Professor Edward J. Nell
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An Empirical Study in Transformational Growth with Austrian School Capital Theory

Term Paper

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Abstract

In this paper I formulate a theoretical framework using Nell's concepts of Transformational Growth and "early" (1870 to 1914) and "modern" (1948 to the present) capitalism in which to test Austrian School capital theory's ability to describe the significant differences in growth between the two periods based on institutional and cultural development. I present an overview of the development of the Austrian School's 'stages of production' model through Menger, Bohm-Bawerk, Hayek and its current proponent, Garrison, and offer my own methodology for creating an index to compute an 'average period' which can be used for comparison between the two periods of capitalistic development in the U.S.A. Although my method fails to describe the institutional and cultural differences between the two periods - due to my own errors in data classification or in data capture in the source data, or through my own methodological error - a simplified version of the Austrian Capital theory, based on investment in inventories, does show the predicted results in more roundabout stages of production. The analysis in the paper includes both the 'reproducible' economy and the 'non-reproducible' economy. This paper might be a useful addition in the literature for those interested in both capital theory and the evolution of capitalism as a system.

Keywords

Capitalism, Transformational Growth, Capital Theory, Political Economy

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Introduction

Transformational Growth

The purpose of this paper is to apply the Austrian School theory of capital to the concept of Transformational Growth as espoused by Edward J. Nell. Both Professor Nell and the Austrian School reject the neo-classical school of economics (or, mainstream economics) assumption that growth is steady; both see the need for a *dynamic* concept of capitalism, "In fact, cases of steady growth are rare – if they exist at all."[1] I believe that I can add value to Nell's concept of capitalism as a system with evolving institutions by using the Austrian's School's theory of capital as stages of production to conduct empirical analysis of the evolution of capitalism from its "early" to "modern" stages.[2] This empirical analysis might be a useful addition in the literature for those interested in both capital theory and the evolution of capitalism as a system.

In his work Nell studies the change, the evolution, of the social relations and economic institutions of the craft economy in the 1800s and how these societies evolved into the institutions of capitalism as more and more goods and services were traded outside of the traditional craft societies, not least because of migration

[1] Nell 1998b, 13, in addition, Nell 1998, 18-19.

[2] Professor Nell in his Spring 2008 Seminar on Transformational Growth at the New School of Social Research has dated "early" capitalism from 1870 to 1914, and "modern" capitalism from 1948 to the present. This is consistent with the present author's judgment, although this author might prefer the term "welfare state capitalism" to "modern" capitalism. This is also consistent with Nell 2008b, 33, "And it [capitalism] has redefined the state twice, first from monarchy to republic, then from Nightwatchman to Welfare State."

to the cities brought upon by technological change in farming.[3] The institutions of capitalism evolved to meet the needs of capital and the changing social relations of the new capitalist system. Economic growth under capitalism is due to these ever-evolving institutions of capital, "capital breeds what it needs."[4]

In order to continue further, we need to define capitalism as a system.

> So, what is capitalism, then? What do we mean to say when we say that production, distribution and exchange are organized capitalistically? It is not simple; the question cannot be answered in a word or two. The many different aspects of capital have to be noted and described, but then, most importantly, they have to be related in a particular kind of system, one in which the components are in continuous motion. Capital, then, is not an object, a thing, like a sum of money, nor is it a collection of items, like a set of machines and equipment. It is a system, a way of organizing the work of society, including distributing the proceeds of that work. It is based on rights and contracts, but the main purpose is the organization of work, so that the work will be directed by incentives, and can be redesigned and reconfigured, likewise in response to incentives. Equally important, however, is control over the results of work, allowing for distribution through the market in such a way that the system is made ready for another round of work. It is a system of expanding reproduction, producing a surplus and distributing it chiefly as profit (Nell 2008b, 32).

In this paper we are specifically concerned with the process of how the system reproduces itself and expands, and we use the Austrian School's capital theory concept of 'stages of production' to show how this has occurred from early to modern capitalism.

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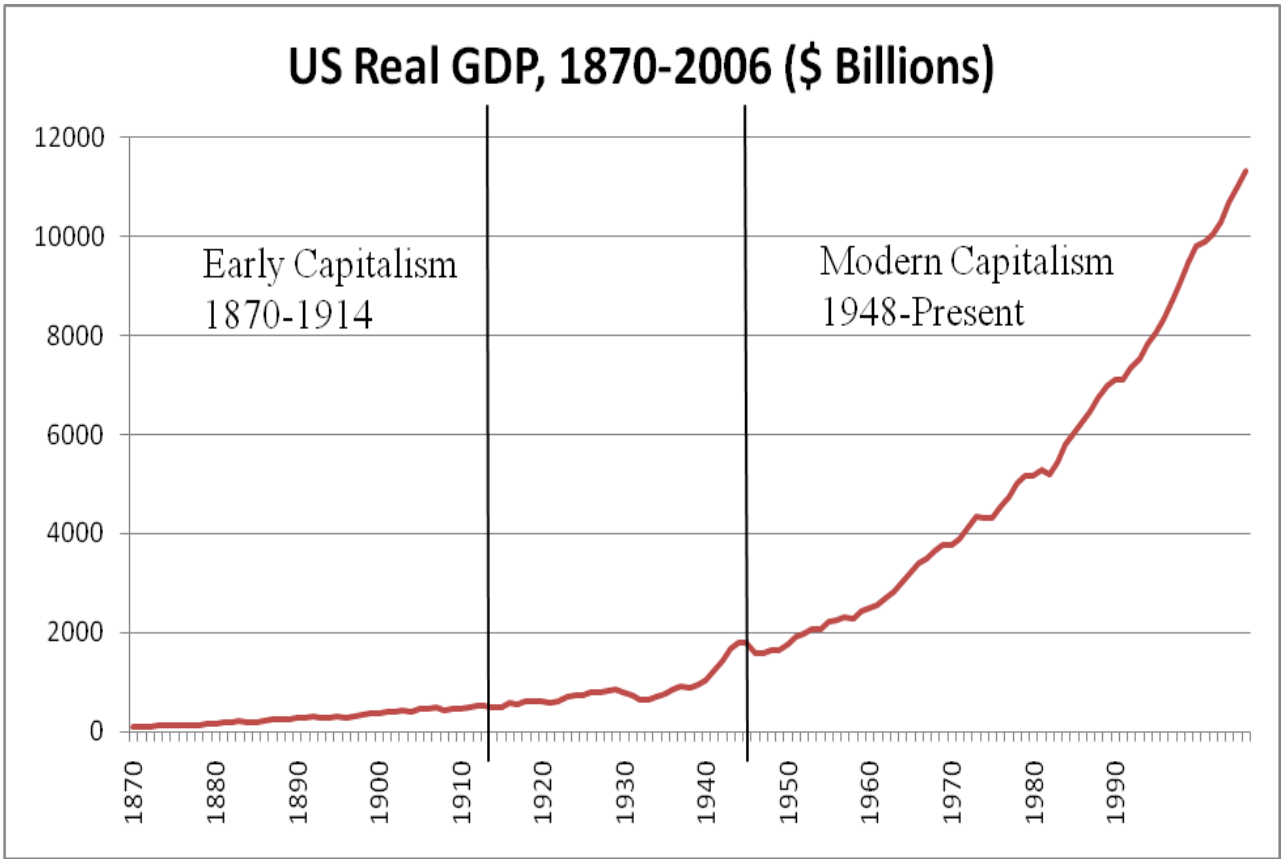
[3] John Locke in 1690 describes the fencing-in of traditionally shared lands and the evolution of rule of law. Adam Smith, too, was interested in how the market evolved, "As it is the power of exchanging that gives occasion to the division of labour, so the extent of this division must always by the extent of that power, or, in other words, by the extent of the market" (Smith 1776, 19).

[4] Professor Nell calls this his 'Law of Institutions,' or, "Capital shapes the institutions of society to its needs" (Nell 2008b, 36).

Early and Modern Capitalism

Professor Nell defines early capitalism as the period from 1870 to 1914 and modern capitalism from 1948 to the present. Illustration 1. below shows in no uncertain terms that modern capitalism has provided the United States with a much greater rate of growth than early capitalism. Capitalism is clearly a *dynamic* system.

Illustration 1.[5]



[5] Source: author, with data from measuringwealth.com, accessed 3/4//2008.

For the purposes of this paper, the main "stylized trends and tendencies"[6] showing the difference between early and modern capitalism are in order. We come to these again later in our empirical analysis.

- In early capitalism government was around 4% of the economy, in modern capitalism government is around 30% of the economy.
- Modern capitalism has shown a rise in the FIRE sectors (finance, insurance and real estate) compared to early capitalism.

In the next section of this paper we present an overview of the Austrian School capital theory, and, then, we show how this theory can help us to provide hard data supporting Nell assertion that, "It is a system of expanding reproduction, producing a surplus and distributing it chiefly as profit."

The Austrian School Theory of Capital

In this section we give an overview of the Austrian School capital theory, present its historical development, and explain how we can build upon what has conceptualized to date through applying empirical research. In the Austrian School model of the economy, it is the entrepreneur[7] who takes investment decisions based on his or her view of the world and risk preferences, It is the entrepreneur who takes Nell's 'surplus distributed as profit' and then reinvests this surplus into the means of production for both reproduction and expansion, the expansion we view in lllustration 1.

[6] These significant differing characteristics between early and modern capitalism are from Nell's lectures during the Seminar in Transformational Growth, Spring 2008, Nell 2008a.

[7] In the Austrian School theory of the market process it is the *entrepreneur* who is the economic agent, the unit of analysis. This, it might be fair to say, differs from the classical and neo-classical schools, which use 'classes' of people for their unit of analysis, for example, 'labor' and 'capital', e.g., workers and capitalists. And, in the work of Ricardo 1817, landowners, e.g. rentiers. In the Austrian School, again it might be fair to say, everyone in society is an entrepreneur with his or her own endowments to allocate based on his or her own preferences, even if these endowments are only time itself.

> Entrepreneurs operating at different stages of production make decisions on the basis of their knowledge, hunches and expectations, informed by movements in prices, wages, and interest rates. Collectively, these entrepreneurial decisions result in a particular allocation of resources over time (Garrison 2001, 33).

It is this 'allocation of resources over time' which in the Austrian School gives us the *dynamic* economic system, the expansion of output and material growth, which as we learn from Nell, carries with it evolving sets of institutions to allow these investments to occur under a system of rights and contracts.

> Money as coin developed in distant trade, and for the payment of taxes, then separately as a unit of account – and a means of paying rent – on the manor. Wage labor emerged both in the guilds and on the manor as a means of engaging supplementary labor. Forward looking calculation emerged in trade, especially in calculating insurance; it is also separately developed as a way of figuring the price to be paid for a royal monopoly or license. But these initially unconnected elements fitted together, reinforcing each other and formed a system which had unexpected, 'emergent' features – it turned out to be a self-reinforcing, and most importantly, a self-adjusting system – the 'Invisible Hand' (Nell 2008b, 33-34).

Nell also gives the example of the development of the banking system to facilitate the payment of salaries (the 'wage fund' in economic parlance) and as the family firm gave way to mass production we find the development of long-term financing.[8]

The Austrian School theory uses *time-preference* as its key to understanding the expansion of output in an economy. As society develops, as risk is reduced through new institutions and stable forms of government, the period of production in an economy is elongated (the risk to more innovative means of production is reduced) and goods – more goods and more variety of goods – are produced and available for consumption. Time-preference, the preference for using resources now versus the use of resources later in time, is reduced as the investment climate improves.

[8] Nell 2008a.

The Austrian School capital theory is based on the work of Carl Menger who introduced differing 'orders of goods' to expound upon Adam Smith's concept of the division of labor as leading toward opulence. The lowest order of good, the first order, is that which is directly consumed. A second order good is used in the production of a first order good, a third order good is used in the production of a second order good, and so on. As these orders increase as society evolves dynamically, the extent of the market is increased through the division of labor.

> Assume a people which extends its attention to goods of third, fourth and higher orders, instead of confining its activity merely to the tasks of a primitive collecting economy – that is, to the acquisition of naturally available goods of lowest order (ordinary goods of first, possibly second, order). If such a people progressively directs goods of ever higher orders to the satisfaction of its needs, and especially if each step in this direction is accompanied by an appropriate division of labor, we shall doubtless observe that progress in welfare which Adam Smith was disposed to attribute exclusively to the latter factor. We shall see the hunter, who initially pursues game with a club, turning to hunting with a bow and hunting net, to stock farming of the simplest kind, and in sequence, to ever more intensive forms of stock farming. We shall see men, living initially on wild plants, turning to ever more intensive forms of agriculture. We shall see the rise of manufactures, and their improvement by means of tools and machines. And in the closest connection, with these developments, we shall see the welfare of this people increase (Menger 1871, 73).

From Menger we find that as a society develops, the capital structure deepens; the order of goods become higher in number. This idea was then built upon by Eugen Bohm-Bawerk who called the production of these ordered goods the 'stages of production' in his capital theory, with the higher the order of the good, the more 'roundabout' the stage of production.

> Every mass of capital is, by its nature, composed of a mass of intermediate products, and the common goal of all these products is to ripen into consumption goods of means of enjoyment. They reach this goal through the continuation of that production process in the course of which they themselves have come into existence. They are all, as it were, on the way towards the goal of human consumption. But the length of the road which they have had to travel is different. This is partly because the various branches of production adopt roundabout ways of various length; mining, for instance, or railway building, take a much more roundabout and lengthy method than woodcutting (Bohm-Bawerk 1888, 106-107).

> But there is still another circumstance that works in the same direction. The ripening of intermediate products into consumption goods demands a steady addition of current productive powers. At each stage of the production process new labor is added to the intermediate products which have been passed on to it from the previous stage, and they pass on to the following stage in a more advances state (Bohm-Bawerk 1888, 109).

Bohm-Bawerk has followed the classical economists in analyzing first the reproduction of society, then its expansion.

Hayek and Capital Theory

This idea of stages of production building upon each other for reproduction and expansion was then followed-up upon by F.A. Hayek, who specifically ties a dynamic element to the 'capitalistic' system through the lengthening of production stages over time within a society.

> I have already pointed out that it is an essential feature of our modern 'capitalistic', system of production that at any moment a far larger proportion of the available original means of production is employed is employed to provide consumers' goods for some more or less distant future than is used for the satisfaction of immediate needs. The *raison d'etre* of this way of organizing production is, of course, that by lengthening the production process we are able to obtain a greater quantity of consumer's goods out of a given quantity of original means of production (Hayek 1931, 37).

Hayek also then attempts shows his concept of the organization of capital in a society (e.g. the capital structure in an economy) analogically, with the introduction of what became known as the 'Hayekian triangles', Illustration 2.

Illustration 2.[9]

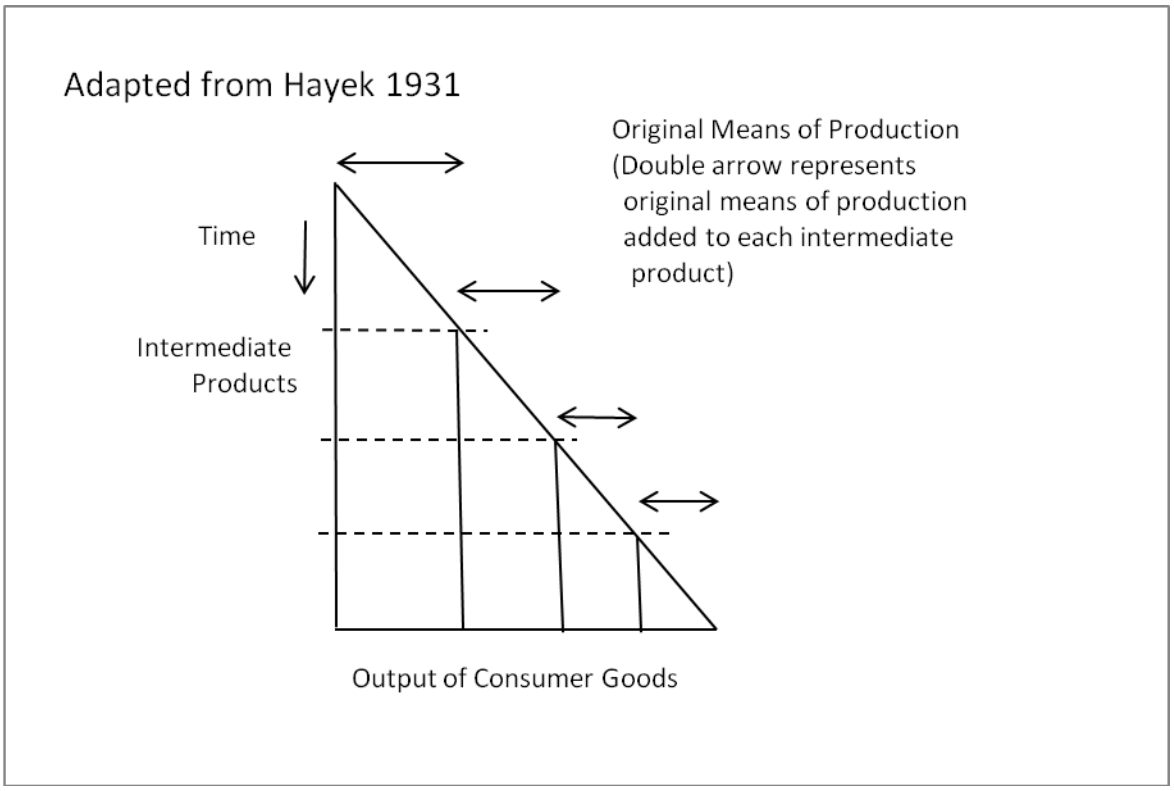
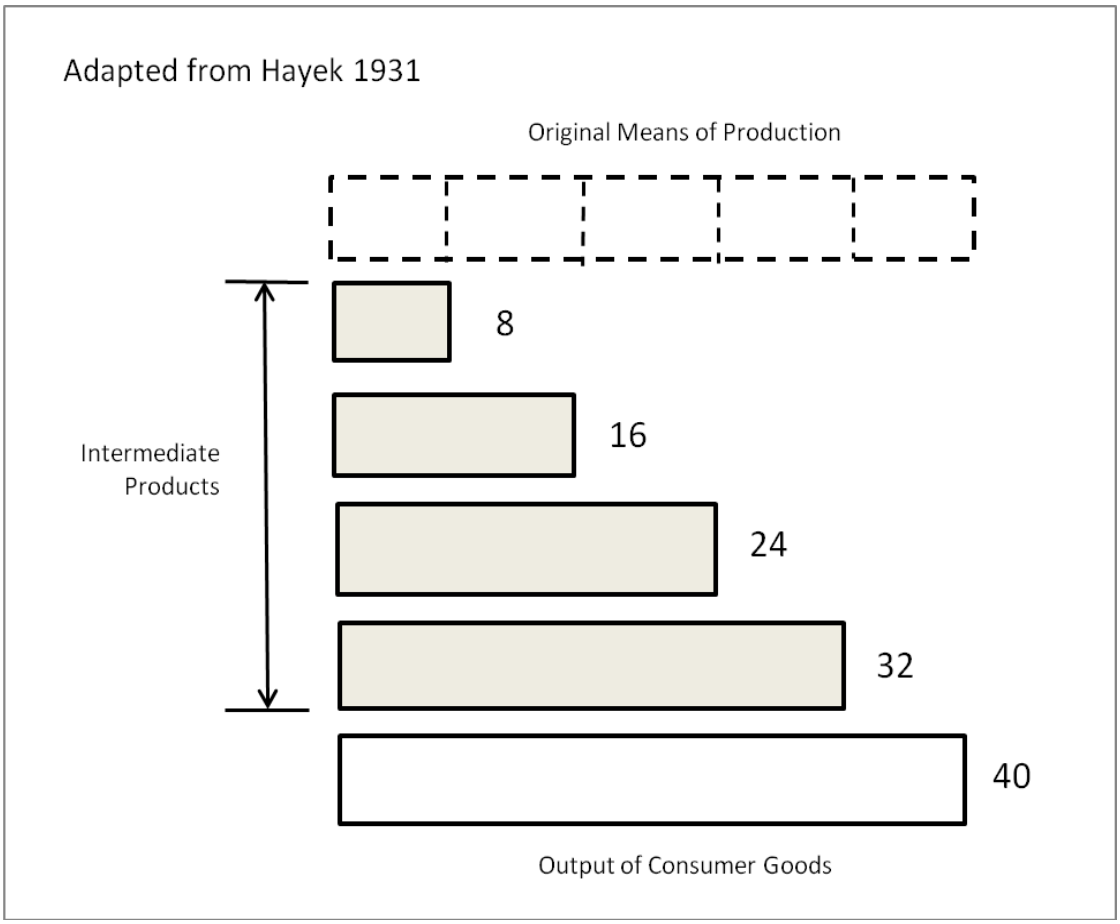


Illustration 2. shows a simplified adaptation of Hayek's original triangle. In this triangle it is unclear what is a stage of production, what is added to each stage of production to get the next stage of production, and what is the output of consumer goods in the capital structure. Although the triangles represent the fact that the stages of production are interconnected, heterogeneous and continuous in time it must have been clear to Hayek that a better exposition was needed so the next Illustration (Illustration 3.) shows Hayek's attempt to better explain the capital theory.[10] However it should be noted that the Hayekian triangles were later picked up by Roger Garrison, and it is to Garrison's work we turn after Hayek.

[9] Adapted from Hayek 1931, 39, Figure I.

[10] Hayek (1931, 43) states in introduction to the simplified exposition of his triangles, "Probably the simplest method of transforming the picture of the continuous process into a picture of what happens in a given period is to make cross sections through our first figure [the 'triangle'] at

Illustration 3.[11]



From Illustration 3. we are able to visualize the Austrian School capital theory. The ultimate aim in an economy, as we have shown above from the writings of Carl Menger, is consumption. For the given period there are 40 units of consumer goods produced.[12] To make-up these 40 units, 8 units of the good are passed

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intervals corresponding to the periods chosen, and to imagine observers being posted at each of these cross cuts who watch and note down the amount of goods flowing by." We shall call Illustration 3. the Hayekian 'rectangles'.

[11] Hayek 1931, 44, Figure II.

[12] Note that Hayek uses the *economic good* as the unit of measurement in his exposition, "So far, I have used this schematic illustration of the process of production only to represent the

down from each stage of production to the next lower level stage of production. For example, at the highest stage of production[13], that stage of intermediate products labeled "8", we find 8 units of original means of production passed down to the next stage, that stage labeled "16". There are four higher order goods (four intermediate stages of production) each contributing 8 units to the next level below, thus the four stages of production net 32 units of economic goods (4 x 8 = 32). The last 8 units are produced at the lowest level of production, where the consumer good is produced directly without an intermediate stage.

As we have shown from the writings of Nell, Bohm-Bawerk and Hayek, another purpose of economic analysis is to explain the difference and relationship between reproduction and expansion of society's resources. Hayek uses his 'rectangles' (e.g., Illustration 3.) to show how this is done through the capital structure of an economy. Hayek differentiates between the shaded areas (the intermediate stages of production which require re-investment) and the non-shaded consumption goods area which does not require re-investment. The consumer goods produced (and we can assume, consumed) represents the income of the economy[14] whereas the shaded areas represent the amount of investment for the period. By definition then, part of this investment is 'reproduction' of the investment used-up in the production of intermediate goods, and part of the investment is new investment.

> In a stationary state, which is the only state I am considering, this output of consumers' goods is necessarily equal to the total income from the factors of production used, and is exchanged for this income. The proportion of the white area to the shaded area, in this diagram 40:80 or 1:2, expresses the proportion between the output of consumers' goods and the output of intermediate products (or between the amount of consumption and the amount of new and renewed investment during any period of time) (Hayek 1931, 45).

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movement of goods. It is just as legitimate to use it as an illustration of the movement of money" (Hayek 1831, 45).

[13] The highest stage of production is that which requires the longest production time, is the most risky in terms of return on investment and therefore might find the least amount of investment in the economy's capital structure. Therefore it makes sense in Hayek's analogical 'triangles' and 'rectangles' to show that each lower stage of production contributes increasingly more to the next lowest order good in the production process.

[14] Note that this concept of income is similar to, and predates, national income accounting which uses the value-added along the production chain to determine the output of an economy.

The Austrian School capital theory as espoused by Hayek it should be noted is dynamic and continuous in nature. Hayek uses his 'rectangles' only as an analogy to illustrate the concept in a simplified non-dynamic form. We later return to this 'moment in time' capital structure as measureable "stocks"[15] of capital in order to make comparisons between early and modern capitalism in the United States. Before we move on to Garrison's work on capital, which allows us to illustrate the Austrian School capital theory of growth in a simplified manner, the following quote from Hayek allows us to understand more fully our capital theory as a comprehensive one capturing the non-linear dynamics of an economy including a tendency towards growth.

> The question takes on a somewhat different complexion, however, when we remember that even the process leading up to a particular commodity is not usually linear, but will as a rule consist of many separate branches of different lengths which gradually form up together to form the main stream. In order to obtain the input function for the complete process, we must of course make a summation of each stage of all the input invested at the same moment (that is, in that same stage) in all the various branches of the process. Beginning with the one which starts earliest, we shall, as we progress to later stages, have to include more and more of these branch processes which have for a time been going on simultaneously but separately. Now, even if input is applied at a constant rate in each of these sub-processes, the aggregate effect must be that, as the number as the number of such sub-processes which are going on simultaneously increases, the rate at which input is applied in the process as a whole will tend also to increase (Hayek 1941, 123).

We see that the tendency under the system is to grow as the "number of such sub-processes which are going on simultaneously increases", this can be construed to mean that as the extent of the market increases, so does the capital structure. Then as 'capital breeds what it needs', institutions arise to accommodate this growing and changing capital base.

[15] In economics, finance and accounting there are two types of measurable quantities, stocks and flows. Stocks measure an accounting entity at a moment in time, i.e., a Balance Sheet, and flows measure an accounting entity over a period of time, i.e., a Financial Statement. In our empirical study later in this paper we use "stock" data at a moment in time.

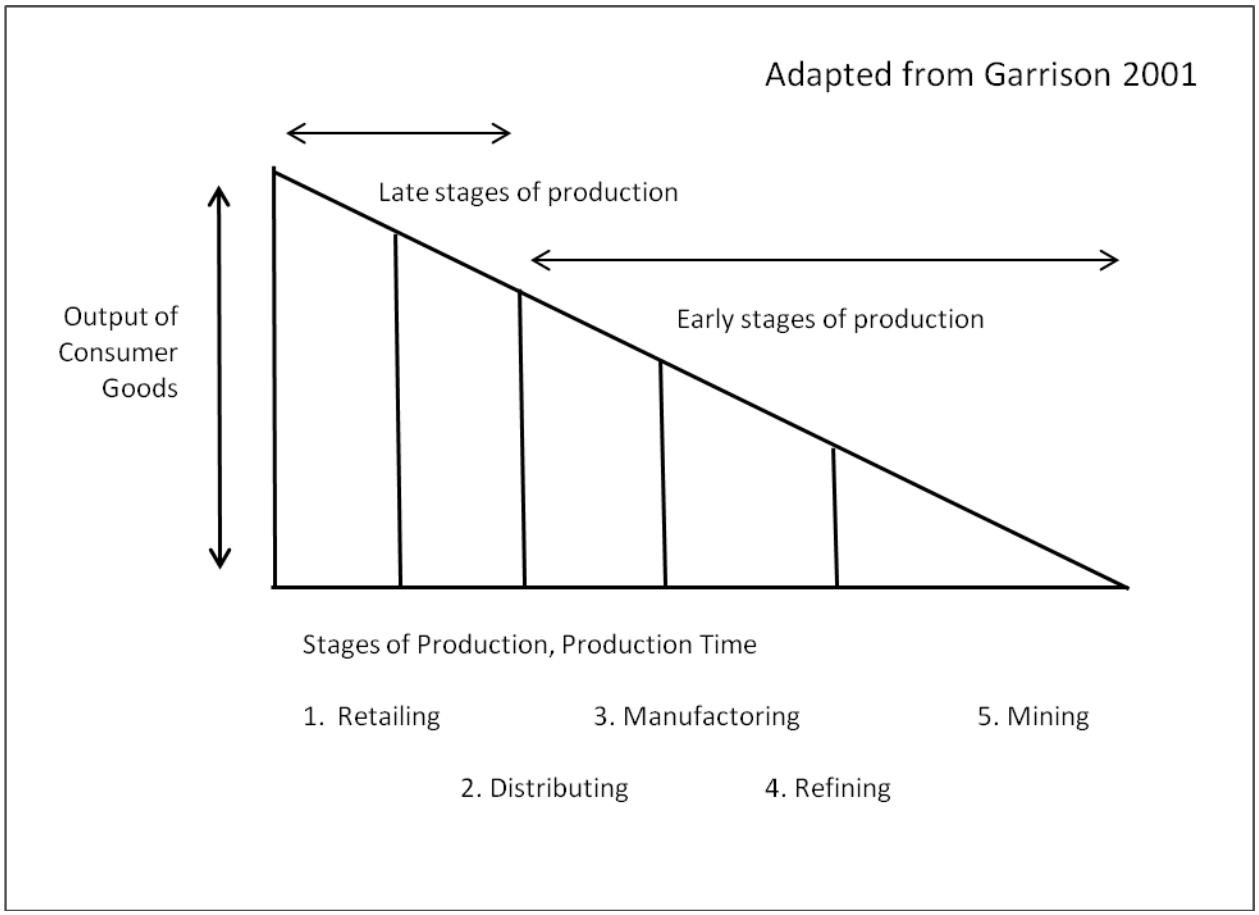
Garrison and Capital Theory

Roger Garrison has continued to expand upon the Austrian School theory of capital using Hayek's triangles as a basis for analysis. Garrison uses the triangles as heuristics to explain the growth of the economy, of consumption, as one in which, as the stages of production increase in time the economy reproduces and expands.[16] Illustration 4. shows what Garrison calls the "the structure of production (continuous-input/point-ouptut)" (Garrison 2001, 47, Figure 3.5).

[16] It may be impossible to really know what causes the decrease in time-preferences of individuals and the changes in capital structure in a society over time. Nell writes that it is capital as a process which causes the institutions of capital to form. Others (see i.e., Mulligan 2007) propose that it is good government institutions and the rule of law which allow the decrease in time-preference and thus wealth-creation through investment. Still others (i.e., Procacccia 2007) write that it is the culture of a people's themselves which is the necessary condition to give rise to the institutions needed for the capital system. Finally, others (e.g. Garrison 2001) write that that macroeconomic policy, such as taxing consumption as opposed to income, allows for the time-preference to decrease and investment to be prioritized over consumption. Alternatively, Schumpeter (1942) would describe the evolution of more roundabout and differing stages of production the 'creative destruction' of the capital system, with human innovation playing a key role.

Perhaps this illusive causal chain, the difficulty in isolating cause from effect, is best described by Veblen (1898, 378) who coined the term 'cumulative causation', or in recent vernacular to give precedence to the historical contingency of each instance, 'path-dependence'.

Illustration 4.



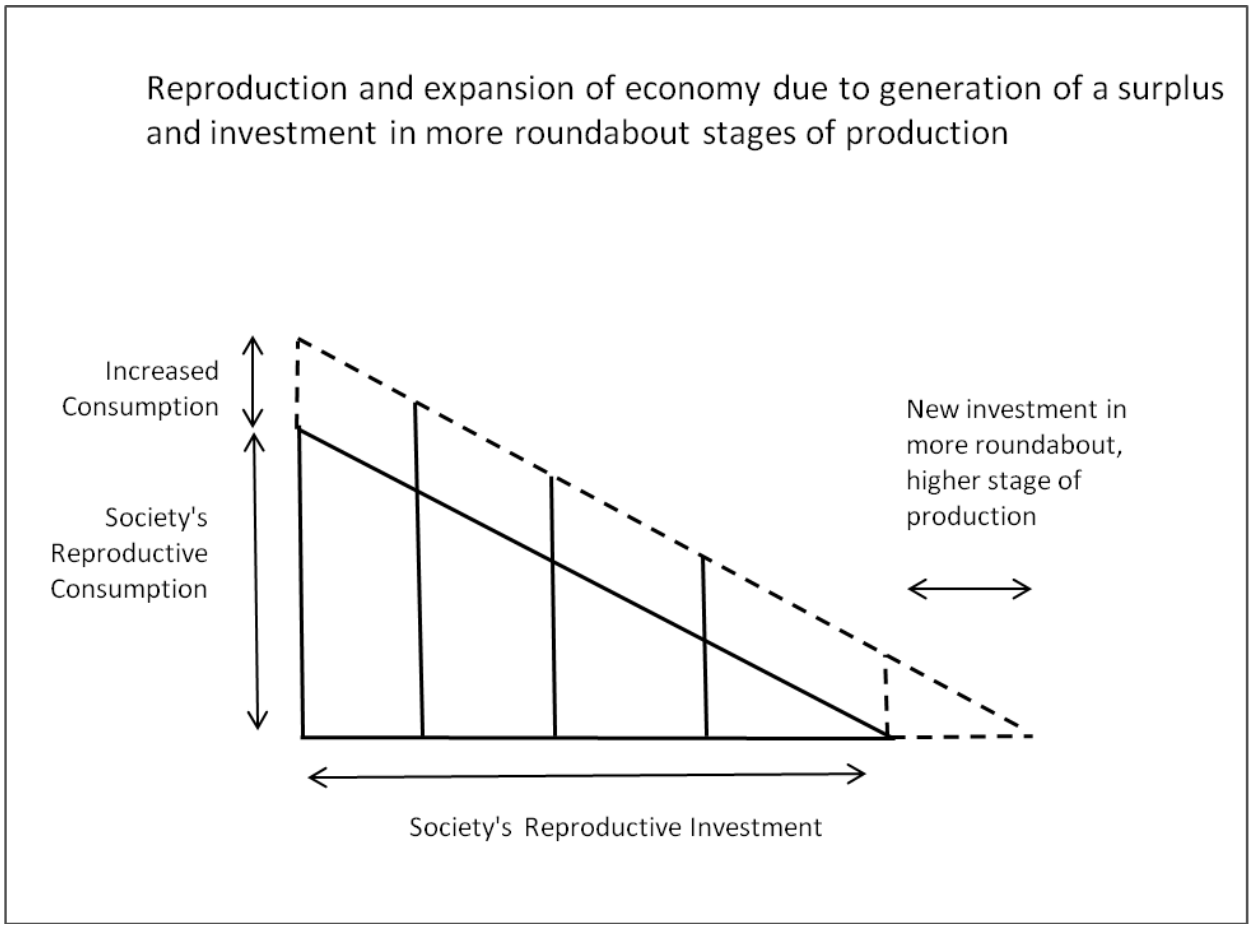
Garrison in his Hayekian triangle gives specific examples (mining, refining, manufacturing, distributing and retailing) of stages of production from the earliest (least time-preference investments) to the latest (those with the most time-preference, including immediate consumption). It is from this example that we will draw-upon later in the paper when we research the actual capital structures of the U.S. economy for early and modern capitalism. From Menger we learned that the longer in time, the more 'roundabout', the capital structure in an economy, the more productive the economy in terms of expansion of the economy. Garrison's (Hayek's) triangle can also represent the society itself. If the size of the triangle is static over time, then the economy does not produce a surplus and only reproduces. If the size of the triangles grows over time due to real changes in economic

incentives or innovation then this means that there is a surplus which is used for new investment in more roundabout production stages of production.[17]

Using Garrison's model we can visualize what happens when a surplus is generated and used for investment in longer-term stages of production. Illustration 5. uses the triangles to show an economy which has reproduced and expanded through investment in more roundabout technologies.

[17] It should be noted that a key point in Austrian School capital theory is that time-preference decreases, and thus investment increases in more roundabout methods of production, must be based on behavioral changes caused by changes in real incentives, such "through the evolution of governmental and legal institutions" (Mulligan 2007, 21). Illusionary changes in policy do not allow for sustainable growth because incentives are misread and this can cause bad investment which then creates unsustainable boom and prolonged bust cycles as the bad investments are cleansed from the capital system. "What initially appears to be genuine economic growth can turn out to be a disruption of the market process attributable to some disingenuous intervention on the part of the monetary authority" (Garrison 2001, 34). It is beyond the scope of this paper to explore policy effects on capital structure, the intent of the paper is to evaluate the capital structure at given points in time many years apart, e.g., a comparison between the capital structures of early and modern capitalism.

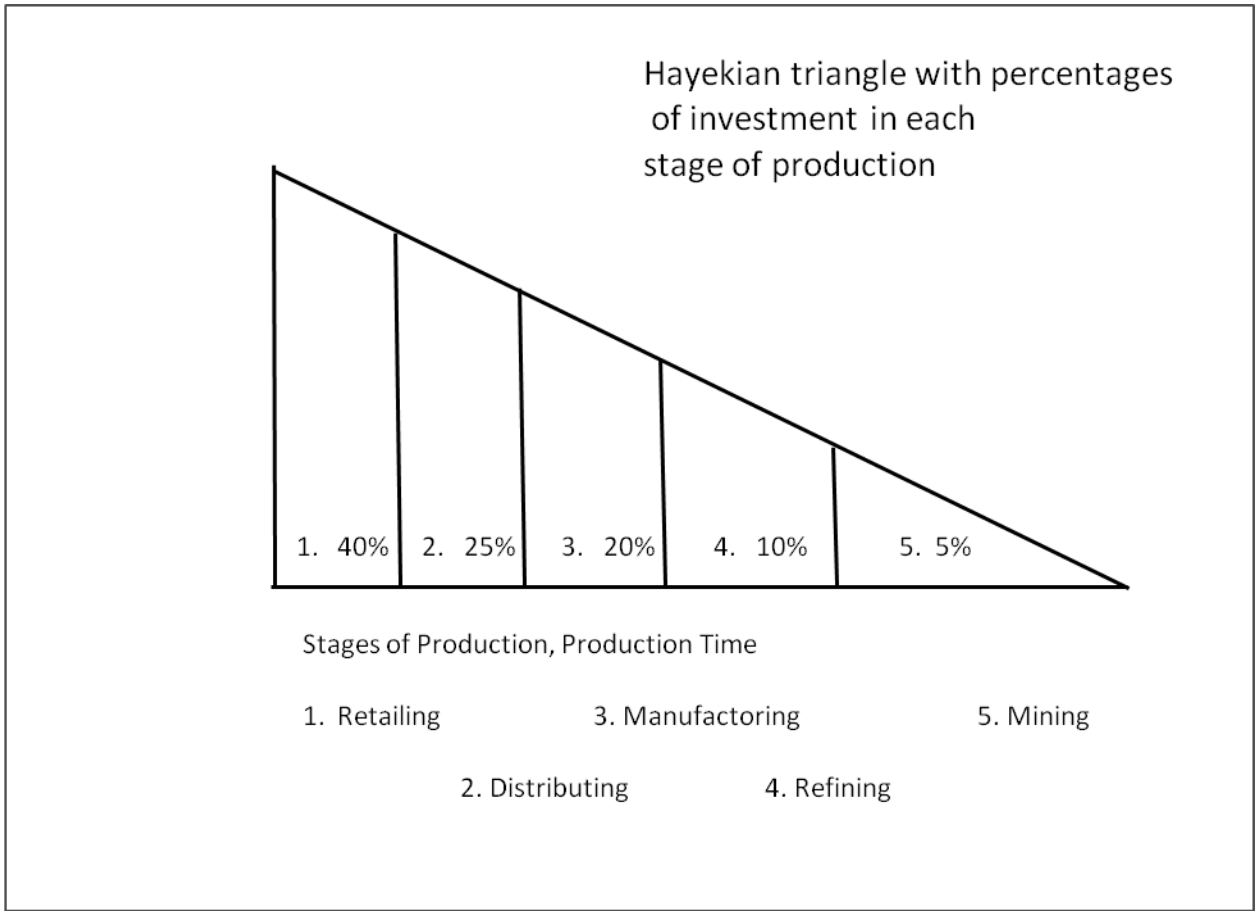
Illustration 5.



Towards a Method of Comparative Analysis for Austrian School Stages of Production

In this section of the paper I present a method for creating an "average period of production" index which allows the comparison of capital structures between economies, or in our case, for different time periods in the United States. First we will return to Garrison's triangle (as in Illustration 4.) , however we now add the percentage of the economy's investment in each stage of production, Illustration 6.

Illustration 6.



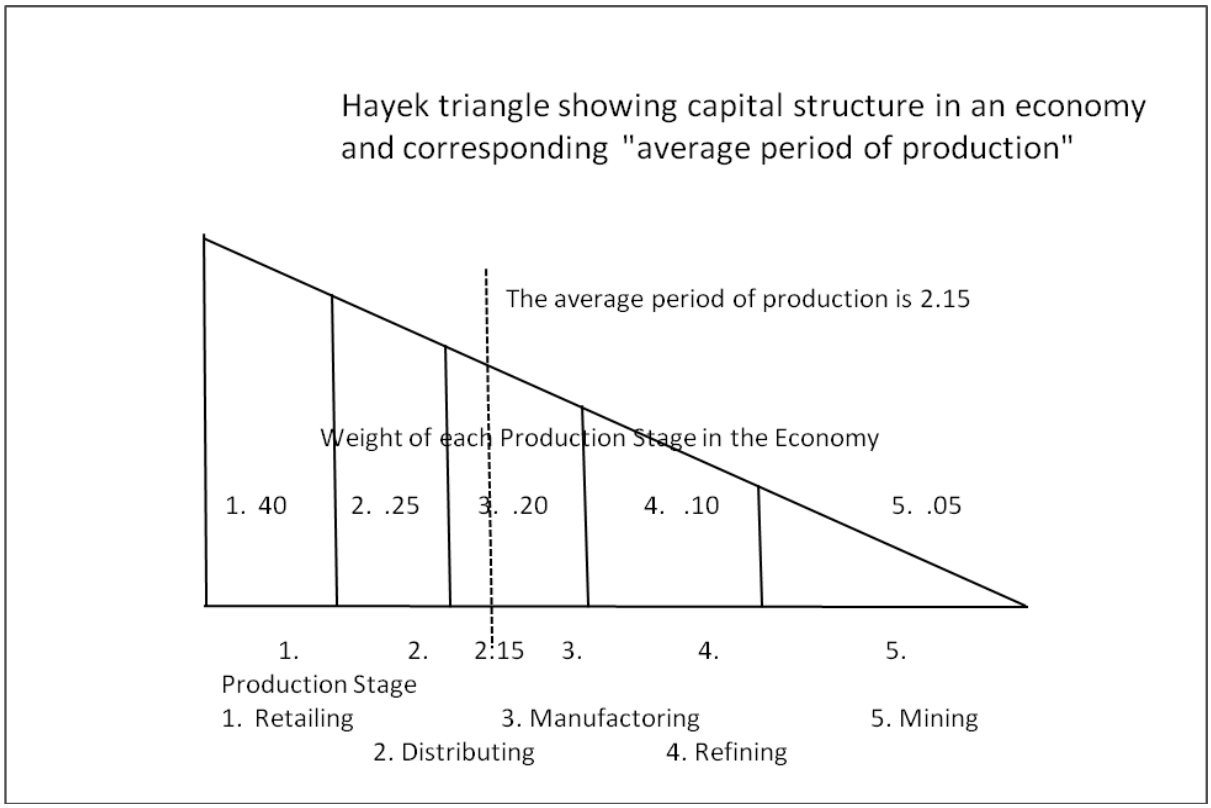
We see in Illustration 6. that at a given point in time our example economy has 40% of its investment (wealth) in Retailing, 25% in Distribution, 20% in Manufactoring, 10% in Refining and 5% in mining. From here we can then use Bohm-Bowerk's concept of an "average period of production"[18] to create an average period of production for our sample economy. This average period then can be used as a measure of comparison between economies to evaluate which economy has the more developed capital structure, e.g., which economy has the longest average period of production. It should follow then, as we have seen from Austrian School capital theory, that the economy with the longest average of period of production should have the greater wealth.

The average period of production is calculated by taking the weight of each production stage and multiplying it by the number of the production stage. The result for our example economy is shown in Illustration 7.

[18] For Bohm-Bawerk on '"the average period" see Bohm-Bawerk 1888, 88-89. It should be noted that Bohm-Bawerk provides an example which uses the average amount of labor-time spent, and when that labor-time was paid, in producing the consumer goods through its various stages of production to derive an average period. For example the consumer goods in Economies A and B might each take 6 months to produce, but in Economy A the labor was paid over 6 months, whereas in Economy B the labor was paid, on average, over a ten-year period. Economy B has the longer average period of production.

Our method deviates from Bohm-Bawerk's and creates an index which measures an 'average period' based on numbering each stage of production in an economy and the percentage of the economy's investment in that stage. Our concept is more abstract, but empirical data can be applied to it, unlike, without great difficulty, Bohm-Bawerk's method.

Illustration 7.



In Illustration 7. above we see that the index we have created for our example economy based on Roger Garrison's Hayekian triangle places the average period of production equal to 2.15[19]; towards the lower stages of production in the manufacturing sector.

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[19] 2.15 is equal to (.4 x 1) + (.25 x 2) + (.2 x 3) + (.1 x 4) + (.05 x 5).

Formally, the average period of production index is given by,

Average period of production = $\sum_{i=1}^{k} x_i \; w_i$.

Where $i = (1, 2, \ldots, k)$, k is equal to the number of the highest stage of production in the economy (in our model $k = 5$, where five represents the mining stage of production); x is each stage of production, and w is the weight of the production stage's quantity of capital in relation to the quantity of capital in the economy as a whole,

$\sum w_i = 1.$

From here we are ready to move on to our empirical analysis. We have set-up a framework which shows that capital as a system is one which reproduces and, when a surplus is generated[20], expands itself through investment in longer, more roundabout, stages of production. With this as a theoretical background the next step is to compare the capital structures of early capitalism (1870 – 1914) with that of modern capitalism (1948 to the present) and to see if indeed Austrian School capital theory can explain the increase in growth of modern capitalism based on a longer, more roundabout capital structure, keeping in mind Nell's stylized facts of an increase in the FIRE (finance, insurance and real estate) and the growth of government.

Empirical analysis

For our empirical analysis we are using the *Historical Statistics of the United States*,[21] specifically the data contributed by Susan B. Carter and Richard Sutch. The earliest period available for consistent and comparable data is 1900 and the latest is 1958 so these are the dates we will use for measuring "early" and "modern" capitalism respectively. From this data we derive 9 stages of production based on Carter and Sutch's classification schema, from the lowest to the highest order of goods, or from the lowest to highest stage of production.

1. Farm Inventories[22]

[20] There are many theories as to why or how a surplus is created, ranging from the Austrian School view of the entrepreneur seeking a profit to the Marxian view of labor exploitation.

[21] Note that our empirical analysis of the capital structure in the U.S. is based on very high-level (aggregated) data. A great field of research has been developed into the differing approaches for measuring capital formation in more detail. For an excellent summary of the literature see Gallman 1986. We are using the data Carter and Sutch labeled "reproducible only" (e.g., we are not including land) because we are following Nell's model of the economy as one which reproduces and if a surplus, expands, in continuous cycles of reproduction and expansion. Land is not reproduced.

[22] We are placing those items listed as farm-related as higher ordered goods in like-classes because it is well understood that as an economy develops it devotes less resources to farming. For example see footnote 3. re. Locke and related mainbody text re. Nell.

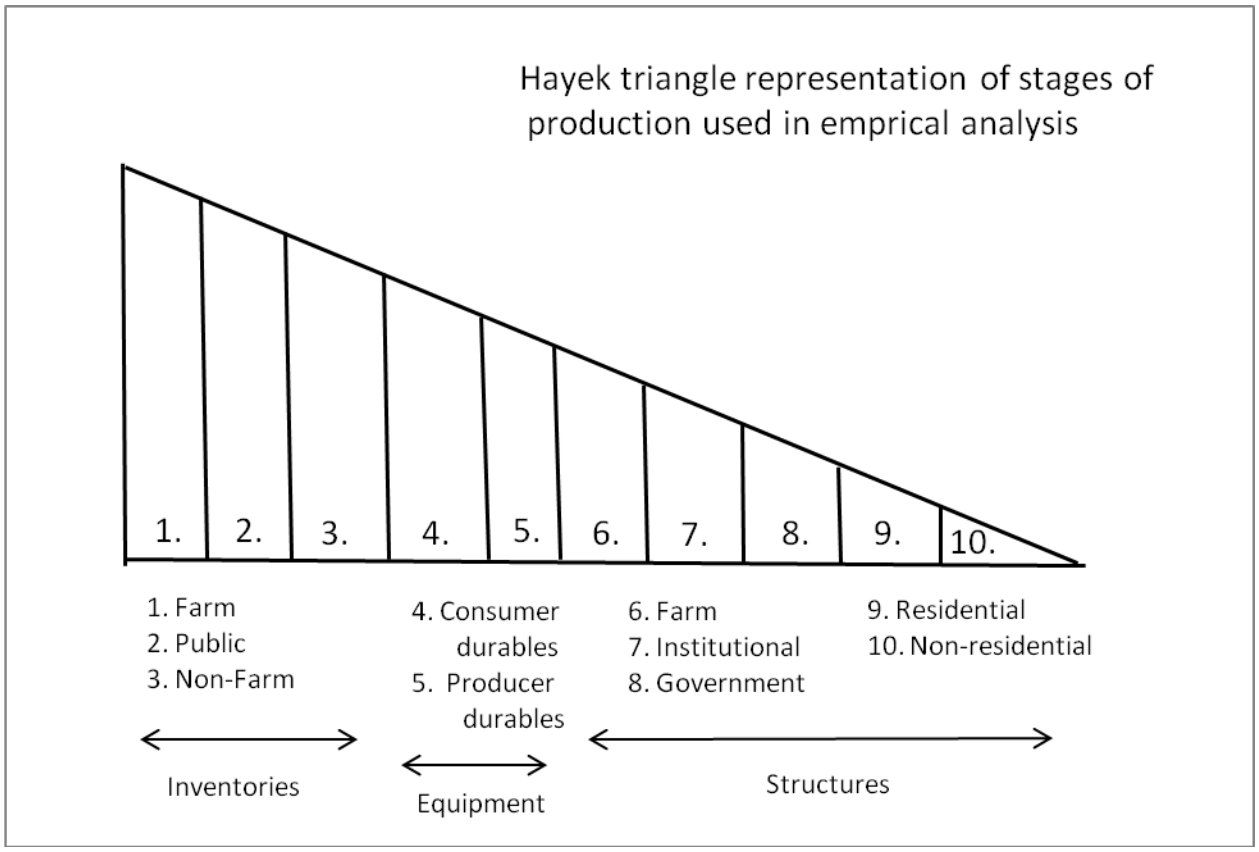
2. Public inventories
3. Non-farm inventories
4. Consumer durables equipment
5. Producer durables equipment
6. Farm structures
7. Institutional structures
8. Government structures[23]
9. Residential structures
10. Non-residential structures

Illustration 9. shows how these stages of production are represented in the Hayekian triangles.

[23] It could be debated whether government structures should be placed before or after institutional (not-for-profit) structures, non-residential structures (commercial real-estate excluding land) and residential structures (housing). We have made the decision to place government structures before commercial and residential real estate because government provides "transaction" services, e.g. services not representative of more roundabout technologies, in addition to long-term infrastructure. See Wallis and North 1986 on the 'transaction sector'.

It is also debatable where government inventories should be placed in relation to farm and non-farm inventories (although government inventories are relatively insignificant in amount compared to non-government inventories). We have placed government inventories before non-farm inventories as non-farm inventories are more indicative of time-preference (entrepreneurial) incentives and therefore represent a higher-ordered good. We have place residential real estate before non-residential, despite the, usually, longer 30-year financing of residential because in our judgment non-residential investment is more indicative of entrepreneurial behavior. Lastly, we have excluded Carter and Sutch's "Money gold and silver" category from analysis as these in our judgment do not represent ordered goods or stages of production (these amounts are also insignificant in relative value to other wealth in the economy).

Illustration 9.



The next step is to calculate the weight of each of these stages of production in the U.S. economy in 1900 (early capitalism) and 1958 (modern capitalism) and the corresponding average period of production for each date. Illustration 10. Shows our result.

Illustration 10.[24]

Captial Structure Analysis with Government Included

		Early Capitalism (1900)		Modern Capitalism (1958)	
Stage of Production		Dollars ($ Billions)	% of Total	Dollars ($ Billions)	% of Total
1	Farm inventories	18.4	8.38%	25.6	2.44%
2	Public inventories	n/a	n/a	8.9	0.85%
3	Non-farm inventories	14.2	6.47%	75.4	7.18%
4	Consumer durables equip.	21.7	9.88%	159.7	15.21%
5	Producer durables equip.	20.5	9.34%	187.4	17.85%
6	Farm structures	13.6	6.19%	28.2	2.69%
7	Institutional structures	4.7	2.14%	17.8	1.70%
8	Government structures	9.5	4.33%	126.8	12.08%
9	Residential structures	68.1	31.01%	283.6	27.01%
10	Non-residential structures	48.9	22.27%	136.4	12.99%
Total		219.6	100.00%	1049.8	100.00%
	Average period of production		7.03		6.95

We can see that that, counter-intuitively, the average period of production in modern capitalism (1958) decreased slightly from that of early capitalism (1900), 6.95 versus 7.03.[25] However we also see, as expected, that farm inventories and farm structures as a percentage of the economy decreased while non-farm inventories, and consumer and producer durables equipment increased, showing a move toward the manufacturing sector away from the agriculture sector. We also see that the housing sector remained relatively stable (decreasing slightly) while government structures increase almost 300 percent; this fits our stylized fact of an increase in government in the economy in modern capitalism. We also see a significant decline in non-residential structures[26], this would seem counterintuitive

[24] All data in this empirical analysis section taken from Carter and Sutch 2006, 329.

[25] Although the average period of production decrease (from 7.03 to 6.95) might be considered insignificant, we would expect to a significant increase due to the significantly larger growth in modern capitalism.

[26] Note that non-residential structures (meaning factories and other private investments classified as more long-term investment than equipment) declined by almost 10% from early to modern capitalism. This data trend alone accounts for the failure of the average stage of production methodology I have formulated in this paper to show more roundabout production processes in

to the stylized fact of an increase in the FIRE (finance, insurance and real estate) sectors, however the increase in government structures (real estate excluding land) almost makes-up for the decrease in non-residential structures.[27] The large increase in equipment is of course also indicative of an increase in the financial sector needed to fund this equipment; this is consistent with the stylized facts of an increase in FIRE sectors.

It should be noted that thus far the way we have conducted this analysis may not be true to the Austrian School theory of the market process which states that it is the time-preferences of *entrepreneurial* actors which decreases over time as an economy develops over time. The government sector is not entrepreneurially-based risk-taking but part of the dynamics of the political process. [28] In addition, at the time the Austrian School was forming its theory, government was yet to reach its modern period of around 30% of the economy, so perhaps this is why government was not explicitly included in the capital theory, and therefore our

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modern capitalism. Because of this anomaly I traced the data integrity back to the original author cited by Carter and Sutch for their data, Goldsmith 1962, to ensure that the data was accurate. Goldsmith states,

> This close similarity between the gross value of corporate plant and equipment derived from the perpetual inventory method and reported in corporate tax balance sheets must mean one of two things. First it may mean that the capital expenditures on plant and equipment underlying the perpetual inventory estimates are very close to the capital expenditures entered in their own books (or, more correctly, the set of books they keep for tax purposes); and that the estimates of the length of life of the different types of reproducible assets used in the perpetual inventory method are close to those employed by corporations for their own accounts. Or, second, it may mean that, insofar as there are deviations between the figures underlying the perpetual inventory method and those used in the corporations' own accounts – and undoubtedly there are – those deviations happen to cancel out, not only for the entire decade but for most individual years, when all non-agriculture corporations and all types of depreciable are combined. It is unfortunately not possible to determine whether the satisfactory correspondence in the aggregate series is the effect of only moderate discrepancies for individual industries and individual types of assets, or whether it is the result of very wide but fortuitously offsetting deviations (Goldsmith 1962, 84-85).

This might highlight the difficulty in relying on tax records for calculating capital and wealth values, especially when we recognize that the federal income tax did not become constitutional in the United States until 1913 with the ratification of the Sixteenth Amendment to the U.S. Constitution, e.g., and whose effects therefore do not appear in our data until modern capitalism and may, it might be reasonable to assume, skew reported values downward.

[27] It should again be noted that land wealth is excluded from this stage of our analysis, an important part of the real estate sector, because it is not part of the reproducible economy.

[28] It is beyond the scope of this paper to discuss political philosophy or public choice economics.

classification of the data may not be appropriate. We will redo the analysis excluding the government sector from the analysis and report the result, Illustration 11.

Illustration 11.

Captial Structure Analysis excluding Government

		Early Capitalism (1900)		Modern Capitalism (1958)	
Stage of Production		Dollars ($ Billions)	% of Total	Dollars ($ Billions)	% of Total
1	Farm inventories	18.4	8.76%	25.6	2.80%
2	Non-farm inventories	14.2	6.76%	75.4	8.25%
3	Consumer durables equip.	21.7	10.33%	159.7	17.47%
4	Producer durables equip.	20.5	9.76%	187.4	20.50%
5	Farm structures	13.6	6.47%	28.2	3.09%
6	Institutional structures	4.7	2.24%	17.8	1.95%
7	Residential structures	68.1	32.41%	283.6	31.03%
8	Non-residential structures	48.9	23.27%	136.4	14.92%
Total		210.1	100.00%	914.1	100.00%
	Average period of production		5.51		5.34

Again we find that the average period of production has decreased from early to modern capitalism even when the government sector is excluded. It is plain to see that this is due to the decrease in non-residential structures as a percentage of the economy.

It may be instructive to see if the Austrian School capital theory can be used to explain the entire economy, meaning including land and government, and dropping the assumption that we should be concerned with the reproducible economy only.

Illustration 12.

Captial Structure Analysis including Government and Land

Stage of Production		Early Capitalism (1900) Dollars ($ Billions)	% of Total	Modern Capitalism (1958) Dollars ($ Billions)	% of Total
1	Farm inventories	18.4	5.86%	25.6	2.05%
2	Public inventories	n/a	n/a	8.9	0.71%
3	Non-farm inventories	14.2	4.52%	75.4	6.05%
4	Consumer durables equip.	21.7	6.91%	159.7	12.82%
5	Producer durables equip.	20.5	6.52%	187.4	15.04%
6	Farm structures	13.6	4.33%	28.2	2.26%
7	Institutional structures	4.7	1.50%	17.8	1.43%
8	Government structures	9.5	3.02%	126.8	10.18%
9	Residential structures	68.1	21.67%	283.6	22.76%
10	Non-residential structures	48.9	15.56%	136.4	10.95%
11	Agriculture land	41.7	13.27%	52.9	4.25%
12	Public land	11.5	3.66%	34.2	2.74%
13	Residential land	19	6.05%	44.6	3.58%
14	Non-residential land	22.4	7.13%	64.6	5.18%
Total		314.2	100.00%	1246.1	100.00%
	Average period of production		8.35		7.55

Again we see an inability for the Austrian School capital theory, as we have formulated it in our average period of production methodology, to account for the increased growth in modern capitalism compared to early capitalism in an economy-wide capital structure including land and government.

Lastly, we note that Garrison's triangles (and the writings of the earlier Austrian School theorists) do not include government, agriculture, land, nor housing in their capital structures or in their definitions of consumer or capital goods.[29] Illustration 13. shows the results when we remove these sectors from our analysis.

[29] It may be proposed that the reason government, agriculture and housing do not form part of the core of Austrian Capital theory is because these institutions existed prior to capitalistic development.

Illustration 13.

Captial Structure Analysis excluding Government, Housing and Agriculture

Stage of Production		Early Capitalism (1900) Dollars ($ Billions)	% of Total	Modern Capitalism (1958) Dollars ($ Billions)	% of Total
1	Public inventories	n/a	n/a	8.9	1.52%
2	Non-farm inventories	14.2	12.91%	75.4	12.88%
3	Consumer durables equip.	21.7	19.73%	159.7	27.27%
4	Producer durables equip.	20.5	18.64%	187.4	32.00%
5	Institutional structures	4.7	4.27%	17.8	3.04%
6	Non-residential structures	48.9	44.45%	136.4	23.29%
Total		110	100.00%	585.6	100.00%
	Average period of production		4.48		3.92

We again fail to show the ability of Austrian School capital theory to explain the differences in growth between early and modern capitalism; early capitalism still shows a more roundabout capital structure (a longer average period of production index). Again it is plain to see that the main structural difference in the economy, in the methodology the way we have formulate it and in the accounting methodology adopted by Carter and Sutch, is that private non-residential structures decreased significantly from early to modern capitalism, and as we have shown previously, this decrease was almost made up for by an increase in governmental structures. This is compatible with the stylized facts of Nell on the difference between early and modern capitalism viz. the growth of government in the economy.[30]

[30] If we were to classify government structures (as well as all government investment in the economy) as the highest order good for each class of assets we may see that the average period of production based on our index methodology has increased from early to modern capitalism. However this is anathema to the Austrian School theory of time-preference being entrepreneurial and subjective to individuals. If government was the highest order good, *reductio ad absurdum*, we would have the state-economy of the Soviet Union, which we learned from history, was unsustainable economically.

A Simplified Approach to Quantifying Austrian Capital Theory

If we revisit Garrison's triangle of stages of production, as show in Illustration 4., we see that he classifies the stages into two categories, "late" and "early". Retailing and distribution are "late" stages (those relating to highest time-preference, e.g. primitive stages of capitalistic development) and the "early" stages being everything that is not retailing and distribution, e.g., those that require more roundabout production technologies (such as mining and manufacturing). We shall apply this concept to the Carter and Sutch[31] data, by evaluating the percentage of inventories in the economy for our two dates (1900 and 1958) under study and compare these percentages with the rest of the economy. This is a simplified approach to test the validity of the Austrian School capital theory's ability to explain the growth differences between early and modern capitalism, and may help reduce data classification anomalies. Illustration 14. shows the result when we include both land and government, e.g. our model which includes the non-reproducible economy.

[31] It is beyond the scope of this paper to evaluate alternative accounting methods for measuring capital structures and to apply these alternatives to the methodology we have derived for capturing an average period of production. Additional research in this area may be fruitful for further insight into the applicability of Austrian Capital theory to explain institutional and cultural development within and between economies. For example one starting point might be to construct comparable data for capital formulation in the years 1900 and 2000. However this data is not currently available due to differences in accounting methodology in the literature, particularly for investment in information technology, after 1958; see Gallman 1986 and Carter and Sutch 2006.

Illustration 14.

Stage of Production		Early Capitalism (1900) Dollars ($ Billions)	% of Total	Modern Capitalism (1958) Dollars ($ Billions)	% of Total
1	Farm inventories	18.4	5.86%	25.6	2.05%
2	Public inventories	n/a	n/a	8.9	0.71%
3	Non-farm inventories	14.2	4.52%	75.4	6.05%
	Inventories Percentage		10.38%		8.82%
4	Consumer durables equip.	21.7	6.91%	159.7	12.82%
5	Producer durables equip.	20.5	6.52%	187.4	15.04%
6	Farm structures	13.6	4.33%	28.2	2.26%
7	Institutional structures	4.7	1.50%	17.8	1.43%
8	Government structures	9.5	3.02%	126.8	10.18%
9	Residential structures	68.1	21.67%	283.6	22.76%
10	Non-residential structures	48.9	15.56%	136.4	10.95%
11	Agriculture land	41.7	13.27%	52.9	4.25%
12	Public land	11.5	3.66%	34.2	2.74%
13	Residential land	19	6.05%	44.6	3.58%
14	Non-residential land	22.4	7.13%	64.6	5.18%
	Non-Inventories Percentage		89.62%		91.18%
	Total	314.2	100.00%	1246.1	100.00%

From Illustration 14. we find that indeed the investment (wealth) in the U.S. economy is greater in longer (non-inventory) stages of production in modern capitalism (91.18% of the economy) than in early capitalism (89.62%). This result is consistent with Austrian Capital theory as a means to explain the transformation between early and modern capitalism as shows that the time-preference for investment has decreased, that entrepreneurs are more willing to take investment in more roundabout stages of production such as equipment, structures and land.

In Illustration 15. we have excluded the government and land sectors to see if the Austrian School "inventory approach" can help explain the transformation in the reproducible economy only.

Illustration 15.

Captial Structure Analysis based on Inventories and Non-Inventories
with Reproducible Sectors Only

		Early Capitalism (1900)		Modern Capitalism (1958)	
Stage of Production		Dollars ($ Billions)	% of Total	Dollars ($ Billions)	% of Total
1	Farm inventories	18.4	8.76%	25.6	2.80%
2	Non-farm inventories	14.2	6.76%	75.4	8.25%
	Inventories Percentage		15.52%		11.05%
3	Consumer durables equip.	21.7	10.33%	159.7	17.47%
4	Producer durables equip.	20.5	9.76%	187.4	20.50%
5	Farm structures	13.6	6.47%	28.2	3.09%
6	Institutional structures	4.7	2.24%	17.8	1.95%
7	Residential structures	68.1	32.41%	283.6	31.03%
8	Non-residential structures	48.9	23.27%	136.4	14.92%
	Non-Inventories Percentage		84.48%		88.95%
Total		210.1	100.00%	914.1	100.00%

Again, using the inventories approach, we see that the Austrian School capital theory can help explain the transformation between early and modern capitalism based on an increased preference for more roundabout stages of production in the reproducible economy; long-term (non-inventories) investments make-up 88.95% of the economy in modern capitalism and 84.48% in early capitalism.

Conclusion

In this paper I have tried to show that the Austrian School's capital theory might be one way of explaining the greater growth and wealth creation in modern capitalism (1948 to the present) compared with early capitalism (1870 to 1914). Professor Edward J. Nell's explication of Transformational Growth describes the transformation of society and institutions from feudal and guild systems to the capitalist system as one coinciding with an increase in, to use Adam Smith's phrase, the "extent of the market" and the development of rules of law to support contracts and property rights. In Nell (and in the work of the classical economists, and as we have seen in our paper, the work of Bohm-Bawerk and Hayek) society is

one which reproduces itself, then if a surplus is created and invested, expands economically. This expansion coincides with the development of new institutions to support its expansion.

The Austrian School proposes that the development of society, both culturally and economically, is based upon individual economic actors having changing time-preference for investment. These time-preferences decrease as a society develops and this provides for investment in longer-term, more roundabout, technologies of production which in-turn create more and more-varied consumption goods. I have proposed in this paper a method for quantitatively measuring for comparison-sake an 'average period of production' index in an attempt to measure time-preference in an economy. I have applied this methodology to data which allows comparability between two periods of time in the United States, one representing early capitalism (1900) and one modern capitalism (1958).

My methodology has failed to describe, and to reconfirm, that longer periods of production coincide with the two stage of capitalism, both for the reproducible sectors and for the economy writ-large including land and government. This may be due to an error in data capture or classification or in methodological approach. Using a simplified version of classifying the data based on inventories and non-inventories to represent time-preference (with a preference for inventories meaning a preference for less roundabout stages of production) the data does indeed show that time-preference has decreased between early and modern capitalism. The simplified classification schema works for verifying the Austrian School capital theory applicability to both reproducible and non-reproducible models of the economy.

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