1999). The distinction made by Marx between the two major mechanisms by which the division of labor is coordinated, i.e., authority in the employment relation associated with the firm and decentralized exchange without central authority in the market, must have a familiar ring to a Coasian economist, for it is precisely this distinction that plays *the* crucial role in Coase’s (1937) celebrated theory of the firm. Yet, Coase did not seem to be aware of Marx’s

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(1991).

pioneering insights when developing his path-breaking transaction cost theory of the firm (Cf. Putterman and Kroszner 1996, p.17).

As to organization of production within a factory, Amasa Walker (1874) made some fairly interesting points on coordination (supervision) costs, which he presciently realized impose limitations to “prevent aggregation of capital ... (that) would (otherwise) swallow up the whole industry of a state” (p. 40).<sup>13</sup> Coordination costs, or essentially the same thing put in different terms, of course has received a great deal of attention in the modern literature as a limiting factor of the division of labor, especially of the scale of operations of the firm, (see, e.g., Williamson 1967, Becker and Murphy 1992 among many others).

One major detrimental *sociological* consequence of the division of labor, namely, alienation, has occurred virtually throughout the history of ideas of the division of labor, ranging from Plato (Apology; see Plato 1997, pp22-23) and Aristotle (Cf. e.g., Gordon 1993, p.3) to Ferguson (1767), Smith (1776), Ure (1835), Marx (1867), let alone to mention philosophical critique by Rousseau, Herder, Schiller, Hegel, etc.<sup>14</sup> No attempt, however, is made here to consider the voluminous literature, mostly sociological, philosophical or political, centred around such a topic of undoubted importance. Instead, I content myself with referring only to some particularly interesting conceptual clarifications. The seeming contradiction contained in Smith’s (1776) writings on the positive and negative effects of the division of labor could be largely resolved by drawing a distinction between its *economic*

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<sup>13</sup> Another observation by Amasa Walker that may be worthy a mention is on the division of *mental* labor. He, drawing attention to increasing specialization in the fields of law and medicine, offers an interesting illustration (p. 42).

<sup>14</sup> Refer to Sun (2005a) for a carefully selection of theses on negative aspects of the division of labor by Ferguson, Smith, Ure and Marx.

(favorable) and *sociological* (partly unfavorable) consequences. (see, e.g., Groenewegen 1977 and an exchange of views between West 1964 and Rosenberg 1965). Although Ferguson (1767) and Smith (1776) both explicitly discuss harmful effects on specialized laborers, as already mentioned, Ferguson (1767) appears of deeper insight to its far-reaching sociological consequences, having served as a more important inspiration on this crucial point to both Marx and Hayek.<sup>15</sup> Marx's (1844, 1867) "alienation" thesis of the capitalist division of labor is more complicated in several dimensions than Smith and Ferguson's. West (1969) contends, by drawing upon sociologists' approach to studies of alienation of which a survey is found in Seeman (1959), that Marx's alienation indeed includes "powerlessness", "isolation", and the most philosophically rich notion of "self-estrangement" (dehumanized, and alienated from the laborer's "inner self") and that the similarity between Smith and Marx's understanding of the harmful sociological effect of the division of labor largely lies in the third aspect: self-estrangement alienation. It should go without saying that the sociological consequences, both favorable aspects (social cohesion, for instance) and unfavorable ones, have been extensively explored in sociology (see, for instance, Durkheim's (1893/1933) classical study of social division of labor).

## **V. Spontaneous Order, Money and Knowledge: Mandeville, Ferguson and the Austrian Insights**

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<sup>15</sup> See, e.g., Hamowy (1968), and Rosenberg (1965, esp. footnote 2 on p.135).

As shown above, it seems legitimate to claim that Ibn Khaldūn deserves to be seen as one pioneering theorist of the self-generating socio-economic dynamics. The very thesis of the spontaneous order, was nonetheless fully developed only in the hands of Mandeville, the Scots and Austrians. It is Mandeville, as Hayek (1978, p.250) points out, who made the “definitive breakthrough in modern thought of the twin ideas of evolution and of the spontaneous formation of an order”. It appears that Hayek (1960) coined the term “spontaneous order”. That which emerged from Mandeville’s writings is nicely summarized by Hayek as,

“His main contention became simply that in the complex order of society the results of men’s actions were very different from what they had intended, and that the individuals, in pursuing their own ends, whether selfish or altruistic, produced useful results for others which they did not anticipate or perhaps even know; and finally, that the whole order of society, and even all that we call culture, was the result of individual strivings which had no such end in view, but which were channelled to serve such ends by institutions, practices, and rules which also had never been deliberately invented but had grown up by the survival of what proved successful.” (1978, p.253)

It is worth noticing that the theme of spontaneously generated order is an overarching one, of which the spontaneous market order coordinated by the decentralized price system stands only as one special case, and so do the language, morals, money, property rights, etc.<sup>16</sup>

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<sup>16</sup> There has recently emerged a literature coming to grips with the origins of social conventions by exploiting evolutionary game theory. For instance, Sugden (1989), drawing on the replicator model in evolutionary games, analyses the spontaneously evolving conventions, especially property rights. We shall turn to the modern literature of the origin of money that was inspired by Menger (1892) below.

The Scottish moral philosophers, noticeably David Hume, Adam Smith and Adam Ferguson, significantly further developed Mandeville's thesis of the spontaneously formed order, especially its vast importance to understanding the self-regulating nature of the market in coordinating the division of labor and exchange.<sup>17</sup> Largely through Hume and Savigny, Mandeville's thesis was also an important inspiration to Carl Menger's theory of the formation of law, morals, market order, and money (Hayek 1978, pp.264-5).

One remarkable feature of Ferguson's theory of spontaneously formed social orders including the division of labor and civil laws is its emphasis on unintended consequences of actions of numerous *ordinary* human individuals (1867). He wrote,

“Mankind, in following the present sense of their minds, in striving to remove inconveniencies, or to gain apparent and contiguous advantages, arrive at ends which even their imagination could not anticipate, and pass on, like other animals, in the track of their nature, without perceiving its end. He who first said, “I will appropriate this field: I will leave it to my heirs”, did not perceive, that he was laying the foundation of civil laws and political establishments.” (1767/1995, p.119).

It may deserve notice that the last point above spells out what later on appears as a promising research agenda on the origin and evolution of property rights (see, e.g., Sugden 1989).

Ferguson's emphasis on the unintended long-term consequence of interplay of actions, rather than of designs, which individuals undertake in

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<sup>17</sup> The intellectual influence of Mandeville on the Scots (with measurable reservations on some of Mandeville's views) has been extensively studied. See, e.g., Campbell and Skinner (1982), Hont and Ignatieff (1983), Hamowy (1987) and Goldsmith (1988).

pursuing myopically their own ends, was highly regarded and significantly advanced by Hayek (see, Ferguson 1767/1995, p.119, Hayek 1967), who, unquestionably the most original and the most important thinker in the 20<sup>th</sup> century of the spontaneous order theory without which theories of liberalism would be unimaginable, pioneered some important theses to be “rediscovered” by complexity scientists during 1980-1990s.<sup>18</sup> Indeed, Hayek’s theory of the spontaneously generated social order has become one thriving industry since the fall of the Berlin Wall (see, e.g., Birner and van Zijp 1994, Vanberg 1994 and Fleetwood 1995).

But in what follows we focus on only his socio-economic theory of (dispersed) knowledge, perhaps *the* most important contribution among many other ones made by Hayek to the economic science.<sup>19</sup> Critically examining the meaning of “economic equilibrium” in his 1937 “*Economics and Knowledge*” paper, a turning point not only for Hayek himself in economic thinking, Hayek identifies what he sees as the “central question of all social sciences: How can the combination of fragments of knowledge existing in different minds bring about results which, if they were to be brought about deliberately, would require a knowledge on the part of the directing mind which no single person can possess?” (Hayek 1948/1937, p.54). As a matter of fact, the question Hayek asks also lies in the very core of the Smithian economics, namely, the economics of how the division of labor (and hence division of knowledge), which Smith believes constitutes

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<sup>18</sup> Cf. Tucker (1996); for refutations of the “rediscovery” allegation, refer to, e.g., Kilpatrick (2001).

<sup>19</sup> Upon reflecting on his career as an economic theorist, Hayek himself remarks that, “... the paper on “Economics and Knowledge” which I read in 1936 as the presidential address to the London Economic Club, together with some later related papers reprinted in *Individualism and Economic Order* (1948), ... seems to me in retrospect the most

*the* source of economic progress, can be coordinated by the “invisible hand”. Division of labor necessarily implies division of knowledge, or as Hayek characteristically puts it, dispersion of knowledge among individuals. As such, any scientific theory of the division of labor has to come to grips with a sound understanding of how the knowledge dispersed among individuals of different specializations is utilized by society as a whole (Hayek 1945). Hayek convincingly rules out the feasibility for any imaginable central planning mechanism to undertake this task, for the data of which the central authority can make use to do such a job has to be “given”, yet the dispersed knowledge of particular circumstances, which are continuously changing, of time and space, can not be given as such.

It is the decentralized price system, standing as an instance of spontaneous orders, that can effectively convey the local knowledge among the individuals and thus makes efficient utilization of the dispersed knowledge.

“The price system is just one of those formations which man has learned to use (though he is still very far from having learned to make the best use of it) after he had stumbled upon it without understanding it. Through it not only a division of labor but also a coordinated utilization of resources based on an equally divided knowledge has become possible.” (Hayek 1945, p. 528)

Decades later, in a public lecture, Hayek puts it more succinctly, “We can have a far-reaching division of labor only by relying on the impersonal signals of prices” (Hayek 1983, pp 19-20).

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original contribution I have made to the theory of economics.” (Kresge and Wenar 1994, p.79)

In illustrating the powerfulness of the price system in utilizing division of knowledge and division of labor, Hayek remarkably noticed that, “The most significant fact about this system is the economy of knowledge with which it operates, or how little the individual participants need to know in order to be able to take the right action” (1945, pp. 526-7). The economy of information required by the price mechanism was rigorously formulated in the later literature of the mechanism design (Cf. e.g., Hurwicz 1973).<sup>20</sup>

As mentioned earlier, the necessity of money as a medium of exchange to support the network of the division of labor was already noticed by Greeks. John Law and Adam Smith further elaborated on this topic, and in fact Smith illustrated in anthropological details the origin of barter money and its historical evolution into fiat money. Despite that, it is only in the hands of Carl Menger (1892) that a theory of the origin of money as a spontaneously generated institution was developed.<sup>21</sup> Menger’s central thesis is that the nature of commodity which can be used as the medium of exchange (money) lies in its degree of “Absatzfähigkeit” (“saleableness”, as translated by Caroline A. Foley in 1892; Leland B. Yeager and Monika Streissler translate as “marketability” (see Menger 2002)), and that money essentially arises

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<sup>20</sup> The informative nature of the price system had indeed been noticed, without explicit reference to dispersed knowledge problem as in Hayek’s theory, in earlier generations of the Austrian economists. See, e.g., Streissler (1990) for an illustration of how Wieser’s economics topics that emerged during 1880-1890s had inspired Mises and Hayek.

<sup>21</sup> The most influential, and the most widely read, piece by Menger on money is doubtless his 1892 *Economic Journal* publication (translated by Caroline A. Foley), which indeed contains the most important elements of his spontaneous order theory of the origin of money. The original article in German, a much more lengthy one in Menger’s verbose and unusually complicated writing style, of which his *Economic Journal* 1892 article is a deliberately shortened, more neatly presented version, was accessible to the English readership only quite recently due to Leland B. Yeager and Monika Streissler’s valuable work (see Menger 2002). The original version is “Geld”, *Handwoerterbuch der Staatswissenschaften* (3<sup>rd</sup> edition), J. Conrad et al. (eds.), Vol IV., Fischer, Jena, 1892, pp. 555-610.

spontaneously from interplay of individuals' pursuit of their own self-interests without government intervention.

It should be noticed that Menger (1892) also indicates the role played “by way of legislation” in establishing the *social* institution of money, but emphasizes that “this is neither the only, nor the primary mode in which money has taken its origin” (p. 250). He contends that the network effect, a crucial element in the interplay between decentralized actions of heterogeneous agents, suffices for the most marketable commodity to be eventually instituted as money.<sup>22</sup> Despite some controversies centred around Menger's thesis that money as a *social* institution arises without intervention from social organizations,<sup>23</sup> Menger (1892), as it happened, has recently been serving as a major intellectual inspiration to an extensive literature of the origin of money, which indeed is still explosively growing. Schmitz (2002) provides a critical review of neoclassical theories of money, represented by Townsend's (1980) spatial separation model, the overlapping generation dynamics model, and most prominently, the search model originating from Kiyotaki and Wright (1989, 1991). Schmitz cogently argues that, compared to Menger's original theory on the genesis of money, a common and major drawback of all the above-mentioned models is their crucial assumption of an exogenously given social institution of money, which effectively begs the very Mengerian question of its emergence.

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<sup>22</sup> For a recent study that incorporates adaptive learning and network effects into the standard search-theoretical model in an attempt to account for the spontaneous evolution from barter money to fiat money, see Selgin (2003).

<sup>23</sup> See, e.g., Goodhart's (2004) book review of Latzer and Schmitz (2002) for a criticism of this aspect of Menger's monetary theory.

## **VI. Concluding Remarks**

Hopefully we have in the above sketched out, at least one major part of, the conceptual development of the economics of division of labor over twenty-five centuries up to Hayek's (1940s) thesis of the division of knowledge as a by-product of the division of labor. In particular, we emphatically highlight important insights of ancient Greeks, medieval Islam and pre-Smithian political economists, and critically review literature of recent two centuries on three deliberately chosen topics, namely, the interdependence between the division of labor and the extent of the market, distinction as well as connection between social division of labor and manufacturing division of labor, and the spontaneous order theory of division of knowledge and the origins of money. There are quite some topics of importance, such as implications of increasing returns to the division of labor for international trade, economic growth, general equilibrium analysis, organizational change, technical progress, income distribution, industrialization, etc., which we either discuss fairly briefly and superficially or leave untouched at all in this article, and which we leave to a sequel of the present article (Sun forthcoming). Nonetheless, we hope that this article might serve as a mini guide-book to the most fundamental developments in history of the economics of division of labor.

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