Historical Antecedents of Contemporary Endogenous Growth Theory

By

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Introduction:

At the dawn of the 21st century, we continue to live in a world in which inequality in economic development levels persist and significant differences in per capita income and quality of life abound. This is a time in which a few countries of the world possess the majority of global wealth, and their citizens live in a state of great opulence when compared to the mass of individuals whose daily struggle is solely one of survival. Thus, lingering questions about the keys to alleviating poverty for the long term and bringing about the possibility of improvement in standards of living continue to be explored.

Following World War II, European powers began a process of significant decolonization, which led to an increased interest in the field of development economics as former colonies started along their journey of independence with the hopes of some day emerging from the depths of underdevelopment and into the so-called modern world. During this period of time, a theory of growth that would later be used as the basis for policy formation during the market fundamentalist reign of the 1980's came to fruition. It is called the Solow neoclassical growth model, named after Massachusetts Institute of Technology (MIT) Professor and Nobel Prize winner Robert Solow.[1] The Solow model suggests that growth in the gross domestic product (GDP) of a country is attributed to changes in investment in human and physical capital stock, the size of the labor force, and a residual factor often referred to as "technical progress."[2] The Solow residual is considered an exogenous factor of growth, such that improvements in technology are considered to be independent of the economic actors.[3]

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[1] Todaro, Michael P. and Steven C. Smith. *Economic Development*. 8th ed. (Boston: Addison-Wesley, 2003) 141.
[2] Stern, Nicholas. "The Determinants of Growth." *The Economic Journal*, Vol. 101, No. 404 (Jan., 1991), 125.
[3] Todaro and Smith 146-147.

The primary policy implication of the Solow model is that the way to stimulate economic growth is to ensure that savings rates exceed rates of depreciation and are used to make investments in human and physical capital stock.[4] The main criticisms of this model rest upon the fact that it fails to explain the actual source of technological change as well as different residuals between countries that have attained similar levels of technological advancement.[5] Criticism of the Solow model led to the development of what is today referred to as endogenous growth theory or new growth theory.

Essentially, endogenous growth models are different from exogenous models in that they posit that improvements in productivity (in addition to the gains from changes in the factor inputs of human and physical capital and labor) are attributed to endogenous factors (things taking place within the economic model) as opposed to some sort of external forces of change.[6] Endogenous growth theorists see the division of labor as a primary factor for growth internal to the economic model, among others that have become more apparent over time. These internal factors of growth are then responsible for leading to increasing returns to scale, which is a state of affairs that occurs when "a proportionate increase in all inputs allows for a more than proportionate increase in outputs; in the single-output case, this implies a decreasing average cost curve".[7] In other words, with increasing returns to scale, firms and industries can expect larger returns on their investment in human and physical capital, which can lead to improvements in overall economic growth in terms of GDP.

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[4] Ibid 141-142.
[5] Ibid 147.
[6] "Growth." *The Economist: Economics A-Z*. (http://www.economist.com/research/Economics/alphabetic.cfm?letter=g#growth).
[7] Eatwell, John, Murray Milgate, and Peter Newman, eds. *The New Palgrave: A Dictionary of Economics*. (London: Macmillan, 1987) 761.

Furthermore, models of endogenous growth allow for the possibility of sustained long-term growth given sufficient investment in physical and human capital, which "[generates] external economies and productivity improvements that offset the natural tendency for diminishing returns".[8] Such a result is not possible within the Solow model. The major implication for development economics of the possibility of sustained long-term growth is the persistence of inequality gaps in GDP between wealthy and poor countries due to differences in the levels of investment in such things as human capital, infrastructure, and research and development on top of a foundation that is already skewed in favor of developed countries.[9] Finally, since contemporary endogenous growth models primarily attribute technological progress to "public and private investments in human capital and knowledge-intensive industries," the public policy implications of these models involve "promoting economic development through direct and indirect investments in human capital formation and the encouragement of foreign private investment in knowledge-intensive industries such as computer software and telecommunications."[10]

Now that the context in which endogenous growth theory exists has been established, it is worthwhile to consider why we should examine the historical antecedents of this theory. First, although the economic ideas we will primarily examine do not appear in the mathematical forms that are common in the field of economic study today, they do still provide a great deal of relevant information that can lead to a more thorough understanding of the evolution of economic thought that has occurred over time and led to the contemporary models in this theory. This understanding can allow us to become aware of the obstacles economists have faced over time in the development of their ideas, such that we can avoid those in our own thinking.

[8] Todaro and Smith 147.
[9] Ibid 148.
[10] Ibid.

Furthermore, the reexamination of past ideas within the context of the present can sometimes lead to a new way of thinking about an old idea that can prove helpful to the continued evolution of thought. Finally, it only seems appropriate to give proper recognition and credit to individuals in the past whose ideas are responsible for serving as the foundation of thought for the ideas of today.

Overview:

Since the time of the Greek philosophers Plato, Aristotle, and Xenophon, a rudimentary understanding of the benefits of a "division of labour…associated with specialization and cooperation and their consequences for labour productivity" has been present.[11] Following that time period, the issue of the division of labor was picked up again in the late 1600's and given a fair treatment by such economists of the time as the Englishman Sir William Petty, who looked at the benefits of the division of labor used in the cloth-making process and suggested that such a division of labor be applied to the manufacture of ships in his 1671 work, *Political Arithmetick.*[12] Petty would later discuss the advantages of increased specialization of industries as well as the advantages of developing related industries within a close geographical area when he looked at various manufacturing processes in the city of London in *Another Essay on Political Arithmetick Concerning the Growth of the City of London.*[13]

Other economic thinkers would address the issue of the division of labor as well during the 17th and 18th centuries; however, such a significant focus on it due to a belief that the issue was central to understanding economic growth would not come to the fore until classical economist Adam Smith's seminal work *An Inquiry into the Nature and Causes of the Wealth of*

[11] Eatwell, et al. 901.
[12] Ibid.
[13] Ibid.

Nations was published in 1776. Smith's discussion of the division of labor is noteworthy, not because he discovered the concept (he clearly did not), but because of his "*emphasis* on the division of labor as a factor in growth via its enormous influence on productivity."[14] It is for this reason that we start our examination of the roots of endogenous growth theory by considering Smith's thoughts on the division of labor.

Beyond Smith, we then look to the contributions of Charles Babbage and Alfred Marshall, both of whom are responsible for expanding upon certain aspects of the division of labor originally found in *Wealth of Nations* as well as offering some unique and refined contributions of their own. Next, we discuss the various factors that decreased emphases on the centrality of the division of labor, increasing returns, and economic growth for a period of time. Then, with the introduction of Allyn Young's 1928 article, "Increasing Returns and Economic Progress," we delve into the intellectual territory that began to revive the issues raised by Smith. It is within this revival that we see even more variations and extensions of core ideas that would ultimately lead to the contemporary state of thought on these issues, represented most prominently by the works of Paul Romer. Overall, it is the primary objective of this paper to present an overview of the historical foundations, particularly with respect to the earlier works, of what is today referred to as endogenous growth theory (with most of the focus on the division of labor and increasing returns to scale), which is an area of economic inquiry that is still in flux and which is increasingly being applied to current debates beyond the division of labor.

[14] Ibid 902.

The Early Roots:

- *Adam Smith:*

As noted above, the prominent position that Adam Smith gives to the issue of the division of labor in *Wealth of Nations* is the reason why he is considered the founder of current thought on the subject. In the first three chapters of the first book, Adam Smith specifically discusses the division of labor. He starts by pointing out that while in the process of producing a small number of a certain item, it is possible to find all of the various types of workers responsible for the production process within a single "workhouse," such is not the case for the manufacture of products that are consumed by a great deal of the people of a given society.[15] In those circumstances, what occurs is the development of a multiplicity of "peculiar trades" that constitutes the various steps in the process that have been delineated by those within the trade as being unique aspects in the production process that can be carried out by a single person.[16]

Smith discusses the process of pin making, which is divided into about eighteen different steps carried out by ten different people, and suggests that the result of this division of labor is the production of around 48,000 pins in a day of work.[17] However, had this division of labor not been in place, and

> if they had all wrought separately and independently, and without any of them having been educated to this peculiar business, they certainly could not each of them have made twenty, perhaps not one pin in a day; that is, certainly not the two hundred and fortieth, perhaps not the four thousand eight hundredth part of what they are at present capable of performing, in consequence of a proper division and combination of their different operations.[18]

Thus, he concludes that while the division of labor in the production of other goods may not be as dramatic as it is in the case of pin making, the consequence of the division of labor is still the

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[15] Smith, Adam. *An Inquiry into the Nature and Causes of the Wealth of Nations*. (Oxford: Oxford, 1993) 11.
[16] Ibid 12.
[17] Ibid.
[18] Ibid 13.

same, which is "a proportionable increase in the productive powers of labour."[19] Once Smith has determined that the division of labor results in increased labor productivity, he discusses the three reasons that he sees for this increased productivity.

First, "the improvement of the dexterity of the workman necessarily increases the quantity of the work he can perform," and since the division of labor breaks down each worker's focus to a simple task in the production process, this greater dexterity does indeed come about.[20] To illustrate this point, Smith provides another telling example:

> A common smith, who, though accustomed to handle the hammer, has never been used to make nails, if upon some particular occasion he is obliged to attempt it, will scarce, I am assured, be able to make above two or three hundred nails in a day, and those too very bad ones. A smith who has been accustomed to make nails, but whose sole or principal business has not been that of a nailer, can seldom with his utmost diligence make more that eight hundred or a thousand nails in a day. I have seen several boys under twenty years of age who had never exercised any other trade but that of making nails, and who, when they exerted themselves, could make, each of them, upwards of two thousand three hundred nails in a day.[21]

Smith goes on to mention the various steps in making a nail that are carried out by a worker and suggests that "the rapidity with which some of the operations of those manufactures are performed, exceeds what the human hand could, by those who had never seen them, be capable of acquiring."[22]

Second, Smith points out "the advantage which is gained by saving the time commonly lost in passing from one sort of work to another." This, he says, is more significant than one might guess without seriously thinking about the matter.[23] Again, his example is more than

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[19] Ibid.
[20] Ibid 15.
[21] Ibid.
[22] Ibid 16.
[23] Ibid.

helpful for understanding this point, while also providing a glimpse into the writing style used by those discussing economic theory at the time.

> A man commonly saunters a little in turning his hand from one sort of employment to another. When he first begins the new work he is seldom very keen and hearty; his mind, as they say, does not go to it, and for some time he rather trifles than applies to good purpose. The habit of sauntering and of indolent careless application, which is naturally, or rather necessarily acquired by every country workman who is obliged to change his work and his tools ever half hour, and to apply his hand in twenty different ways almost every day of his life; renders him almost always slothful and lazy, incapable of any vigorous application even on the most pressing occasions. Independent, therefore, of his deficiency in point of dexterity, this cause alone must always reduce considerably the quantity of work which he is capable of performing.[24]

Third, Smith argues that the development of machinery is responsible for greater labor productivity. He states that when workers are devoted to completing the same task over and over due to the division of labor, they are more likely to come up with inventions that help them do their work even more easily than they had before. To illustrate this point, Smith provides yet another example that represents what led him to such a conclusion.

> In the first fire-engines, a boy was constantly employed to open and shut alternately the communication between the boiler and the cylinder, according to the piston either ascended or descended. One of those boys, who loved to play with his companions, observed that, by tying a string from the handle of the valve, which opened this communication, to another part of the machine, the valve would open and shut without his assistance, and leave him at liberty to divert himself with his play-fellows. One of the greatest improvements that has been made upon this machine, since it was first invented, was in this manner the discovery of a boy who wanted to save his own labour.[25]

[24] Ibid.
[25] Ibid.

At this point, then, Smith credits the division of labor as the reason for the production of such a great quantity of goods in a society, which leads to "universal opulence…[extending] itself to the lowest ranks of the people."[26]

Next, in chapter two of *Wealth of Nations*, Smith attempts to pin down the cause of the division of labor within society. Rather than crediting such an organization of production to some great mind that is able to see the benefits of it, he attributes the division of labor to "a certain propensity in human nature which has in view to no such extensive utility; the propensity to truck, barter, and exchange one thing for another."[27] Smith sees man in civilized society as being uniquely in need of cooperation with his fellow man and "more likely to prevail if he can interest their *(his brethren)* self-love in his favour, and shew them that it is for their own advantage to do for him what he requires of them."[28] He goes on to state "it is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest."[29] In other words, all of the things that one needs to live one's life are not available to someone without the assistance of someone else, and this leads one to trade with others who can fulfill those needs. Moreover, Smith says that this reality drives every individual to find some occupation to which to devote his efforts toward. This allows him to become especially talented in that occupation, such that he can create enough of a particular good or service to sell so as to fulfill his needs and those of his family.[30]

Finally, in chapter three, Smith discusses how the division of labor is not infinite but is limited by the extent of the market. By making this point, Smith means that the greater the size of the market for a particular good, the more opportunity there is for a division of labor to take

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[26] Ibid 18.
[27] Ibid 21.
[28] Ibid 22.
[29] Ibid.
[30] Ibid 23.

root. He says that "when the market is very small, no person can have any encouragement to dedicate himself entirely to one employment, for want of the power to exchange all that surplus part of the produce of his own labour, which is over and above his own consumption, for such parts of the produce of other men's labour as he has occasion for."[31] He goes on to suggest that some occupations cannot even be worthwhile for a person unless they are in an area that is more highly populated than a village.[32] Furthermore, Smith uses this relationship between the division of labor and the extent of the market to explain why it was that most highly developed cities of the world at his time were located at seaports, and he argues that the greatest advantage that any industry can have is the ability to have access to overseas shipping to expand their market size.[33] Little did Smith know that this idea of the division of labor being limited by the extent of the market would be crucial to the revival of the concept of the division of labor as central to understanding economic growth 150 years later.

- *Charles Babbage:*

The next person to whom we look as a contributor to the early thought on the division of labor and its relation to increased productivity, increasing returns, and economic growth is Charles Babbage, who wrote *On the Economy of Machinery and Manufactures* in 1832. Although he did not give the issue the kind of prominence that Adam Smith did,[34] Babbage did state very clearly that "perhaps the most important principle on which the economy of a manufacture depends, is the division of labour amongst the persons who perform the work."[35] In

[31] Ibid 26.
[32] Ibid.
[33] Ibid 27-30.
[34] While Smith discussed the issue in the first three chapters of book one, Babbage waited until chapters 19 to 22 in his.
[35] Babbage, Charles. *On the Economy of Machinery and Manufactures*. (1832). (http://www.economics.mcmaster.ca/ugcm/3ll3/babbage/index.html).

his discussion of the issue, Babbage places himself into the history of the analysis of the division of labor:

> The various principles on which the advantages of this system depend, have been much the subject of discussion amongst writers on political economy; but the relative importance of their influence does not appear, in all cases, to have been estimated with sufficient precision. It is my intention, in the first instance, to state shortly those principles, and then to point out what appears to me to have been omitted by those who have previously treated the subject.[36]

Babbage explains enumerates six principles on which the advantages of the division of labor depend. First, he says "it will readily be admitted, that the portion of time occupied in the acquisition of any art will depend on the difficulty of its execution; and that the greater the number of distinct processes, the longer will be the time which the apprentice must employ in acquiring it."[37] Thus, his first principle is simply that it takes much less time to learn one's job when the production process is divided. Secondly, he suggests that the division of labor will reduce production costs by resulting in less waste as someone will not ruin as many production materials if he only has to learn how to use the tools and materials involved with a single step in the production process. Thirdly, he discusses the division of labor as saving time that would otherwise be lost as a worker moves from task to task:

> When the human hand, or the human head, has been for some time occupied in any kind of work, it cannot instantly change its employment with full effect. The muscles of the limbs employed have acquired a flexibility during their exertion, and those not in action a stiffness during rest, which renders every change slow and unequal in the commencement. Long habit also produces in the muscles exercised a capacity for enduring fatigue to a much greater degree than they could support under other circumstances. A similar result seems to take place in any change of mental exertion; the attention bestowed on the new subject not being so perfect at first as it becomes after some exercise.[38]

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[36] Ibid.
[37] Ibid.
[38] Ibid.

Fourthly, Babbage suggests that the division of labor saves time in the production process that would have otherwise been lost to switching between various tools that are used to make a certain product. Because certain steps in the production process often require the use of a finely tuned tool for that step, not having to readjust the tools and leaving them alone for the person who uses the tool in a specific way saves time. Fifthly, specifically reiterating a point made by Adam Smith, Babbage notes that the repetition of the same process over and over makes a worker very skilled at that particular task. Sixthly, the division of labor allows a worker to become familiar enough with their tools to be able to come up with ways to improve them, and "such an improvement in the tool is generally the first step towards a machine."[39]

After Babbage discusses his principles underlying the advantages of the division of labor, he points out that he has thought of another principle to add which he says had been neglected to this point. This final principle, according to Babbage, is as follows:

> That the master manufacturer, by dividing the work to be executed into different processes, each requiring different degrees of skill or of force, can purchase exactly that precise quantity of both which is necessary for each process; whereas, if the whole work were executed by one workman, that person must possess sufficient skill to perform the most difficult, and sufficient strength to execute the most laborious, of the operations into which the art is divided.[40]

To illustrate this principle, Babbage undergoes an extremely detailed discussion of the pin-making process, looking at how it is performed and examining costs and quantities of materials involved, which allows him to conclude that having a structured division of labor enables the manufacturer to minimize costs in the production process.

Some other points that Babbage makes include his discussion about the division of labor being not only cost-effective in the physical production process, but also in the division of labor among tasks of the mind. Beyond that, Babbage also concludes that those manufacturers who do

[39] Ibid.
[40] Ibid.

not take advantage of the same degree of the division of labor as their competitors would be disadvantaged because of higher production costs.

- *Alfred Marshall:*

The final contributor to economic thought during the early roots phase of discussion on the important role of the division of labor is Alfred Marshall, whose treatment of the subject in *Principles of Economics* (first published in 1890) added a good deal more to the discussion of the issue by bringing the matter up to date with more references to the increased mechanization of production and the development of production abilities of a much larger scale than had been present at the time of Adam Smith.

Marshall's first major point about the division of labor is that with an increased division of labor comes an increase in the use of machinery in the production process.[41] Although machinery replaces manual labor, the tendency toward larger-scale production processes brings opportunities for workers that otherwise might not have existed in a smaller production facility.[42] He says that these new positions in larger-scale firms come about because of the increased complexity of the machines being used as well as the greater need for people to fill management positions.[43]

Furthermore, while some in the past may have been concerned that the division of labor and the introduction of machinery would lead to more deskilling or dumbing down of the labor force, Marshall seems to be a bit more optimistic, suggesting that machine operators must meet a certain intellectual threshold in order to operate in increasingly complex production environments:

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[41] Marshall, Alfred. *Principles of Economics*. 8th ed. (London: Macmillan, 1920) 255.
[42] Ibid 256.
[43] Ibid.

> Take for instance a beautiful machine which feeds itself with steel wire at one end, and delivers at the other tiny screws of exquisite form; it displaces a great many operatives who had indeed acquired a very high and specialized manual skill, but who lived sedentary lives, straining their eyesight through the microscopes, and finding in their work very little scope for any faculty except a mere command over the use of their fingers. But the machine is intricate and costly, and the person who minds it must have an intelligence, and an energetic sense of responsibility, which go a long way towards making a fine character; and which, though more common than they were, are yet sufficiently rare to be able to earn a very high rate of pay.[44]

Another effect of the introduction of machinery on the production process is the blurring of lines between certain trades that were once highly developed specialties due to the fact that workers can more easily move from machine to machine than they can from one skilled trade to another.[45] Marshall mentions an example to illustrate this point:

> In old times it would have been very small comfort to watch-makers, who happened to be suffering from a diminished demand for their wares, to be told that the gun-making trade was in want of extra hands; but most of the operatives in a watch factory would find machines very similar to those with which they were familiar, if they strayed into a gun-making factory or sewing-machine factory, or a factory for making textile machinery. A watch factory with those who worked in it could be converted without any overwhelming loss into a sewing-machine factory: almost the only condition would be that in the new factory no one should be put to work which required a higher order of general intelligence, than that to which he was already accustomed.[46]

Furthermore, Marshall builds on some of his previously mentioned ideas when he asserts that while the worker is now freer from manual labor in the printing industry, he is more likely to need to meet "the demand for judgment and discretion and literary knowledge of the reader," which "increases the demand for the gifted and highly-trained."[47] This increased mechanization in printing, allowing for more publications, also "tends to increase the work of photographers

[44] Ibid 257-258.
[45] Ibid 258.
[46] Ibid 258-259.
[47] Ibid 261.

and electrotypers, and stereotypers, of the maker's of printer's machinery, and many others who get a higher training and a higher income from their work than did those layers and takers off, and those folders of newspapers who have found their work taken over by iron fingers and iron arms."[48]

Again, Marshall wants to emphasize that an increasingly mechanized production process has positive benefits. Nothing highlights this sentiment more than when he says that "those trades in which the work is most subdivided are those in which the chief muscular strain is most certain to be taken off by machinery; and thus the chief evil of monotonous work is much diminished."[49] He continues by stating, "the social surroundings of factory life stimulate mental activity in and out of working hours; and many of those factory workers, whose occupations are seemingly the most monotonous, have considerable intelligence and mental resource."[50]

Next, Marshall attempts to outline what he thinks are the main economic components responsible for ensuring that the advantages of the division of labor can be retained. It is at this juncture that he introduces the ideas of *external economies* and *internal economies*.[51] Internal economies are economies "dependent on the resources of the individual houses of business engaged in it [the industry], on their organization and the efficiency of their management."[52] The issues we have discussed thus far in Marshall's analysis of the division of labor refer to internal economic issues. External economies are economies "dependent on the general development of the industry," and it is to these external economies that we now turn.[53]

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[48] Ibid 261.
[49] Ibid 263.
[50] Ibid.
[51] Ibid 266.
[52] Ibid.
[53] Ibid.

Marshall's discussion of external economies revolves around the notion of localized industries. Essentially, the grouping of related production processes within an isolated geographical area marks localized industries.[54] The localization of industries occurs for several reasons, according to Marshall, including "the character of the climate and soil, the existence of mines and quarries in the neighbourhood, or within easy access by land or water."[55] While Marshall briefly mentions that international trade is crucial to a country's economic growth and represents a localization of industries on a global scale, he suggests that we can also look to these localized industries in cities in order to gain a better sense of how they function.[56] He suggests that localized industries flourish for several reasons, such as the inheritance of certain skills from one generation of workers to the next that have been employed within a certain industry for a long time.[57] This inheritance of skill reduces the time needed for educating new workers, which decreases costs for the manufacturer over time. Furthermore, Marshall notes that subsidiary trades will develop around a localized industry, specializing in the production of certain items that may be needed in part of the production process for a certain industry.[58] All of this discussion about the localization of industry is absolutely crucial, because as Marshall asserts, "the advantages of variety of employment…combined with those of localized industries in some of our manufacturing towns…is a chief cause for their economic growth."[59]

Marshall's final major contribution to the evolving discussion of economic growth relates to the idea of the advantages of large-scale production. He suggests that "the chief advantages of production on a large scale are economy of skill, economy of machinery and economy of

[54] Ibid 267.
[55] Ibid 268.
[56] Ibid 270-271.
[57] Ibid 271.
[58] Ibid.
[59] Ibid 272.

materials: but the last of these is rapidly losing importance relative to the other two."[60] According to Marshall's notion, the economy of skill refers to the idea that less waste of materials occurs when all of the planning is centralized within a single large firm as opposed to being scattered about among numerous smaller firms. Furthermore, he suggests "the larger manufacturer has a much better chance than a small one has, of getting hold of men with exceptional natural abilities, to do the most difficult part of his work—that on which the reputation of his establishment chiefly depends."[61] Also, Marshall seems to suggest consolidating production in a large factory will increase the likelihood of large-scale innovation and the ability to look at long-term, bigger picture issues, as whoever is in charge "can keep his mind fresh and clear for thinking out the most difficult and vital problems of his business; for studying the broader movements of the markets, the yet undeveloped results of current events at home and abroad; and for contriving how to improve the organization of the internal and external relations of his business."[62] As far as the economy of machinery is concerned, he puts forth the idea that larger factories are more likely to have access to better machinery because they are able to afford those costs more easily than a smaller manufacturer.[63] Of course, this access then gives manufacturers engaged in large-scale production processes an even greater advantage over their smaller competitors. In addition, larger manufacturers are able to buy the items they need in greater quantities and to sell their products in large quantities, thus paying a lower cost per unit and cutting down on expenditures.[64] Ultimately, large-scale production, which again only comes about because of the core division of labor, leads to greater growth of the firm, as Marshall illustrates:

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[60] Ibid 278.
[61] Ibid 283.
[62] Ibid 284.
[63] Ibid 279-280.
[64] Ibid 282.

> …it is otherwise in which a large business can command very important advantages, which are beyond the reach of a small business. A new man, working his way up in such a trade, has to set his energy and flexibility, his industry and care for small details, against the broader economies of his rivals with their larger capital, their higher specialization of machinery and labour, and their larger trade connection. If then he can double his production, and sell at anything like his old rate, he will have more than doubled his profits. This will raise his credit with bankers and other shrewd lenders; and will enable him to increase his business further, and to attain yet further economies, and yet higher profits: and this again will increase his business and so on….And if his goods were not very difficult of transport, nor of marketing, he might extend this district very wide, and attain something like a limited monopoly; that is, of a monopoly limited by the consideration that a very high price would bring rival producers into the field.[65]

That concludes the major contributions of Marshall to the evolution of thought on the advantages of the division of labor as well as the end of what marks the early roots of thought on the subject.

In summary, Adam Smith's main contributions to early thought include making explicit the positive effects of the division of labor for productivity and individual financial well-being as well as establishing the notion that the extent of the marketplace is responsible for limiting the division of labor. Charles Babbage was responsible for reiterating the importance of the division of labor for the productivity in manufacturing while also providing a more detailed presentation of the advantages of the division of labor using a complex pin-making example. Finally, Alfred Marshall advanced thought in this area by taking into account an increasingly industrialized production process and the growth in size of manufacturing firms. Marshall also established the benefit of external economies brought about by the localization of industries as well as offering an explanation for how larger firms are able to be more competitive than smaller firms within the same industry. Next we turn to a time during which the prominence given to the role of the division of labor insofar as economic growth is concerned was threatened and nearly lost.

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[65] Ibid 285-286.

The Challenges:

One of the major challenges to the centrality of the division of labor to economic growth was actually contained within Marshall's own *Principles*; thus, he foresaw some of the problems that his ideas about the division of labor and economic growth might face against the backdrop of how economics was being understood at the time. In Appendix H of *Principles*, Marshall discusses the "limitations of the use of statical assumptions in regard to increasing returns."[66] His basic concerns are with the possibility of moving points of equilibrium within a supply and demand model. Marshall suggests that changes in supply will affect the equilibrium point and cause it to move about. Furthermore, the idea that there can be a stable supply is antithetical to the idea of increasing returns (which occurs with the division of labor), because the dynamic aspects of increasing returns and growth create the ever-present possibility of change in the ratio of capital to labor, allowing for decreasing costs of production and a moving supply curve.[67]

Piero Sraffa's "The Laws of Returns under Competitive Conditions," published in 1926,[68] added another facet to the debate. In this article, Sraffa looks at some interesting points related to what occurs in "competition" with producers that have increasing returns to scale. He suggests that there really is not the sort of competition that one would expect to occur and that there actually is the possibility of an equilibrium point in cases of markets where competitors have increasing returns.[69] How can this be the case? Sraffa suggests, " the chief obstacle which hinders the free play of competition…is the absence of indifference on the part of the buyers of goods as between the different producers."[70] Furthermore, he argues:

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[66] Ibid 805.
[67] Ibid 808-809.
[68] Sraffa, Piero. "The Laws of Returns Under Competitive Conditions." *The Economic Journal*, Vol. 36, No. 144 (Dec., 1926), 535-550.
[69] Ibid 544.
[70] Ibid.

> any firm which endeavours to extend beyond its own market by invading those of its competitors must incur heavy marketing expenses in order to surmount the barriers by which they are surrounded; but, on the other hand, within its own market and under the protection of its own barrier each enjoys a privileged position whereby it obtains advantages which—if not in extent, at least in their nature—are equal to those enjoyed by the ordinary monopolist.[71]

Thus, the idea that increasing returns will always be advantageous for a particular firm rests upon the assumption that there will be free competition and that buyers will always buy in accordance with the lowest price. This notion is what Sraffa challenged with his 1926 article.

Another challenge to the prominent role of discussions regarding the division of labor and increasing returns in economics came from Lionel Robbins, who wrote *An Essay on the Nature & Significance of Economic Science* in 1937, in which he suggested that the study of the "technical arts of production" belongs to the field of engineering, while "motion study" belongs to the field of industrial psychology, even if it means removing the concept of the division of labor from economics.[72] Robbins' challenge would have credibility, as he was the chair of the London School of Economics at this time.

Finally, as if the role of the division of labor within economics was not threatened enough at this point, there were other critics who were suggesting that the issue should be left to the field of sociology, "because Durkheim, and before him, Comte and Herbert Spencer, had absorbed division of labour with this then emerging discipline."[73] So, it seems that there was a combination of a number of different forces that threatened to bury the division of labor in the history of economic thought in the early part of the 20th century. However, a man before his time would write another seminal work that would later be the foundation on which (in addition

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[71] Ibid 545.
[72] Robbins, Lionel. *An Essay on the Nature & Significance of Economic Science*. 2nd ed. (London: Macmillan, 1937) 32-38.
[73] Eatwell, etal. 905.

to Smith's originating principles) today's endogenous growth theorists base their work. That man is Allyn Young, and it is to him that credit is given for the revival of the discussion of the central role that the division of labor plays in creating increasing returns to scale and resulting in economic growth.

The Revival:

- *Allyn Young:*

Allyn Young's article "Increasing Returns and Economic Progress" appeared in *The Economic Journal* in 1928, the time at which the challenges to the issue under discussion were at their peak.[74] However, the importance of this article would not be established for another 50 years when one of Young's students, Nicholas Kaldor, said that he was "convinced that it [Young's work] was so many years ahead of its time that the progress of economic thought has passed it by" and stated that "this was partly because Young was a man of exceptional modesty, who underplayed, rather than emphasized, the full implication of what he was saying; his manner of exposition is suggestive, rather than compelling, and at times…obscure."[75]

So, what did Young have to say in his article? Essentially, Young expands upon the idea of the division of labor being limited by the extent of the market (one of Adam Smith's main principles), looking at economy-wide increasing returns. Young emphasizes the increased usage of indirect or roundabout methods of production, which involves specialization among industries in the production of certain intermediate goods that are necessary components of a final product to be produced elsewhere.

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[74] Young, Allyn. "Increasing Returns and Economic Progress." *The Economic Journal*, Vol. 38, No. 152 (Dec., 1928), 527-542.
[75] Targetti, F. and A.P. Thirlwall, eds. *The Essential Kaldor*. (New York: Holmes & Meier, 1989) 381-382.

Furthermore, Young suggests that the ratio of capital to labor is a function of the extent of the market, as increased capital will be more beneficial for a production process that has a larger market. This is because certain machinery is only more efficient with large-scale production, a notion that Alfred Marshall's writings confirm.

Beyond that, Young emphasizes that the size of a market is determined not only by the capacities of the producer (i.e. a producer with more goods to sell is more likely going to reach more buyers) but also by the extent of the market in terms of trade, a point that had been mentioned by Smith and Marshall as well. Young's addition to this last idea, though, is that increased trade allows for more large-scale production and an increase in the roundabout nature of the production process.

The ultimate conclusion we can reach from Young is that an increased division of labor coupled with the maximization of trade and more efficient changes in the production process is both a "cumulative" process and a "self-reinforcing" process, in that the larger the industry with a larger market, the easier it is for that industry to grow even faster.[76]

- *Nicholas Kaldor:*

Nicholas Kaldor deserves a great deal of credit for reviving Allyn Young's work as an admiring student and academic himself, but he is also noteworthy because he contributed to the discussion of increasing returns and economic growth and to debates about the possibility of equilibrium.[77] One of the early articles Kaldor wrote in relation to the topic of this paper was "Capital Accumulation and Economic Growth" in 1961. In this article Kaldor offers his own model for understanding economic growth and emphasizes the fact that increasing returns to

[76] Peon, Sylvia Beatriz Guillermo. "Increasing Returns: A Historical Overview." *Aportes: Revista de la Facultad de Economia*. (Apr., 2003). (http://www.aportes.buap.mx/22ap5.pdf).
[77] Thirlwall, Anthony P. *Nicholas Kaldor*. (Washington Square, NY: New York University, 1987) 172-181.

scale are inherent in technological change and caused by economies of scale and specialization.[78] Regarding economies of scale, he suggested that with an increased output, the average cost of each unit falls for a manufacturer due to the spreading out of fixed costs.[79] Furthermore, specialization involves the substitution of direct for indirect labor, resulting in an increase in the ratio of capital to labor, as well as more learning, leading to innovations and improvements in the quality of machines.[80]

Kaldor also offers a strong criticism of equilibrium theory in such articles as "The Irrelevance of Equilibrium Economics" of 1972, "What is Wrong with Economic Theory?" of 1975, and "Equilibrium Theory and Growth Theory" of 1977[81]. The significance of this criticism is, of course, related to the idea of the incompatibility of increasing returns with a stable point of equilibrium that was noted by Alfred Marshall in *Principles*. Essentially, Kaldor sees equilibrium economics as "a major obstacle to the development of economics as a *science*" or a field of study with empirically derived theorems whose assumptions and predictions can be verified with real-world data.[82] He stresses that "abstract models lead nowhere" and believes that the idea that the economy always approaches or is near a state of equilibrium, in which it would be efficiently using all resources, cannot possibly hold in reality.[83] So, where does Kaldor place the blame? He says that those of his contemporaries who were still proponents of equilibrium were merely descendants from a long line of bad economists, originating with Adam Smith and his discussion of the idea of a "natural price" determined by the cost of production (irrespective of demand), which assumes constant production costs and constant returns to

[78] Ibid.
[79] Ibid.
[80] Ibid.
[81] Targetti and Thirlwall 373-433.
[82] Ibid 373.
[83] Ibid 377.

scale.[84] Kaldor also says that the "co-existence of increasing returns and competition" is an important issue but that economists do not fully understand "*how* competition works in circumstances where each producer faces a limited market as regards *sales* and yet a highly competitive market as regards *price.*"[85] Finally, he suggests that "self-sustained growth" is not the result of exogenous factors but is a fragile process that requires manufacturers to expand their productive capacity with growing sales as well as a "passive" monetary and banking system that is willing to lend without much difficulty.[86]

- *Kenneth Arrow:*

The final person to whom we briefly look as being a part of the revival of the focus on the division of labor and increasing returns in economic growth is Kenneth Arrow, who published "The Economic Implications of Learning by Doing" in *The Review of Economic Studies* in 1962.[87] In this article, Arrow develops a model that accounts for learning as one factor in the process of work that results in greater productivity. He suggests that increases in the ratio of capital to labor was not a sufficient explanation for increases in per capita income, which eventually led him to formulate the idea that the productivity of labor increases with more experience because labor learns through experience.[88] In his model, "experience" is considered the technical advance factor and is defined as cumulative gross investment.[89] It is noted that learning by doing is especially noticeable in new forms of production, as a labor force becomes better at whatever it is they are doing as they gain more experience over time, without the

[84] Ibid 378-379.
[85] Ibid 392.
[86] Ibid 393.
[87] Arrow, Kenneth. "The Economic Implications of Learning by Doing." *The Review of Economic Studies*, Vol. 29, No. 3 (Jun., 1962), 155-173.
[88] Ibid.
[89] Ibid.

introduction of any other variables that could account for increased productivity.[90] This emphasis on the role of learning among laborers would be an important shift in the discussion of growth, as it corresponds with much of the focus of contemporary ideas in endogenous growth theory.

In brief, the contributions of thought in the period I have termed "the revival" are significant and can be considered as responsible for leading into the contemporary era of economic thought, which I shall discuss next. First, Allyn Young's main role was to expand upon Adam Smith's idea that the division of labor is limited by the extent of the market. Young provided a more rigorous notion of this concept through his discussion of roundabout methods of production and its role in improving large-scale industry-level productivity through specialization in the production of intermediate goods. Nicholas Kaldor can be credited with insuring a greater focus on Young's contributions. He is also responsible for shifting more attention to the idea that technological change results in increasing returns to scale, bringing about an unstable equilibrium, which was mentioned by Alfred Marshall in the appendix of *Principles* and was considered to be an obstacle at a time when general economic equilibrium was the primary mode of understanding. Finally, Kenneth Arrow ushered in the contemporary era by developing a model that considered knowledge gained through experience (or "learning by doing") as a key component of increases in productivity, especially in newly developed forms of production. Now, we shall conclude with a glimpse into some of the key features of the current state of thought in endogenous growth theory.

[90] Ibid.

Contemporary Era:

Today, much of the emphasis on endogenous growth factors has expanded beyond a focus on dividing up the process of pin making in order to make workers more productive to look at such things as technological innovation and investment in human capital. One of the leading contemporary economists dealing with such issues is Professor of Economics at Stanford University, Paul Romer, who is responsible for such articles as "Increasing Returns and Long-Run Growth" in 1986, "Growth Based on Increasing Returns Due to Specialization" in 1987, and "Endogenous Technological Change" in 1990.

One of the noted features of Romer's ideas is the notion that human capital, in addition to the typical idea of physical capital, is an especially important factor in economic growth.[91] Again, human capital is understood as "the augmentation of basic human skills through education and training."[92] Furthermore, Romer and others have looked at the significance of the growth of knowledge among labor through investment in research and development as well as the effects of knowledge available as a free public good from the work done in universities and government laboratories.[93] Romer's model of endogenous growth suggests that technological developments spill over from firm to firm as "the knowledge part of the firm's capital stock is essentially a public good" available for consumption by all within an economy.[94]

Although Romer's model is considered to be the leading model within endogenous growth theory today, it is not without criticism. First, the Romer model, as with prior models, assumes uniformity across all sectors of production in an economy; his model then fails to take into account "the crucial growth-generating reallocation of labor and capital among the sectors

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[91] Scherer, F.M. *New Perspectives on Economic Growth and Technological Innovation*. (Washington, D.C.: Brookings, 1999) 32.
[92] Ibid.
[93] Ibid 34-35.
[94] Todaro and Smith 149.

that are transformed during the process of structural change."[95] Second, the model fails to consider factors of inefficiency often present in developing economies, such as "poor infrastructure, inadequate institutional structures, and imperfect capital and goods markets."[96] Finally, it is argued that the Romer model is not very helpful in understanding real-world development economics because its main aim is determining growth rates in the long-term as opposed to tracking the fluctuations seen in shorter periods of time.[97]

In short, Paul Romer's contributions to endogenous growth theory have principally involved shifting more attention to the importance of investment in knowledge, particularly that which is funded by the public and made available without cost to all firms. While the division of labor, the issue of the extent of the market, and other ideas discussed before are no longer dealt with in as much depth in current thinking as they have been in the past, this obviously is not because these factors have been disregarded as important endogenous factors of growth. Instead, the preponderance of evidence supporting these ideas has led us to the point where it is assumed that those studying growth will already be aware of their central role. Thus, the contemporary era of economic thought with respect to endogenous growth is marked by the continued exploration of new determinants of growth resting atop the foundation established by the minds of Smith, Babbage, Marshall, Young, Kaldor, and Arrow, signifying a continuity in the evolution of thought over time.

Closing Remarks:

I have attempted in this paper to offer a clearer understanding of the foundations of economic thought upon which contemporary endogenous growth theory rests, as well as to

[95] Ibid 150.
[96] Ibid.
[97] Ibid.

highlight various changes and nuances in emphasis along the way by some of the major figures dealing with the issue of the division of labor, increasing returns, and economic growth. This area of knowledge within contemporary economics is still in flux, as new ideas and new evidence to confirm and deny theories and models is regularly being addressed. Ultimately, the field of development economics and theories of growth remain open to continued progress in the evolution of thought. Undoubtedly, at some point in the future, today's leading model of growth will be replaced by another model that is better able to account for the actual determinants of economic growth and all of the factors that need to be considered in the development process. After all, much more is at stake than competing theories to intrigue the minds of those within academia. The well-being of billions of people depends upon the continued pursuit of ideas that accurately correspond with reality and can lead to the implementation of effective economic policy measures.

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