AN INSTRUMENTAL APPROACH TO FULL EMPLOYMENT:

WITH POLICY IMPLICATIONS

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AN INSTRUMENTAL APPROACH TO FULL EMPLOYMENT: WITH POLICY
IMPLICATIONS

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ABSTRACT

The study proposes that in order to assure full employment, policy measures
must address both Keynesian unemployment, and unemployment caused by structural
and technological change. It is possible to attain full employment via expansionary
fiscal policy advocated by Keynes. However given on-going technological change, it
is not possible to maintain full employment with Keynesian policy alone. In order
for any full employment policy to be effective it must address both of these issues.
The purpose here is an investigation of the theory of unemployment from a Keynesian
perspective and a structuralist perspective. I will make an argument that these
are two sides of the same coin. Using an input-output framework it will be shown
how the ELR program formally fits into the economy and addresses both types of
unemployment. Furthermore, it will be shown that the ELR program works in conjunction
with the private sector. The initial introduction of the ELR program causes
an increase in the final demand for private sector goods and services, thus creating
additional employment in the private sector. In order for the investigation of structural/technological
unemployment, a structural framework of the ELR program is

required. The dissertation will lay out a structural model of the economy with and without an ELR program. This then allows for an investigation of comparative benefits of such a program in addressing unemployment over current government policies. Simulations of model economy with and without the ELR program will be done to show that the ELR program stabilizes final demand. Additionally it will be seen that the ELR sector maintains full employment given structural and technological change.

The faculty listed below, appointed by the Dean of the College of Arts and Sciences have examined a thesis titled "An Instrumental Approach to Full Employment: with Policy Implications" presented by Michael J. Murray, candidate for the Doctor of Philosophy degree, and certify that in their opinion it is worthy of acceptance.

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CHAPTER 1

POST KEYNESIAN APPROACHES TO ECONOMIC THEORY

There is a methodological division in contemporary Post Keynesian macroeconomics. The first approach is the American Post Keynesian approach which focuses on the macro-economy and the second approach is the "Structuralist Post Keynesian" approach which emphasizes the microfoundations of macroeconomics and describes the economy in terms of its structure of production. The first approach, the American Post Keynesian approach, follows a framework set by Paul Davidson, Basil Moore, and Hyman Minsky. For Post Keynesian macro-economists, much of their work is methodologically a continuation of the work of J.M. Keynes *The General Theory of Employment, Interest, and Money* (hereafter *GT*). Keynes' *GT* was supposed to serve as an alternative to the traditional approach, while leaving policy prescriptions in the background. Unlike Keynes' *GT*, the work of most contemporary Post Keynesians focuses on both economic theory and public policy. The approach of Post Keynesians puts heavy emphasis on historical time, fundamental uncertainty of investment expectations, the role of money and finance, and the principle of effective demand (Holt, 2007). With regard to unemployment, Post Keynesians see it as a problem, but nevertheless a natural consequence of the capitalist system. In the construction of Post Keynesian theory, Davidson explains the occurrence of unemployment as a natural phenomenon, the explanation for unemployment is inspired directly from Keynes' theory of money. Davidson begins his approach with Keynes' definition of money and money's essential properties; the most important property is that money

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cannot be readily produced.

> Unemployment develops, that is to say, because people want the
> moon; –men cannot be employed when the object of desire (i.e. money)
> is something that cannot be readily chocked off (Keynes, J.M. 1936:
> 235; quoted in (Davidson, 1991b, 295)).

> Post Keynesians ... see unemployment as a fundamental problem
> of any money economy ... [and] that unemployment tendencies are
> an inherent weakness in any money economy and that only public
> policy can prevent this weakness from manifesting itself and perhaps
> destroying an otherwise desirable system of organizing economic ac-
> tivities (Davidson, 1991b, 295).

Furthermore, Davidson puts forth that Post Keynesian theory is built upon
the standpoint that a modern production economy exists for the purpose of producing
a monetary gain for the capitalists. As Keynes outlined in the GT, because capitalists
are only concerned about their own personal self-interests, the result is an insufficiency
of aggregate effective demand at full employment.

> In a monetary, production, market-oriented economy, even if en-
> trepreneurs hire at the full employment level of workers, there can
> be an insufficiency of aggregate effective demand, when all the goods
> currently produced cannot be profitably sold at any price-money wage
> level. It is the prospect of possible insufficient effective demand at full
> employment which differentiate Keynes's analysis (Davidson, 1991a,
> 205).

The capitalist mode of production and unemployment are inseparable; unem-
ployment is simply a product of capitalism (a point also addressed by Karl Marx but
for very different reasons). Davidson's (and Post Keynesians who follow Davidson's
general approach) recommendation for the attainment of the macroeconomic goal of
full employment is for proactive government involvement in the economy geared to-

wards expansionary fiscal policy. Government spending increases aggregate demand which closes the recessionary gap (the gap between the current level of aggregate demand and the full employment level of aggregate demand). Public policies along these Keynesian lines help to ensure the generation of aggregate demand stimulus towards the achievement of full employment.

The general methodological framework of this group of Post Keynesian macroeconomists has put precedence on the inadequate nature of aggregate demand and the role of excess labor as a disciplining device. One can be critical of both hypotheses. There is no doubt that the nature of the economic process is one of inadequate aggregate demand. However, this is simply one side of the story.

Achieving full employment and maintaining full employment are two separate policy objectives. The attainment of full employment via aggregate demand stimulus does not ensure the maintenance of full employment. To understand the conditions which necessitate the maintenance of full employment, a different methodological approach than aggregate demand is required. The issues of a monetary production economy and the roles of effective demand, expectations, investment uncertainty, and historical time, outlined by the American Post Keynesians need to be bridged with an analysis of the roles of structural and technological change.

The associated effects of modern production, capital accumulation, and structural and technological change has been addressed principally by economists on the other side of the Atlantic. Rather than taking Keynes as their foundation, the Struc-

turalist Post Kenyesians[1] are rooted in, and have emphasized the principles of Marxian economics and post-Marxists such as Michal Kalecki and Piero Sraffa. At the same time Post Keynesian Structuralists have followed a "middle path"[2] (Forstater, 2007) incorporating the central American Post Keynesian concepts of money, effective demand, and uncertainty within a production framework. Early members of the Structuralist Post Keynesians include Ingrid Rima, Edward J. Nell, and Jan Kregel. This group has historically dominated the Post Keynesian Structuralist School in the United States. These economists, especially Rima and Nell, have been influenced by the earlier economists of the German Historical School such as Adolf Löwe, (hereafter Adolph Lowe), Hans Nessier, and Lowe's student Alfred Kähler, who were all members of the Kiel Institute for World Economy in Germany and later would emigrate to the United States. (Lowe was still a major presence at the New School for Social Research in New York City when Nell received an appointment there in the 1969.)[3] The research which came out of the Kiel Institute in the 1920s, and early 1930s which

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[1]This dichotomy in the discipline was seen as early as 1980 by Paul Davidson. What has been referred to as "Structuralist Post Keynesian" (Forstater, 2007) Davidson has referred to those Structuralists, i.e. Sraffa, Pasinetti, Harcourt and Eichner as "Neo-Keynesians" and himself, Minsky, Harrod, Shackle, Wells *et al.* as "Keynes". All are grouped under the heading of Post Keynesian by Davidson. (Interestingly he includes Neoclassical synthesis Keynesians such as Solow, Samuelson, Tobin *et al.* in the Post Keynesian group, a designation which he no longer agrees with. (See Davidson "Setting the Record Straight on 'A History of Post Keynesian Economics"' *Journal of Post Keynesian Economics*, Vol. 26, No. 2 (Winter, 2003-2004), pp. 245-272) (Davidson, 1990 [1980]: 282-283).

[2](Forstater, 2007, 435) also refers to 'Post Keynesian Structuralists' as 'Post Keynesian Institutionalists' to capture the pluralistic nature of their work.

[3]See (Forstater, 2004, 309-310)

would be revived and continued over the coming decades in the United States had focused on a return to the classical questions of the relationship between technical progress, capital accumulation and employment. It should also be mentioned that included in the early Kiel Institute group was Wassily W. Leontief, a Russian economist who emigrated to Germany in the 1920s and would later be recruited to Harvard University. Leontief continued the early input-output work begun by Kähler.

The return to the classics and Marx regarding the relationship between technical progress, capital accumulation and employment is seen throughout Nell's writings, and is evident in the writings of Rima and the earlier work of Kregel[4] in the 1970s, and is the foundation of the approach of Luigi Pasinetti.

Mathew Forstater, whose work takes inspiration from this group of theorists, who has drawn heavily from Lowe, Nell, and Pasinetti, also has put emphasis on the structural and technical bottlenecks to full employment coupled with the American Post Keynesian's concerns of insufficient aggregate effective demand. Forstater (2002) echoes Pasinetti's call for a synthesis between the two schools stating that any full employment policy "must consider effective demand and structural and technological change (Forstater, 2002, 195)." In order to achieve a synthesis between Keynes

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[4]It is not evident that Kregel was directly influenced by this particular group of economists out of Germany. Kregel's structural framework as presented in *The Reconstruction of Political Economy* discusses the sub-division of the economy into a two-sector (consumption-investment) economy, which allows for a discussion of the issues of the Structural Post Keynesians. It appears that Kregel's work may have been influenced more heavily by Piero Sraffa and Luigi Pasinetti rather than the economists coming from the Kiel School. However Kregel is a contemporary of Nell, and Nell is referenced among other Structuralists in Kregel's early work on Post Keynesian economics.

and the Structuralists there must be an understanding of the interconnectedness of effective demand and structural dynamics of production. Structural representations of production processes allows for an investigation of this sort. Specifically addressing the dynamics of employment through analyzing how the structure of production responds to changes in input requirements; such as changes to technology, labor, the availability of natural resources, and the associated changes in the level and composition of final demand.

1.1   Contribution to the Literature

The contribution to the literature of this current work is to propose a methodological framework in which the benefits of the Employer of Last Resort (ELR) approach to full employment and environmental sustainability can be shown. To this end, it will address how Keynesian aggregate demand policies alone are insufficient for maintaining production at the full employment level given the dynamics of modern capitalistic production. Furthermore, it will address how the ELR approach may be constructed in such a manner as to maintain a level of production at full employment, but which is also environmentally sustainable. The methodology constructed will serve to strengthen the arguments for the implementation of such a program and serve as a framework to further the research program. Given the high social and economic cost of unemployment, and the continuing ecological concerns which face society, it is hopeful that the framework provided may serve as a stepping stone towards a policy relevant research program which broadens the scope of economics and economic problems, integrating economic theory into a sociological and ecological context. To the achievement of these ends the following work is divided into five

chapters.

1.2 Overview the Study

Chapter Two addresses the economic, social, and psychological costs of unemployment. The premise of full employment and economic flexibility illustrated by traditional neoclassical models is discussed followed by the traditional Keynesian analysis. The two approaches, which dominate the economic discipline, are critiqued and an analysis of each approaches' respective shortfalls is provided. The Keynesian analysis, as outlined above, investigates unemployment caused by an insufficient level of aggregate demand and provides a solution towards the attainment of full employment. The chapter also provides a review of the Structuralist notion of technological unemployment. Following a review of the leading literature from the respective schools, it is argued that a synthesis of the two approaches is needed. It will be argued that achieving full employment, let alone maintaining production at the full employment level can not be accomplished without active government involvement.

The revival of the job guarantee approach to full employment has been seen over the previous decade. The primary goal of the work is to formalize how the implementation of this type of program (known as the Employer of Last Resort (ELR) model) may be used to alleviate the negative employment effects caused by insufficient effective demand and structural and technical change. What's more, the chapter dispels the myth that unemployment allows for flexibility. It is shown how the ELR approach to full employment allows true structural flexibility. Last, the ELR approach to full employment verses traditional solutions to unemployment are addressed in this chapter. Why the ELR approach to combating unemployment? This section attempts

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to answer that question.

Following chapter two, chapter three investigates and critiques the leading Post Keynesian Structuralist approach to production theory. The structural approach to production may be categorized into two frameworks, the horizontalist approach and the vertically integrated approach. The horizontal modeling approach to production has had a long history going back to at least Quesnay and the Physiocrats. Horizontal models have been put into practice by Marx, Leontief, Piero Sraffa and Lowe. This approach to modeling the production framework is able to capture the inter-industry relationship of production through the development of input-output analysis. The input-output technique has the ability to combine "economic facts with theory (Leontief, 1966, 13)." The technique details the social relationships of production among industries and sectors within a modern mass production economy. This is contrasted to the vertically integrated approach of the neo-Austrians and of Post Keynesians such as Pasinetti. Vertically integrated models, according to Pasinetti, has the ability to capture the structural dynamics of production. In Pasinetti's model the sectors are linked by final demand and adjustments to the level of sectoral final demand are caused by structural change including technical change (Pasinetti 2007; 1993; 1981). Given the assumptions of the model, Pasinetti's framework can be a robust modeling technique which has the ability to capture the dynamics of production. The shortcomings of Pasinetti's model are that these linkages fails to consider the social relationships of production and thus fails to capture the realism of a mass production economy which the inter-industry approach is capable of demonstrating. Other shortcomings of Pasinetti's approach will be addressed below.

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Like Pasinetti's model, the horizontalist, interindustry approach to production modeling has drawbacks as well. The chapter investigates and critiques the horizontalist models, and its variants found in the literature. In doing so, I am able to present an appropriate framework which allows for the formalization of the ELR program. The formal model is used to illustrate how the implementation of such a program in a monetary production economy allows for flexible full employment in a dynamic economy. The ELR framework can be modeled via the use of any of the structural approaches found in the literature. There are advantages and disadvantages to each approach. The choice of the model depends upon the characteristics one is analyzing. If one is interested in simply describing how the ELR approach responds to structural changes, and accepted the assumptions of Pasinetti's pure labor model, then Pasinetti's approach could satisfactorily meet this purpose. However Pasinetti's assumptions have been contested and are addressed below. Furthermore, if one is to examine how a government ELR sector fits seamlessly into the existing economy, then a horizontalist framework becomes appropriate. Chapter three sets forth an analysis of the main theories of production in the heterodox literature, and prescribes a suitable approach for the dynamic modeling of the ELR program.

In the present approach, particular emphasis is placed on the role of the modern business enterprise and its particular relationships to the production process as a whole. This is coupled with the role of households whose interaction lies as the supplier of labor power and a demander for final goods and services. The government makes up the final piece of the puzzle as it serves too as a demander for final goods and services and serves as a producer of services, and provides the financing to

the private sector for the production of "public goods" like roads, schools, hospitals, etc. Additionally, it is proposed that the government is in the unique position to maintain production at the full employment level through serving as a producer of public goods and services through acting as an employer/producer of last resort. The methodology for this will be instrumental inference. Instrumental inference begins with the macroeconomic goals, here the goals of full employment and environmental sustainable development, as given. Following this, it will be demonstrated that a government job guarantee approach for the maintenance of full employment and sustainable development is advantageous given a dynamic system of production with perpetual structural adjustments and technological transformations.

Chapter four builds on chapter three, and simulates the implementation of the ELR approach to full employment. Utilizing the instrumental approach built in this current chapter, I simulate how the structural model developed in the previous chapter responds to structural and technical change, and to changes in the composition and level of aggregate demand. The simulations presented further demonstrate the "interlocking emergence of new products and new processes, creating new markets, and new industries", or what has become known as "transformational growth" (Nell, 1992, 106). Nell's theory of transformational growth allows for illustrating the causes and effects of structural change. These changes are due to the nature of the productive economy. The productive economy is dominated by oligopolistic competitive markets. The goal of which is to, at a minimum, maintain market position. Competitive pressures breed innovation. Innovation leads to the expansion of existing markets and to the creation of new markets, which in turn give rise to further com-

petitive pressures, leading to a bigger push to innovate, furthering the expansion and the creation of markets, and so on. Structural and technological change is central to the theory of transformational growth as it rejects the notion of steady-state growth, instead viewing growth as disproportional, qualitative, and disruptive (Nell, 1988).

It is thus seen that the focus on the dynamics of the structural relationships of the production process is necessary to generate a complete picture of the factors behind structural and technological change (i.e. the decisions to engage in innovations and investment by the oligopolistic competitive corporations.) Above all, the simulations will demonstrate the macroeconomic consequences of the decisions made on the microeconomic level.

In the chapter, two structural models will be simulated, a model with the ELR program and without the ELR program. This allows for insights to be made as to the effectiveness of the ELR program in a modern monetary production economy. Thus, it allows for a conclusion of what may be discerned from the approach taken up here as compared to the ELR current literature (Wray 2000a, Wray 2000b, Tchnereva 2003). Furthermore, the chapter investigates how the modeling of the ELR program may also be joined with the existing literature and is hopefully able to push the literature forward.

Chapter five is an extension of the previous chapter. Here it is discussed how this research can be furthered in many different areas. Specifically, the chapter examines the maintenance of a full employment level of production given environmental constraints.

1.3 Instrumentalism

Political economics, like traditional economics, is a theoretical science. As such it tries to derive a past state of the system or a future state from the knowledge of the given state and from some "law of motion" (Lowe, 1987, 157).

Instrumentalism stems from the work of Lowe (1965), and his reformulation of political economics. For Lowe, the crucial distinction between traditional and political economics is that traditional (classical and neoclassical) theory rests upon rules, behaviors, and motivations that are exhibited in early phases of capitalism. These assertions are now losing realistic significance in today's economy where production is on a large scale. The modern production economy is composed of corporate enterprisers which brings together a complex matrix of inputs from numerous suppliers. These corporations have a high degree of technological and administrative organization, technical interdependence and can exhibit varying degrees of market power. The traditional approach to economics is neither a relevant nor a realistic approach to the theory of production or to the material provisioning process. Lowe's instrumental approach to economics is a more suitable methodology which coordinates the micro behaviors of corporations and the macroeconomic goals of policy makers.

Underlying Lowe's instrumental approach to economics, which mirrors the overall theoretical approaches of the contributors to the Institutionalist school such as Thorstein Veblen and Karl Polanyi, is the fundamental importance of the inclusion of institutions, both formal and informal, and institutional adjustment as the central core of the analysis. Like Veblen, (1909) who refers to "settled habits of thought" and Karl Polanyi (2001), who make reference to "institutional mechanisms", Lowe (1965,

1976) refers to the importance of society's "behaviors and motivations." Lowe's economic framework, like that of the Institutionalists, calls for the reintegration of social institutions. Human societies and societal institutions are not static and should not be treated as such. The analysis must be dynamic to include institutional change (including structural and technical change) within the broader approach of political economy. Veblen describes these dynamics as normal features of the economic system. The motivations behind corporations engaging in technical innovations and investment are towards the generation of profits, a central fact in the Keynesian, Institutional, Marxian, and Structuralist literature. This is a central concept in the current study, as one of the primary reasons why neither full employment nor environmental sustainability is achieved through the self-regulation of markets is because such goals do not serve the independent businessman. As Veblen stated:

> The production of goods and services is carried on for gain, and the output of goods is controlled by businessmen with a view of gain. ... The vital point of production with him is the vendibility of the output, its convertibility into money values (Veblen, 1904, 50-51)

Given the dynamics of the current state, the successful achievement of the macro-goals of full employment and of environmental sustainability are of doubtful propriety if left up to the market alone. The objective for the present work here (and of the new political economics which Lowe refers to as 'instrumentalism') is to determine organizational rules in the modern society which are appropriate for the fulfillment of the pre-specified macro goals. Instrumentalism assumes that actual forces that guide economic movements are not known a priori; rather they are in themselves categories of unknowns.

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It's the fundamental theorem of realistic theory that under the particular social conditions of the industrial system, data and process are involved in a regular and continuous interaction which makes any concrete constellation, and therefore the system as a whole, essentially unstable and liable to transformation. For this reason in any long period analysis concerning the industrial system, on the principle the data are to be handled as dependent variables (Lowe, 1935, 146-147).[5]

For Lowe, the major undertaking of instrumental analysis is to devise an analytical framework in which these unknowns can then be determined. This is precisely the opposite approach of the traditional neoclassical view. Under the neoclassical view, it is the macro goal which is treated as an unknown, and that the path that the economy is moving along is treated as a known. Lowe's instrumental analysis inverts the problem. It is the macro-goals of full employment, full resource utilization, and environmental sustainable economic growth that are clearly defined and these are (semi) independent of any existing rules or behaviors. Lowe's instrumental approach is used for prescription rather than prediction. It describes the direction of which the economy *should* move towards and the specific governmental regulations which are additionally required for the achievement of pre-specified macroeconomic goals. The approach pre-specifies the "knowns" and then sets out to discover the required macroeconomic data, what Lowe calls the category of "unknowns". The methodology of instrumentalism is discussed in the following section.

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[5]This position taken by Lowe is similar to the position taken by Hyman Minsky's analysis of capitalism, specifically his financial instability hypothesis theory.

Instrumentalism: The Knowns

The specific questions concerned are namely how production is to be maintained at a full employment level of output and how is this level of production to be maintained given environmental considerations? An economic system which exhibits these two features is considered the final state (or terminal state) as defined within Lowe's instrumental approach. The final state of the economic system is predetermined and falls within the category of "knowns". Central to this is that the prescribed macroeconomic goals of society are outlined *irrespective of the current economic, political, or social makeup of the system.* Now, having clearly defined the macroeconomic goals which society desires to achieve, the task turns to an examination of where society is currently situated, the initial state of the economic system. The initial state of the economic system cannot be simply defined through an examination of economic and social relationships of the present day; rather a comparison has to be made between the end state and the initial state as both states need to exhibit the same properties so that the same variables can be compared against each other. To do this, there must be a realization of the specific features of a goal adequate final state, and then, through direct observation, one can select the relevant units of analysis of the current economic and social structure in order to devise an initial state of the economic system. Thus, it is easy to surmise that one may define many initial states and each initial state is relative to the precise definition of the macro goal or set of macro goals of the final state of the economy.

As it concerns the analysis here, the final state of the economic system is defined as a level of production in the aggregate economy which is consistent with the

maintenance of a fully employed and environmentally sustainable economy. Within this context, the initial state can be defined as: *all the available resources, the degree as to which they are being utilized, and the technical and social relationships that govern such utilization.* As Lowe (1965) has addressed, during the traverse from one steady state level of growth to a new level, the technical and social relations also act as constraints on the system towards the fulfillment of the macro-goals. The micro-decisions of businessmen in independent firms base their decisions of levels of employment upon what is physically required for any given level of output. A decision to increase output, and thus employment is based upon the expected profitability of such an increase. Thus firms are only willing to hire employees up to the point that is physically needed for the production of output and the generation of profit. It seems unreasonable to assume that the aggregate level of output, chosen based upon pecuniary gain, would coincide with full employment. Thus it is sensible to assume that in no way would there be conformity between the micro-goal and the macro-goal.

It is necessary to separate the two interrelated macroeconomic goals of full employment and environmental sustainability and approach them one at a time. The macroeconomic goal of full employment is easy to define; anyone who is willing and able to work will be able to find employment at the current wage. Thus we can represent the final, and the initial state of the economic system as the structural model of production, rather than defining the behaviors of economic agents. A structural model is used to define the rules which govern those behaviors. It outlines the methods of production (the mix of , labor, and natural resources) for each industry, and it outlines the social relationship of the production process. By "social relationships

of production" I mean the relationships among capitalist producers. Capitalists must purchase capital goods and intermediate inputs from other producers. Therefore there are continuous arrangements made among capitalists as to the quantity, quality, and price of inputs. Further, there are relationships between capitalists and workers as regards to the offered wage, the length of the work day and work week, working conditions, leisure time between shifts, and many other arrangements between capitalists and workers. These arrangements may be in the form of explicit contracts or implicit contracts. Output per industry is governed by final demand for the output, and governed by anticipated demand for that output as an intermediate input into production for other industries. Each other industry is conducting the same formulations in the determination of output (Nell, 1992, 119-120). The economy represented by its structure of production can then be analyzed and applied toward the realization of the macro-goals.

Lowe's separation of macroeconomic goals and microeconomic objectives, and the (conflicting nature between the two) developed in the early to mid 1930s is seen earlier in the works of Marx and Veblen, and was famously developed around this same time in Keynes' *General Theory*. The attainment of full employment would surely be an accident. Given technological innovation, businessmen would strive to lower their cost and increase their productivity through the substitution of machinery for labor. Thus given the structural dynamics of the economic system, the maintenance of full employment cannot be achieved by the private sector alone.

For Marx the micro goal of the capitalist class is profit generation, achieved through accumulation of capital. Capital is the means which generates surplus value.

The surplus value is then appropriated by the capitalist class between revenue and additional capital. Additional capital, especially labor-saving capital accumulation, achieves even greater amounts of surplus value while generating the 'reserve army of labor'. The reserve army of labor is further necessary in Marx as it serves to keep wages at subsistence while serving as a disciplinary device for workers. Capital accumulation increases the mass of the 'laboring poor'. Increases in mechanical specialization in production further limits the wage-laborer as simply a disposable unit to the production process. The worker is enslaved to the machine he/she uses. Capital accumulation is 'Moses and the Prophets' because it benefits the capitalists two fold: 1) it increases capitalist's revenue, and 2) reproduces and extends an exploitative system which is controlled by the capitalist class for the benefit of the capitalist class in terms of their own incomes and power relative to that of the working class. It is because workers do not own the means of production that they are forced to sell their labor power for wages. The capitalists, the owners of the means of production, do not produce wealth, the workers do. However the capitalists control the wealth, and take wealth from the working class to ever greater extents. Capitalism, for Marx, is incapable of providing full employment. Given that the system is controlled by capitalists, a macro-goal of full employment clearly conflicts with the micro-goals of the capitalist class.

The argument is also addressed in Veblen and Keynes:

> The production of goods and services is carried on for gain, and the output of goods is controlled by business men with a view to gain. ...by the sale of output the business man in industry 'realizes' his gain. To 'realize' means to convert salable good into money values. The sale is the last step in the process and the end of the business

man's endeavor. when he has disposed of the output, and so has converted his holdings of consumable articles into money value, his gains are as nearly secure and definitive as the circumstances of modern life admit. ... *The vital point of production with him is the vendibility of output, its convertibility into money values, not it's serviceability for the needs of mankind* (my emphasis) (Veblen, 1904, 50-51).

An entrepreneur is interested, not in the amount of product, but in the sums of *money* which will fall to his share ... The firm is dealing throughout in terms of money. It has no object in the world except to end up with more money than it started with. That is the essential characteristic of an entrepreneur economy (Keynes, 1988, 82).

Having defined the "knowns", the task then turns to the discovery of the particular set of causes that are applicable for the realization of the macroeconomic goals (Lowe, 1965, 264).

Instrumentalism: The Unknowns

The purpose of instrumental inference is to determine organizational rules which are appropriate for the fulfillment of pre-specified macro goals. It is a "discovery procedure", and is the heart of Lowe's political economics. Political economics for Lowe assumes that the actual forces that guide economic movements are not known a priori; rather they are in themselves categories of unknowns. Having now identified the initial state as an interdependent system of production and the movements which are guided by businessmen for the expectation of profit, and given the predefined macroeconomic goals, the task then becomes that of discovering suitable technical paths by which these goals can be achieved, and the behavioral and motivational patterns capable of setting the system in motion along such paths.

The structural model allows for an investigation of the adaptability of the

production system to structural changes such as an increase in the labor force or a change to the availability of some natural resources, and the adaptability of technological changes, or to changes in final demand (Forstater 2003b: 60). Lowe (1952, 1965, 1976) identifies that the production system is characterized by structural and technological unemployment, and structural rigidities and bottlenecks. Through a three-sector hierarchical horizontalist framework, Lowe was able to identify the bottlenecks which prevent the transformation to a full employment level of production. Lowe's concern was with the elasticity of the productive process to technological innovation and structural change towards his macro-goal of full resource utilization. There is always going to be a trade-off between system flexibility and full employment (Forstater 2002; 2003b; Lowe 1952; 1976) Furthermore, Lowe (1965; 1976; 1987b) points out that 'spontaneous conformity' of independent businessmen in the direction of full resource utilization was a fantasy. Given the inadequateness of laissez-faire policies, a requirement for the achievement of the goals must be government regulation (what Lowe termed 'public control'). The purpose for government regulation is to align the otherwise conflicting micro-behaviors of businessmen and the macro-objectives of policy makers.

Method

Lowe's instrumental approach has now been defined. I now turn to investigating: 1) the nature of unemployment, 2) the ELR approach to full employment, 3) the motivations of independent corporations and the macroeconomic consequences of these, 4) and the appropriate modeling of the economy traversing from an initial state below full employment to the final state of an ecologically-sustainable production at

the full employment level.

The development of a structural model of the ELR framework into a monetary production economy is done to rectify the drawbacks with current approaches to full employment policy by considering simultaneously effective demand and structural and technological change. The simulations performed on the structural model are used to demonstrate how the addition of the ELR sector allows for full employment and flexibility by simply shifting workers from any one or more of the sectors to the ELR sector, thus alleviating technological unemployment, while maintaining the level of aggregate final demand at the full employment level. In addition, given the real time needed for structural adjustments, and the specificity of real capital goods, the ELR sector absorbs these workers, thus addressing the structural unemployment problem. This is enabled by the fact that, unlike the other private sectors of the market system, the ELR sector is not motivated by pecuniary gain; rather the ELR sector's sole purpose is the maintenance of full employment, and the enhancement of the welfare of society. As a producer of services and an employer of labor the government ELR sector would require some level of real capital (buildings, machinery, etc). However, the difference with a government ELR sector is that the level of employment which they can hire is not dependent upon profit expectations. In the non-ELR sectors, it simply would not make sense to hire labor beyond what is necessary to meet the needs of other industries, (one industry's output, may be delivered as an intermediate input to other industries employed into production) and of the final demand. The governmental-ELR sector does not function in this manner. The ELR sector must be welfare enhancing. The ELR sector would employ all workers desiring employment

regardless if it is "profitable" to do so. This way the effective demand problem by maintaining a fully employed workforce is also solved, which in turn stabilizes investment decisions, decreases the volatility of the business cycle, allows for system flexibility and maintains full employment. It can also be shown how the ELR sector may be utilized in achieving environmental sustainability.

1.4 Full Employment and Environmental Sustainability

Ecology, as a separate scientific discipline, can be thought of as "the historical study of relations between social formations and the environment (Leff, 1995, 17). Robert Heilbroner has famously classified the economic system of production and distribution into three distinct types, tradition, command, and market.[6] In traditional societies labor was/is relatively inefficient. The ecological impact from production was minimal. The process of production was done utilizing mostly animate sources of energy (people and animals). However as society mostly transitioned from a traditional system, then to command, and finally to a capitalistic mode of production, so did society transition from relying on mainly animate natural resources to inanimate natural resources.

One of the essential features of the capitalist mode of production is it's use of machines. The mechanization of production requires a great reliance on inanimate sources of energy. Today, in the United States, the majority of energy consumed in the United States comes from fossil fuels. Renewable resources account for a mere

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[6]See Heilbroner, R.L. and W. Milberg (2008) *The Making of Economic Society, Twelfth Ed.*, New York, NY: Pearson/Prentice Hall.

7 percent of the total energy consumed while fossil fuels provide more than 85 percent of the total energy consumed in the United States. Fossil fuels contributes to almost two-thirds of the total electricity consumed and nearly all transportation fuels.[7] Much of this production is through the increased use of fossil fuels, namely oil and coal. Oil and coal are used as they are able to produce incredible amounts of energy. At the same time, coal and oil, and other such fossil fuels must be treated as exhaustible capital. Coal is the most abundant of the fossil fuels worldwide. At current rates of consumption, the U.S. Department of Energy currently estimates a 138 year supply.[8] On the other hand, there is an estimated 42 year supply of world oil reserves at current production rates.[9].

Two main areas of environmental disruption normally discussed are the problems of exhaustable resources and the problem of pollution. Resources are themselves produced means of production. However, this being so, they still exhaustable. However, even exhaustable resources need to be sub-classified into renewable exhaustable (like plant and wildlife which are renewable, but may go extinct) and non-renewable exhaustable. It is true that as a society, we have only "used up" resources which were renewable. Some of this wildlife became extinct as a side-effect to harvesting

[7]Source: U.S. Department of Energy, Official Energy Statistics; (Accessed: December 2, 2009) $http : //tonto.eia.doe.gov/energyexplained/index.cfm?page = us - energy - home$

[8]Energy Information Administration: Official Energy Statistics from the U.S. Government (accessed Dec. 2. 2009); $http : //tonto.eia.doe.gov/energyexplained/index.cfm?page = coal - reserves$

[9]Rachel Graham and Alexander Kwiatkowski (2009) "World Oil Reserves Fell for First Time in 10 Years, BP Says " $Bloomberg.com$

other natural resources. The diminution of bio-diversity is an important sub-field in ecological economics, especially when the focus is on "renewable exhaustable".

However, with the focus on production, the utilization of natural resources is heavily skewed towards that of fossil fuels, which are not "renewable-exhaustable", but rather "non-renewable exhaustable". The use and dependability of fossil fuels in modern day production is not only of concern due to their limited supply, but also because of the by-products which get emitted. Fossil fuels provide tremendous amounts of energy, but at the same time emit dangerous amounts of carbon dioxide into the atmosphere. Pollution emissions in the production process is the second main area of environmental disruption that ecologists are concerned about.

Given the ecological concerns over fossil fuels in production, the question is raised: "How may the ELR program serve in maintain production at full employment *and* environmental sustainability?" As employment increases, and production increases, so must the utilization of non-renewable natural resources into production. The rate of utilization increases even further with an increase in the labor force. So what can be done? It will be shown how such as program can lead to both full employment and environmentally sustainability through the creation of a green jobs corp. Such a concept is not new, and it stems from the job programs of the New Deal. The dual-problem of fossil fuels, their use as limited resources, and their contribution to harmful emissions within the process of production will be elaborated further in chapter 5. Lastly, chapter 5 will conclude with the ELR approach to environmental sustainability.

1.5   Scope of the Study

The primary purpose at present is to show through simulations how an ELR sector achieves higher income and output at all stages of the business cycle. Modeling the ELR framework is also advantageous since the ELR-model economy has the same structural form as the non-ELR economy; (regardless whether one chooses a vertically integrated or horizontalist approach) thus the comparative benefits and also the direct costs of an ELR can be demonstrated. New insights can be reached regarding the benefit of such programs and can be used for policy development. It will be shown how the economy can sustain full employment, given labor dispelling technological change, through an increase in effective demand by the inclusion of the ELR sector.

The present study focuses on advanced capitalist, market based economies, where unemployment is persistent and pervasive. Environmental degradation is (or at least should be) a leading concern for policy makers. Implementing an 'instrumental approach', the analysis begins with the macro goals of full employment and environmental sustainability as given. The task, then, is to derive the behavioral and motivational patterns of entrepreneurs to move towards a path which these pre-defined end goals may be achieved. It is important to lay out the role of the government, in order for the assurance of the macro-goals. To this end, it will first be illustrated that unemployment, while inherent, is neither a necessity nor serves any function within a modern capitalist, mass production economy. Furthermore, it will be addressed that the causes for unemployment are due both to inadequate effective demand, and structural and technological change. It becomes important to discuss the innovation and investment decisions of oligopolistic firms, the types of technological innovations that

take place, whether they are labor or capital dispelling, and the consequences of such investments in new technologies on the level of employment. Investment may lead to job-led growth or jobless growth. It will be seen that both labor-displacing innovations and labor-attracting innovations may occur simultaneously given the dynamics of the system. However, because of these very dynamics, full compensation of the displaced labor is never possible. The government must step in at this stage to counteract any labor displaced due to technological innovations. Technological unemployment must be taken seriously and combated. Even if innovations are labor-attracting, through the creation of new sectors, it is still necessary to take into consideration historical time. The difference in the real time between decisions to engage in investment and the implementation of the investment decisions must be accounted for.

CHAPTER 2

THE PROBLEM OF UNEMPLOYMENT

2.1 Introduction

Full employment refers to the full employment of labor. The under-utilization of capital is not nearly as important as the unemployment of labor. In fact full utilization of capital (no reserve capacity) is not desirable. A normal level of reserve capital, that is above what is required for current production, allows for temporary changes in the degree of utilization without requiring real time to build up capital equipment. This differs from excess capital equipment which is the result of an economic downturn. A normal level of reserve capital gives the system some flexibility and enables production to vary to satisfy additional demand. Given the importance of some reserve capacity, when discussing unemployment in this thesis, it is of reference to the unemployment of labor alone and is defined as *any and all laborers whom are without paid employment and would accept a paid position if one were to become available.* Also included in the definition is the full-time employment for those who are employed part-time but would prefer full-time work. As earlier noted unemployment is a consequence of insufficient aggregate demand and structural and technological change. Full employment is meant to mean that there is no unemployment due to skill mismatch of workers nor due to cyclical fluctuations of output. Full employment, as defined, does allow for a moderate level of frictional unemployment. A fully employed economy includes the whole of the labor force that are willing and able to work in a capitalist market economy. It does not leave out involuntary part-timers nor discour-

aged workers. As of April 2009 there were 2.4 million workers marginally attached to the labor force. Of these 1.2 million are discouraged workers.[1] By definition, true full employment does not leave out productive members of society who consider themselves unemployed, and would accept employment if it became available. As defined by Keynes:

> Men are involuntarily unemployed if, in the event of a small rise in the price of wage-goods relatively to the money-wage, both the aggregate supply of labour willing to work for the current money-wage and the aggregate demand for it at that wage would be greater than the existing volume of employment (Keynes, 1936, 15)

True full employment corresponds to the absence of involuntary unemployment. This was the message of Keynes and continues to be that of Post Keynesian economists.

This chapter is organized in the following manner. First, the competing theories as to the nature and problem of unemployment is discussed. It will begin with the economics of Keynes followed by the past and current theories of the mainstream neoclassical approach and Post Keynesian alternatives. Two Post Keynesian alternatives to neoclassical theory takes, in general, two different directions. The first direction is the macroeconomic approach of the American Post Keynesians. The second is the direction of the Structural Post Keynesians, which puts emphasis on the surplus approach and highlights the microfoundations of macroeconomics. The chapter will argue that both Post Keynesian approaches make significant contributions, and that the two theories need to be bridged to gain a more complete understanding of the economic causes of unemployment. The chapter will conclude with an analysis of the

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[1] *BLS News Release USDL-10-0589*, Bureau of Labor Statistics, May 7th 2010.

social costs of unemployment and the proposed ELR approach to full employment.

2.2   Keynes and the American Branch of Post Keynesian Theory

> We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come–namely, technological unemployment. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour. But this is only a temporary phase of maladjustment. All this means in the long run that mankind is solving its economic problem (Keynes, 1963, 364).

Keynes was well aware of technical and structural change. However, Keynes makes very little reference to technical change in his writings. Keynes see's technological unemployment as having an effect in the short-run. But Keynes considers this as "a temporary phase of maladjustment" and in the long-run technical progress is desirable. Keynes chose to hold the state of technology constant in the GT, so that he could focus on unemployment due to the insufficiency of effective demand, which Keynes assumed was the primary determinant of unemployment. At the time of writing the GT, most of the capitalist world was in the midst of the Great Depression. Given these economic conditions, it is easy to surmise why the focus of Keynes was on effective demand rather than effective demand coupled with technological change. For Keynes to demonstrate that the level of effective aggregate demand need not be associated with full employment was by itself a theoretical breakthrough and stood in stark contrast to the established economic theory at that time. Keynes' primary goal in his critique of the existing approach was to reconstruct the discipline into a framework that he felt was more applicable to reality. Keynes' colleagues at the University

of Cambridge such as Joan Robinson, and Richard Kahn, as well as their students furthered Keynes' original mission with the development of Post Keynesian economics. There have been breakthroughs in Post Keynesian economics in the fields of Microeconomics, Monetary Economics, and now Ecological Economics. However, when it comes to Keynes' original message, American Post Keynesians have fallen into the trap set by the *GT*. There is much emphasis in the literature on the effective demand problem without addressing structural and technological change. This is however an extreme generalization and does not apply to all Post Keynesians (Forstater, 2002, 195).

The Economics of J.M. Keynes

The publication of J.M. Keynes', *The General Theory* was clearly a "major shift" from the established neoclassical version of economics. Keynes contention is that the 'classical' [2] theory is not an adequate framework for the actual determination of output and employment.

> I shall argue that the postulates of the classical theory are applicable to a special case only and not to the general case, the situation which it assumes being limiting point of possible equilibrium. Moreover, *the characteristics of the special case assumed by the classical*

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[2]The "classical" theory is the term that Marx utilizes to cover Ricardo, Mill, and their predecessors. However many economists today would also include Marx as a "classical" theorist. Keynes' use of the term "classical" covers the aforementioned theorists, but also includes Alfred Marshall and A.C. Pigou, the latter a contemporary of Keynes. In fact most of *The General Theory* is really a critique of the *neoclassical* framework of Marshall and Pigou. Therefore when Keynes refers to the *classical* approach, he is really referring to the *neoclassical* approach.

theory happen not to be those of economic society in which we actually live, with the result that its teaching is misleading and disastrous if we attempt to apply it to the facts of experience (emphasis in original) (Keynes, 1936, 3).

Instrumental analysis is seen as the approach Keynes had taken in the *GT*. Recall instrumental analysis has three steps, 1) a pre-defined set of desired macro-goals, 2) definition of the initial present state of the economic system, and 3) policy prescriptions to move the economy from the present state to the desired state. Instrumental analysis is seen throughout the *GT*. The first stage of instrumental analysis in Keynes *GT* is the pre-defined macroeconomic goal of full employment. The initial state, as Keynes made explicit, is one of unemployment which Keynes classified as the general state of capitalistic economies. Following this, the *GT* provides a policy prescription for the economy to move toward the full employment level of production, the third stage of instrumental analysis. Keynes concludes that absent government intervention, the unlikelihood of full employment is due to the incompatibility of the motivations of the capitalists as it regards their investment decisions with this macro-goal.

In the "Concluding Notes" of the *GT*, Keynes calls for the *socialization of investment*. The government's role is not towards the ownership of the means of production, but rather have the government work in coordination with the private sector "without a break in the general traditions of society (Keynes, 1936, 378)." As Keynes has stated:

The State will have to exercise a guiding influence on the propensity to consume partly through its scheme of taxation, partly by fixing the rate of interest, and partly, perhaps, in other ways. Furthermore, it seems unlikely that the influence of banking policy on the rate of

interest will be sufficient by itself to determine an optimum rate of investment. I conceive, therefore, that a somewhat comprehensive socialisation of investment will prove the only means of securing an approximation to full employment; though this need not exclude all manner of compromises and of devices by which public authority will co-operate with private initiative. But beyond this no obvious case is made out for a system of State Socialism which would embrace most of the economic life of the community. It is not the ownership of the instruments of production which it is important for the State to assume. If the State is able to determine the aggregate amount of resources devoted to augmenting the instruments and the basic rate of reward to those who own them, it will have accomplished all that is necessary. Moreover, the necessary measures of socialisation can be introduced gradually and without a break in the general traditions of society (Keynes, 1936, 378).

Keynes' work is considered among most economists revolutionary in this regard as it differs from the work of previous theorists and of Keynes' contemporaries. Keynes was forced to build the foundation for the existence of an unemployment macroeconomic equilibrium. Even given Keynes' limiting assumptions he dispelled much of the existing neoclassical framework, especially the neoclassical theory of Say's Law, the neoclassical theory of the labor market, interest rates, and the neoclassical savings and investment relationship.

Introduction to the Misinterpretation of Keynes' Theory

Keynes' theory of unemployment has been, and is currently misinterpreted by neoclassical economists to be caused by sticky prices and wages (Yellen, J. 1884; Gordan, R. 1990; Mankiw, N. 1990; Kregel, J.A. 1998, Rotheim, R. 1998). Adherents to sticky wage-price interpretation of Keynes have proposed that freeing restrictions

on money wages and prices allows for the self-adjustment of the market, and thereby conforms with neoclassical theory prior to Keynes' *GT*. According to the neoclassical interpretation of Keynes' economics, Keynes comes down to contributing no more than a theory of partial disequilibria. However, this is a misinterpretation of Keynes' writings. Keynes did assume a rigid money wage in much of the *GT*. This assumption was merely a simplifying assumption from the very beginning, and is clearly stated by Keynes that the "essential character of the argument is precisely the same whether or not money wages ... are liable to change (Keynes, 1936, 27)." After relaxing the assumption of fixed money wages Keynes concludes that a reduction in money wages:

> ... involve some redistribution of real income (a) from wage-earners to other factors entering into marginal prime cost whose enumeration has not been reduced, and (b) from entrepreneurs to rentiers to whom a certain income fixed in terms of money has been guaranteed. ... What the net result will be ... is more likely to be adverse than favourable (Keynes, 1936, 263).

According to Keynes, the reduction in money wage leads to an expectation for a further reduction in money wages sometime in the future. This will only lead to a decrease in output and employment. Thus, even if labor were to continually respond to diminishing levels of employment by offering it's services at lower and lower money wages this would not, as in the neoclassical model, lead to a decrease in the real wage because of the adverse effect that this has on output. Keynes warns of the destructive nature of such a laissez-faire policy for the promotion of wage and price flexibilities.

> The chief result of this policy would be to cause a great instability of prices, so violent perhaps as to make business calculations futile in an economic society functioning after the manner of that in which we live. To suppose that a flexible wage policy is a right and proper adjunct of a system which on the whole is one of *laissez-faire*, is the

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opposite of the truth (Keynes, 1936, 269).

2.3 The Principle of Effective Demand in Keynes' *General Theory*

Keynes set out to demonstrate that the behaviors and motivations of consumers and corporations alike fails to achieve a level of production consistent with full employment. Keynes' principle of effective demand was the central argument to arrive at this conclusion. For Keynes, the principle of effective demand is regarded as a macroeconomic principle, and is used by Keynes to replace the earlier neoclassical version of Say's Law. The principle of effective demand in Keynes' GT begins with the assertion that the whole of output is not necessarily purchased. For Keynes, national output and national income is determined by the sum of aggregate consumption and aggregate investment. The level of effective demand may not (and often will not) be associated with a full employment level of output based upon Keynes' definitions of the aggregate consumption function and the aggregate investment function. Keynes defines aggregate consumption to be partly autonomous, and partly a functional relationship of the marginal propensity to consume (MPC). Through introducing the MPC, Keynes demonstrated that as income goes up consumption does increase, but the increase in consumption will only be proportionate to the increase in income and will be less than unity. This proportion leaves open a gap between aggregate consumption and aggregate output, investment spending may be used to fill this gap.

The second component of effective demand is aggregate investment. Here too, the level of investment undertaken may not be sufficient to fill the void between aggregate consumption and aggregate output. The reasoning is based upon the determination of aggregate investment. In Keynes investment is a function of the marginal

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efficiency of capital (MEC), which is defined as the return on investment, and is governed by the rate of interest and the state of short and long term expectations. The first component of this relationship, the MEC, is determined by capitalists' willingness to engage in investment spending. Keynes' argument is that investment spending will occur when the supply price of such investment is less then the present value of the investment's expected future earnings. The larger this difference is the greater the expected rate of return. As investment increases the supply price of capital goods also increases thus decreasing the rate of return.[3,4]

Keynes states that investment will increase to the level where the rate of return on such investment is equal to the rate of interest on money. This belief brings Keynes to the conclusion that:

> As the stock of the assets, which begin by having a marginal efficiency at least equal to the rate of interest is increased, their marginal efficiency ... tends to fall. Thus a point will come which it no longer

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[3]There is a confusion in Keynes' GT between ex ante and ex post. The MEC is an ex ante concept, and the rising supply price of capital goods must be ex post.

[4]Keynes has assumed in the GT that in the short period, and having capital equipment given, the expectation of return on such capital goods is given independently of the level of investment. This is because the amount of investment which can be carried out cannot significantly change the total amount of capital goods supplied. Thus there is a rising supply price of capital goods. The rising supply price is then used by Keynes to derive the downward sloping demand curve for investment goods. However, it is unlikely that individual businessmen would expect a rising supply price when their own investment decisions are being made. The supply price would only increase if suppliers are willing to produce investment goods. Thus a rising supply price is clearly ex post. Keynes got this confused in the GT. Furthermore, the expected returns which form the basis of the MEC are ex ante. So in Keynes theory of investment there are both ex ante and ex post factors which are involved (Asimakopulos, 1971, 382).

pays to produce them, *unless the rate of interest falls* pari passu. When there is *no* asset of which the marginal efficiency reaches the rate of interest, the further production of capital-assets will come to a standstill (Keynes, 1936, 228).

In the short period, holding constant the: 1) state of long-term expectations of investors, 2) the money supply 3) the production technique, 4) and the MPC, the economy will equilibrate to the point where the MEC is equal to the rate of interest and hence where the level of aggregate investment is equal to the aggregate level of savings in the economy. The point of equilibrium certainly may not be associated with a full employment level of output. Whereas in the neoclassical case, the interest rate equates savings and investment and the pool of savings finances investment. For Keynes, investment yields an increase in output and then income. The income in turn is divided between consumption and savings, and the proportions of which are determined by the MPC. Thus aggregate savings increases and will level off where it is equal to investment, but in Keynes savings is the residual. Full employment is not guaranteed because it is capitalists who make investment decisions. Keynes argues that the incentive for capitalists is not to ensure an adequate level of investment consistent with full employment, rather capitalists decisions regarding the level of investment is based upon the expectation of the future profitability of such investment.

> ...whereby investment, unlike consumption, is not constrained by current income and is predominantly determined by expected profitability, allowing him [Keynes] to develop a theory of underemployment equilibrium. The labour market could remain uncleared when the product market cleared because the unemployed had no effective means to signal to the entrepreneur that it would be profitable to employ them (Hamouda and Harcourt, 1990, 6-7).

There exists a situation where the micro-incentive of achieving profits does not

align with the macro-goal of full employment. The achievement of full employment is not of interest to the capitalists. According to Keynes' theory, the micro-goal of capitalists and the macro-goal of full employment of policy makers may only be aligned without intervention through a fall in the money rate of interest. However as Keynes notes, the money rate of interest is fixed or at least falls slower as output increases than the own-rates of interest[5] of capital assets. This is due to the special property of money. Fiat money, unlike capital assets, has a zero elasticity of production. As the price of money increases, more labor cannot be applied to money to increase money output, thus lowering the rate of interest (Kregel, 1987, 99-102).

Now to the second component of the investment function, the state of short and long-term expectations. Investment in capital assets is a function of the relationship between the money rate of interest and the rate of return of such assets, given the state of long term expectations. Keynes' theory is, however, far more complex than simply equating the MEC with the rate of interest. The heart of Keynes' argument is that while the MEC does determine the level of investment, the primary determinant of the MEC is the state of long-term expectations of the capitalists. For Keynes, it is improper to take the state of confidence of the capitalists as given. The state of business confidence is in fact is a crucial determinant of the MEC. It is dependent upon "the actual observation of markets and business psychology (Keynes, 1936, 149)." The state of confidence of capitalists is furthermore an outcome of mass psychology, which in Keynes' view was volatile. Due to waves of optimism and pessimism which

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[5]'Own-rates of interest, defined by Keynes is percentage change in the spot price of a commodity compared with its known future price of that commodity. See (Keynes, 1936, 223).

can be both "unreasoning and in a sense legitimate ... no solid basis exists for reasonable calculation (Keynes, 1936, 154)." For Keynes this was the heart of his theory of effective demand. The MEC becomes very unstable and hence attaining a level of effective demand at a high enough level to correspond to full employment becomes difficult. Investment spending is based upon fundamental uncertainty. Keynes' theory of investment is far from a simple deterministic model. He presents a theory which provides room for the complex social and psychological inter-relationships involved in the determination of the level of investment and consumption in the economy. This level of aggregate effective demand is inconsistent with full employment because given a laissez-faire economy, the overall behavior of the micro-economic forces are towards their individual initiatives rather than the promotion of full employment. For Keynes the only mechanism for the achievement of full employment, even for the short period, is for government intervention in the economy through both monetary and especially fiscal policy:

> The State will have to exercise a guiding influence on the propensity to consume partly through its scheme of taxation, partly by fixing the rate of interest, and partly by other ways. Furthermore, it seems unlikely that the influence of banking policy on the rate of interest will be sufficient by itself to determine an optimum rate of investment. I conceive, therefore, that a somewhat comprehensive socialisation of investment will prove the only means of securing an approximation of full employment; ... If the state is able to determine the aggregate amount of resources devoted to augmenting the instruments and the basic rate of reward to those who own them, it will have accomplished all that is necessary (Keynes, 1936, 378).

2.4 Neoclassical Models and Post Keynesian Alternatives

Keynes' GT revolutionized the discipline of economics. Neoclassical theory, for the most part, attempted to incorporate some of Keynes' theories into its framework. However neoclassical theory did not give up their core propositions. Neoclassical economic theory assumes rational, or near rational, expectations. Contemporary neoclassical theory further assumes that prices may not be free to adjust due to market rigidities, which in their models, is a source of involuntary unemployment. Neoclassical theory relaxed previous assumptions of perfectly clearing markets in the short run to provide an analysis for sticky wages and prices (Snowdan and Vane, 1997, 459). Sticky wage and price models is the attempt made by the neoclassical school to reconcile Keynes' framework within their own theory. In an attempt to do so, neoclassical theory missed the core of Keynes' argument as presented in the GT. Specifically, Keynes dealt with the problem of uncertainty, especially as it regards investment decisions. As it is proposed below, the neoclassical model essentially limits Keynes to a disequilibrium economist. Keynes' theory is not only much deeper than this, but Keynes made explicit that the economy will equilibrate to a level below full employment given price rigidities or not.

The Post Keynesian critique of the neoclassical analysis of labor markets begins essentially as a critique of the fundamental assumptions of neoclassical theory. Neoclassical theory is predicated upon the assumptions that market participants are seen as maximizers basing their decisions on rational choices. From the side of the worker, much of contemporary neoclassical analysis is built upon Gary Becker's model of human capital. "The rational choice analysis of family behavior builds on maxi-

mizing behavior, investments in human capital, and the allocation of time (Becker, 1993, 398)." Becker's analysis of human capital is built upon traditional marginal analysis as is the conventional approach of mainstream economics.

> Human capital analysis starts with the assumption that individuals decide on their education, training, medical care, and other additions to knowledge and health by weighing the benefits and costs. Benefits include cultural and other nonmonetary gains along with improvement in earnings and occupations, whereas costs usually depend mainly on the forgone value of the time spent on these investments (Becker, 1993, 392).

Becker's (1965) analysis of household decision making is the foundation for the labor-leisure trade-off analysis which is a basis for the efficiency wage models of Yellen (1984). The efficiency wage theory is further a foundation for the sticky-wage models which have been dominant in the neoclassical literature (Mankiw, 1990; Akerlof and Yellen, 1990; Gordon, 1990; Akerlof, 2002) to the present day (Williamson, 2008, 593-625). Following Becker's lead, the sticky-wage hypothesis assumes that households engage in the allocation of time to participate in the market, which then generates the upward sloping supply curve for labor in neoclassical models (Williamson, 2008, 606-607).

The neoclassical theory of the behavior of firms assumes that firms will employ labor based upon marginal productivity (Romer, 1993, 8-10). Neoclassical theory thus assumes that firms have full information and are able to engage in maximizing behavior and will make those decisions rationally (Gordan, 1990, 1135-1137). Union activity in neoclassical models can be taken accounted for (Akerlof and Yellen, 1990; Yellen 1984). While unions alter the wage-employment relationship from what it would otherwise be given free competition, neoclassical theory has assumed that the same

market forces operate through the institutions of collective bargaining as they would in those which are non-union. These assumptions allow for construction of supply and demand diagrams for the labor market and also allow for the re-construction of the Phillips curve and the redevelopment of the NAIRU hypothesis no different than that of the expectations-augmented Phillips curve of Friedman and Phelps (Roberts, 1995).

Post Keynesian alternatives to the neoclassical models can take several directions, as "Post Keynesian" is itself a broad term. Those who classify themselves as Post Keynesian are in fact a fairly heterogenous group. Post Keynesians can be classified into two general frameworks, the macroeconomic approach of the American Post Keynesians, and the micro-foundations approach of the Structural Post Keynesians. American Post Keynesian theory gets their origins from Keynes and the *GT*. "The implications of the *Treatise* and the *General Theory* were the base on which the American post-Keynesians built (Hamouda and Harcourt, 1990, 7)." The second group is the neo-Ricardian branch of Post Keynesian theory, what I have termed the "Structuralist Post Keynesians" which finds its origins in Ricardo, Marx, and Sraffa, and to which Keynes' contributions of effective demand have been added (Hamouda and Harcourt, 1990, 2-3). However, the overall general framework of Post Keynesian theory as a school of thought should incorporate both the "American branch" and the many contributions of the neo-Ricardian branch (Lavoie, 1992, 3). Both groups of Post Keynesians reject the neoclassical notion of scarcity (this is important as the entire neoclassical school is built upon the existence of scarcity) but come at it from two different frameworks. American Post Keynesians reject the

notion of scarcity from the lens of the *GT*. This group puts much of their focus and analysis on the principle of effective demand (Lavoie, 1992, 15-16) outlined above. The neoclassical notion of scarcity becomes incoherent when resources, especially labor is unemployed and capital is under-utilized. American Post Keynesians are said to be building upon Keynes' ideas from the *GT* and other works and "extends them to their full logical development (Arestis, 1992, ix)." The "neo-Ricardian" Structuralist Post Keynesian branch rejects the notion of scarcity reflected by supply and demand and returns to the classical "surplus approach" outlined below. In the surplus approach prices are not based upon scarcity, but rather prices and wages are based upon production (Hamouda and Harcourt, 1990, 6).

Both American and Structuralist Post Keynesians share commonalities with the Institutionalist tradition of Thorstein Veblen, particularly Veblen's view of industry and business enterprise. For Veblen "The material framework of modern civilization is the industrial system, and the directing force which animates this framework is the business enterprise (Veblen, 1904, 1)." Veblen separated out business from industry. Thus the goal of the business enterprise is towards pecuniary gain, and:

> "industry is carried on for the sake of business, and not conversely;
> . . . The adjustment of industry takes place through the mediation of
> pecuniary transactions, and these transactions take place at the hands
> of the business men and are carried on by them for business ends, not
> for industrial ends (Veblen, 1904, 25-26)."

Veblen focused his attention on the linkage between the industrial corporation and business enterprise as a means to explain market competition. The industry is there to serve the businessman to exploit in terms of higher revenue. However the primary objective of the businessman is not towards the short-run acquisition of profits, rather

the businessman's primary objective is oriented towards survival and growth (Parada 2008, 7; Baskoy, 2003, 1128). Veblen pointed to the "aquisition of gain through taking advantages of those conjectures of processes in the industrial system (Veblen, 1904, 49)."

Here the connection is made between Veblen's theory of the business enterprise and the American Post Keynesian theory of financial fragility and economic crisis. On the one hand American Post Keynesians such as L. Randall Wray suggest that Veblen's main purpose in the *Theory of Business Enterprise* was to examine the operations of credit economy (Wray, 2007, 618). In this interpretation, the businessmen's interests are towards profits which are realized through growth, but growth can become "over-capitalized". To support this argument Wray cites Veblen's distinction between "industrial capital" (by capital Veblen refers to market capitalization) and "business capital". Industrial capital is the value of actual physical machinery which are used for production of output, while business capital is compromised of industrial capital, or credit which can be obtained using industrial equipment as collateral, and good-will (Wray, 2007, 618). Wray argues that it is management's interest to spread the gap between "industry capital" and "business-capital". The means of doing so is the ever increasing creation of good-will, which leads to over-valuation, but also leads to the ever expanding amount of credit, which leads to further over-capitalization, and so on. Soon the over-capitalization will be realized, financiers will re-access the earnings potential downward, credit will stop flowing, liabilities will come due, and assets will be sold (Wray, 2007, 618-620). Both of which can lead to the consolidation of industry.

Both Veblen and Keynes view the capitalist economic system as a monetary production economy. For both Veblen and Keynes investment was seen as a primary driver towards realization of additional monetary gains. However Wray (2007) contends that perhaps most importantly were Veblen's insights as to the importance of credit economy for monetary production, and how the credit economy creates booms and busts of the real economy. In this view, Wray is making the obvious connection between Veblen's view of the credit economy with that of Keynes' theory, particularly the stress Keynes put on the finance motive.[6] Furthermore, the extension of credit is a tenet of the American Post Keynesian theory, as it is the foundation of endogenous money approach of the Post Keynesians (Wray, 1990), and the financial instability hypothesis formalized by Hyman P. Minsky (1986).

Veblen's theory also has many commonalities with the Structuralist theory of modern Post Keynesians. Specifically in *Absentee Ownership* Veblen made insights regarding the structural organization of the economy and on the level of output and pricing. As concerns the former, Veblen approaches the structure of capitalist economy as:

> ... the industrial work of the community has fallen into the shape of a three-fold division or stratification of industries which work together in a balanced whole, a moving equilibrium of interlocking processes of production: (a) the primary, initial, or key industries, so called, which command the greater natural resources of the country and turn out the prime staple necessaries of the mechanical industry in the way of power, transportation, fuel, and structural material;

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[6]The finance motive was left out of the GT but in his post-GT writing Keynes stressed the role for credit to provide additional liquidity for investment (Keynes, 1973, 222-223).

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(b) the secondary or continuation industries, manufactures, which turn these crude supplies and services into consumable goods and distribute them; (c) agriculture (Veblen, 1923, 233).

Veblen's three sectors are categorized as the primary sector, the mechanical industries sector, and the agriculture sector. The primary sector provides inputs for mechanical industries and agriculture. The first sector can be described as the "basic-sector" in the Sraffian sense. Meaning, all other production is dependent on the production of output from the first sector. This has further commonalities with the structural models of Adolph Lowe.[7]

> Each of these three industrial groups or strata occupies a peculiar place in the industrial system, in respect of ownership and business connections. There are at the same time no sharp lines of division between the three groups. They overlap, interlock and blend; and each group will show doubtful and marginal cases; but in the large, as component factors in the framework of the industrial system, each group stands out by itself, typically distinct from the rest, particularly in respect of the business considerations by which each is bound or actuated. ...Agriculture, e. g., still rests on a body of such oldfashioned holdovers, much of it of unknown antiquity and out of touch with the logic of the mechanical industry. Yet in the main and as contrasted with what has gone before, and allowing for extensive holdovers, the industrial system that engages the civilised nations runs on a technology of physics and chemistry, and its work 'converges on quantity production of mechanically standardised goods and services. Therefore manufactures are the focus of the industrial system. It is a technology of manufacture, of mechanical standardisation and quantity production; and the same technical principles and procedures are all the while reaching out into the outlying fields of agriculture and back into the other extractive industries that have to do with the primary supply of power, fuel, and raw and structural materials (Veblen, 1923, 234-236).

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[7]Lowe's structural model will be outlined in chapter 3

Veblen clearly describes the economy in terms of production. This type of analysis is at the heart of the Structuralist Post Keynesian viewpoint. While Veblen's approach is not as sophisticated as input-output analysis, the fundamental inter-connections of the business enterprise are there. Alfred Eichner (1985) suggests that that the business enterprise, especially in the form of the modern corporation, or megacorp, is the source of decision making on prices, wages, the level of output and the level of investment (Eichner 1985, 3). The megacorp is the representative corporation in an industry comprised of oligopolistic corporations. As such, there is the ability of the megacorp to set prices in order to maintain a predetermined profit margin via a mark-up over costs (Eichner, 1985, 29). Eichner maintained that prices in oligopolistic sectors are set to allow for oligopolistic industries to generate internal financing for purposes of long term growth (Eichner, 1973). Eichner (1991; 1985) further stresses that the analysis of the corporate economy and it's pricing decisions are appropriately modeled within a production framework. "The megacorp is a price setter (or price matcher) rather than a price taker. This means that the prices in each of the industries are seller-rather than market-determined, with those prices established by adding a certain mark-up, or margin, to the unit costs of production (Eichner, 1973, 33). Frederic Lee's empirically grounded pricing theory (1998) further echoes Eichner's analysis of prices within a production framework. Lee argues that while some Post Keynesians may hold the view that it is unnecessary to specify the underlying production schema in pricing models, Lee contends that material inputs and

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labor inputs are explicit components of Post Keynesian pricing models,[8] he argues "that the foundation of the [Post Keynesian] pricing model must be closely related to the general schema of production of capitalist economies (Lee, 1998, 219)."

It has been addressed then that there are aspects of the institutionalist approach which are shared by both American and Structuralist Post Keynesians. While the two groups have chosen to emphasize different themes in Veblen's analysis, the Vebenian approach of the business enterprise is seen in the macroeconomics of the American Post Keynesians, and is also clear in the analysis which highlights the micro-foundations of the macro-economy of the Structuralist Post Keynesians.

2.5   American Post Keynesian Approach

American Post Keynesian theory has become the dominant approach of Post Keynesian macroeconomics. The highlights of the American Post Keynesian macroeconomics are an inclusion of Keynes' contribution of effective demand and endogenous money and the role of the credit economy (Lavoie, 2006).

Effective demand drives the economy and investment spending is the driving force of effective demand. In Keynes' GT the analysis of investment spending is based upon the state of long-term expectations which were declared as the most fundamental components affecting the marginal efficiency of capital and in turn the level of investment (Keynes, 1936, 147-164). Economic behavior analyzed in Keynes' GT placed a ceiling on the level of effective demand and henceforth places a ceiling on

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[8]Lee (1998) provides a thorough review of Post Keynesian price theory. See also Downward (1999, 43-73) for a nice examination of contributions towards Post Keynesian price theory

output and employment, which most often corresponds to production below the full employment level. Underlying the state of long term expectations for Keynes were the roles of 1) fundamental uncertainty, 2) non-ergodicity,[9] and the 3) socio-psychological behavior of members of society operating in the real world. The economy, left to it's own devices, would never attain, let alone maintain, a level of aggregate output consistent with full employment. This is why Keynes in the concluding remarks of the GT had proposed for government led policies to promote full employment. The kind of government intervention for Keynes was really specific and that public policy should be targeted in such a way to allow for the interest rate to fall to the level where the MEC corresponds to a level of investment consistent with full employment. The MEC, as stated earlier, is however heavily tied into the state of confidence of capitalists, whom are literally betting that their expectations on the future returns of a given investment are proven correct. "The principle of effective demand, the concept that demand constraints are the dominant factor in explaining variations on output, is the backbone of the Post Keynesian approach (Hudson, 2003, 116)."

The principle of effective demand holds a prominent position in in American Post Keynesian theory. There is less emphasis for American Post Keynesians on structural and technological change. The structure of production is highlighted in the surplus approach to economic theory. This approach has been that of Structural Post Keynesians, a theory which we shall now turn to.

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[9]This term means that the economic system will not return to it's previous state. This assumption is a complete contradiction to neoclassical theory which states that the economy tends (returns) to full employment if disturbed from such it's equilibrium path from an exogenous shock.

2.6 Structuralist Post Keynesians: The Surplus Approach

The surplus approach of Post Keynesian theory is an attack on traditional neoclassical analysis. Whereas neoclassical economics defines economic theory around the problems of scarcity and optimization, the surplus approach is concerned with production and distribution. Production is seen as a circular process. When production is viewed as a circular process the notion of scarcity is rejected (Sinha, 2001, 668). The distribution of income between wages and profits, and the interconnectedness of wages and profits is also central to the theory. The "core" (Garegnani, 1984) of the surplus theory is the emergence of the "social surplus" (Garegnani, 1984, 292), or as Quesnay called the "produit net". The surplus is over and above the necessary conditions for reproduction and the surplus could be disposed of without impairing the conditions which are required for economic survival. The foundation of the surplus approach in Structuralist Post Keynesian theory is a return to the classical economics of Smith, Ricardo, and Marx. Furthermore, Sraffa's (1960) "critique of economic theory" also laid much of the foundation for contemporary Post Keynesian economics. Ian Steedman (1981b) and Peiro Garegnani (1984) are also important contributors as they reconcile Marx's theory of wages, profits, and prices, with Sraffa's *Production of Commodities by Means of Commodities*.[10]

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[10]The reconciliation between Marx and Sraffa also included the transformation problem. In Marx, the rate of profit is said to depend on constant capital, variable capital (in terms of the labor necessary to produce them) and surplus value. However, competition distributes profits in terms of prices of constant and variable capital, not on values of labor embodied. Marx, in *Capital III* attempted to solve this transformation problem. However his solution was inconsistent and is later solved by (Steedman, 1981b, 29-36).

The size of the economic surplus is known in physical terms, however the distribution of the surplus must still be determined. The surplus, as was said, is divided between wages and profits. Thus the surplus approach further rejects the neoclassical notion of the real wage. The real wage in the surplus approach is seen as an independent variable, and it is determined separately from the size of the surplus and the technical conditions of production, which are all determined independently. However this is not to mean that the wage can not be influenced by any one or more of these variables (Garegnani, 1984, 296). Sraffa's (1960) price equations[11] depict just that. Let i be commodities produced in a given year requiring L_i laborers, and require constant capital of A_i, B_i, ... K_i; where i is equal to commodities a, b ... k produced. Let w be the wage rate, and r be the rate of profit. The value of these commodities is equal to one, thus let $\lambda_a p_a + \lambda_b p_b + \ldots + \lambda_k p_k = 1$. Where λ_i represents the value of commodity i. (Sraffa, 1960, 11) Sraffa's price-equation model is illustrated as:

$$
\begin{aligned}
(A_a p_a + B_a p_b + \ldots + K_a p_k)(1 + r) + L_a w &= A p_a \\
(A_b p_a + B_b p_b + \ldots + K_b p_k)(1 + r) + L_b w &= A p_b \\
\ldots\ldots\ldots\ldots &\quad \ldots \\
(A_k p_a + B_k p_b + \ldots + K_k p_k)(1 + r) + L_k w &= A p_k \\
\lambda_a p_a + \lambda_b p_b + \ldots + \lambda_k p_k &= 1
\end{aligned}
\tag{2.1}
$$

Represented in equations 2.1 is a depiction of the national economy, with k commodities. Equations 2.1 are $(k + 1)$ in number with unknowns p_a, p_b, ..., p_k,

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[11]Here, and in the forthcoming chapters "prices" refer to prices of production, not necessarily market prices.

r, w. If the wage rate (or any other variable) was set to be the numeraire then there would be an equal number of unknowns as equations. The result of adding the wage rate as also variable is that the number of unknowns exceeds the number of equations by one. The objective to allowing the wage rate to be variable is to show the effect of changes in the wage rate on the rate of profit. Sraffa has shown that, for a given technique, that as the wage was gradually increased from 0 to 1, the rate of profit falls in direct proportion to the increase in the wage rate (Sraffa, 1960, 22-23). The Sraffian system is a return to the classical economists and Marx in the determination of the distribution of the economic surplus.

Contrary to neoclassical analysis, these equations show that prices are independent of demand. In price-quantity models (detailed in chapter 3 and 4), changes in final demand have an effect on the allocation of labor, and have an effect on the total quantity produced, but *demand alone* can have no effect on the distribution of income between wages and profits (Sinha, 2001, 670).

2.7 Effective Demand and Structural and Technological Change

Keynes and American Post Keynesian's alike have dealt principally in the short-run, addressing the unemployment problem through the lens of insufficient effective demand. As has been addressed, aggregate demand stimulus allows for the attainment of full employment, but not necessarily the maintenance of full employment which can be shown only in the long-run. Bridging the long-run theory of effective demand with the surplus approach to production requires rejecting the determination of prices by supply and demand, rejecting marginal analysis, and thereby rejecting

the neoclassical analysis of Keynes' investment demand schedules which are based upon marginal analysis (Harcourt, 2001, 266). The long run economy is dynamic, exhibiting continuous technical and structural change due to the adoption of investment in new technologies, change to the size of the labor force, and change to the utilization and/or availability of natural resources. These dynamic processes, most notably technological change, effect profit levels and result in changes to short-term and long-term expectations. The profitability of investment activity has feedback effects on current investment decisions. Keynes treated expectations as independent of current conditions. Keynes should have allowed for the double-sided relationship of investment and profits, in which current profits have an effect on investment activity and on the state of long-term expectations (Asimakopulos, 1991, 73-76).

Furthermore, the attainment and maintenance of full employment are two separate policy objectives and require separate methodologies (Forstater, 2002). The macroeconomic theory of the American Post Keynesian approach which has been presented does not provide for an adequate framework for studying the phenomena. To gain an understanding of the institutional structure, and the behavioral aspects of it, requires a framework which highlights the micro-foundations of the macro-economy exhibited by the Structuralist Post Keynesian price and production models. Lower levels of aggregation allow behavioral forces which guide investment and consumption decisions to be properly analyzed. It is perhaps more appropriate to aggregate by industrial sectors rather than to aggregate the economy as a whole. A structural representation of the economy accomplishes this goal.

The aim of the structural model is to show the rules that govern behavior.

They show the social relationships among producers, and between producers and the rest of the world. The structural model provides a framework for the basic exchanges which need to be done in order for the economic system to reproduce itself (Nell, 1998, 122-128). Structural models are at their core descriptive. The model describes what has to be done for reproduction to take place given the rules which govern behavior and to define the course of action which are available within the system. Structural analysis considers the relationships which hold between institutions. The relationships are found through linkages and interdependencies that are established in the production of output. These structural relationships are first technological, but also outline social relationships of production which plays a role in setting the level of employment for certain jobs in certain industries, and the material inputs which are used in production and their level of utilization given ecological considerations.

The structural model is also more powerful, more robust, than simply providing a framework for detailing the technical and social relationships of production. The structural model can also be used for prescription. The model can be, in Lowe's terms, an "instrumental" model. The instrumental model can be used to outline the initial conditions of the economic system defined by the initial technical and social relationships of production which corresponds to a specific level of output. From here, given the macroeconomic goals, the model can be used to determine the best course of action for producers, consumers, and the state, to achieve pre-defined macroeconomic goals.

The economic system is characterized by production, wage labor, markets, and money. The produced output consists of material goods which are allocated among

industries and consumers in the economic system. The transactions that take place are for money receipts. Thus it may be said that the structural representation describes an economy which produces goods for sale on the market in return for money, meaning it is a monetary production economy that is being described.

Now that the economic system has been described, the question then turns to examining how these processes carry themselves out. A given level of production implies that labor, machines, and natural resources are mobilized in a specific manner as part of a social process in which the necessary transactions guarantee (at a minimum) the reproduction of the economic system. This framework can then be used to identify policy recommendations for the realization of macroeconomic goals.

The model to follow in chapter 3 incorporates the micro-foundations of Alfred Eichner (1976, 1985, 1991), and the Post Keynesian empirical pricing model of Frederic Lee (1998). In which the economic system is represented by the structural model of production. The business enterprise is classified as a collection of oligopolistic corporations within an industry that produce the same type of output. These collection of industries can be further aggregated to the industrial-sector level. The collection of sectors is said to then make up the production framework. Social reproduction is described in the system as a circular flow model in which the business enterprises contained in the sectors make decisions on what and how much to produce based upon the needs of other business enterprises in the system and based upon the level of final demand for the given output. In order for production to take place, managers must hire labor, and laborers in turn sell their labor power for an agreed sum. Thus the economic system is a class based system.

Following Eichner (1985, 28-31) the business enterprises operate in a oligopolistic environment and each have some degree of pricing power. The level of output, price, and investment, decisions are made at the firm level. These decisions determine the macrodynamic behavior of the economic system as a whole, and is reflected by the growth of output and the change in employment. Reflecting Keynes' (1964) analysis of investment the amount of capital expenditure is based upon expectations of future sales of output. In structural models the level of employment is determined jointly by the level of final demand and the state of technology.

Structural models detail structural and technological change, the linkage of this change with effective demand, and the contribution of both of these effects on the level of employment. Given a change in one or more of the exogenous determinants of production, such as changes in the supply of the labor force, supply and availability of natural resources, or technical progress, a multi-sectoral framework prioritizes the problem of structural bottlenecks. Or to say it differently, a multi-sectoral framework analyzes the inadequacy of the old capital stock to respond to these exogenous changes. There is an adjustment path that is required which takes real time for the capital adjustment to transpire. For example, assume an exogenous increase in the labor force. Unlike neoclassical and Keynesian models, production can not simply be brought to a higher level to employ the increase in the labor force. While there is some normal level of reserve capacity available to producers, if the increase in the labor force is above what is required after the utilization of reserve capacity, then additional capital must be built up. This takes real time. Multi-sectoral models describe the necessary inputs which are required to produce intermediate and

final goods at any given level. When a higher level of output is called for due to an exogenous change in the data, then there must be growth in the sectors producing machinery and other intermediate goods first, which will then be used as inputs to produce a greater volume of consumption goods to satisfy the additional population. Furthermore labor-expelling technical progress will have the same effect on the structure of production as an increase in the labor force. When their exists unemployment due to technical progress, the system of production will have to respond in the same manner.

Traverse analysis now becomes relevant. Traverse analysis is the analysis of the transition process from one steady-state to another following an exogenous change to the data (Hicks, 1965). For illustration assume a simple two sector model, where sector one produces machines and sector two produces consumption goods and the labor employed is divided evenly between the two sectors. Assume initially the system is stable at a level of production corresponding to full employment. Assume there are 240 people employed, which 120 are employed in the production of machines and 120 laborers for the production of consumption goods. Now say a new labor saving technology in the consumption goods sector is introduced which expels half of the labor employed in this sector. After this introduction, the level of employment in the economy stands at only 75 percent, 120 laborers for production of machines, 60 for the production of consumer goods, and 60 workers are unemployed. Of those still employed there are two laborers producing machines for every one laborer producing consumption goods. The savings in wages paid by the capitalists in the consumption sector is transferred into profits. For the economy to return to full employment there

must be an increase in output. The idea of structural bottlenecks and historical time can now be taken into consideration. For the economy to return to full employment, given the 2:1 labor ratio between sectors, to employ the 60 unemployed workers, 40 laborers will be employed in the production of capital goods and the remaining 20 laborers will be employed in the production of consumption goods. However, the increase in output is not instantaneous. To return to full employment there must first be an increase in the production of machines which that employ 40 additional laborers. Then, after these machines are produced they will be transferred to the consumption goods sector which, only then will the remaining 20 laborers become employed in the consumption goods sector. It is seen from this simple example that to increase output to a higher level takes real time and instantaneous adjustment to a higher level of output is not possible. However traverse processes are not that simple. For the illustration just presented to work out in this manner assumes that machines are produced by labor alone. This obviously is not an accurate depiction of the production process. Production of machines requires as inputs it's own output to be used for the machines which get used up in the production process and for consumption goods. In this setting the path which the system takes to traverse to a higher level of output becomes slightly more complicated. Such models will be reserved for later discussion. For current purposes, it is simply important to recognize the structural framework, and the time element which is required to bring production back to it's full employment level (Lowe, 1976; Hagemann, 1992; Gehrke, 1998).

2.8 Structural and Technological Unemployment

The long run maintenance of full employment includes effective demand considerations, but also focuses on the dynamics of the production system. The primary consideration is what has been called the "machine question". The introduction of new machinery is contested in the history of economic thought. Adam Smith, in his famous pin factory illustration puts focus on the improvements of labor productivity through the introduction of new machinery. However, elsewhere, Smith has emphasized the interdependence of the production process.

> Observe the accommodation of the most common artificer or day-laborer in a civilized and thriving country, and you will perceive that the number of people of whose industry a part, though but a small part, has been employed in procuring him this accommodation, exceeds all computation. The woollen coat, for example, which covers the day laborer, as coarse and rough as it may appear, is the produce of the joint labor of a great multitude of workmen. ... What a variety of labor, too, is necessary in order to produce the tools of the meanest of those workmen! To say nothing of such complicated machines as the ship of the sailor, the mill of the fuller, or even the loom of the weaver Were we to examine, in the same manner, all the different parts of his dress and household furniture, the coarse linen shirt which he wears nest his skin, the shoes which cover his feet, the bed which he lies on, and all the different parts which compose it ... if we examine, I say, all these things, and consider what a variety of labor is employed about each of them, we shall be sensible that without the assistance and co-operation of many thousands, the very meanest person in a civilized country could not be provided, even according to what we may falsely imagine the easy and simple manner in which he is commonly accommodated. (Smith, 1986, 167-168)

This passage, while less famous then the pin factory example, illustrates the interdependent nature of the production process. To bring a simple wool coat to sale on the market requires, even at Smith's time, an especially complex set of input-

output processes. Smith recognizes in this passage the indirect intermediate goods which are required for a simple wool coat, the production of all intermediate goods and the production of machine tools all require additional labor. Such employment of labor also in turn stimulates demand for other final consumer goods. Thus Smith is essentially laying out, without formalizing, the social relation of production. Envisioning the economy in terms of production was seen in the classical economists.

The inter-dependent nature of production is seen in the writings of Smith. But Smith's analysis does not shed light on the employment effects of technological change. The conception that technical progress may not benefit all classes of society was first addressed by Ricardo. In the first two editions of *The Principles of Political Economy* Ricardo held a very different view. In the opening chapter Ricardo puts forth that the introduction of new machinery will result in lower production costs for the capitalist class, thereby increasing output and a decrease in prices, the reduction of which is a result of competition. In a short period of time, the 'stimulus to the population' will result from the introduction of machinery (Ricardo, 2004, 16-17). Ricardo further assumes that labor will be relocated easily and quickly through different sectors of the economy. After the debates with Malthus, Ricardo changes his stance, the addition of chapter 31 "On Machinery" to the third edition of *Principles* demonstrates a change in Ricardo's thinking. This chapter furnishes an alternate side to technical progress, seeing technical progress as damaging to the class of laborers.

Ricardo expresses that the addition of the chapter "On Machinery" represents a "considerable change" (Ricardo, 2004, 386) on his earlier opinion towards the subject. The earlier opinion stems from Adam Smith who considered that one's desire

for material possessions is limitless. Ricardo's old position as summarized above, is that the introduction of machinery allows consumer goods to be produced more cheaply, and that both the capitalist class and the laboring class would equally benefit from this reduction. However Ricardo becomes convinced that the substitution of machines for human labor "is often very injurious to the class of labourers (Ricardo, 2004, 388)." Ricardo defends this proposition by providing a scenario in which after the introduction of machines, part of the labor force will now be employed into the production of machines and part into the production of consumption goods. This shift will cause simultaneously, an increase in the net product (capitalist's revenue) but will also cause a reduction in the value of the gross product. The power to support a nation depends entirely on the gross produce of a nation and not on a nation's net produce. Thus a reduction in the value of gross produce must mean a reduction in the demand for labor, and the level of employment will fall "and the situation of the labouring class will be that of distress and poverty (Ricardo, 2004, 390)."

As concerns the net product, Ricardo (*ibid*, 190) suggested that this is used to satisfy the wants of the capitalists. Capitalists will be urged to use these funds towards the utilization of more machinery. However, with expanded machinery requires additional workers to operate them. However "the demand for labour will continue to increase with an increase in capital, but not in proportion its increase; the ratio will necessarily be a diminishing ratio (*ibid*, 395)."

There is a mixed view of the impact of technology in the history of economic thought. It has been argued both ways by the classical economists, Adam Smith and David Ricardo have argued that technology is favorable to all members of so-

ciety, while later Ricardo, who changes his position, and Marx have illustrated how the introduction of machinery is detrimental to society. Here it is important to clarify the distinction between innovation (technological progress) and investment (capital accumulation). The two often are conflated.[12] Innovation is the "application of accumulated technological and organizational knowledge in a *new form*" (Courvisanos and Richardson, 2008, 185), whereas investment is the process of accumulating physical capital used in production. Investment leads to increases in employment, and therefore increases to income, effective demand, and output. Contrary to this, innovation creates structural change. Innovation causes 'old' capital to become obsolete and thereby decommissioned. The consequence of innovation (technological process) is unemployment. The incentive for firms to engage in behaviors which result in innovations is the expectation of profit, which is normally ensured through the dismissal of labor. Innovation is necessary for economic development and represents a potential increase in the standard of living. However one's standard of living is not increased if he/she becomes unemployed via the introduction of a new technology. One can also not assume that displaced laborers will be re-absorbed through an increase in investment. While it is true that innovation and investment are linked, additions in investment cannot re-employ all workers who were displaced through innovation.

Given the definitions above, it can now be concluded that technological un-

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[12]It is also important to clarify what we mean by innovation. We need to make a distinction between process innovations, and product innovations. Product innovations refers to new, or improvements in existing products in order to achieve a higher market share. This will not be dealt with in this study. Rather, it will concentrate on process innovations which is defined as technological progress.

employment is not the result of all kinds of technical progress. Rather, technological unemployment is the level of unemployment caused by labor-displacing technical process which is not counterbalanced by the introduction of new industries resulting from labor-attracting technical progress. Labor-dispelling technical progress is seen when the production of new capital goods in a given period is qualitatively different then the production of capital goods by the same industry in the preceding period. If the expulsion of labor is not compensated in any way this inevitably results in technological unemployment. Nessier (1942) describes the capitalistic model of production as a race between those laborers who are displaced by technological progress and of those who are brought back into production through capital accumulation. Nessier concludes that there will always be some level of permanent technological unemployment.

Technological progress leads to cost reductions which are then shown through either a fall in prices or an increase in profits. Or in other words there is an increase in the purchasing power of either workers or capitalists. But this may not lead to a subsequent increase in employment. The main question is "whether the free market is endowed with a *systematic mechanism that assures compensation within the Marshallian short period* (Lowe, 1976, 250, emphasis in the original)." The answer clearly is no. Lowe (1987, 97-100) and Hagemann (1995a, 1995b) shed additional light on why this is the case. In an ideal world, technological progress would create an increase in purchasing power of capitalists. In turn this would cause an increase in investment spending, increasing aggregate demand and employment until full employment is reached. However, in reality the introduction of productive technologies

will create an increase in productive power, not purchasing power (Hagemann, 1995b, 40). There is no guarantee that technical progress will increase the purchasing power of those still working. The theory that the creation of aggregate demand stimulus because of technical progress will allow for the reabsorption of the initially displaced workers *assumes that an increase in aggregate demand will actually occur.* This occurrence will happen if and only if the savings in the wage-bill due to fewer workers are actually passed onto those who are still working instead of going towards profits. Higher wages to those who still have jobs create aggregate demand stimulus. Or, what is closer to reality is that the savings in the wage-bill went towards profits, it is thought that this revenue will go towards the purchase of additional capital goods, which increases employment. However the fallacy in the latter argument is that the demand for capital goods is not the same as the demand for labor. Technological progress, by definition, ensures that expenditures on new capital goods, once produced and utilized, requires for it's utilization less labor than the old capital which it replaced (Lowe, 1987, 101). So even with an increase in the utilization of capital goods there are still some who will be technologically unemployed. Leaving some unemployed causes actual aggregate purchasing power to be below that of potential purchasing power. This emphasizes Hagemann's distinction between an increase in purchasing power, and an increase in productive power. Technological progress creates an increase in productive power. When labor displacement occurs, there is still a loss of purchasing power (Hagemann, 1995b, 42), resulting in insufficient aggregate demand to maintain full employment.

This conclusion highlights Forstater's (2002) argument, and Pasinetti (1993,

1981) before him, that full employment policies must thus take into consideration technological and structural change coupled with effective demand. Given structural and technological change, the pertinent question is what types of policies might be implemented which satisfy such changes while maintaining a level of production consistent with full employment?

2.9   Social Costs of Unemployment

It is important to briefly digress at this stage to broaden the scope of our analysis. Up to now, we have simply considered competing approaches to the unemployment problem. Here we will provide a fuller picture of the problem. Up to now, there has only been a consideration of the economic causes of unemployment. The economic cost of unemployment is a permanent loss in output, and actual GDP at levels well below potential GDP. Unemployment also has very real non-economic consequences. The social costs of unemployment falls outside the realm of the structural model, and the non-economic costs as a whole are hard to measure. Unemployment has been shown to have devastating effects on mental and physical health of those whom are affected by it (Brenner, 1973). Furthermore there is historical evidence to demonstrate that unemployment, especially long-term unemployment, has plagued minorities disproportionately. Thus this section will examine the human toll, and also serve as evidence for the implementation of pro-active measures to combat the unemployment problem.

Granovetter (2005) has proposed for an analysis of labor market activity within the context of it's underlying social influences. He disputes the traditional job search model, in favor of a framework that is focused on social networks. Social networks

focuses on weak social ties. Weak social ties are defined as social ties with one's acquaintances and are people less actively involved within one's social network. This differs from strong ties which are defined as close friends and family and where social connections are strong. Granovetter focuses on the importance of weak ties in social networks by arguing that the only thing that binds two social networks with strong ties is a weak tie: "[strong tie networks] would not, in fact, be connected to one another at all were it not for the existence of weak ties (Granovetter, 1983, 202)." Weak ties are important in Granovetter's theory as they serve as connections to other groups of people. As concerns the labor market, prospective employers and employees learn about each other through weak ties, mainly social contacts that are primarily maintained for non-economic reasons. Additionally since these social contacts are already in place, it does not require any 'costs' for employers and employees to learn about each other. Once these social networks are in place it becomes fairly easy to move into employment and career advancement.

Granovetter's framework can be extended to explain the non-economic causes of employment and unemployment. It is argued that weak social ties which are gained through employment helps expand one's social network. The greater an individual's social network the greater an individual's prospects of maintaining employment throughout their lives. However now consider the opposite extreme. The loss of employment can cause a deterioration in weak social ties. This results in a reduction of one's social network. The reduction of one's social network can have an effect on the unemployed's ability to regain employment. The literature on the psychological effect of unemployment backs this position up.

Turning to the literature on the psychological effect of unemployment, I will begin with Marie Jahoda's (1933) *Marienthal* study. Marienthal is an Austrian village where the livelihood of the community was dependent upon the local factory. When the factory closed in 1929, a wave of prolonged unemployment in the village began (Feather, 1990). The conclusions of the Marienthal study found that the unemployed proceed through four behavioral stages 1) *unbroken* high hopes, plans for future employment, children and household maintained 2) *resignation*, all loss of hope, no plans for the future, but children and the household are maintained; 3) *in despair*, greater feeling of resignation, including a feeling of depression and a continuous comparison to the present state and a previous higher state of well being during employment; 4) and an *apathetic* state. The apathetic state is the most severe psychological state of the unemployed. It is defined as:

> ...state of complete passivity, the absence of any effort. Home and children are dirty and neglected, the mental outlook is not desperate but simply indifferent ...Nobody plans for a more distant future, not even the days or hours ahead (Jahoda, 1933, 54); quoted in: (Feather, 1990, 13).

As the period of unemployment becomes prolonged, the unemployed's psychological state regresses towards that of an apathetic state. This is a generalization for the most part and every individual response to unemployment is different based upon their unique circumstances. But broadly speaking the state of mind of the unemployed will regress as the duration of unemployment lengthens.

The downward psychological spiral of the unemployed is further evidenced in Browman's et al. (2001) study. This study analyzes the effect of unemployment of auto workers in Detroit following the plant closings of General Motors in the late

1980s. This found similar results to Jahoda's study. Browman et al. (2001) finds evidence that as the duration of unemployment increases, the opportunities for re-employment diminish. Even if the unemployed eventually find work, the probability of subsequent job-loss is greater. Browman's study is important as it links social and personal effects such as increase in crime, increase in divorce rates, deterioration of mental and physical health, etc. as all consequences of stress. This is however only partly true. The relationship between stress and unemployment is both circular, and cumulative in causation. Economic conditions such as unemployment are the cause of stress (Brenner, 1973). It is thus high stress which leads to both social and physical/psychological consequences. This clarification becomes important as it is the response to unemployment that becomes imperative to the overall level of stress which the unemployed are subjected to. It is not surprising that the response to un-employment is different for different individuals. One's support network at the time of unemployment plays an important role, as does the current financial situation, as well as the original reason for unemployment. Browman et al. (2001) find evidence that unemployment due to mass layoffs (such as plant closings) is not an initial stressor in workers' lives. This group of the unemployed tend not to fault themselves for circum-stances which, in their minds, are beyond their control. What is important however is the circular, cumulative, and causative nature of unemployment and stress. Sources of exposure to stress cause additional stressful situations (as unemployment as an initial stressor causes financial hardship) which in turn lead to anxiety, hostility, and depression, which is then turn opens the door for further exposure and vulnerability to additional stressors (Browman et al., 2001, 11). As Browman concludes:

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Simply put, to have become unemployed and hence distressed–depressed, anxious, whatever–is to less likely gain reemployment or more likely to lose a subsequent job. Unemployment deals a double whammy because its consequence, distress, has further consequences–reduced employability–which make it harder to get back to square [one], unemployment leads to family stress and disruption, this too can have consequences for future employment, if only because it feeds the spiral of distress. Even the most 'event-like' of life disruptions are in fact processes which have antecedents, concomitants, and [secondary consequences] (Browman et al., 2001, 10-12).

Even if the initial cause of unemployment is of no fault of the worker, as time passes, workers' inability to become re-employed are a major cause of stress in their own lives. Worker's now see themselves as being at fault for the inability to acquire employment. This causes great stress in the unemployed workers lives, especially as financial hardship continues to mount. This then leads to lower self-worth, anxiety, depression, family disruption, increases in drinking and drug use to cope with the stress, poor physical health of the unemployed and their families, and increased thoughts of suicide (Brenner, 1973). Furthermore stressful situations simply do not pass, these are life altering situations. As unemployment is prolonged these symptoms progress. This further impedes the possibility of re-employment.

The chronically unemployed lose all sense of time when they have nothing to do. Time and time-keeping become simply irrelevant. Jahoda (1933) makes clear that becoming unemployed is not the same as increasing one's leisure time. In her study she found that the average day for the employed is seventeen hours, eight of those being spent on the job. While the average day for the unemployed is far less. The unemployed tend to break up the day into three intervals: waking, midday lunch, and going to bed. In her survey of the daily activities of the unemployed these three

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events are the one's that stand out. What is illuminating are the responses of the activities taking place between these events. Simply put, there are little activities that take place. The unemployed worker's day is filled with inactivity. With so much free time, little actually gets done. Unlike the employed, where free time is scare, these leisure hours are carefully planned out into productive activities (going to grocery store, caring for the house, etc.).

Not only does regular employment provide a basic income for individuals, but it sets up a much needed social environment that is important and necessary for individuals. Employment has formal and informal social relationships. Losing one's regular job decreases their level of social activity that they were previously engaged in (Kelvin and Jarrett, 1985). Workers become friends, and they engage in social activities inside and outside the workplace. Unemployment causes dependency issues within families. Inside and outside the family structure, the unemployed, especially the long term unemployed, are seen as second class citizens (Kelvin and Jarrett, 1985, 6). Being viewed by society in this manner disrupts the normal functioning of the family, and in addition the normal day to day functioning of the unemployed within society.[13]

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[13]It must be made clear that the non-economic costs to unemployment as described only relate to capitalist economies. Capitalism has created a society in which one's self worth is defined, mostly, by their occupation in life. Thus, workers do not have jobs, they have "livelihoods". There is a premium placed on the working day in capitalist societies that is not found in other types of economic systems.

2.10   Unemployment, Inequality, and Crime

The relationship between unemployment, racial inequality, and crime should also be considered. Thirty-four percent of Americans claim minority status in the United States in 2008. Of these Hispanics make up the largest share with 45.5 million Hispanics residents, accounting for 15 percent of the U.S. population, and African Americans comprising the second largest minority group with 40.7 million, accounting for 13.5 percent of the U.S. population.[14] However the distribution of unemployment in the United States is disproportionately skewed towards that of minorities. The two largest minority populations (Hispanics and African Americans) consistently have high unemployment rates as compared to whites.

The official U.S. unemployment rate from 1980 - 2007 for whites, African Americans, and Hispanics is illustrated in Figure 1.[15] Since 1980 Hispanics have been able to close the unemployment gap between themselves and whites, whereas for African Americans, the unemployment rate has consistently been about twice that of whites.

Even though the overall trend in the rate of unemployment has gone down for all groups, the disproportional effect that unemployment has on minorities, notably to the African American population has not improved with time. Figure 2 demonstrates the trend from 1980 - 2007 of the Black/White and Hispanic/White

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[14]David Minkler "U.S. Minority Population Continues to Grow", May 14, 2008, U.S. Department of the State (http://www.America.gov) Accessed: September 30, 2008

[15]All data collected that is detailed in this Figure 1 and in Figure 2, below have been obtained from the *Bureau of Labor Statistics*. Data is publicly available and can be found online at *http://www.bls.gov*.
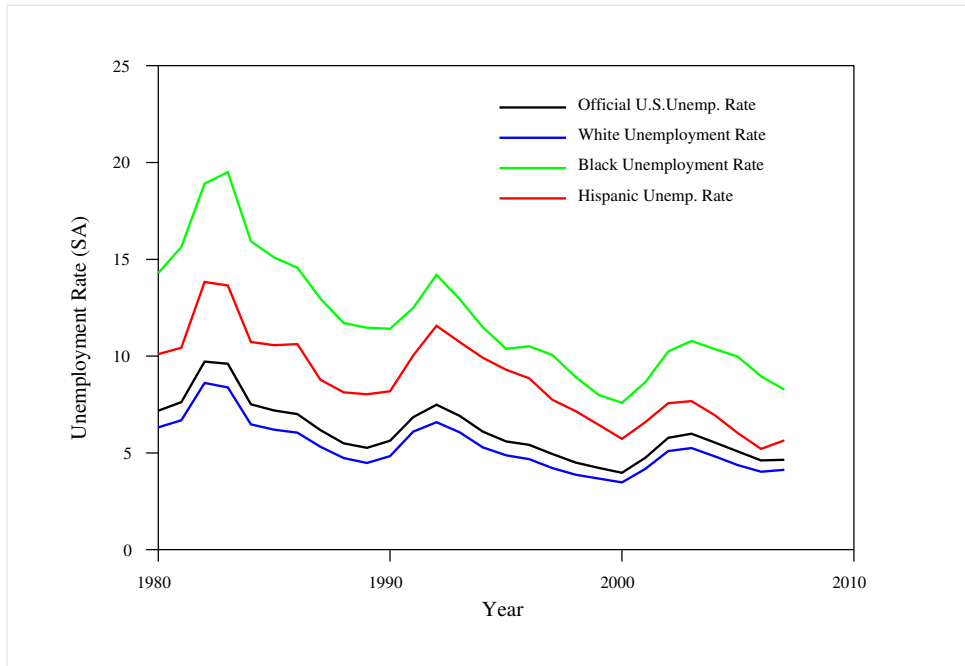
Figure 1.   Unemployment Rate in the United States, 1980 - 2008

unemployment ratio. The ratio can be used as a measure of inequality between that of minorities and whites. The ratio is calculated by dividing the minority unemployment rate over that of the white unemployment rate. Equality would be a ratio of one. African Americans continually are disproportionately affected by unemployment. The ratio has been between 2.0 and 2.5 since 1980. Hispanics have always had an unemployment ratio below that of African Americans, and has been steadily improving since 2000. The illuminating feature of Figure 2 demonstrates that while the overall trend improved, whites have been disproportionately favored. The economic boom of the 1990s benefited the white population over minorities. It is seen that during this period of economic expansion the Black-White and the Hispanic-White

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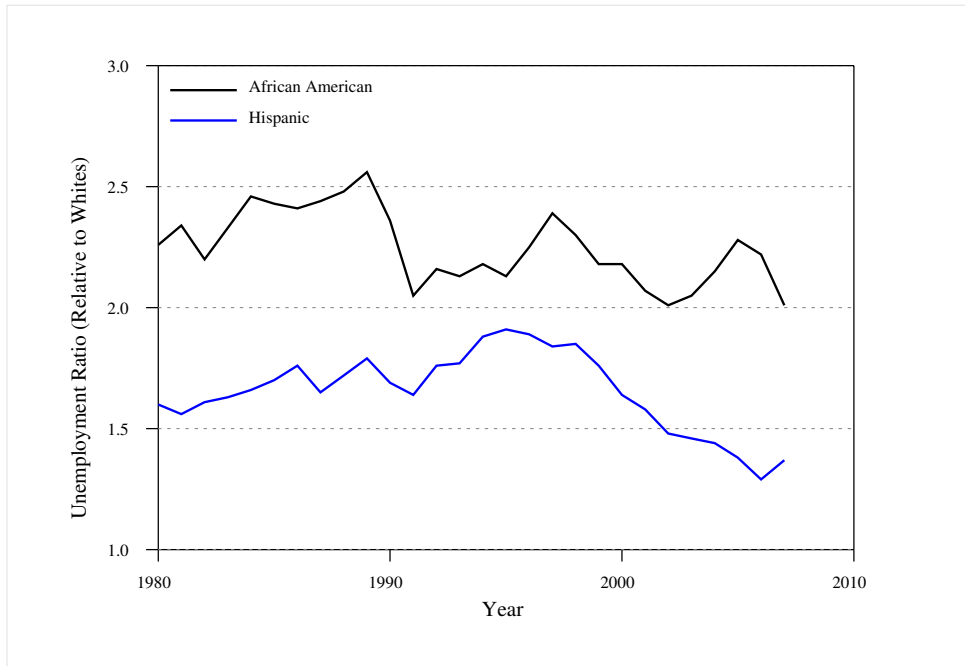
Figure 2.   Black/White, Hispanic/White Unemployment Ratio 1980 - 2000

ratios actually grew over the expansion, peaking at the height of the expansion, and having the smallest ratio during recessions (as is illustrated in 1991, 2001). This demonstrates that it is not that minorities are becoming better off, but rather that in general whites are worse off during periods of economic downturn, which closes this gap. The two figures together demonstrate that previous economic expansions, even in the 1990s, overwhelmingly favors the white majority population, while the minority population still struggles with unemployment rates devastatingly high. Furthermore it also demonstrates that even current economic policies have been unable to solve the problem of unemployment, and current policies have been unable to solve the disproportional distribution of unemployment which has been historically skewed

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unfavorably towards minorities, notably African Americans.

The relationship between unemployment and crime shows that for all crimes, but especially income generating crime, that crime rates and unemployment are positively correlated. A large literature on the subject occurred following the economic boom and the concurrent drop in overall crime in the 1990s. Between 1992-1997 the unemployment rate fell to a thirty year low to 4.5 percent while the crime rate dropped thirty percent (Raphael and Winter-Ebmer, 2001, 259). Politicians would like to claim that this drop in the crime rate was due to their 'war on crime'. But in actuality, what is more likely the case is that the crime drop was a result of the decade long economic expansion (Wallman and Blumstein, 2005, 319-348).
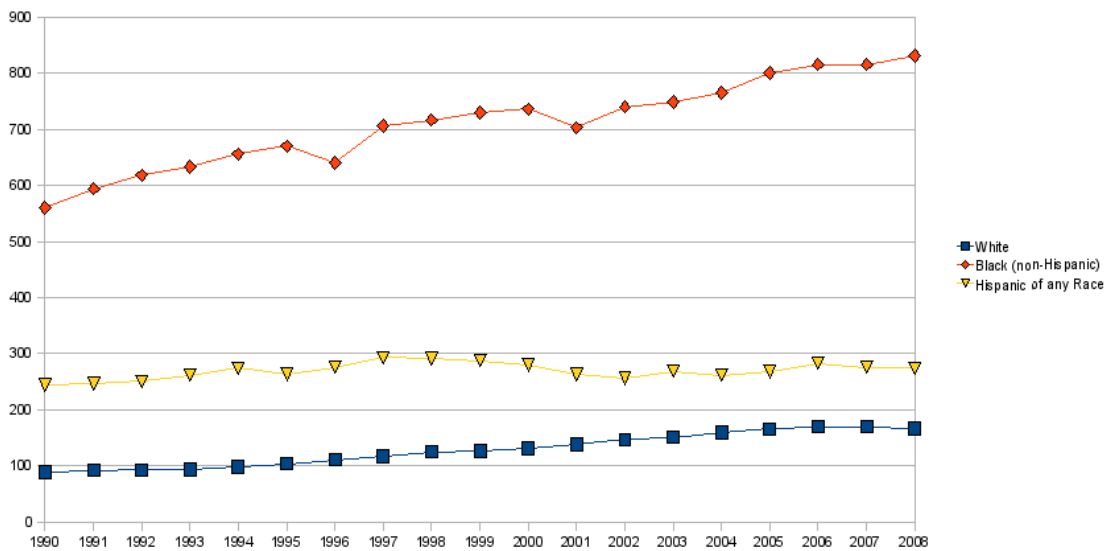
Figure 3.   Incarceration Rates by Race per 100,000 Residents

Turning to criminal behavior, just as minorities experience higher rates of unemployment than their white counterparts, so do they experience higher rates of criminal behavior. Using incarceration rates as a proxy for criminal behavior,[16] Figure 3[17] illustrates that minorities, especially African Americans have overwhelmingly higher rates of incarceration than whites. By population, African American's are the second highest minority group, yet their incarceration rates are not proportionate to their population relative to Hispanics and whites.

Figure 3 illustrates obvious disparity in incarceration rates between whites and non-whites. In addition, there is disparity in the length of incarceration. African American offenders lengths of incarceration is almost twice that of whites (Spohn, 2001, 433). "Racial disparity in the criminal justice system exists when the proportion of a racial or ethnic group within the control of the system is greater than the proportion of such groups in the general population (Nellis et al., 2008, 1)." However disparity is distinct from discrimination. Discrimination "is a difference that results from differential treatment based on illegitimate criteria, such as race, gender, social class, or sexual orientation (Spohn, 2001, 432)." Disproportionate rates of incarceration and lengths of prison sentences by race is evidence for racial dispar-

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[16]I have used incarceration rates as a proxy for criminal behavior because this is the best variable which there is accurate data for by race. There is accurate data for arrest rates but arrests do not imply guilt. Whereas, incarcerations occur only after the defendant has been proven guilty of criminal behavior. For this reason incarceration rates are used as a proxy for criminal behavior. However there are problems with this measure, especially as it concerns race, and these problems are discussed in the present section.

[17]Source: U.S. Department of Justice, Bureau of Justice Statistics

ity, however it does not imply racial discrimination. The disparity in the length of sentences of offenders may be due to differences in criminal activity between whites, blacks and Hispanics. Offenders who commit more serious offenses, use a weapon to commit their crime, cause injury or death to their victim, or have a prior criminal record receive harsher sentences. The longer length of prison sentences for black and Hispanic offenders could be because blacks and Hispanics commit harsher crimes, or are more likely to be repeat offenders than their white counterparts Spohn (2001). This is not to imply that discrimination does not exist. The differences could be result of economic discrimination between whites and non-whites as was presented in Figure 1. Blacks and Hispanics are more likely to be unemployed. Those who are unemployed may be sentenced more harshly than those who are employed (Spohn, 2001, 433). Thus while economic discrimination is not explicitly racial discrimination there is indirect racial discrimination (Spohn, 2001, 433), which has consequences in sentencing offenders.

> It is certainly possible that offenders with stable, well-paying jobs may be perceived as less dangerous and threatening than those with unstable, poorly paid, secondary sector jobs, who may be viewed as less dangerous and threatening than those who are unemployed. If this is true, the effect of race or ethnicity on sentence outcomes may be conditioned not only by the offender's employment status (i.e., employed or unemployed), but also by the quality of employment for those who are employed (Spohn and Holleran, 2000, 303).

Racial discrimination may not be disguised at all. Overt racial discrimination exists within the criminal justice system. As evidenced by Figure 3 Hispanics and blacks have higher incarceration rates than whites. Hidden in the figure is the fact that young black males have the highest incarceration rates than any other demographic

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(Steffensmeir et al., 1998). If, at least part of this was due to overt discrimination in the criminal justice system this implies:

> ... that judges who are confronted with black, Hispanic, and white offenders convicted of similar crimes and with similar prior criminal records impose harsher sentences on racial minorities than on whites. It implies that judges, the majority of whom are white, stereotype black and Hispanic offenders as more violent, more dangerous, and less amenable to rehabilitation than white offenders (Spohn, 2001, 433).

The stereotyping of minorities, especially young minorities is a result of *moral panic*, defined as "a condition, episode or group of persons emerges as a threat to societal values and interests; its nature is present in a stylised and stereotypical fashion by the mass media (Cohen, 2002, 1)." The evident stereotyping of blacks, especially young black males is given by Steffensmeier et. al (1998).

> Other evidence suggests that the crime-prone stereotype is apparently applied by some whites to blacks as a whole, but the most widespread aspects of this stereotype are evoked in reference to black males and particularly to young black males. Black males are portrayed by the mass media in a limited number of roles, most of them deviant, dangerous, and dysfunctional. However, the brunt of the stereotyping falls most heavily on young black males, whom the media and others refer to by a variety of labels: "dropouts," "delinquents," "dope addicts," "street-smart dudes," and "welfare pimps" (Steffensmeir et al., 1998, 769).

Racial discrimination does not stop with the media, but societies perception of minorities is also overt in the courtroom. A study by Carole Wolff Barnes and Rodney Kingsnorth (1996) sets out to test the hypothesis of judicial system racism. There conclusions are that judicial system racism does exist, and it serves as another reason why minorities have higher incarceration rates and longer prison sentences.

> African Americans are significantly more likely than Caucasians
> or Latinos to have their cases rejected or dismissed by prosecutors;
> Caucasians are more likely to be placed on diversion and to have their
> charges reduced to a misdemeanor; African Americans are more likely
> than Latinos who are more likely than Caucasians to receive a prison
> term; and, when sentenced to prison, African Americans and Latinos
> receive substantially longer terms than Caucasians (Barnes and Kingsnorth,
> 1996, 39).

Judicial discrimination may be a result of economic discrimination. Poor defendants are more likely to be unemployed and are less likely to have a private attorney and are less likely to be released prior to trial Cohen (2002). Detention prior to trial further increases the likelihood of incarceration.

> All of these factors may be related to sentence severity. Defen-
> dants represented by private attorneys or released prior to trial may
> receive more lenient sentences than those represented by public de-
> fenders or in custody prior to trial. Defendants who are unemployed
> may be sentenced more harshly than those who are employed. Since
> black and Hispanic defendants are more likely than white defendants
> to be poor, economic discrimination amounts to indirect racial dis-
> crimination (Nellis et al., 2008, 13).

Criminal behavior, and incarceration rates is not a simple functional relation-ship with a single variable. There are many factors that contribute to the disparity between white and minority incarceration rates. However this further substantiates the argument that the study of human behavior, here criminal behavior, can not be investigated from a single lens. There are many contributing factors. But economics, specifically income and employment, plays a factor in incarceration rates. Income and employment, or lack there of, for the minority population (specifically young black males) contributes to the negative perception of these groups by society and reinforces preconceived stereotypes. It is perhaps not a coincidence that young black

males have the highest unemployment rate of any demographic, the highest incarceration rate of any other demographic, and young black males create moral panic. This was addressed by Steffensmeir et al. (1998) in the above quote, that young black males are considered "deviant, dangerous, and dysfunctional" by whites.

Unemployment has been addressed as the key social problem. Unemployment contributes to poverty, psychological and mental anguish, criminal activity, and racism. So public policy put towards alleviating unemployment could be a large stepping stone to solve many other social problems, *including* criminal behavior. After the unemployment problem is addressed, it may be surprising the number of other social problems that are simultaneously addressed.

2.11 Employer of Last Resort Approach: Solution to Unemployment

The main issue is that the unemployed are viewed as what they are not. Since they are not employed, and in the official definition, sometimes not even part of the labor force, they are viewed in a negative light. Not only is confidence lost but important skills are lost as well. Nell (2000) gives a simple definition of why unemployment exists. There are simply not enough jobs. He states that in the aggregate businesses do not need to produce more goods and services than they are already producing. It is simply a demand problem. Therefore many skilled workers who would like a job simply can not find one. If lower income individuals have a higher tendency to be unemployed, then employing this group of workers will have a greater impact on the demand for goods and services because they have a higher marginal propensity to consume. This will cause employers to increase production, hire more workers, which will increase spending, which will then have multiplier effects in the economy until

the economy reaches true full employment.

This Keynesian argument then raises the question of how to spur effective demand. As was previously addressed, Keynes focused his attention on government spending as the catalyst to push the economy towards full employment. But instead of simply tax decreases or government spending on goods and services, what if government spending is used on direct job creation? This may not eliminate, but it will decrease the effects of insufficient effective demand. In addition it can promote racial equality by providing employment to minorities and other disadvantaged groups which have historically higher unemployment rates than that of whites.

This is where the Employer of Last Resort (ELR) program comes in. The nature of the ELR program is to guarantee public employment for those who are willing to work. The ELR approach to full employment has taken on renewed interest. Stemming from the earlier work of Hyman P. Minsky (1986) the government job guarantee approach to full employment is to hire off the bottom, hiring the workers who are unable to find private-sector employment. As Minsky argued:

> The policy program is two develop a strategy for full employment that does not lead to instability, inflation, and unemployment. The main instrument of such a policy is *the creation of an infinitely elastic demand for labor* at a floor or minimum wage that does not depend upon long- and short run profit expectations of business. Since only government can divorce the offerings of employment from the profitability of hiring workers, in infinitely elastic demand for labor must be created by government (Minsky 1986, 307).

Much focus in discussions of the ELR approach involves affordability and feasability. Concerning affordability the main proponents of the ELR approach take

a functional finance perspective, positing "...that any nation that operates it's own currency, and which adopts a floating exchange rate, can implement an ELR program, each nation might formulate the specifics of its program in accordance with it's own political and economic situation (Wray 2000, 1)." In making the case for an ELR program takes the functional finance perspective of government debt (see for example, Wray 2000; 1998, 155-176).

The functional finance approach to the ELR program is built upon Abba Lerner approach to government debt and deficits. This approach of Lerner (1943; 1947) is the theory of functional finance. The crux of his argument is that there can be no financial constraint on a government which operates a sovereign currency. The first law of functional finance states that the main financial responsibility of the government is to control the printing of money, so the supply of money in the economy is just sufficient to buy the whole of the output, at the full employment level, at current prices. In other words there is no financial constraint on a government, who is the monopoly issuer of its own currency to provide for both full employment and price stability. The ELR approach to full employment is a direct means of the government providing for full employment (and printing the money to do so) rather than providing fiscal stimulus and waiting for multiplier to kick in so that the private sector can provide jobs.[18] The second law of functional finance states that the government should borrow when it is desirable for the public to have less money to

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[18]Do not make this to mean that there are not additional advantages to the ELR sector than just being able to provide immediate unemployment. The major advantage to the ELR over regular fiscal stimulus is that the ELR maintains full employment even when the private sector is unable to do so. This point will be detailed and formalized in chapter 4

maintain positive interest rates. According to the functional finance view the government debt could just be considered the amount of bonds which needed to be sold to maintain positive interest rates. The government debt is not really a "debt" in the conventional term, rather the government debt can be considered the interest rate maintenance account Wray (1990)

It is the personal view of the author that regardless of one's perspective on budget deficits, the functional finance perspective or otherwise, it is still important to devise estimates as to the cost of such a program. The 2000 estimate of the cost on the implementation of the ELR stood at 100 billion dollars (Wray, 2000).

Employing workers from "off the bottom" has obvious stimulus effects. Employment provide stimulus for individuals to increase their spending in the private sector. Given that lower income people, under a Keynesian framework, have a higher marginal propensity to consume, this will provide the necessary initial boost in demand for employers in the private sector to increase investment, and increase output to satisfy the additional demand. Increased production in the private sector will then cause an increase in the demand for workers. Workers will then move from ELR employment to private sector employment (see Forstater 2000, Tcherneva and Wray 2005, Carlson and Mitchell 2002). The ELR program will move countercyclically to the business cycle. Government spending on an ELR program will then also be countercyclical.

An ELR program is an improvement upon unemployment insurance because instead of the government paying unemployed individuals to not work through the

issuance of unemployment checks, they are paying workers to work. Keeping this group of workers employed maintains skill-levels, reduces the previously discussed social costs of unemployment, and quickly alleviates the insufficient effective demand problem as addressed by Keynes (Wray, 1998). Not only does an ELR program address these concerns, but it has been proposed that the ELR program can also provide education and training for workers. Keeping workers trained and employed will increase their productivity thus lowering costs to private sector production. It also fully addresses the unemployment problem from all sides because an ELR job would be offered to anyone with the willingness to work, regardless if they were structurally or technologically unemployed or if their unemployment was simply due to a stagnate economy. The ELR program leaves out only the voluntary unemployed, and those who are unable to work due to age or health issues. In these latter case, existing government programs can still provide for these individuals even with an ELR program.

CHAPTER 3

HETERODOX APPROACHES TO PRODUCTION

The current chapter will be a critical examination of the approaches of structural models of production. Structural modeling is used in the second stage of Lowe's instrumental approach. The second stage of instrumental analysis requires a microeconomic investigation of the structure of the economic system. Decisions regarding production and distribution for an industry are not independent of other industrial sectors. The production is interconnected both within a given sector and across industrial sectors. The path to full employment requires first an analysis of the interworkings of the system of production. However, there is not simply one approach used to model productive processes. The current chapter sets forth to provide an overview, and analysis of competing production models. The chapter will explore the merits and deficiencies of competing methodology, and an appropriate methodology will be chosen for further simulations of the ELR program.

Structural modeling is a methodology which represents the economic system by it's physical network of flows of produced goods and services and by the institutional arrangement behind the production of goods and services (Baranzini and Scazzieri, 1990, 243). This is the approach which has been taken up by Marx, Leontief, Lowe, Hicks and others. Structural modeling, in some instances, allows for a further socioeconomic investigation of economic relationships. These approaches to structural modeling, namely that of Leontief and Lowe, allow for a deeper analysis of integrating social aspects of production and distribution, what Lowe termed 'middle principles'.

> [D]eterminateness of reasoning is secured by inserting some middle
> principles into the categories of a pure theory of exchange, and in both
> cases the purport of these principles is a sociological one, pointing to
> certain objective institutions and subjective rules of conduct, which
> prevail in the society under consideration (Lowe, 1935, 98-99).

Generally for Lowe, economic theory, and specifically instrumental inference requires a proper consideration of "objective institutions and subjective rules of conduct." The institutions described by Lowe can be generalized by a structural model of production. This generalization is on the assumption that the actions and behaviors of the capitalist class and working class are each directed toward their own, however conflicting, objectives. The structural framework allows for a concentration of the structural and social forces which either allow for, or prevent due to institutional constraints, the achievement of our stated macro-goals. If through the structural models it can be shown that a full employment level of production, consistent with environmental sustainability, cannot be achieved through market forces alone, the structural model then allows for an analysis of appropriate intervention towards achieving these macro-goals.

There are two, broadly speaking, methodologies used when studying production. Production may first be viewed as 'mapping' (Scazzieri, 1993) the quantities of inputs to quantities of outputs in which there is circular production. This approach is that of the input-output approach of Leontief (1986), and the "production of commodities by means of commodities" approach of Sraffa (1960). The second view, production can be classified as a series of transformation stages, from intermediate inputs to final goods. This sequential process of transformation has its roots in the Austrian (Hicks, 1965) and neo-Austrian (Hicks, 1973) theory of J.R. Hicks, and a

variant of this approach is found in Pasinetti (1981, 1993). Finally there is a third approach, the Post-Classical models of Lowe (1976). Lowe's formulation takes into consideration both the circularity of production as in the input-output approach, and the transformation of inputs through successive stages of production. Lowe's model is appropriate for highlighting the bottlenecks in the production process.

One of the central concerns is the consideration of historical time. The incorporation of new technologies into production is always time intensive. The economy is always moving in a uni-directional path in historical time. What is of concern is the "evolution of disequilibrium over time (Hagemann, 1995a, 202)". This is what Hicks (1973, 81) and later Lowe (1976, 10) termed "traverse-analysis", which is the out of equilibrium analysis of an economy's path dependent processes through historical time (Kriesler, 2003, 355-359).

Hicks and Lowe set out to construct a detailed analysis of the disequilibrium path through which the economy moves. Hicks' (1965) initial attempt of traverse analysis began as a Marxian-type (or Sraffian) two sector model with one capital good. However later in life, Hicks moved away from the 'classical' traverse, to studying the disequilibrium path in a more neoclassical (neo-Austrian) setting. Hicks' (1973) neo-Austrian model highlights the stages of production to turn original material into final consumer goods. Given the nature of neo-Austrian models, Hicks fails to adequately treat the nature of fixed capital, and in addition fails to highlight the critical role of the machine-tools sector as addressed by Lowe.

Lowe develops, what may be termed as an instrumental traverse. Lowe's work in production models was towards the discovery of the path or paths, that the

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economy moves along to reach it's predefined, goal-oriented, equilibrium state. The instrumental traverse is connected with Joan Robinson's teachings that where the economy ends up is a path-dependent process. This is why Lowe takes the instrumental, or backwards looking approach. The instrumental approach begins at the final state, and then it is precisely because the system is path-dependent that the instrumental approach maps out the required path or path towards the achievement of the macro-goals. Joan Robinson is correct on these two points, that any equilibrium state is path dependent, and that the economic system is more likely to be in disequilibrium than in equilibrium. Here Lowe uses the concept of the traverse to develop an instrumental traverse, i.e. the devising of a path(s) that will only lead to the predefined macroeconomic goals.

The traverse differs from economic growth. It is natural that an economy exhibits growth, if nothing else, due to the natural growth of the population. The traverse, is the study of the *movement* of the economic system, the disequilibrium path, from one equilibrium growth rate to another. This can be caused by changes in level or composition of the labor force, changes in the availability of natural resources, and to changes in the technological structure of production.

Before the investigation of the traverse, we turn to outlining competing models of production. From here we will investigate the reproduction models of Marx and Leontief, before turning to the vertical integration technique of Hicks and Pasinetti, and the Post-Classical structure of Lowe.

3.1   Competing Models of Production

The structural model of production in the horizontal (or circular) approach defines the division of labor in the economic system, sets out to determine the exchanges required for reproduction, and sets the requirements for capital accumulation and economic growth. The structural model defines the technical and social framework required for sustainability. The production structure is determined by defined sets of technical and social relationships. These relationships in turn dictate the level of production, price formation, the level of employment, and the level of consumption. All that can be altered is the composition of productive output and the composition of consumption given: 1) the current production structure, 2) the state of technology, 3) the supply of labor, and 4) the current level and usage of natural resources. The economic system defined by the structural model of production provides an alternative understanding of the economy. To use Lowe's term, the structural model of production defines the *knowns*- the economic data, that describes any economic system (Bortis, 1990, 64-69).

3.2   Marx's System of Reproduction

> Whatever the social form of the production process it has to be continuous, it must periodically repeat the same phases. A society can no more cease to produce than it can cease to consume. When viewed, therefore as a connected whole, and in the constant flux of its incessant renewal, every social process of production at the same time is a social process of reproduction (Marx, 1990, 711).

Modern day production theory, all variants of it, owes a debt to Karl Marx. As illustrated in the above quotation, Marx makes clear that above all, for society to sustain itself production requires reproduction. Exchanges among capitalists and

between capitalist and laborers are required for the viability of capitalist society. Clearly, when society is being "reproduced" it is the reproduction of an exploitive system. Just as capital is being reproduced to replace worn out capital equipment, capitalists just as consistently produce and reproduce the worker as a wage-laborer. Marx is an important starting point and fundamental to our understanding of how the economy may move to a level of production consistent with full employment and environmental sustainability.

To gain an understanding of Marxian simple and expanded reproduction models it is imperative to understand Marx's theory of surplus value. Marx's biggest accomplishment to economic science was the theory of surplus value, and the discovery of the basic 'laws of motion' of the capitalist system. First the capitalists are compelled to accumulate. Capital appears in the form of accumulated money. Competition is foremost the prerequisite for accumulation. While surplus value is produced in the process of production it is realized in the process of circulation. Surplus value is increased through the cutting of production costs, or in Marx's terminology, the cutting of necessary labor time, which cuts the variable cost to production. Capitalists are limited in the degree which the variable cost of production can be cut. First there are limitations to the length of the working day (Marx, 1990, 341). The day itself is limited to 24 hours, and no one laborer can work both days and nights. This limitation introduced the shift-system (Marx, 1990, 367-370). The introduction of the 24 hour work day and seven day work week allowed for the maximum amount of surplus value to be achieved. However, the working day is still limited to 24 hours, creating a limitation for capitalists to expropriate surplus value. The other limitation

to the expropriating surplus value is the wage rate. At a minimum the laborers will have to be paid a subsistence wage. However beyond this there are both worker's resistance to wage cuts and wage-rate requirements set by law (Marx, 1990, 900-902). Because of these limitations to cutting necessary labor time, capitalists are motivated to search for other variable cost saving techniques. In the end, Marx suggests that these limitations leave capitalists with a constant drive towards technological innovation.

> The accumulation of capital, which originally appeared only as its quantitative extension, comes to fruition, as we have seen, through a progressive qualitative change in its composition, i.e. through a continuing increase of its constant capital component at the expense of its variable component (Marx, 1990, 781).

Technological innovation frees up labor costs, thus increasing the surplus value for the capitalists. The additional surplus value may then be used fully towards capitalist's own consumption (in his simple reproduction models), or a portion or all of the surplus value may be applied towards accumulating additional capital (expanded reproduction models). Given that competition breeds innovation, the capitalists strive to accumulate *new* labor-saving capital goods rather than *old* forms of capital. Overtime technological advancement in the capital goods sector is what frees labor and increases the reserve army of the unemployed. Again, for Marx unemployment is natural, but also functional, as technological improvement leads to an increase in the reserve army of the unemployed which favors the capitalist class in keeping wages at the subsistence level and serves as a disciplinary device for the laborers (Marx, 1990, 784).

The representation of the required transactions of both intermediate goods

and the distribution of final consumption goods is seen easily in Marx's models. The basis for introducing production models for Marx is to illustrate the breakdown of the social annual product between the parts required for the replacement of capital, and the parts which are consumed by the workers and the capitalists for social reproduction. In doing so, Marx is able to illustrate how production, and reproduction of both the capitalist and working class also ensures the reproduction of the existing class-based, exploitive, social structure (Marx, 1992, 468).

To describe reproduction both on a simple and expanded scale, Marx separates the economy into two sectors (or what Marx terms as departments). Department 1 consists of the *Means of production* which describes "commodities that possess a form in which they ... enter productive consumption", and Department 2 is the *Means of consumption*, which describes "commodities that possess a form in which they enter the individual consumption of the capitalist and the working class (Marx, 1992, 471)."

Marx further breaks down the capital applied to each of these departments. *Variable capital* is the labor power required for production of output in both departments. The value of labor is equal to the sum of wages paid to the laborers. The second component to capital is *constant capital*. Constant capital is the physical inputs applied in the process of production. Marx further divides constant capital into two main categories in order to make a distinction between stocks of and flows of constant capital. The stocks of constant capital Marx coins as *fixed capital*. Fixed capital is the "machines, instruments of labor, buildings, draught animals, etc. (Marx, 1992, 272)" which is not entirely consumed in the process of production. The constant capital flows or *circulating capital* are the "materials of production, such as raw and

ancillary materials, semi finished goods, etc. (Marx, 1992, 472)."

<center>Simple Reproduction</center>

The value of the total annual product created by production in these two departments breaks down into three components: 1) the value of constant capital which is consumed in the process of production (c), 2) the replacement of the variable capital (v), and 3) the value in excess of these is surplus value (s). The total annual product of each department is $c + v + s$.

$$\text{Department One:} \quad C_1 + V_1 + S_1 = O_1 \tag{3.1}$$

$$\text{Department Two:} \quad C_2 + V_2 + S_2 = O_2 \tag{3.2}$$

In Equation 3.1 and Equation 3.2 the total value of the annual product is equal to $O_1 + O_2$. The two departments together illustrate the transactions necessary for social reproduction to take place. That is, worker's wages in Department 2 and the workers wages in Department 1 must be spent on the means of consumption. The amount spent on consumption goods is equal to $V_1 + V_2$. However, under simple reproduction (i.e. no capital accumulation and no expansion) the surplus value, $S_1 + S_2$ of the capitalist in Department 1 and Department 2 must also be spent on consumption goods.

The exchange required between Department 1 and Department 2 is that $V_1 + S_1$, which is the value spent on consumption goods, must be equal to the value of

constant capital, C_2 which is delivered from Department 1 to Department 2. The constant capital in Department 1, C_1, are means of production, which can only be used in Department 1 and is used to replace the constant capital used up in Department 1.

The following are identities in Marx's reproduction model. These identities represent the exchanges which take place among departments and between departments for the simple reproduction of society (Gussani, 1991, 471-472).

$$C_1 + C_2 = O_1 \tag{3.3}$$

$$V_1 + S_1 = C_2 \tag{3.4}$$

$$V_1 + S_1 + V_2 + S_2 \quad = O_2 \tag{3.5}$$

Marx's reproduction scheme illustrated quantitatively in equations 3.3 - 3.5, does not only describe the reproduction and exchanges of goods in value terms, but these values represent at the same time physical material exchanges that take place for simple material reproduction. However here there is no economic growth.

Expanded Reproduction

Simple reproduction models simply set out the necessary requirements for social reproduction. Marx's seminal contribution is an analysis of capitalistic production in which the drive is to create a system in which labor can be exploited to it's fullest extent and then work to continually reproduce this system, and if possible alter the

system to exploit the laboring class to an even greater level.

If one were to aggregate both departments, the amount of labor time employed (L) is broken down into variable capital (i.e. the value of workers labor) and surplus value. Here $L = s + v$, likewise $s = L - v$ (Marx, 1973, 398). So as is easily represented by this equation, for economic growth to occur production must expand. A prerequisite for economic expansion is the requirement of capital accumulation. In turn capital accumulation is only possible if capitalists choose to expend a portion of the surplus value obtained on new capital. They must be able to decrease the amount of money paid to labor in the aggregate, thus by lowering v.

Under expanded reproduction, the surplus value which is now utilized for capital accumulation is: $s_1 = \Delta c_1 + \Delta v_1$; and $s_2 = \Delta c_2 + \Delta v_2$. From the identities given in 3.3 - 3.5 it is seen that:

$$c_1 + v_1 + \Delta c_1 + \Delta v_1 \quad = \quad O_1 \tag{3.6}$$

$$c_2 + v_2 + \Delta c_2 + \Delta v_2 \quad = \quad O_2 \tag{3.7}$$

Assume the proportion of surplus value which gets transferred between constant and variable capital are k_{c_i} and k_{v-i} (where $i = 1,2$) respectively, the proportions of which must sum to one. These equations can then be substituted into Equation 3.6 and 3.7 respectively. It yields:

$$O_1 = c_1 + v_1 + k_{c1}s_1 + k_{v1}s_1 \tag{3.8}$$

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$$O_2 = c_2 + v_2 + k_{c2}s_2 + k_{v2}s_2 \tag{3.9}$$

From equations 3.8 and 3.9 the exchanges required for expanded reproduction can be deduced. Department 1 must sell v_1 and $k_{v1}s_1$, and it consumes c_1 and $k_{c1}s_1$, which are the means of production. Department 2 likewise sells c_2 and $k_{c2}s_2$, and consumes v_2 and $k_{v2}s_2$. This result is under the assumption that capitalists consume nothing and invest all of their profits.

The principal means of achieving greater profits has been through an advancement in labor productivity (Marx, 1973, 399), while holding the length of the working day constant. Technological advancement will reduce the necessary labor time paid by the capitalists down to subsistence wages. As a result, technological advancement further expands the length of the working day which is non-necessary, or being the same thing, increasing the number of non-necessary working days. It is then seen that decreasing the value of variable capital in relation to the constant component of capital goes hand in hand with accumulation. As suggested by Marx, if the ratio of constant to variable capital was 1:1, given capital accumulation this ratio may grow to 2:1, 3:1, 4:1 etc. So that instead of $\frac{1}{2}$ of the total value turned into labor power, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, etc. is turned into labor power while the remainder in each successive period is turned into the means of production (Marx, 1990, 781).

> The working population [through an ever rapidly increasing organic composition of capital] produces both accumulation of capital and the means by which it is itself made superfluous; and it does this to an extent which is always increasing (Marx, 1990, 783).

Technological advancement is the essence of Marx's overall theory of capital-

ism. Technological advancement is fundamental to the ever higher and higher rates of surplus value given the constraints capitalists face as to the wage level and the length of the working day. Decreasing the necessary labor time towards the production of commodities is further constrained by the technique of production. However the technique of production is the only variable which capitalists can affect. The only option capitalists have is towards continual technical advancement in order to free up labor and increase the capital-labor ratios, given that the wage and the working day are held constant. Thus the causality in Marx runs from technological advancement, to an increase in the reserve army, to an increase in surplus value, to further technological advancement, etc. Again the interesting paradox in Marx is that technological advancement and in turn capital accumulation is made possible only through labor power. Hence laborers recreate, and expand, a system which is to their detriment.

3.3   Leontief System

Wassily Leontief has credited Marx for "developing the fundamental scheme describing the interrelationships between consumer and capital good industries (Leontief, 1966, 77)." Leontief himself also set out to show the mutual interdependence of industries. In doing so, Leontief developed the interindustry, input-output approach to modeling production.[1] This approach is a return to the classical approach discussed in Smith and Ricardo and is based upon the foundation of the structure of production which was laid by Marx. In the input-output approach, production is not a simple vertical succession between original factors of production to factors of consumption

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[1]Although lesser known, Alfred Kähler simultaneously did research on the same input-output approach (Gehrke, 2003, 142-157).

(Leontief, 1966, 76). The central theme of production is one of a circular flow, which suggests that the same goods appear as both inputs and outputs in the process of production. Commodity production is described as a *social*, historical process, rather than stemming from a natural origin.

> Leontief draws attention to an important feature of the reproduction model, which is often assumed to be characterized by a perfect symmetry between factor inputs and the output. Here on the contrary 'outputs of one year can become inputs of later years, but not vice versa' (Leontief, 1987, 863), which involves a precise sequence in the time profile of production of commodities and of their use as inputs for subsequent processes of production (Baranzini and Scazzieri, 1990, 233).

Leontief, through the development of the input-output technique, set out a direct factual study of the structural properties of production and distribution. Modern day input-output models are constructed from data that can be directly observed for a particular economic area; normally nations, states, and other smaller, but strictly defined regions. The I-O model describes the exchanges in the economic system through illustrating the sales and purchases of physical goods (Leontief, 1987; Leontief, 1986, 41-54; Miernyk, 1969, 9-30; Miller et al., 2009, 10-62). The I-O data produced are normally in monetary (usually in producer's prices) terms. This character may perhaps be a drawback of I-O analysis as changes in the magnitudes of the exchanges conflate both changes to price and quantity of output. Thus the model does introduce problems with changes in input prices which are not reflected by changes in the quantity of inputs.[2] However the I-O tables are left in monetary terms as measuring

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[2]Such problems could arise when using input-output models as a forecasting tool. When constructing input-output multipliers, the results make an assumption that

in physical terms introduces a whole host of measurement problems when industries sell more than one good (Miller and Blair, 1985, 7). This does not have to be the case when modeling within an I-O framework. Leontief himself models the input-output relationships both in monetary terms and in physical quantities.

The I-O relationships are described by the transactions table. The transactions table represented in Table 1, summarizes the transactions that take place within a given time interval in the economy. The rows of the table illustrate the distribution of producer's output throughout the economy, whereas the columns of Table 1 describe the composition of inputs required by a particular industry to produce its output.

The "Final Demand" columns of the transactions table, depicted in the column "GDP" which is the sum of the columns "Consumption" and "Investment." GDP is normally broken down even further into five individual components: 1) government expenditure, which is determined by the current state of the domestic economy and the international community, 2) consumption expenditures, decisions regarding the quantity and composition of aggregate consumption are based upon tradition and societal norms, 3) investment[3] where decisions towards investment are based upon

these are quantity changes, i.e. if additional output is forecasted, the value represented is still in monetary terms, however the monetary increase in aggregate output is assumed to represent an increase in quantity produced represented in the tables by a total increase in its aggregate value. In other words input-output multiplier analysis, even though measured in dollars, represents changes in quantity produced, not price changes. For an introduction to these issues see Miller and Blair, 2009, 243-258, and Miernyk, 1969, 30-55.

[3]Investment is further broken down into private fixed investment and change in private inventories. *Private fixed investment* is investment in real capital by indus-

Table 1. Hypothetical Input Output Table

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	100	20	50	350	200	**720**	250	200	**450**	**1170**
B	80	40	20	140	150	**430**	150	150	**300**	**730**
C	300	10	60	410	300	**1080**	270	120	**390**	**1470**
D	200	50	60	80	150	**540**	290	220	**510**	**1050**
E	90	35	40	200	120	**485**	220	170	**390**	**875**
Int. Purchases	**770**	**155**	**230**	**1180**	**920**	**3255**	-	-	-	-
Wages	236	236	236	236	236	-	-	-	-	-
Profits	200	150	120	220	170	-	-	-	-	-
Total VA	**436**	**386**	**356**	**456**	**406**	-	-	-	**2040**	-
Total Income	**1206**	**541**	**586**	**1636**	**1326**	-	-	-	-	**5295**

the requirements for a given level of total output 4) expenditures on exports and 5) revenue from imports, where decisions to export and import are based upon decisions of the domestic and international community and their economic relationships.

Table 1 illustrates the necessary transactions between the productive sectors of the economy at a given point in time for a given state of technology. This is in relation to the final demand of GDP. It makes economic sense that final demand is independent of the processing sector (the upper left hand corner of the table). Final Demand is given by economic decisions, and can be considered exogenously determined. The input output table provided in Table 1 can be considered as a snapshot of the model economy with the outputs in each sector in the horizontal rows, and inputs in each sector in the vertical columns.

The value added rows are equal to the quantity of laborer employed (L) times the wage rate (w) plus the predetermined profit margin (pm). Following this division, national income is then equal to the summation of value added, which is subdivided between wages and profits less taxes and subsidies, the proportion of which is socially determined.

The physical output in the ith sector in Table 1 can be denoted as q_i. Therefore q_{ij} is denoted as the amount of product produced in sector i delivered as an input to sector j. The coefficients in Table 2 are ratios and can be easily generalized by $a_{ij} = \frac{q_{ij}}{qj}$.

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tries. It is the physical machinery that is used for the means of production and for the replacement of depreciating capital worn out from the previous period. *Change in private inventories* is the change in the physical volume of inventories owned by private business which are valued at the average prices for that period.

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Table 2. Input Output Coefficient Matrix

Input/Output	A	B	C	D	E
A	0.085	0.027	0.034	0.333	0.229
B	0.068	0.055	0.0136	0.134	0.171
C	0.256	0.014	0.041	0.286	0.343
D	0.171	0.068	0.041	0.076	0.171
E	0.076	0.048	0.027	0.190	0.137
Labor	0.202	0.323	0.161	0.225	0.270
Profits	0.171	0.205	0.082	0.209	0.194

3.4 The Price and Quantity Model in the Leontief System

The balance between total output and combined inputs is described in the above tables can be generalized as:

$$\mathbf{A} \times \mathbf{Q} + \mathbf{Y} = \mathbf{Q} \tag{3.10}$$

Solving 3.10 for $\mathbf{Y}$ yields:

$$\mathbf{(I\text{-}A)} \times \mathbf{Q} = \mathbf{Y} \tag{3.11}$$

$$\mathbf{l} \times \mathbf{Q} = L \tag{3.12}$$

Where L is the total labor force, and $\mathbf{l}$ is a $n \times 1$ row vector of labor coefficients.

From Equation 3.11 $\mathbf{I}$ is an $(n \times n)$ identity matrix, $\mathbf{A}$ is an $(n \times n)$ interindustry matrix of technical coefficients, $\mathbf{Q}$ is a $(n \times 1)$ unknown quantity column vector, and $\mathbf{Y}$ is $(n \times 1)$ column vector, representing exogenously determined final demand.

Analogous to this, the pricing model can be demonstrated, where the column vector $\mathbf{V}$ is a $(n \times 1)$ vector of exogenously given values added, which in the present case does not consist of any fixed capital stocks. In this case, the value added in each industry is equal to the amount paid out to wages. Lastly the price vector p_i is unknown. Thus:

$$\mathbf{P} \times \mathbf{A} + \mathbf{V} = \mathbf{P} \tag{3.13}$$

The solutions for $\mathbf{Q}$ and $\mathbf{P}$[4] are represented by:

$$(\mathbf{I} - \mathbf{A})^{-1} \times \mathbf{Y} = \mathbf{Q} \tag{3.14}$$

$$\mathbf{V} \times (\mathbf{I} - \mathbf{A})^{-1} = \mathbf{P} \tag{3.15}$$

The Leontief inverse $(\mathbf{I} - \mathbf{A})^{-1}$ represented in Equation 7 is described as the matrix multiplier. Final demand is related to output in a very Keynesian fashion. A growth in final demand for consumption and/or investment goods ($\mathbf{Y}$) must be met by a growth in output ($\mathbf{Q}$), proportioned by the inverse of the technology matrix $(\mathbf{I} - \mathbf{A})^{-1}$. I.e.:[5]

$$(\mathbf{I} - \mathbf{A})^{-1} \times \Delta \mathbf{Y} = \Delta \mathbf{Q} \tag{3.16}$$

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[4]The conditions that guarantee positive solutions for quantities $\mathbf{Q}$ and prices $\mathbf{P}$ is that $\mathbf{A}$ is a positive semidefinite, nonsingular matrix with a maximum eigenvalue less than one. See Pasinetti (1977) 266-276.

[5]See Leontief, 1986, 19-41; Miller et al. 2009, 10-71;

The quantity of total employment[6], L, is given by:

$$L = a_n q_1 + a_n q_2 + \ldots + a_n q_{n-1} + y_n \tag{3.17}$$

This only reflects the level of employment, it does not suggest that the economy is at full employment. Let L_{max} = total labor force in the economy. The economy is only at full employment if and only if:

$$L_{max} = L \tag{3.18}$$

Equation 3.18 it may be noted that if $L_{max} > L$, unemployment exists by the difference $L_{max} - L$. Even if unemployed workers are willing to work at the going wage rate, there is still no desire for firms to hire because all that is being supplied is being sold either as interindustry inputs or as final demand. This relationship is seen in Equation 3.18 which demonstrates total employment is equal to total output in the economy, which is ultimately driven by the level of final demand of goods (both consumption goods and investment goods) and services (Leontief, 1986d; Pasinetti, 1977; Kurz and Salvadori, 1995).

The effective demand condition in Leontief's model is that the value added component (the sum of wages and profits) must be equivalent to the value of final demand of the economy and it is not necessary for this to correspond to the full employment level. Keynes and Post Keynesians alike have advocated for expansionary fiscal policy to drive up effective (final) demand until the level of final demand corre-

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[6]Labor is assumed to be homogenous

sponds to full employment. For current purposes it would be noted that even in a five sector model economy, any demand stimulus through an increase in government expenditures (a component of final demand) must also be correlated with an additional supply of goods and services. The need for increased inputs of intermediate goods in any given sector (or sectors) creates a supply response, and in turn creates additional employment in the sectors whom are the suppliers of these intermediate goods. It was seen that sectors are intimately linked with one another. When the economy is moving forward the creation of a proportionate increase in orders for intermediate goods (say in sector i) is governed by the capital-output ratios of sector j. This in turn creates an increase in the demand for employment in sector i, the quantity of which is based upon the capital-labor and labor-output ratios. Increased employment creates a further increase in the demand for consumption goods, which spurs another round of final demand stimulus, and so on and so forth. (Miernyk, 1969, 42-55). However, Keynesian demand stimulus can only go this far under the assumption of a given technique of production. This is rarely, if ever, the case, as continual technological innovation and investment is a natural consequence of the competitive forces of capitalist economies (Pasinetti, 1981, 68-71). Technical progress implies the formation of new capital which when set into motion lowers the production costs. Overtime technical advancement may create an expulsion of laborers from the process of production (Pasinetti, 1993, 50-55). Given these dynamics, aggregate demand stimulus can only reduce the level of unemployment. Because technical progress is assumed to be a *continual* process, it follows that aggregate demand stimulus is incapable of both the attainment and maintenance of full employment in the long run (Pasinetti,

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1993, 58-59).[7]

Essentially the argument that I am making in this thesis is that fiscal stimulus is always responding to unemployment. Government response to unemployment is always ex-post. Also I am assuming, following Pasinetti (2007, 279-288; 1991) that both expansion to the labor supply because of population growth, and labor-displacing technical progress, are both continuous variables. Further technical progress will have contemporaneous effects on the level of unemployment. Given these assumptions on the nature of technical progress and population growth, fiscal policy to both Marxian and Keynesian unemployment will always be responding to unemployment. In essence the government will always be catching up. True full employment can neither be attained nor maintained for any significant period of time given continual technological progress. This conclusion is due to the ex-post nature of government's response. Therefore true full employment can only be *maintained* if both effective demand and structural and technological change are considered (Pasinetti, 1993, 36-59; 1981, 80-108). Furthermore fiscal policy must be designed to respond to unemployment contemporaneously rather than responding to unemployment ex post.

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[7]The notion of technical progress as being a continuous function follows from the modeling approach of Luigi Pasinetti (1981, 1993, 2007). Furthermore Joan Robinson (1965) provides empirical observations of why technical progress is continual. Joan Robinson's argument is summarized in chapter 4, pp. 65-67. Furthermore, in general economic processes are modeled utilizing continuous, rather than discrete functions, since historical time is continuous.

3.5 Dynamic Leontief Model

All production processes must make use of stocks of input factors. The stock input is not used up in the production process as are the flow inputs represented in the $\mathbf{A}$ matrix, however we may allow for normal deterioration as the stock is being utilized. It is important to address the problem of unemployment from a different cause, namely from structural and technological change. Leontief introduces the capital stock $\mathbf{B}$ matrix[8] which describes the capital structure of the economy for a

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[8]The $\mathbf{B}$ matrix has the same properties as the $\mathbf{A}$ matrix. It is an nonsingular, positive semidefinite matrix, with a maximum eigenvalue less than one. This last assumption concerning the $\mathbf{B}$ matrix is of particular importance. A maximum eigenvalue less than one ensures stability. Furthermore, a maximum eigenvalue less than one also assumes a surplus (Kurz and Salvadori, 1995, 111). Meaning there is not full utilization of capital goods and in terms of productive capacity the system is always elastic. The reason why the economic system does not operate at full capacity is because of the unemployment of labor. With excess capacity, the problem of instability is solved. Arguments against the stability of the dynamic Leontief model has been presented by Jorgenson (1960). Jorgenson proves that the the dynamic Leontief model will result in unstable prices and quantities. This is because Jorgenson (1960a, 1960b) begins with the neoclassical assumption that "... (1) all output levels are at capacity and there are no excessive or deficient holdings of stocks; [and] (2) the output of each industry is equal to demands for current consumption and for investment in the expansion of capacity; there are no excess demands or excess supplies for commodities in the economy; (Jorgenson, 1960, 421)." Stability is important in dynamic input-output models because instability leads to price and quantity solutions which tends towards infinity. "If the dynamic input-output system is not macro-economically stable, the economic interpretation of the model cannot be retained (Jorgenson, 1960, 422)." If this was the case, the dynamic Leontief input-output model would not be useful to explain actual economic dynamics. However while Jorgenson's conclusion of the importance of stability is correct, the reasoning which causes the dynamic Leontief model to be unstable is based upon the neoclassical theory of full employment and full utilization. If this was not the case, and excess capacity were allowed to exist (as shown by Leontief (1953)) the dynamic Leontief model is shown to be stable. Steindl (1952) argued that investment decisions were based upon a planned

given set of technologies. Essentially the **B** matrix lies in the background of the interindustry **A** matrix, which is used to describe the flows of inputs, including labor, *given the current state of technology*, i.e. the **B** matrix. The interindustry **A** matrix must be a functional relationship of the capital stock matrix, **B**. Technological change is represented by one or more changes in the capital structure of the economy, i.e. changes in the **B** matrix. The coefficients of the **B** matrix are not fixed, rather changes to the **B** matrix then cause a related change to the flow matrix **A**. The capital stock matrix is depicted in the matrix 3.19.

$$
\mathbf{B} = \begin{bmatrix} b_{11} & b_{12} & \ldots & b_{1,(n-1)} \\ b_{21} & b_{22} & \ldots & b_{2,(n-1)} \\ \vdots & \vdots & \vdots & \vdots \\ b_{(n-1)1} & b_{(n-1)2} & \ldots & b_{(n-1),(n-1)} \end{bmatrix} \tag{3.19}
$$

The structure of the **B** matrix of capital coefficients is similar to that of the **A** matrix. It is of rank (n-1). The nth row and column of the technology matrix are all zeros in an open Leontief model. According to Leontief (1951), the capital coefficient b_{ij} is defined as:

[T]he technologically determined stock of the particular kinds of

---

degree of capacity utilization. Planned degree of capacity utilization is less than full utilization to allow for unexpected increases in final output. In *The Economics of Imperfect Competition* (1969) Joan Robinson makes a similar argument as Steindl in her introduction: "Imperfect competition came in to explain the fact, in the world around us, that more or less plants were working part time . . . firms could work their plants at less than full capacity and still earn a profit (p. vi)." The business enterprise can increase output without changes to the capital stock because capital operates on varying levels of capacity, thus allowing for system stability.

goods–machine tools, industrial buildings, "working inventories", of primary or intermediate materials–produced by industry i that industry j has to employ per unit of it's output. In other words, each column of matrix **B** describes the physical capital requirements (per unit of it's total output) of a particular industry, *in the same way that the corresponding column of matrix **A** describes it's "current inputs" requirements* (my emphasis) (Leontief, 1986d, 30)

The Leontief system describes the necessary capital stocks and input flows which are required for any given level of aggregate demand. The shortcoming to this point has been no analysis of technical change. Technological advancement would give change to the coefficients of the **B** matrix, *and* the **A** matrix. To discuss technological change we need to describe the functional relationship between the capital stock matrix and the input flow matrix. Furthermore, it is wrong to assume that technological advancement is instantaneous. Historical time needs to be incorporated. Thus we need to move past the static Leontief model into the dynamic Leontief input-output model

Structural and technological change may be introduced into a dynamic input-output model. To accomplish this task requires defining additional variables. Let Q_{it} equal output from sector i, produced in year t, and let **Y** equal a column vector of deliveries of final demand. Following the static framework, matrix **A** represents the flow matrix of current inputs and to introduce a dynamic framework, matrix **B** represents the capital stock matrix.

Historical time now can be considered within a dynamic framework. It is unlikely that investment goods produced in the current time period will be available for production within the same time period. To consider the time element, it is assumed that investment made in the current period will not be available for production un-

til the consecutive time period. Following this assumption, from the definitions just given, the input requirements for any level of final demand are:

$$\mathbf{Q}_t - \mathbf{A}_t\mathbf{Q}_t - \mathbf{B}_{(t+1)}(\mathbf{Q}_{(t+1)} - \mathbf{Q}_t) = \mathbf{Y}_t \qquad (3.20)$$

The left hand side of Equation 3.20[9] represents the current input requirements for all industries in year t, as well as the investment in capital required from year t to year $t+1$ to expand capacity from $\mathbf{Q}_t$ to $\mathbf{Q}_{(t+1)}$.[10] The time subscripts on the technical coefficients allow for an incorporation of technical change. This is consistent with the assumption that investment goods that are produced in year t, are installed and put into operation in the following year. The subscript on the capital goods matrix indicates the period in which the capital goods are put into operation, not when they were produced, which incorporates historical time into the model (Leontief, 1986b, 295).

It is seen that the dynamic input-output model is consistent with many of the assumptions of Post Keynesian economics. In this approach, ultimately the level of aggregate output and employment is driven by the level, or the expected future level,

---

[9]The **B** matrix does not consist of full capacity utilization. There will always be some planned level of unutilized capacity which allow businesses to respond to changes in demand. This than also resolves issues concerning the stability of the **B** matrix. Now that the **B** matrix consists of investment goods in the dynamic Leontief model, the final demand vector, **Y** now consists of only consumption and government goods.

[10]Investment is endogenous in dynamic Leontief input-output models. The models does not incorporate decision making of businesses regarding investment activity. This is a drawback of the dynamic Leontief model for heterodox economists.

of final demand. Further, it is a multi-sector framework which allows for an investigation of the socio-economic relationship among capitalists and between capitalists and laborers. Input output tables allow for an analysis of the interdependences between different industries. Along with this it incorporates important multiplier effects consistent with Keynes's demand driven approach in *The General Theory*. Also the dynamic model is consistent with the study of how the economy may traverse from one growth path to another predetermined growth path. Given the macro-goals that have been defined here, the important question is how is the system able to move towards an environmentally sustainable, full employment level of production. In order for full employment to be attained, proper adjustments in final demand need to be undertaken. This can be achieved through fiscal policy quite easily. But in a dynamic framework, changes in technique, detailed by changes in the make-up of the capital stock matrix, will create adjustments in the **A** matrix as well. Most notably, any adjustments to the level of employment as a new technique is introduced will create problems for full employment to be maintained. Simulations detailing the impossibility of the maintenance of full employment will be carried out in the forthcoming chapter. Here, after the introduction of the input-output methodology, it is clear that it is a suitable framework for modeling the traverse towards the macro-goal of full employment. The next question which will be addressed is whether input-output is a suitable framework for studying environmental sustainability.

3.6 Input-Output and Environmental Sustainablity

Pollution is a natural by-product of any production process. The level of pollution and types of pollutants are directly correlated to the level of production and

the given technique. If full employment is to be achieved and maintained, once environmental considerations are introduced the maintenance of production at the full employment level may not be desirable for ecological reasons.

Pollutants are byproducts of both production and consumption. The structural coefficient matrix of the national economy details the level of production and consumption. To include pollutant byproducts into the structural matrix interindustry coefficients requires the matrix to be partitioned into two sub-matrices as in Figure 3.6 (Miller and Blair, 2009, 475-478). The partitioned interindustry $\mathbf{A}$ matrix in Figure 3.6 is composed of two sub-matrices detailing interindustry production and pollution. Sub-matrix A_{11} is the normal interindustry coefficient matrix which have been dealt with. The component a_{ij} is the input of good i per unit of output of good j. The partition A_{21} describes the level and type of pollutant byproducts whose emissions are associated with the sectoral output. Likewise, component a_{gi} is the output of pollutant g per unit of output of good i produced by sector i. The partition $\mathbf{V}$ is the value added, wages and profits, as addressed earlier.

It has been seen (Leontief, 1986d) that the Leontief Inverse $(I-A)^{-1}$ describes the direct and indirect effect of \$1 million dollars worth of increase in final demand for the products of any given industry on the total output of this and all other industries. The level of pollutants must also increase in the same fashion. The pollution multiplier is simply the output of pollutants per industry output, times the multiplier. This is simply $A_{21} \times (I-A)^{-1}$.

The partitioned $\mathbf{A}$ matrix as introduced by Leontief (1986a) and shown in Figure 3.6 may be used to trace the increase or decrease in pollution given changes in

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$$\begin{array}{c} \boxed{\begin{matrix} \\ A_{11} \\ \\ \hline \\ A_{21} \\ \\ \hline V \end{matrix}} \end{array} = \left[\begin{array}{cccc} a_{11}\, a_{12} & \cdots & a_{1m} \\ \vdots & & \\ a_{m1}\, a_{m2} & \cdots & a_{mm} \\ \hline a_{m+1,1}\, a_{m+1;2} & \cdots & a_{m+1m} \\ a_{m+2,1}\, a_{m+2;2} & \cdots & a_{m+2m} \\ \vdots & & \\ a_{n,1} \quad a_{n,2} & \cdots & a_{nm} \\ \hline v_1 \qquad v_2 & \cdots & v_m \end{array}\right]$$
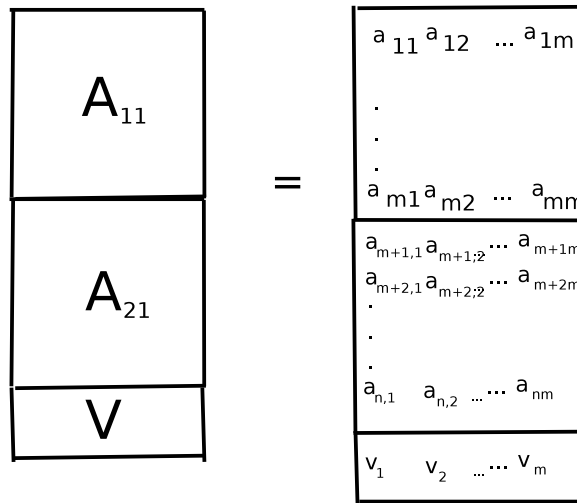
Figure 4.   Partition Interindustry Coefficient Matrix

final demand, or changes in the technical structure of the **A** matrix (Miller and Blair, 2009, 478-480).

Suppose that we have an economy as illustrated above in Table 1. There are five sectors, A through E. Now let U denote the generation of a specific pollutant, say carbon-dioxide. For the sake of illustration, given in the bulleted list below, assume the levels of pollutant for the given level of economic activity by sector. Even though these are only fictitious numbers, the idea is that the level of pollutants is directly measurable for each sector for a given level of economic activity (Leontief, 1986c).

- Sector A generated 80 pounds of pollutant
- Sector B generated 35 pounds of pollutant
- Sector C generated 110 pounds of pollutant
- Sector D generated 70 pounds of pollutant
- Sector E generated 50 pounds of pollutant

Let the subscript p denote pollution generation. Then following the notation

used above, $z_{pA} = 80$ pounds of pollution generated by Sector A, $z_{pB} = 35$ pounds

of pollution generated by Sector B etc. Thus the pollution generation coefficients a_{gi}

which was defined as the output of pollutants per unit of output of good i for Sector

A is $\frac{80}{1170} = 0.068$, Sector B, $a_{pB} = \frac{35}{730} = 0.0479$. The coefficient matrix in Table 2 is

extended in Table 3 to include the partition of pollutants as has just been described.

Table 3.   Input Output Pollution Coefficient Matrix

Input/Output	A	B	C	D	E
A	0.085	0.027	0.034	0.333	0.229
B	0.068	0.055	0.0136	0.134	0.171
C	0.256	0.014	0.041	0.286	0.343
D	0.171	0.068	0.041	0.076	0.171
E	0.076	0.048	0.027	0.190	0.137
Labor	0.202	0.323	0.161	0.225	0.270
Ret. Earn.	0.171	0.205	0.082	0.209	0.194
Pollutant	0.068	0.0478	0.075	0.066	0.057

The total quantity of pollutant emitted into the air, Q_p, for given quantities

of output Q_A, Q_B, ... Q_E is given by:

$$Q_p = A_{pA}Q_A + A_{pB}Q_B + A_{pC}Q_C + A_{pD}Q_D + A_{pE}Q_E \qquad (3.21)$$

For the example that is illustrated in Table 3 and given the sector quantities

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detailed in Table 1, the total level of pollution is given by:

$$Q_p = 0.068(1170){+}0.0479(730){+}0.075(1470){+}0.066(1050){+}0.057(875) = 345 \quad (3.22)$$

Adding the linear equation from Equation 3.21 into the system of linear equations given in Equation 3.11 yeilds:

$$
\begin{aligned}
(1 - a_{11})Q_A - a_{12}Q_B + \ldots - a_{15}Q_E + 0Q_p &= Y_A \\
-a_{21}Q_A + (1 - a_{22}Q_B) - a_{23}Q_C \ldots + 0Q_p &= Y_B \\
\vdots \qquad\qquad\qquad\qquad\qquad &\quad \vdots \qquad (3.23)\\
-a_{51}Q_A + \ldots + (1 - a_{55}) + \ldots + 0Q_p &= Y_E \\
-a_{pA}Q_A - a_{pB}Q_B - a_{pC}Q_C - a_{pD}Q_D - a_{pE}Q_E + (1 - a_{pp})Q_p &= 0
\end{aligned}
$$

The system of equations detailed in Equations 3.23 can be put in more compact matrix form.

$$
\left[
\begin{array}{c|c}
\textbf{I - A} & \begin{matrix} 0 \\ \vdots \\ 0 \end{matrix} \\
\hline
-a_{pA} \ldots - a_{pE} & 1
\end{array}
\right]
\times
\left[
\begin{array}{c}
Q_A \\
Q_B \\
\vdots \\
Q_E \\
\hline
Q_P
\end{array}
\right]
=
\left[
\begin{array}{c}
Y_A \\
Y_B \\
\ldots \\
Y_E \\
\hline
0
\end{array}
\right]
\quad (3.24)
$$

The framework provided in the matrices shown in 3.24 describes the total level

of pollution generated by any level of final demand (Leontief, 1986a; Miller et. al., 2009, 478-483). This system is a convenient framework to work with. The maintenance of a full employment level of production, especially with a growing population, may be inconsistent with ecological sustainability. When the limits to pollution are clearly predefined, as it is with the macro-goal of environmental sustainability, the framework just described is able to detail the ability or inability to maintain environmental sustainability for a given level of production and for a given technique.[11]

3.7 Hick's neo-Austrian Theory

John Hicks was particularly interested in studying the "machinery question" introduced by Ricardo in the third edition of *Principles*. According to Ricardo, capital accumulation and output expansion may in the long run compensate the initial displacement of labor by machinery (Hagemann, 1995a, 201). Hicks showed the impact of technological change in both the short run and the long run. Specifically Hicks was concerned with the incorporating historical time within economic analysis, and within the study of technical change. Hicks' last book, *Capital and Time* emphasized these last two points. Here Hicks employed the study of traverse which was developed to answer the question of technological change on employment. Hicks investigated two types of traverse, the fix-wage path and the full employment path while employing the neo-Austrian model.

Hicks' traverse analysis is based upon a neo-Austrian representation of the structure of production, where production is based upon vertically integrated sectors.

---

[11]The ecological limitations to economic growth is discussed further in chapter 5, with particular attention paid to the consumption and emission of fossil fuels.

Time is the key element. Time enters the neo-Austrian approach in two ways. The first is the duration in which labor inputs are converted into produced means of production. And production of output at different dates generated by "fixed" capital goods. Also, Hicks' notion of "fixed" capital is not in the same sense that Leontief and Lowe treat fixed capital within the circular or horizontal approach. Hicks treats fixed capital as a flow input, as if it were working capital, moving through different stages of production until it develops into a final consumable good. This is a key criticism of vertical integration which will be dealt with below.

The conception of vertical integration is a retraction from earlier circular processes of production. First, unlike the input-output method the only inputs into production are dated quantities of labor. Thus labor is assumed to be the only original input and labor is assumed to be homogeneous. Capital goods are treated as simply stages within the production process, the production process is simply thought of as capital goods maturing from intermediate inputs into a final consumption good.

Hicks distinguishes between the construction phase of capital goods and the utilization phase. The construction phase can be extended over n periods, and thus bring about *n-1* intermediate products en route to the production of a single fixed capital good.

The first stage of the process is where the first intermediate product is produced and is produced by labor alone. At the second stage of production the intermediate product is combined with labor to produce another intermediate product, so on and so forth, during n periods. After the construction phase is completed then appears a single fixed capital good. Then comes the utilization phase, where the fixed

capital good is transformed further by direct dated quantities of labor to produce a final consumer good after T periods of production.

The economy represented is one in which processes are analyzed sequentially through time. (Hicks, 1984, 275). Production is modeled in a series of stages, in which at the end of the production process is the final output. The final homogenous output is divided between workers and capitalists. In this sense, the neo-Austrian model looks like a corn model, in which the final production of corn may be used as both a consumption good and an investment good. So at the end of the process, the final output which was not consumed is used towards investment and the production process begins again. The full utilization of final output is based upon Hicks' assumption of full performance (Hicks, 1973, 52-54). This assumption differs from the assumption of full employment. Full performance has to do with the purchase of the final output, it assumes that the whole of the final output will be either consumed or utilized by capitalists to begin another production process. Full Performance, however for clarification, has nothing to do with the labor market, meaning full performance is not meant to imply full employment (Hicks, 1973; Amendola et al., 1999).

It is assumed by Hicks that production processes are started and completed, and then production processes start anew. Following this methodology laid out, for a given production process, the system of equilibrium prices are as follows:

$$
\begin{aligned}
wa_1 &= p_1 \\
(1+r)p_1 \quad + \quad wa_2 &= p_2 \\
(1+r)p_2 \quad + \quad wa_3 &= p_3 \qquad \textit{Construction Phase} \qquad (3.25) \\
&\vdots \\
(1+r)p_{n-1} \quad + \quad wa_n &= p_{n0}
\end{aligned}
$$

$$
\begin{aligned}
(1+r)p_{n0} \quad + \quad wa_{o0} &= o_0 p_o \quad + \quad p_{n1} \\
(1+r)p_{n1} \quad + \quad wa_{o1} &= o_1 p_o \quad + \quad p_{n2} \\
(1+r)p_{n2} \quad + \quad wa_{o2} &= o_2 p_o \quad + \quad p_{n3} \qquad \textit{Utilization Phase} \\
&\vdots \\
(1+r)p_{nT-1} \quad + \quad wa_{o(T-1)} &= o_{T-1} p_{n_o}
\end{aligned}
$$

$$(3.26)$$

Where:

1. $a_i (i = 1, 2, \ldots, n)$ denotes the input of direct labor needed to produce one unit of the ith means of production.

2. $a_{ot} (t = 0, 1, 2, \ldots T - 1)$ denotes the input of direct labor combined with the t-period of fixed capital which is needed to produce o_t units of final output.

3. p_1 to p_{n-1} are the prices of intermediate products to produce the fixed capital good.

4. p_{nt} is the price of the fixed capital good at the t stage of production.

5. p_b is the price of the consumption good.

6. w is the wage rate

7. r is the rate of profit.

The system of equations represented in 3.25 and 3.26 lays out the details of the vertically integrated process. Wage are paid ex-post, and the production process is simply uni-directional from original factors of inputs (labor) with homogeneous intermediate products along the way to produce a homogeneous "fixed" capital good (which is really working capital) which combined with dated quantities of labor produce a homogeneous final output. Based upon the assumption of Full Performance the final output is either consumed or reintroduced as a intermediate product into the subsequent process of production. The neo-Austrian process is however a temporal process. From the model the units of the final good produced at the end of period $(t-1)$ is given as o_{T-1} units. Of these units, it can be thought of as consisting of a single machine of type t[12] and the remainder consumption goods. So the production process at time t, utilizes both labor and machines of type t, which are qualitatively different than the machines used during period $t-1$. There is no room for circular production of any sort in Hicks neo-Austrian, vertically integrated theory. The methodology of neo-Austrian model is rather peculiar because, for example, the production of machines (a component of the final good) at time t-1 requires only labor alone. Furthermore, the production of new capital goods requires only older machines combined with labor.

---

[12]I am using type (t) here to reference time. So the machine that is to be utilized in the production process at time (t) is physically different from the machine utilized at time $(t-1)$.

3.8   Pasinetti: Vertical Integration

Some Post Keynesians such as Luigi Pasinetti have favored Hicks' (1973) structural methodology of describing the economy in terms of vertically integrated sectors. Pasinetti models the economy in this fashion (Pasinetti, 1981, 1993, 2007, 274-304). Pasinetti's framework recognizes that the economy is a multi-sectoral industrial system with ongoing technical change, and ongoing changes in the level and composition of final demand. Pasinetti's model, unlike the horizontally integrated models is not linked by interindustry coefficients, but rather each of the sectors are linked by the overall impacts of effective demand (Pasinetti, 1993, 16-26). The nature of employment in Pasinetti's model is due to the division of labor among the sectors, which enables each individual laborer to contribute to only a small portion of the production process, but contributing to the demand of all the goods and services produced in the economy. The model has elements of effective demand (which affects the c_i coefficient detailed below) and technical progress (affecting the l_i coefficient). Thus Pasinetti has accomplished an investigation of the inter-relationships of structural change *and* effective demand. If one were *only* interested in examining structural dynamics and economic change, Pasinetti's model is capable of discussing such issues.

The Pasinetti production process at time t is represented in the price and quantity matrices shown in Figure 3.8. describes the interdependencies of production and distribution, and the structural and technological requirements for the conditions for full employment through a vertically integrated labor coefficients.

Where:

1. N(t) = total population at time (t)

Pasinetti's Pure Labor Model: Physical Quantity System

$$
\begin{bmatrix}
1 & 0 & \dots & 0 & \dots & 0 & -c_1(t) \\
0 & 1 & \dots & 0 & \dots & 0 & -c_2(t) \\
\vdots & \vdots & \ddots & \vdots & & \vdots & \vdots \\
0 & 0 & \dots & 1 & \dots & 0 & -c_i(t) \\
\vdots & \vdots & & \vdots & \ddots & \vdots & \vdots \\
0 & 0 & \dots & 0 & \dots & 1 & -c_m(t) \\
-l_1(t) & -l_2(t) & \dots & -l_i(t) & \dots & -l_m(t) & \mu(t)v(t)
\end{bmatrix}
\times
\begin{bmatrix}
Q_1(t) \\
Q_2(t) \\
\vdots \\
Q_i(t) \\
\vdots \\
Q_m(t) \\
N(t)
\end{bmatrix}
=
\begin{bmatrix}
0 \\
0 \\
\vdots \\
0 \\
\vdots \\
0 \\
0
\end{bmatrix}
$$

Pasinetti's Pure Labor Model: Price System

$$
\begin{bmatrix}
1 & 0 & \dots & 0 & \dots & 0 & -l_1(t) \\
0 & 1 & \dots & 0 & \dots & 0 & -l_2(t) \\
\vdots & \vdots & \ddots & \vdots & & \vdots & \vdots \\
0 & 0 & \dots & 1 & \dots & 0 & -l_i(t) \\
\vdots & \vdots & & \vdots & \ddots & \vdots & \vdots \\
0 & 0 & \dots & 0 & \dots & 1 & -l_m(t) \\
-c_1(t) & -c_2(t) & \dots & -c_i(t) & \dots & -c_m(t) & \mu(t)v(t)
\end{bmatrix}
\times
\begin{bmatrix}
p_1(t) \\
p_2(t) \\
\vdots \\
p_i(t) \\
\vdots \\
p_m(t) \\
w(t)
\end{bmatrix}
=
\begin{bmatrix}
0 \\
0 \\
\vdots \\
0 \\
\vdots \\
0 \\
0
\end{bmatrix}
$$

Figure 5.   Pasinetti Quanity-Price Pure Labor Production Model

2. Q_i = Output of Sector i (i = 1, 2, 3, ..., m)

3. p_i = Price of Sector i = (1, 2, 3, ..., m)

4. $l_i(t)$ = labor coefficients (labor required per unit of output at time t)

5. ρ_i = rate of growth of the labor productivity in sector i

6. r_i = rate of change of the per capita consumption of commodity i

7. $c_i(t)$ = per capita consumption

8. w(t) wage-rate per unit of labor

9. μ = proportion of active to total population

10. v = proportion of working time to total time

The variables described in 1 – 7 depict the structural dynamics of Pasinetti's model. The conditions for full employment is given by:

$$\frac{1}{\mu(t)v(t)} \sum_{k=1}^{m} c_i l_i e^{(r_i - \rho_i)t} - 1 = 0 \tag{3.27}$$

The condition for full employment in Equation 3.27 states that first, the proportion of labor employed in each sector must add to one, and is dependent upon demand for output within each sector (this is due to parameters c_i and r_i), and as well as upon structural and technological change (ρ). The full employment condition is rarely if ever fulfilled and is certainly not a self-equilibrating process (Pasinetti, 2007, 285-304; Pasinetti, 1993, 27-59). The reason is due to the nature of the parameters r_i, which is essentially the effective demand condition, and ρ_i, is labor productivity. The overall effect is on sectoral employment is ξ_i which is given in 3.28.

$$\xi_i = g + r_i - \rho_i \tag{3.28}$$

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Equation 3.28 which can be positive (absorbing labor into sector i) or negative (driving labor from sector i). If, as is most often the case, labor productivity is increasing in sector i, causing ρ_i to be positive, per capita consumption in sector j, k ..., m, must be growing in order for labor to be reabsorbed and return the system to full employment. Pasinetti's result is that the economy, because of its interdependence, is inherently unstable. Non-proportional sectoral growth has an effect on the entire economic system. Full employment is rarely, if ever achieved, let alone maintained, due to the perpetual movement of per capita consumption and technical progress. The two are moving in opposite directions, and so will cancel each other out to some extent, "but never completely, in any systematic way (Pasinetti, 2007, 287)." Pasinetti shows quite clearly the complexity of the economic system. Industrial capitalism suffers from two types of unemployment: technological or Marxian unemployment, and Keynesian unemployment, as described by Pasinetti's model. This leads Pasinetti to the following conclusion:

> Keynes intuition is proved right and the implications are far reaching. ... [The condition for full employment] is not a once and for all condition, except in the extreme trivial case of a perfectly stationary economic system (Pasinetti, 2007, 286)

In a dynamic system, every component of Equation 3.27 is moving, corresponding changes in demand by consumers of given output in given sectors, which further has an effect on all other sectors of the economy. Structural models demonstrate that modern mass production economies are never at rest. They are in continuous flux, with the expansion of industries within sectors, the introduction of new product and process innovations, leading to the addition of new industries and the demise of

obsolete, non-competitive industries. The role of the market in a mass production economy is to foster innovation. Markets reward winners through an increase in demand, and punish losers whose innovations do not succeed (Forstater and Murray, 2009, 166-170).

3.9   Criticisms of Vertically Integrated Models

Pasinetti (1981, 109-117) puts forth the similarities of the vertical integration approach with that of input-output analysis. Pasinetti derives mathematically the vertically integrated labor coefficients directly from input-output analysis. According to Pasinetti, the vertically integrated methodology is superior to modeling dynamic economies which exhibit continual technological change. Given technological change Pasinetti argues that the interindustry relationship breaks down. Under an input-output methodology technological change may require the addition of new industries and the expulsion of obsolete industries. Technological change is both continuous, and complex. It thus becomes difficult to model changes in the technological structure empirically, unless the industries are aggregated. But then aggregation loses the advantages of the usefulness of input-output framework. According to Pasinetti (1981, 116) experts in the field of input-output analysis are then at a struggle to find the appropriate level of aggregation, where technical change can be effectively modeled, while still maintaining enough disaggregation so that it maintains its usefulness.

Pasinetti argues that the vertical integration model is pre-institutional. It allows for a discussion of income and distribution, employment, unemployment, effective demand, and structural and technical change outside of any institutional context. Heterodox economists have obvious objections to this. Vertically integrated models

do not define any specific class structure in which to build the framework. Further, the "natural economy" which Pasinetti models is governed by individuals without any specific economic objectives or motivations towards the decision for production or consumption. Technical progress is taken place in the natural economy, but the economic institutions which allow for technical progress, such as a banking sector is absent. Post Keynesian macroeconomists in the tradition of Basil Moore and L. Randall Wray would find this objectionable. Furthermore, Davidison argues that the principle of effective demand could not be discussed without money. Hicks and Pasinetti construct a barter economy which has no place for money (Trigg and Lee, 2005; Shapiro, 1985; Hagemann, 1995a).

Natural labor commanded prices will be equal to vertically hyper-integrated labor requirements, which further allows for the exapansion of capacity in each sector to be in line with labor growth (Steedman, 1981a, 369). Steedman asks what the effect would be if Pasinetti did not assume homogenous labor requirements. This is a question which Pasinetti does not address. By assuming homogeneous labor, it provides Pasinetti with a degree of flexibility which is not there in the real world. Pasinetti's model is different from interindustry models in this manner too which are capable of modeling both homogeneous and heterogeneous labor.

Furthermore, the vertical integration modeling procedure is only, and can only be, a macroeconomic model. There is no room for discussion of the behaviors and motivations of individual producers and consumers. Thus it is inconsistent with Keynes's own theory of effective demand, particularly the theory of the marginal propensity to consume, when determining consumption, but also it is inconsistent with Keynes'

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theory of investment, in which the state of long-term expectations guide investment decisions of business men and women.

The Hicks-Pasinetti framework is unsuitable for instrumental analysis. One of the cornerstones of instrumental analysis is to analyze the motivations and behaviors of business men and women, in regards to their decisions towards investment, and the decisions guiding technological progress. This can not be done in the "pre-institutional" Hicks-Pasinetti model and is therefore inadequate for traverse analysis under instrumental inference.

3.10   Adolph Lowe's Post-Classical Model

Lowe's model originates from Marx's framework, and is similar to the framework also developed by Leontief with a few key differences that makes Lowe's model unique. What makes Lowe different from both Sraffa and Marx is the significant role he places on the machine tools sector. As given by Lowe:

> An extreme position is taken by P. Sraffa ... who eliminates linear processes of production altogether. Less extreme but still extreme is the statement, "For the production of coal, iron is required; for the production of iron, coal is required; no one will say whether the coal industry or the iron industry is earlier or later in the hierarchy of production. ... What we require for the production of coal is extractive machinery with the help of the truly circular factor "machine tool". ... Then we will see at once the critical bottleneck "in the hierarchy of production" arises from the machine tool stage and that only after capacity has been increased there, can output of ore-steel-extractive machinery and, finally, coal be increased (Lowe, 1976, 34).

Lowe's model, unlike Marx's and Sraffa's framework, is a three sector model which combines transferability with specificity (Hagemann, 1992, 236). For the continuity of production there are two conditions which must be fulfilled. Labor and

equipment have to operate within a technically defined, predetermined manner and is combined with stocks of original natural resources[13] and natural resources transformed into working capital. The second condition which must be fulfilled is that the stocks of equipment, natural resources, and labor which have been used up in production have to be replenished at the end of the period (Lowe, 1976, 27). These are similar conditions which was required in the earlier models that have been discussed. Lowe's structural model is given in equations 3.29 - 3.31. The complete model contains sets of casual relationships. Stocks of capital (K_i), combined with stocks of labor (L_i) and stocks of natural resources (N_i) to produce (indicated by a right arrow) stocks of output (o_i) in sector i. The capital letters indicate stocks , whereas lower case letters indicate flows. The symbol $\oplus$ indicates that the inputs of capital, labor, and natural resources are combined in fixed proportions (Lowe, 1976, 28).

The model consists of three horizontal stages, and within each sector four successive stages, indicated by subscripts in which a given stock of natural resources is transformed simulatenously by stocks of labor and capital into a final consumption good (Lowe, 1976, 28).

$$K_1 \oplus L_1 \oplus N_1 \rightarrow o_1 \qquad \textbf{Sub-Sector 1a:} \qquad (3.29)$$

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[13]Lowe does not make a clear distinction whether natural resources should be taken as given, or whether natural resources are produced means of production. Both interpretations can be inferred, at one point Lowe refers to natural resources being the land which factories and other durable capital equipment rest, other times he refers to natural resources undergoing stages of transformation. In the latter case natural resources must then be replenished and can be thought of as a produced means of production. This latter interpretation is more consistent with the heterodox viewpoint of natural resources.

Four-Stage Process - Sub-Sector 1a

1. $k_{11} \oplus l_{11} \oplus n_{11} \to o_{11}$ (Extractive Machinery)

2. $k_{12} \oplus l_{12} \oplus n_{12} \oplus o_{11} \to o_{12}$ (Blast Furnaces)

3. $k_{13} \oplus l_{13} \oplus n_{13} \oplus o_{12} \to o_{13}$ (Steel Mills)

4. $k_{14} \oplus l_{14} \oplus n_{14} \oplus o_{13} \to o_{14}$ (Machine Tools/Steel Mills/Blast Furnaces/Ext. Machinery)

$$K_2 \oplus L_2 \oplus N_2 \to o_2 \qquad \textbf{Sub-Sector 1b:} \tag{3.30}$$

Four-Stage Process - Sub-Sector 1b

1. $k_{21} \oplus l_{21} \oplus n_{21} \to o_{21}$ (Ore)

2. $k_{22} \oplus l_{22} \oplus n_{22} \oplus o_{21} \to o_{22}$ (*Pig Iron*)

3. $k_{23} \oplus l_{23} \oplus n_{23} \oplus o_{22} \to o_{23}$ (Steel)

4. $k_{24} \oplus l_{24} \oplus n_{24} \oplus o_{23} \to o_{24}$ (Gin/Spindles/Looms/Sewing Machines)

$$K_3 \oplus L_3 \oplus N_3 \to o_3 \qquad \textbf{Sector 2:} \tag{3.31}$$

Four-Stage Process - Sector 2

1. $k_{31} \oplus l_{31} \oplus n_{31} \to o_{31}$ (Cotton)

2. $k_{32} \oplus l_{32} \oplus n_{32} \oplus o_{31} \to o_{32}$ (Yarn)

3. $k_{33} \oplus l_{33} \oplus n_{33} \oplus o_{32} \to o_{33}$ (Cloth)

4. $k_{34} \oplus l_{34} \oplus n_{34} \oplus o_{33} \to o_{34}$ (Dress)

The order of production is vertically divided between two sectors, the equipment goods sector (Sector 1) and the consumer goods sector (Sector 2). The consumer goods sector consists of a finished consumer good only, while the equipment goods sector is subdivided into two sectors, 1a and 1b. Sector 1a is circular, it provides working capital to be used back in it's own sector (for the replacement of fixed capital used

up) and applied towards sector 1b, whereas sector 1b supplied working capital for sector 2 only. The subdivision of sector 1 implies that the output produced in sector 1a and 1b are qualitatively different. Once production occurs stocks of resources get worn out and need to be replaced. Lowe (1976, 31-36) defines k_{ij}, n_{ij}, and l_{ij}, as flows. The magnitude of which is the amount of fixed capital, labor, and natural resources which is "used up" in the production process.

The example which Lowe gives to bring clarity to his model is the production of a simple dress, which Lowe defines as the final consumer good. The process begins with sector 1a. Within sector 1a consists of four vertical stages producing output in a sequential process. The first stage in sector one combines capital, labor, and natural resources (defined as flows) to produce extractive machinery (o_{11}). Extractive machinery from stage 1 is then used as an input in stage 2, to be combined with capital, labor, and natural resources, to produce blast furnaces (o_{12}). The output from stage 2, blast furnaces, are transferred to the third stage, combined with capital, labor, and natural resources, to produce steel mills (o_{13}). Steel mills are then used in stage 4 to produce machine tools (o_{14}).

The final working output from sector 1a, machine tools, serve a dual purpose in Lowe's production model. First, after production occurred the fixed capital which was worn out needs to be replaced. Meaning the capital inputs, k_{11}, k_{21}, k_{31}, k_{41} are entirely used up in production. Thus, $k_{11} + k_{21} + k_{31} + k_{41}$ units of machine tools (the output from stage four) is transferred back into Sector 1a among the four successive stages respectively allowing for reproduction in sector 1a.

Output in sector 1a is also used in sector 1b. The working output from sector

1a, stage 1, extractive machinery is used in *both* sector 1a, stage 2, *and* replaces fixed capital used in sector 1b, stage 1. In other words the working capital in sector 1b, stage 1, (k_{21}) is extractive machinery. Likewise the working capital in stage 2 of sector 1b, k_{22} are blast furnaces, (k_{23}) are steel mills, and (k_{24}) are machine tools.

In clearer terms, sector 1b can be read as: Extractive machinery (k_{21}) produced from an earlier stage of production, is combined with labor and other natural resources (i.e. physical land) to produce ore (o_{21}). Blast furnaces ((k_{22}), from an earlier stage of production, combined with labor and other natural resources transform the ore into pig iron (o_{22}). Then steel mills (k_{24}) combined with labor, natural resources, and the pig iron is used to produce steel (o_{23}). Machine tools (k_{24}) combines with labor, natural resources, and the steel to produce intermediate outputs (gin/spindles,looms,sewing machines). Recall machine tools were also used to replace worn out machines in sector 1a. Sector 1a is a circular sector which uses it's own output for inputs and transfers a portion of its output to sector 1b. For the system to remain viable the output of machine tools from sector 1a must be equal to k_{11} + k_{21} + k_{31} + k_{41} + k_{24}.

Now turning to the final sector the intermediate output from sector 1b must equal to the fixed capital used up in the production process of sector 2. In other words, $o_{24} = k_{31} + k_{32} + k_{33} + k_{34}$. In sector 2, gin (k_{31}) combines with labor and natural resources to produce cotton (o_{31}). Spindles (k_{32}) combines with labor, natural resources, and cotton to produce yarn (o_{32}). Looms (k_{33}) combines with labor, natural resources and yarn to produce cloth (o_{33}). Sewing machines (k_{34}) combines with labor, natural resources and cloth to produce a dress (o_{34}), the final

consumption good.

The stage model depicts a roundabout method of production which can be traced back to the Austrian school of Boehm-Bawerk (Lowe, 1976, 23). However Lowe's model is eclectic. Lowe felt that the Austrian school, made important contributions as to the linear process of production which is not evident in the circular models of Sraffa or Leontief. However the Austrian framework is limited by ignoring circular production. Lowe's model uses both. Putting focus on sector 1b, a sewing machine is one of the final equipment outputs. To produce a sewing machine steel is required as an input, but the converse is not true. To produce steel one needs to produce iron first. However to produce iron ore is required. So there is a specific sequential stage of production. But the concept of roundaboutness is lost because there is also circularity. To produce a sewing machine requires *both* steel and machine tools (from sector 1a). To produce steel requires both steel mills *and* pig iron. But to produce the steel mills in sector 1a required machine tools (produced at a later stage) and blast furnaces. The production of blast furnaces required extractive machinery, but for the production of all output at each of the four stages of sector 1a also requires machine tools as an input. Machine tools are also required as an input in Sector 2, stage 4. Thus machine tools is the crucial circular factor in Lowe's model. Because of the way Lowe designed the model, when the system is operating at full capacity, for the expansion of output first requires the expansion of output of sector 1a, before any other sector can expand output.

Lowe's Instrumental Traverse

Lowe took both Sraffa and Marx as his starting point. Lowe was concerned with traverse analysis, meaning Lowe was concerned with the adjustment path taken by the economic system given changes in the labor supply, technical progress, or the availability of natural resources. Given the framework that existing machines are transferable between the two sub-sectors in the capital goods sector, Lowe's model can be utilized for an understanding of structural change, technical progress and accumulation.

Lowe begins as a starting point with the assumption that all non-labor inputs are fully utilized and labor is fully employed (Lowe, 1976, 38). Lowe began this way because his attempt was to show what economic decisions that need to be taken to move from a lower level of production (Lowe's initial state) to an increase of production.[14] If the economy were not growing at all then the fixed capital worn out in production (denoted by k_{ij} needs to be replaced at the rate of depreciation of capital equipment. (Thus under this assumption k_{ij} is equal to $K_{ij}d$ where K_{ij} is the stock of fixed capital in sector i, stage j, and d is the rate of depreciation of the fixed capital.) Now assume that there is growth in the labor supply of the economy. Given the structural relationships described above, for this is to occur first requires an increase in the level of production in Sub-sector 1a. But, because there is full utilization of capital equipment, this can only occur if there is a fall in the aggregate

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[14]In Lowe's analysis, which we will follow here, Lowe assumes a one-time exogenous increase to the labor force. The problem Lowe investigates is a modeling of economic decisions which need to be taken by both consumers and capitalists, to bring the economy from a previous state of full production and full employment, to an expanded state which will employ the addition to the labor force.

supply of consumer goods. However, this can only occur through a reduction of aggregate demand, meaning an increase in voluntary or involuntary savings in the labor supply. In Keynesian terms this requires a decrease in the MPC and an increase in the marginal propensity to save (MPS). Now in period 2, an increase in the MPS (either voluntary or involuntary) results in labor being displaced from production of consumer goods, causing aggregate demand to fall further. A decrease in demand for consumer goods in turn frees up output from Sub-sector 1b. Also demand from Sub-sector 1a by Sub-sector 1b is also reduced in period 2. However these workers are not displaced. Given the twofold transferability of output in Sector 1 expansion is possible and allows the economy to return to full employment. Part of the original stock of extractive machinery, blast furnaces, steel mills, and machine tools which were in period 1 to be used in the production of intermediate capital goods in Sector 1b are now free in period 2 to produce additional extractive machinery, blast furnaces, steel mills, and machine tools. Furthermore, a proportion of working capital in Sub-sector 1b (steel pig iron and ore) that was used in period 1 to produce consumption goods in Sector 2, are now not needed in Sector 2 given an decrease in the demand for consumption goods. These intermediate goods in Sub-sector 1b may now be shifted back into Sector 1a for additional production of extractive machinery, blast furnaces, steel mills, and machine tools. Now, a greater amount of working capital from Sub-sector 1a can be transferred to Sector 1b, which now allows for employment to increase in sector 1b, and then these goods can be transferred to Sector 2, increasing employment in this Sector, and increasing the production of the consumption goods. The traverse to a higher growth rate given an exogenous shock to the labor supply is

a four-phase process. There first must be a change in inputs before there is a change in outputs. The first phase of the adjustment process is that the proportion of output from Sub-sector 1b which delivered to Sub-sector 1a must first be increased relative to that which is deliver to Sector 2. The second phase is that aggregate output in Sub-sector 1a is increased. The third phase is that an increase in output from Sector 1a is delivered to Sector 1b, and output in Sub-sector 1b is increased. Now, the forth phase of the traverse allows for consumption output to adjust to the higher rate of growth in the labor supply (Lowe, 1976; Hagemann, 1992). The dual-nature of working capital between Sub-sector 1a and Sub-sector 1b allows an increase in the speed at which adjustment to a higher rate of growth is possible.

Lowe's three sector/four stage model is not presented in a manner that is consistent with the previous frameworks considered. However Lowe's three-sector model can follow a framework similar to that of Leontief and Sraffa. Following the framework of the previous models considered, let a_{ij} be machine input coefficients (i, j, = 1, 2, 3). Furthermore, let l_i be the labor per unit of output coefficients, w be the wage rate, d be the fixed rate of depreciation, and r being the profit rate, g the growth rate, p_i the price of output of sector i, Q_i be output of sector i, and L equal the labor force employed. Focusing on just the three-sectors, Lowe's three-sector model can be put into a contemporary framework. The pricing equations become:

$$a_{11}(d + r)p_1 + l_1 w = p_1$$
$$a_{21}(d + r)p_1 + l_2 w = p_2 \qquad (3.32)$$
$$a_{32}(1 + r)p_2 + l_3 w = p_3$$

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Or in matrix form:

$$\mathbf{A}(d+r) + \mathbf{l}w = \mathbf{p} \tag{3.33}$$

The quantity equations can be given in a similar manner. The growth rate g of the labor force must also be the rate of capital accumulation. The quantity equations become:

$$a_{11}(d+g)Q_1 + a_{21}(d+g)Q_2 = Q_1$$
$$a_{32}Q_3 = Q_2 \tag{3.34}$$
$$l_1(d+g)Q_1 + l_1(d+g)Q_2 + l_1(d+g)Q_3 = L$$

The inclusion of the pricing equations given in 3.32 and 3.33 become imperative with a discussion of the traverse. The technical-structural conditions required for the economic system to adjust to higher rate growth has been considered above. Recall for the system to adjust to a higher rate of growth requires intermediate goods from Sub-sector 1a to be transferred back to Sub-sector 1a. But why is this transaction done at all? Now, with consideration of the pricing equations, investment is not a reaction to current conditions given in period 1. In fact, there was a reduction of aggregate demand due to an increase in the rate of savings by laborers. However, there must be an anticipation of future profits based upon an increase in final demand in the upcoming period. There is no reason why capitalists will have these expectations, nor will engage in necessary investments which are required to bring the system to full employment given the higher growth rate. If an increase in the supply of labor stems from technical progress, the required behaviors by capitalists to bring the

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system back to full employment is even more doubtful. Because of this result, Lowe suggests that the achievement and maintenance of full employment requires "public controls'. Public controls are direct government intervention which essentially forces capitalists within the sectors to engage in the necessary investments which ensure the economy will return to a level of full employment.

It has just been addressed that the Lowe model, while unique, incorporates structural and technical change and effective demand. Furthermore the model puts emphasis on the social relationships of production between capitalists within the sectors and stages. Furthermore Lowe considers that capitalists may not independently engage in behaviors which allow the economic system to maintain production at the full employment level. Lowe concludes that if full employment is to be assured, and is achieved in the minimum amount of time possible, that government intervention into markets is necessary. Lowe's model becomes a simple theoretical framework for structural analysis.

3.11 Critiques of the Economic Models

Three models stemming from Marx's two sector model have been considered here, the Leontief model, the Hicks-Pasinetti model, and Lowe's model. Leontief's model is useful as it considered the circularity of the production process. Furthermore Leontief's model is useful as it separates final demand into it's various components. The Leontief model can be used to analyze both Keynesian and Marxian unemployment, and the interconnectedness between the two types. The Leontief model is also robust in that any number of sectors can be considered. This allows for the easy addition of the ELR program, and the modeling the benefits of the ELR program

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given structural dynamics. Furthermore, a key mission of heterodox economics is for economic theory to be grounded in reality. The production process in the 'real world' is modeled via an input-output framework. Thus, even a aggregated input-output model is based upon reality. This feature of the Leontief model further makes for it an appropriate framework for modeling the ELR program.

The vertically integrated model of Hicks and Pasinetti allows for a discussion of both structural and technological change and changes to the composition of final demand. Pasinetti agrees with the Keynes's conclusion that the economy will equilibrate below a full employment equilibrium, however for different reasons. For Pasinetti it was due to the dynamics of the capitalist mode of production which causes the inability of the economy to equilibrate to full employment.

Pasinetti's model fails in the respect to consider the social relationships of production. Output in Pasinetti's model is produced by labor only without considering the inputs of intermediate goods. The sectors in Pasinetti's model are linked by effective demand only. Thus, he fails to take into consideration the social interindustry relationships of the production process. Furthermore Pasinetti model in non-institutional. He fails to consider how decisions regarding investment, technique of production, and decisions regarding consumption are guided. While Pasinetti's model is simple, and considers structural dynamics, the failure to consider social relationships of production becomes problematic.

Lowe's model is useful because it is simple. Lowe illustrates structural bottlenecks because of the prominent position which the machine tools sector had. However, it is important to recognize, that while Lowe defined his model in such a way to em-

phasize structural bottlenecks, bottlenecks are only assumed to exist because of the assumption of the full utilization of capital equipment. However, Lowe's model is capable of discussing both Keynesian unemployment and Marxian unemployment. The conclusion that government intervention is necessary to maintain the system at full employment is easily addressed. Lowe concluded that government intervention is required to align business expectations with the political goal of full employment.

Of these models, the model which can be best appropriate for modeling the ELR program comes down to the Leontief input-output model or the Lowe model. Either model would be adequate. However, given the extensive use of input-output models in actual economies, and in the economic literature, the formalization of the ELR program will be done utilizing the input-output approach. With this approach, the effectiveness and the benefits of the ELR program can be addressed.

CHAPTER 4

EMPLOYER OF LAST RESORT: A STRUCTURAL APPROACH

Karl Marx and John Maynard Keynes opened the eyes of the world to the destructive nature of capitalism. Marx focused on capital accumulation and technological change, while Keynes left technological change as given to focus on the problem of insufficient aggregate demand. Both theorists opened up the debate as to the nature and causes of unemployment. For both theorists unemployment is seen as a natural consequence of the capitalist mode of production. For Marx unemployment is due to capitalists' motivations toward technological advancement. As was addressed earlier, technical progress expels a portion of the labor force, and the reserve army increases. For Marx unemployment, in the sense of the reserve army of labor, is functional for capitalists. The reserve army serves to discipline existing workers and keep wages down, both of which benefit capitalists. However as was addressed in chapter 2, the extent to which unemployment is functional becomes dependent upon the speed and nature of technological progress.

One of Marx's important contributions was the emphasis on technological progress in capitalistic production. Re-employment for those who become unemployed due to increased mechanization is possible, however this is only possible with the introduction of new industrial sectors into the economy. For Marx, there was always a 'floating surplus' :

> In the centres of modern industry factories, manufactures, iron-works, mines, . . . the labourers are sometimes repelled, sometimes at-

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tracted again in greater masses, the number of those employed increasing on the whole, although in a constantly decreasing proportion to the scale of production. Here the surplus-population exists in the floating form (Marx, 1990, 794).

The dynamics of structural change within the production process allow for some workers to be reaborbed into the workforce. However, full re-employment of all those who are affected by increased mechanization is never possible due to continual technological progress. Since technical progress is viewed as a continual process, this leads to the presence (in Marx's terminology) of a permanent industrial reserve army, or in modern day terms, to permanent technological unemployment.

Marxist unemployment is technological unemployment. Technological progress, through innovation, leads to the destruction of entire industrial sectors and the creation of new industrial sectors, new products and new processes. In highly aggregated production models, like Marx's own two department model, the subtraction of 'old' industries producing 'old' capital goods, and the addition of 'new' industries producing 'new' capital goods is hidden. However, technical progress is shown through an increase in labor productivity, evident through a continual increase in capital-labor ratios. Hence, this results "in a constantly decreasing proportion [of labor employed] to the scale of production."

Structural unemployment is defined as unemployment due to changes in the physical structure of production and is a consequence of the capitalist mode of production. Structural change may also be caused by a change in the magnitude or composition of the labor force[1], capital goods, natural resources, or a change in the

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[1]The magnitude of the labor force is an independent variable and is dependant upon the growth rate of the population. The composition of the labor force can

level or composition of effective (final) demand.

4.1 Investment and Technological Progress

Keynes's "chapter 12" model of investment specifically addresses the factors which, in his view, account for the observed volatility of investment activity. For Keynes it is the "state of confidence" which drives investment. The state of confidence is driven by many non-economic factors, which Keynes terms "animal spirits", which guide either action or inaction and are not based upon mathematical expectation. Keynes's approach is an "instrumental" approach in the respect that Keynes is ultimately investigating the behavioral and motivational forces at the microeconomic level which affect investment activity, and in turn overall output and employment.

Structural modeling simply formalizes Keynes's theory of investment activity, details the composition of aggregate output, and describes the level and industrial makeup of aggregate employment. Structural modeling also highlights physical bottlenecks which may prevent the economy from maintaining production at the full employment level. The failure of the maintenance of full employment is ultimately caused by inter-dependent decisions regarding investment in specific technologies. Decisions regarding which technique to employ are made on a continual basis and new techniques are continually being developed and employed in production. The structural model is used to outline this process and can be used to provide a rationale for state intervention into market economies. Such intervention is used to align the microeconomic goal of monetary gain with the macroeconomic goal of full employment

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change only when labor is assumed to be heterogenous, an assumption which is not being made here in this chapter.

and environmental sustainability.[2]

Investment activity holds a central position in Keynes's economics and Post Keynesian economics. Given the existence of unemployment in capitalist society, Post Keynesians have long called for 'pump priming' to stimulate investment activity and achieve full employment. The current chapter argues that pump-priming is an insufficient approach as it only addresses aggregate demand stimulus, however fails to consider structural and technological change and the effect this change has on aggregate demand. What will be addressed and answered in the current chapter is full employment through aggregate demand stimulus, even if it could be achieved, could never be maintained, not even in the short period.

Technological progress is based upon Marx's 'laws of motion' of the capitalist economy. In order to remain viable, the capitalist process must overcome the limitations to production and the barriers of an ever declining addition to surplus labor time (Courvisanos, 2006a,b, 206, 87). These barriers are overcome through technological progress. According to Courvisanos (2006a, 206) technological progress can take three forms, the 1) "opening up of new markets, 2) creating new needs and new demands, and 3) investment in increasingly technologically efficient means of production". The form of technological progress becomes important as it is endogenously linked to aggregate employment. The first two types may increase employment.[3] The

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[2]The current chapter will concern only the first macro-goal of full employment, and public policies towards this end. The following chapter will concern specifically with the macro-goal of environmental sustainability. Then there will be a discussion how the two goals can be achieved simultaneously.

[3]The first two types of technological progress may not be labor absorbing if there is a mis-match between the skill set of the unemployed, and the skills required for the

third type of technological progress leads to an increase in the mechanization of production, leading to technological unemployment. For present purposes labor-expelling technological process will be considered. The effect of technological unemployment has been thought to be balanced out by the opening of new markets. However, a new technique is employed because it is thought to be profitable for the capitalists. Capitalists invest in new, labor-saving capital, for the production of commodities. This assertion echo's Neisser (1942) statements that the "demand for commodities is not demand for labor (p. 50)". The opening up of new markets will not offer full compensation to those who are adversely affected by increased mechanization. In order for full employment to be maintained it must be an actively pursued public policy program.

Investment is a process that takes place in historical time. With a growing population, the economy must increase its overall productive capacity continuously. Within each individual sector there exists a definite relation between the rate of growth of sectoral demand, and the amount of new investment which needs to be fulfilled. Thus in order to maintain full employment throughout historical time, two conditions must be satisfied, an effective demand condition, and a capital accumulation condition. It is very possible, in fact very likely that absent any intervention, even if the the economy begins at full employment of the labor force and full and efficient

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new jobs created from the opening up of new markets. For current purposes (as will be stressed below when the model is discussed) it will be assumed that labor is homogeneous. Not because this is a realistic assumption, but because it will be shown that a dynamic economy will result in a permanent level of of technological unemployment, even with homogeneous labor. Thus relaxing the assumption of homogeneous labor will not only magnify the results.

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utilization of productive capacity, the structural dynamics which cause the productive system to change and will not lead towards the maintenance of full employment (Hagemann, 1995b). This conjecture leads to Pasinetti's conclusion:

> ... that the structural dynamics of the economic system inevitably lead to generate ... *technological* unemployment. At the same time, the very same structural dynamics produce counter-balancing movement ..., but not *automatically*. There is nothing in the structural evolution of technical coefficients on the one side and of per-capita demand on the other, as such, that will ensure ... the maintenance of full employment. Therefore if full employment is to be kept through time, it will have to be actively pursued as an explicit aim of economic policy (Pasinetti, 1981, 90)

Pasinetti's conclusion is of particular importance. In order to sustain full employment there must be an active policy program in order to promote full employment. Pasinetti's conclusion will be tested, however without using Pasinetti's model. The current chapter will employ an input-output methodology as input-output models are empirically grounded, and are consistent with heterodox economic theory.

The chapter is organized in the following manner. Section 4.3 develops a multi-sector model connecting technological progress, investment, retained earnings, and the level of aggregate demand. The model developed connects the Post Keynesian structural model of Pasinetti (2007, 1993, 1981), which highlights structural dynamics, with the macro-models of Richardson and Courvisanos (2008), Carvalho and Oreiro (2008), Ono and Oreiro (2006), and the empirically grounded input-output approach of Leontief and the analysis of the traverse of Lowe (1976) and structural bottlenecks outlined in Lowe (1976) and Pasinetti (1981). The connection between technological progress, structural change, aggregate demand, and the level of employment are the

fundamental connections which will be shown in the models.

It is assumed that when investment is taken place, it is investment in new capital goods which replace older technologies, and that the new technology expels labor from production. The introduction of new capital goods in production means that the new technology employed requires less labor per unit[4] for it's operation. This effect causes a reduction in aggregate demand and therefore a reduction in total output. Total output must be less as the level of aggregate demand must drop with an increase in technological unemployment. However the savings in the wage bill is redistributed to capitalists through an increase in the mark-up, which achieves more revenue which may be allocated towards further improvements and innovations in technology. Importantly, in order for the more mechanized technique to remain profitable, the total loss of revenue from diminishing industrial output must be offset by a greater savings in the wage bill, which is redistributed towards the capitalist sector. Investment in new technologies will continue as long as it remains a profitable

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[4]In the current chapter it is assumed that labor is homogenous. Technological progress will be defined as a new technique which requires less labor for production than previously.

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venture.[5]

A multi-sector input-output model will be introduced in Section 4.3. Techno-
logical progress and structural change will be simulated and the relationship between
technological change, structural change and aggregate demand will be simulated and
the effects on employment and unemployment will be shown. It will be argued that
Keynesian aggregate demand policies alone are insufficient for the maintenance of full
employment given continual technological change. Following this analysis, Section 4.8
will introduce an ELR sector into the input-output model economy and illustrate how
the implementation of the ELR into the input-output model fully addresses Keynesian
and Marxian unemployment.

4.2   Previous ELR Simulations

Previous simulations of the ELR program have been conducted by Majewski
(2004) and Fullwiler (2007), both of these studies make use the Fairmodel for their

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[5]The financing of such research and development towards technological innovation,
and in turn investment has had considerable mention in the literature. There are two
approaches to financing investment, the mark-up approach of Harcourt and Kenyon
(1976), (Harcourt, 2006, 33-54), (Eichner, 1976, 55-107), and (Lee, 2003, 288), where
financing for investment is generated internally, and the financial instability ap-
proach of Minsky (1986), (Wray, 1998, 159-163), (Papadimitriou and Wray, 1999,
6-15). which assumes that the financing of investment (at least partially) is exter-
nally financed. However, it is a widely held belief among Post Keynesians that the
business enterprise consists of industries which are price makers and the pricing de-
cision consists of mark-up pricing over costs. Reserving the discussion of internal
verses external financing for a later time, it will be assumed here that given mark-up
pricing, as a general rule an industry may obtain additional funds towards financing
investment through an increase in its mark-up. External financing for the purposes
of new investment will be considered negligible, and hence ignored for the present
discussion.

simulations. The Fairmodel was developed by Ray Fair in the 1970s. The model has 30 equations and 100 identities. National Income and Product Accounts (NIPA) and the flow of funds data are integrated into the identity equations. The Fairmodel is widely used by orthodox econometricians even though many of the assumptions of the Fairmodel go against standard orthodox thought. The Fairmodel's assumptions are more closely tied with heterodox theory in many instances. Some of the assumptions incorporated into the Fairmodel are that consumption is a function of disposable income, current production is dependent upon lagged production, current sales, and lagged change in inventories.

These simulations were done to estimate the cost of an ELR program. Futhermore previous literature by Nell, and the simulations of Majewski and Fullwiler discuss the effects that the impementation of an ELR program would have on the wage rate, and makes an attempt to provide an answer for whether or not the ELR program would be inflationary. These simulations were not done to show how the ELR program addresses employment due to aggregate demand and structural and technological change. Furthermore they did not address where the input output program would fit into an ELR model. These were not instrumental approaches. In the current chapter we are studying the current state of the system, and how the business motivations towards the microeconomic goal of profit generation are incapable of generating the macroeconomic goal of full employment, and to be addressed in the next chapter, environmental sustainability. The approach here is addressing different questions. The Fairmodel incorporates NIPA data into the macroeconomic identities used for simulation. The approach taken here specifically highlights inter-industry dynamics,

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in a circular production framework. Furthermore, the approach taken here identifies the role of the government to provide discretionary employment within an economy described using input output matricies.

4.3   Post Keynesian Growth Theory: A Multi-Sector Approach
The Building Blocks of the Model

To study the connection between aggregate demand and structural and technological change requires explicitly defining the structural dynamics, and how these dynamics affect the movements of production, labor, and consumption coefficients within an input-output methodology. There are two structural dynamics which are considered, an exogenous rate of population growth (g) and an exogenous rate of labor productivity (ρ) which is a proxy for technological progress. These exogenous magnitudes will have an effect on the movement of labor coefficients, and the movement the consumption coefficients. These coefficients will be incorporated, and studied within an input-output coefficient matrix, and than based translated into the input-output model as was detailed in the previous chapter.

The five sector input-output model economy from chapter three is reproduced in Table 4 and the associated coefficient matrix is reproduced in Table 5. However now, the columns of final demand have been disaggregated further into consumption demand and investment demand. It becomes important to separate the two components of final demand, as with labor displacing technical process, the two may move in opposite directions. Obviously if technical progress is labor expelling it would be expected that aggregate consumption would decrease because of the loss of income. For the analysis in the following section, fixed production coefficients and constant

returns to scale will be assumed. Technological unemployment means a loss in income, which in turn causes a drop in aggregate consumption, as it is assumed for simplicity that the unemployed, since they have no income, consume nothing. However we will also assume a growing economy, so a growing economy, with technical progress, means that aggregate consumption may decrease or increase, depending on the relationship between the rate of labor displacement and the growth rate of the population. Here the analysis will limit the investigation to a closed economy first without government, and then with government spending. The first model considered is a free market economy without government. Thus the final demand component is limited to simply consumption demand and investment demand. Technical progress will be simulated over seven periods and the effect on the level of aggregate demand and employment will be shown. Following this simulation, a government ELR sector will be introduced into the framework, and again the effect on technological progress, aggregate demand, and the level of ELR employment, and total employment will be studied.

It follows from the assumptions already made that production prices, including the wage rate remain constant over time. The ELR wage will be equal to the wage rate offered in private sector employment in order to avoid changes in prices. While it has been argued in the past the the ELR sector should pay a living wage, all this will do is create a one time increase in private sector wages and prices, and the private sector must then compete with the ELR sector for labor. This one time increase in wages and price is not the same as inflation because it is a one time increase. However, I would like to avoid such a discussion and allowing for a livable

ELR wage above private sector wages is beyond the scope of the analysis.

The numeraire is $1.00. The wage rate will also be given a value of $1.00. It can then be thought that the amount of dollars spent on labor is equal to the total labor employed. Allowing the wage rate to equal one dollar will remedy the problem that the input-output tables are in monetary terms not real terms. So letting the wage rate equal $1.00 this is equivalent to 1 unit of labor.[6] For example at time period one from Table 4 total wages paid per sector are equal to $236. Total wages are equal to $1180, and the total population is equal to 1180 at the initial time period. We are going to assume that the wage rate is constant over time. In turn a reduction in aggregate money wages paid over time means a reduction in aggregate employment.

Now after assuming constant wages, labor productivity creates a reduction in labor cost per unit, and an increase in the mark-up, meaning an increase in profits per unit. It will be assumed that capitalists do not save, so all profits will be spent on new investment leaving prices constant. All that is produced is sold at current prices

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[6]If the reader would like, one could also think of this as being expressed as one hour of labor. In which case a reduction a reduction in the labor coefficients would equate to a reduction in aggregate labor hours, which also means that some workers have gone unemployed. In the current chapter, I have used $1.00 in wages instead to equate to one worker employed. Thus a reduction in the labor coefficients would mean a reduction in physical labors employed. Whether one wants to think of this in reference to 'hours worked' or 'physical workers' makes no difference. The result remains the same, that a reduction in the labor coefficient equates to unemployment. The reason why I have chosen to think of this in physical terms rather than hours worked, because when there is labor displacing technological change, and the labor coefficients are reduced, while simultaneously the population is growing, the total wage bill is exactly equal to the number of workers employed. When the total wage bill goes down, this means a reduction in the workforce, and it allows for a direct comparison with this and the physical size of the growing population.

as either consumption or investment. Lastly it will be assumed that the consumer preferences remain constant, thus the composition of consumption spending will stay the same throughout the course of the simulations.

Growth rate of the Population

Let the population grow at constant rate g. The initial population will be 1180. It will be assumed throughout the analysis that the total population at time t, (N(t)) is equal to the labor force (L(t)) at time t.[7] Equation 4.1 defines the population over time:

$$N(t) = 1180e^{gt} \tag{4.1}$$

where N(t) is the population at time t, g is an exogenous percentage rate of annual growth, and e is the exponential ($e = 2.71828$). Equation 4.2 defines the size of the labor force at any time t. This equation assumes that the labor force (LF) is equal to the size of the population.

$$LF(t) = N(t) = 1180e^{gt} \tag{4.2}$$

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[7]Again this is just another simplifying assumption. One would naturally expect that only a fraction of the total population would be in the labor force. Furthermore the proportion of working population to total population may change overtime depending on birth rates, death rates, and the overall age of the population. Again all this just complicates the analysis, and if one would like to bring it in, the population at time t is simply multiplied by a scalar to get the size of the labor force.

4.4   Labor Productivity and Technological Progress

Following Pasinetti (1993, 30), labor productivity will be a proxy for technological progress. It will be assumed that the annual labor productivity of labor (ρ) is given. and it will be assumed to be exogenous. The movement of labor coefficients over time is given in Equation 4.3.

$$l_i(t) = l_i(0)e^{(-\rho \times t)} \tag{4.3}$$

Harold Hagemann has argued that labor productivity should not be treated as exogenous, and that one should not assume equal rates of labor productivity across sectors. Hagemann argues that assuming technical progress as exogenous is actually a limitation of Pasinetti's modeling scheme. The rate of productivity growth in any given industry directly has an effect on other industries. The change in technique by assumption would cause a reduction in the labor coefficients. However it is very likely (in fact it is to be expected) that a new technique will cause a change in the demand of intermediate inputs by capitalist. Then the shift in the use of intermediate products may cause changes in employment in other sectors, depending upon whether the new technique requires more or fewer intermediate inputs from the industries than the previous time period, and whether the shift of the use of intermediate inputs causes a net increase/decrease in total labor employed. This result is ultimately dependent upon the direct labor coefficients for the sectors, and whether the implementation of a new technique in a given sector requires more or less inputs form sectors which may be "labor-heavy". Thus, according to Hagemann, it is proper that technical progress is actually endogenous as the diffusion of new technologies is dependent upon inputs

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of interrelated industries. (Hagemann, 1992, 44-48). The endogenaity of technical productivity is lost in Pasinetti's vertically integrated framework and is at the heart of inter-industry analysis.

If one were to follow Hagemann technical progress *should* be treated as an endogenous variable. However, doing so would require a host of assumptions as to the nature of the new technique, which industries would be affected and how the magnitude at which they would be affected and in one direction, which would change the inter-industry coefficients (a_{ij}), and hence output and employment in other sectors. However for now all that will be shown is the relationship between technical progress and aggregate demand, and how Keynesian-type aggregate demand policies only address half the problem. To accomplish, this assuming an exogenous rate of technological progress is acceptable. Thus, other than the direct labor coefficients (l_i) for each sector, all the other interindustry coefficients will remain unchanged.

From the assumption of an exogenous rate of technical progress, and an exogenous increase in the labor force, the sectoral rate of change of employment is also exogenous. Depending upon the parameters sectoral employment will either increase or decrease. It will increase if the rate of growth of the labor force outweighs the growth rate of labor productivity, and sectoral employment will decrease if labor productivity outweighs the growth rate of the labor force, and sectoral employment will remain unchanged if the two are equal.

4.5　The Economy at the Initial State

It should be made clear at this stage that the initial state of the system is given at full employment. This statement is by in no means realistic, and it is *not* an assumption of full employment, nor is an assumption being made that the economy tends to full employment. What is being demonstrated is just the opposite, which is to show that given a dynamic economy, with continual structural change,[8] a capitalist economy is unable to maintain full employment left to its own devices.

The following analysis is a simulation first and second stage of instrumental inference. The first stage of instrumental inference defines the initial state of the economy which is represented by the input-output table. The input-output table further defines the social relationships of production which is the first step toward the second stage of instrumental inference. Recall that the second stage is an investigation of the microeconomic elements, the producers and consumers, and the decisions regarding their respective consumption and investment activity, and how these decisions have an effect on future decisions regarding consumption and investment.

As detailed in the previous chapter, Table 4 can be considered a snapshot of the economy at the initial time period ($t = 0$). The total level of employment is equal to the summation of wages paid in each of the five sectors. Final demand is separated between the consumption and investment components. It is also noticed that national income is equal to national output (aggregate wages equal aggregate

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[8]The reader is reminded here that by structural change, it is in reference to changes in the structure of economy, i.e. changes to the size of the population, changes in make-up of the capital structure of the economy, and changes to in use or availability of natural resources.

consumption, \$1180, and retained earnings is equal to planned investment which is equal to \$860).

The input output table can be transformed into a coefficient matrix. Following the procedure outlined in the previous chapter, the intermediate inputs for each sector and the labor required for each sector are divided by the output of each sector. Traditional notation (a_{ij}, l_i) will be used to represent the coefficient matrix, so that the interindustry coefficients become:

$$a_{ij} = \frac{A_{ij}}{Q_i} \tag{4.4}$$

$$l_i = \frac{L_i}{Q_i} \tag{4.5}$$

where a_{ij} represents the amount of commodity i used by industry j. For example from Table 5 $a_{14} = 0.333$ which is equal to $\frac{350}{1050}$ from Table 4. This number means that Sector D uses \$0.333 of inputs from Sector A to produce one unit of output.[9] Labor per unit of output (l_i) is found in a similar manner from Equation 4.5.

It will also be of interest to investigate how profits are changing over time. From the assumption that technical process is labor displacing, and assuming prices are held constant, then the savings in the wage bill has to go somewhere. It is assumed that the savings in the wage bill are held over as profits to be employed in research

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[9]The sectors are labels A, B, C, D, E. In terms of subscripting coefficients, the number '1' will represent Sector A, the number '2' will represent Sector B, '3' Sector C, etc.

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	100	20	50	350	200	**720**	250	200	**450**	**1170**
B	80	40	20	140	150	**430**	150	150	**300**	**730**
C	300	10	60	410	300	**1080**	270	120	**390**	**1470**
D	200	50	60	80	150	**540**	290	220	**510**	**1050**
E	90	35	40	200	120	**485**	220	170	**390**	**875**
Int. Purchases	**770**	**155**	**230**	**1180**	**920**	3255	-	-	-	-
Wages	236	236	236	236	236	-	1180	-	-	-
Profits	200	150	120	220	170	-	-	860	-	-
Total VA	**436**	**386**	**356**	**456**	**406**	-	-	-	2040	-
Total Income	**1206**	**541**	**586**	**1636**	**1326**	-	-	-	-	5295

Table 5.   Input Output Coefficient Matrix - At Time = 0

Input/Output	A	B	C	D	E
A	0.085	0.027	0.034	0.333	0.229
B	0.068	0.055	0.0136	0.134	0.171
C	0.256	0.014	0.041	0.286	0.343
D	0.171	0.068	0.041	0.076	0.171
E	0.076	0.048	0.027	0.190	0.137

Table 6.   Labor Input per Sector per Unit of Output at Time = 0

Sector	A	B	C	D	E
Wages	0.202	0.323	0.161	0.225	0.270
Profits	0.171	0.205	0.082	0.209	0.194

and development and investment in new technologies.[10] Thus if the labor coefficients decrease by ρ, the profit mark-up coefficients increase by the same amount. Again, following Marx, it is assumed that capitalists are continually involved in researching and implementing labor-saving techniques. The labor per unit of output and profits per unit of output (π) where $\pi = \frac{\Pi}{Q_i}$ in the initial time period are given in Table 6 for each sector.

Table 5 is defined as the $\mathbf{A}$ matrix. The final demand, vector $\mathbf{Y}$ is the GDP column in Table 4. With this information we can define the quantity model for our

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[10]This conclusion follows from the assumption of fixed wage rates.

hypothetical economy.

$$\mathbf{AQ} + \mathbf{Y} = \mathbf{Q} \tag{4.6}$$

Solving for $\mathbf{Q}$:

$$(\mathbf{I} - \mathbf{A})^{-1} \times \mathbf{Y} = \begin{bmatrix} 1170 \\ 730 \\ 1470 \\ 1050 \\ 875 \end{bmatrix}$$

The price model completes the full model. The price model is found in a similar fashion. For the price model, wages and profits (expressed in the price model in terms of per unit of output, denoted π and w respectively) are paid post factum. The price model is given in equation 4.8. In the pricing model $\mathbf{Ap}$ is the inputs required per unit of output times the price per of the input per unit. This product equates to the material cost of producing one unit of output. Added onto this is the value added, divided between wages per unit of output (w) and the markup per unit of output (π). Thus the pricing equation illustrates calculates the price of each commodity given the total material and labor cost of production per unit, and taking into account the predetermined markup of the commodity per unit.

$$\mathbf{Ap} + (\pi + w) = \mathbf{p} \tag{4.8}$$

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Solving for **p**:

$$(\mathbf{I} - \mathbf{A})^{-1}(\pi + w) = \begin{bmatrix} 2.1335 \\ 1.6710 \\ 2.8855 \\ 1.7946 \\ 1.6302 \end{bmatrix} \qquad (4.9)$$

4.6 Simulation of Technical Progress and Aggregate Demand on an I-O Model

The previous section illustrated the initial stage of the economy which is to be studied. The population at the initial time period is 1180. Recall for simplification it is assumed that this is equal to the size labor force. Now the analysis will move from a static system to a dynamic economy through seven time periods. The results put forth in this section are based off of the initial stage of the economy represented in the input-output table given in the previous section. It will be demonstrated that given an increasing population, and increasing labor productivity, unemployment can not be fully compensated for. The section will simply provide an overview of the simulations and summary of the results. Specifically it will look at:

1. The dynamic nature of population and labor force growth, continual technical progress, the level of aggregate demand and the resulting level of aggregate income, output, and employment.

2. Identifying how technical progress results in an increase in profits and a decline

in the wage bill.

3. How the increase in profits from previous investment yields a subsequent increase in profits consumption demand.

4. Illustrating that the change in aggregate demand is below the full employment level of aggregate demand.

5. Identifying that GDP will always be below potential (full employment) GDP, and total output is always below the potential (full employment) level of total output.

The section will present these five results separately, and data for each of these statistics all drawn from the input-output table for each year over seven years. The results will be presented graphically in a time series for each separate component. However the reader may reference Appendix A for the complete input-output tables for each time frame along with a table of summary statistics for each period.

Simulating a Growing Population

Seven periods are simulated, and the linkages between technical progress, aggregate demand, and employment are studied. The first step in the analysis is to assume a growing population. The initial population is at 1180. Let the population growth rate be 3 percent ($g = .03$). The growth of the population over seven periods is shown in Figure 6.

Investment growth will follow the growth rate of population growth of 3 percent. Additional investment is at the same time expelling labor from production. Let $\rho = .04$ represent the rate of labor productivity.

An increase in labor productivity is normally thought of as a good thing. How-
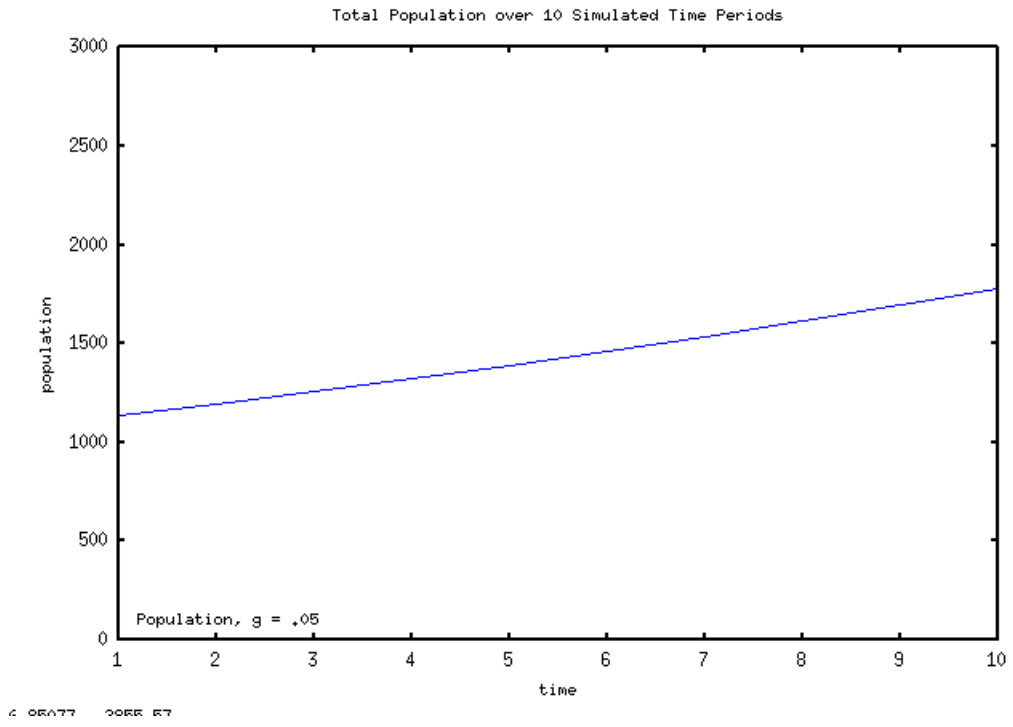
Figure 6.   Population Growth

ever, the increase in labor productivity is at the expense of the working class, à la Marx. In order for workers to consume they must have wages with which to consume. So given an increase in the labor force of 3 percent, and labor productivity of 4 percent, there will be, over time a continual one percent reduction in labor employed over time, and a one percent savings in total wages paid over time.[11]

Consumption spending is going to decline given the change in the savings in the wage bill. In other words, aggregate consumption will fall by the difference between the growth rate of the population and labor productivity $(g - \rho)$. Capitalist's savings from a smaller wage bill will be transferred to retained earnings for investment spending. Since that investment spending is just another form of final demand, investment will increase. This shift in spending compensates for the reduction in aggregate consumption. These effects are shown in figures 7 - 9. Figure 7 illustrates the reduction in direct labor per unit of output given an autonomous rate of labor productivity of 0.04. Figure 8 illustrates the redistribution of income from the working class to the capitalist class. The savings in labor cost per unit has been redistributed in the form of profits. Profits per unit of output is steadily increasing with the decreasing labor force needed. Obviously this conclusion is based on the assumption of an unchanging price level of output, so that none of the savings in labor costs are passed on to the consumer in the form of lower prices. And the whole of the savings in the wage bill is retained by capitalists. These funds are used by capitalists towards investment in

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[11]This conclusion is based upon the assumption that an increase in the growth of the labor force is identical to an increase in the growth rate of economic activity. This is the same assumption which Pasinetti (in all his works up to present day)has used in his modeling of dynamic economies.

new capital goods.[12]

These assumptions are very similar to the argument made by Karl Marx. Marx's analysis of capital accumulation. Capital accumulation "comes to fruition through a progressive qualitative change in its composition, i.e. through a continuing increase of its constant component at the expense of its variable component (Marx, 1990, 781). In Marx's analysis of the capitalist process capital accumulation and technological progress go hand in hand. Therefore, capital accumulation also causes technological unemployment. Laborers are the source of technical progress, so they create conditions which make themselves superfluous, they become part of the "surplus population" (Marx, 1990, 784).

However even under conditions of expanded reproduction the whole of the output is still being purchased. An ever increasing portion of the total output is shifted from workers consumption to the capitalists for investment.

> It must be understood that all the productions of a country are consumed; but it makes the greatest difference imaginable whether they are consumed by those who reproduce, or by those who do not reproduce another value. When we say that revenue is saved, and added to capital, what we mean is, that the portion of revenue, so said to be added to capital, is consumed by productive, instead of unproductive labourers. If all the goods produced are thus swallowed up by human consumption, there can clearly be no room to spare in the total social product for such unconsumable means of production as tolls and machinery, new materials and buildings, and too enlarged

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[12]I am assuming here that the final output produced in all sectors can either be consumed or used towards investment. In other words, investment goods are the same as wage goods. This occurs because of the problem of aggregation, it would require a highly disaggregated model to differentiate which specific industries produce goods for final demand and which produce consumption goods.

production will have to take on a peculiar course (Luxemburg, 1951, 109).

The assumptions in our model follow closely the analysis of enlarged production by Karl Marx and Rosa Luxemburg. The whole of the social product will always be purchased. However because of technical progress and capital accumulation, labor becomes redundant (see Figure 7) and the earnings saved through the expulsion of labor is transferred to profits (see Figure 8) for the purpose of accumulating additional capital. As seen in Luxemburg's analysis, this must be the case for expanded reproduction to occur.
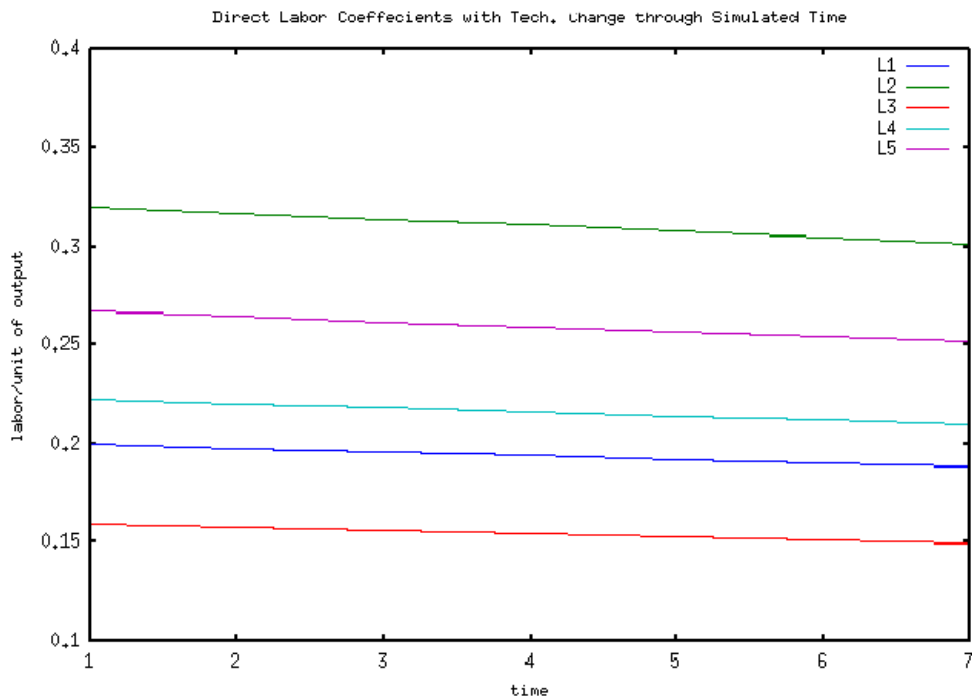
Figure 7.   Direct Labor Coefficients by Sector
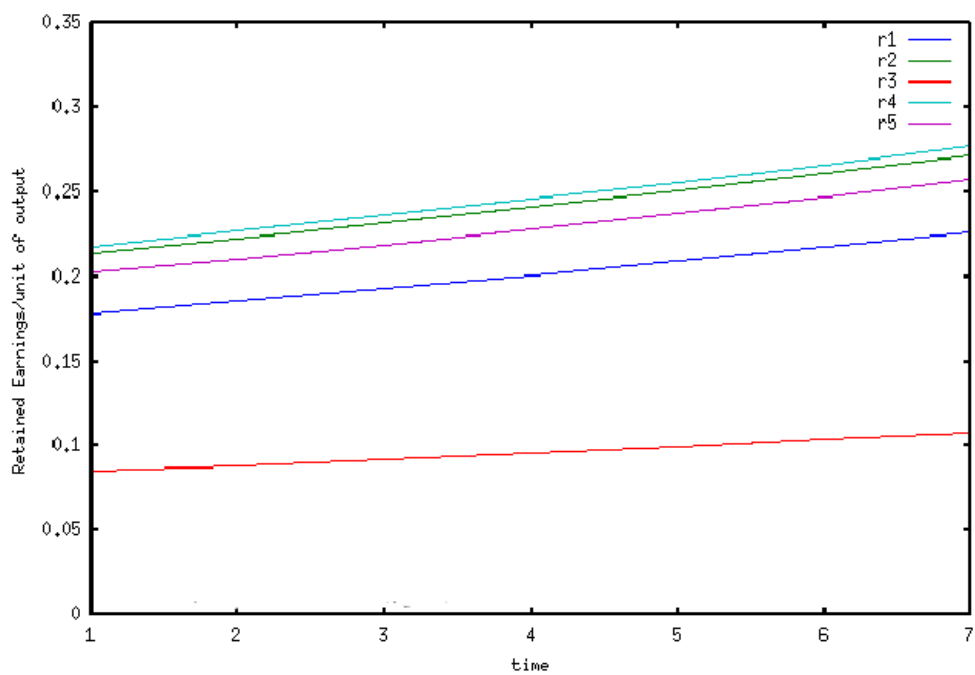
Figure 8.   Profits per Unit of Output

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Gross Domestic Product is seen to actually increase over time. The drop in aggregate consumption is made up for in additional spending by firms for investment. And both national output (final demand (C+I)) and total output (intermediate output plus final demand) increases. But unlike the neoclassical model which assumes that additional aggregate investment (via flexible interest rates) allows the economy to self-adjust to a full employment equilibrium, no such case is made here. It is assumed here the savings in the wage bill, because of labor displacing technical progress, is used to finance additional investment. But, following Keynes's "chapter 12" theory of investment, investment is taken place because it is expected to be profitable. And these expectations are so because all output is sold either as consumption goods or shifted towards investment goods. Thus aggregate consumption is expected to decline even though the population is expanding. However this is redistributed towards investment and therefore investment increases and GDP continues to expand with the growth of the population and total output will also expand. GDP, and the components to GDP are illustrated in Figure 9. Figure 10 illustrates the expansion of total output over the seven time periods simulated. Total output is the summation of intermediate output, plus final demand.

The redistribution of income of consumption to investment allows for all production to be purchased, and indeed it is the continual increase in investment spending which allows for this. It should be pointed out that all the other inputs are growing at three percent, the growth rate of the economy, with the obvious exception of the labor force coefficients. Thus , the models are depicting constant returns to scale. However by assuming constant returns to scale, I am simply suggesting that the mag-
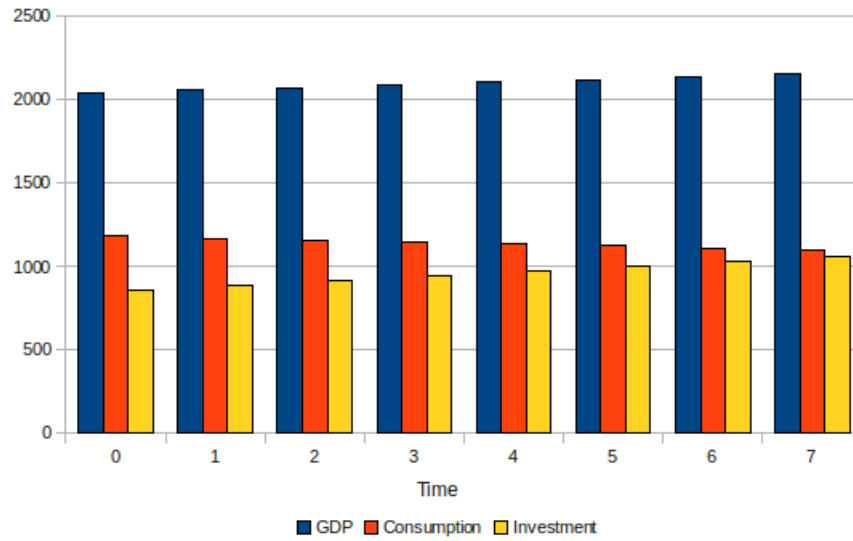
Figure 9.   Total Output, GDP and Components
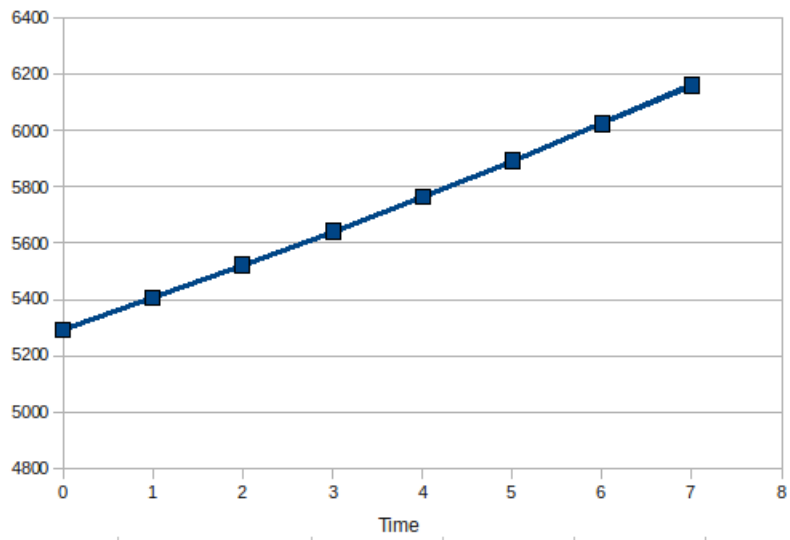
Figure 10.   Total Output in a Growing Economy

nitude of the effects of technological change on the other inter-industry coefficients are dependent upon the specific type of technical advancement, and to what degree those industries our affected. I have made no claims as to the effect technological progress has on other inputs besides labor.[13] Following a Marxian-Luxemburg analysis, the only assumption that is being made is that technological progress is labor displacing, as was noted above. The reduction in labor coefficients over time are seen in the input-output tables in Appendix A. The ratio of capital to labor is continuously increasing. Hence, the production process is becoming increasingly mechanized. As time goes by entrepreneurs are *continually* introducing *new technologies* for purposes of production (Robinson, 1965, 85).

The speed of the diffusion of new technology is dependent upon the physical life of capital goods. Worn out capital goods gets replaced with new capital goods which are the most efficient, and embody the latest inventions. Furthermore innovations which speed up production and utilize less labor are more rapidly diffused. However with durable capital equipment there is a continual game of "leap-frog" being played (Robinson, 1965, 86). As Joan Robinson explains, if ten years is the profitable life of capital equipment, a nine-year old plant will have the highest costs and yield the lowest profits. When this equipment is replaced the following year, the plant enjoys the

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[13]Regardless of returns to scale, technological progress is liable to have an influance on prices. There is not neccesarily a one to one relationship between the price model and the quantity model as I have assumed here. That assumption was made for simplicity, the pricing of output, among many other things, depends upon the impact of technological change on other sectors of the economy. Because not only can adjustments in inputs demanded (caused by a new technique) alter prices, but many other factors such as process innovations. The impact on prices is hard to demonstrate so for simplicity we are assuming that prices remain constant.

lowest costs and highest profits. But after every successive year new entrants would be producing with the latest capital equipment and the plant will lose its competitive advantage over time (Robinson, 1965, 85-85). Thus leap-frogging occurs. The diffusion of capital equipment becomes very rapid as each plant is exposed to pressure of existing competitors and new entrants. Investment in new capital goods will take place only if it is profitable (Robinson, 1965, 87).

The change in the technical composition of capital is caused because of a change in the type of products. The causality of investment activity in the Post Keynesian view runs from invention of new methods of production, innovation, which is technical knowledge, meaning it is the knowledge of the technical application of new products and processes into production, and lastly there is the investment by capitalists of the new technique of production (Courvisanos and Richardson, 2008, 185-188). Technical progress has been defined as new innovations in new capital goods that result in an increased mechanization of production. This conclusion is consistent with Marx's notion of the general law of capitalist accumulation. Profitability is the very reason that investment in new capital goods takes place. Following Richardson and Courvisanos, technical progress results product innovations (and possibly process innovations), which, following Marx's analysis of capitalist accumulation results in increased mechanization of production and a reduction of labor employed, the lower variable cost is shifted towards profits, these profits in turn result in further investment in new capital goods.[14]

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[14]This dispels Marx's theory of the falling rate of profit. The theory of a falling rate of profit has been disputed. Nabou Okishio published a highly influential paper that argued Marx's analysis of technical progress was misguided. Marx argues that

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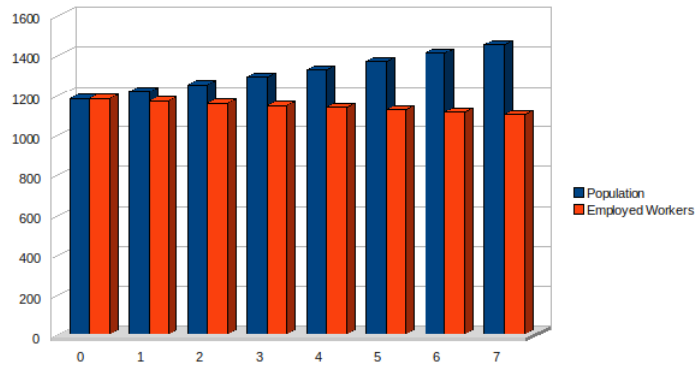
Figure 11.   Population Growth and Decline in Employment

This change in the technical composition of capital, this growth
in the of the mass of the means of production, as compared with
the mass of the labour-power that vivifies them, is reflected in its
value-composition by the increase of the constant constituent of cap-
ital at the expense of the variable constituent. ...This law of the
progressive growth of the constant part of capital in comparison to
the variable part. ...[A]ll methods of raising the social productivity
of labor ...are at the same time methods for increased production
of surplus value or surplus product, which is in turn the formative
element of accumulation (Marx, 1990, 773-775).

The conclusion is that unemployment must set in. The unemployment rate

began at zero percent in the initial time period. However the labor force also grew. In

order to meet the additional demand of a growing economy production must increase.

However in order to increase production requires the employment of additional cap-

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technical progress would be introduced if it raises the productivity of labor. Okishio
argues that capitalists are concerned with both productivity per se, but rather they
are concerned with lowering their unit cost of production. Okishio proved that tech-
nical change will only be viable if it is cost-reducing, and this will never lead to a fall
in the general rate of profit (Okishio, 1961; Cullenberg, 1992, 49-50, Laibman, 1992.
181-192).

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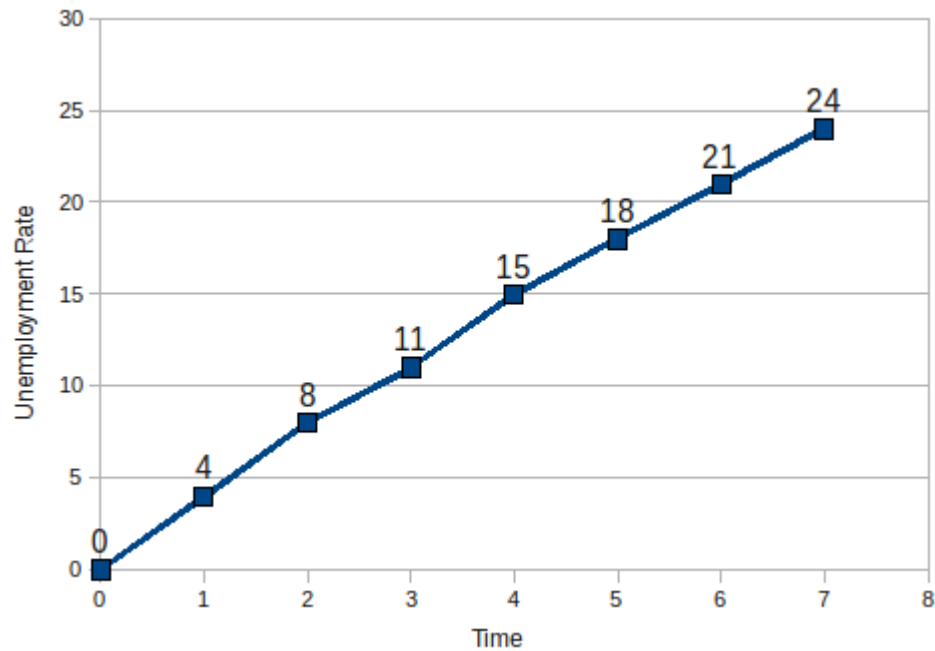
Figure 12. Unemployment Rate in a Growing Economy w/ Tech. Progress

ital. But capitalists will not employ "old" capital goods, they will always employ "new" capital goods which expels labor from the labor force. The population grows, and aggregate demand increases, and all output is being sold either in the form of consumption goods or investment goods. However the problem is that this level of production will always be below potential production, given the existence of unemployment. The unemployment rate over time is increasing as displayed in Figure 12.

Thus in a dynamic economy, with continual technological change, policy makers need to examine the implications of aggregate demand, and structural and technological change (Forstater, 2002, Pasinetti, 1993, 1981). In the current simulations

Time	Total Output	GDP	Cons./Wages	Inv./RE
0	5292	2040	1180	860
1	5406.65	2054	1168.2	885.8
2	5522.12	2068.89	1156.52	912.37
3	5641.52	2084.7	1144.95	939.75
4	5764.97	2101.44	1133.5	967.94
5	5892.58	2119.14	1122.17	996.98
6	6024.47	2137.83	1110.95	1026.88
7	6160.77	2157.53	1099.84	1057.69

Table 7.   Summary Results of Aggregate Expenditures over 7 Periods

(as evidenced in the input-output tables given in Appendix A) the structural changes were an exogenous change in the size of the labor force, and changes in the type of capital goods employed in production. Normally changes in the type of capital goods employed will have an affect on the whole input-output table. Just for simplicity, these dynamics were not considered, and the only factor input that was allowed to adjust over time was the direct labor inputs per unit of production. The main statistics of the economic aggregates from the simulations over seven time periods are illustrated below in Table 4.6.

4.7   Ineffectiveness of Keynesian Policy Alone

The previous simulation addresses Keynes's principle of effective demand. As Keynes stated:

> Thus to justify any given amount of employment, there must be an amount of current investment sufficient to absorb the excess of total output over what the community chooses to consume at the given level. For unless there is this amount of investment, the receipts of the entrepreneurs will be less than is required to induce them to offer

the given amount of employment. It follows, therefore, that, given
...the community's propensity to consume, ...the equilibrium level
of employment will depend upon the amount of current investment
(Keynes, 1936, 27).

The summation of aggregate consumption and aggregate investment determines the level of aggregate employment in the economy. Aggregate demand does drive the system. Based upon the assumptions that all wages and profits are spent on consumption and investment, the system still fails to achieve full employment, let alone maintain it.

The primary concern here is the relationship between the distribution of income between aggregate wages and aggregate profits. In line with this is the relationship between the size of the total capital stock with that of the labor force, the influence of capitalist competition which results in the rapid diffusion of technology, and the technique of production (Robinson, 1965, 70). Because of this it has been argued that full employment policies need to consider both Keynesian and Marxian unemployment. This is because two interconnected dynamics are pushing the system. First, the growth in the labor force is increasing. This *should* increase consumption, investment, output and employment. However this is not the only dynamic taking place. Simultaneously we saw investment in new technologies. The new technique increases the mechanization of the production process expelling workers. It was assumed that labor productivity outweighed the growth rate of the labor force, which pushed consumption to fall. However, when aggregate consumption fell, aggregate investment made up for it. But the level of investment was insufficient to bring the economy to the full employment level.

There are two inter-related dynamic components taking place. One is an ag-

gregate demand (or effective demand) component taking place. The second dynamic component relates to the productivity of labor over time. In order to maintain full employment over time, it is quite clear that technical progress needs to be taken seriously, and needs to be considered simultaneously with effective demand.

> [T]he fulfillment of [the effective demand condition] at any given time, no longer automatically entails that it will remain fulfilled through time . . . [E]ven if full employment of the labour force and full capacity utilisation are realised at a given point in time . . . the structural dynamics of the economic system cause that position to change and therefore make it impossible in general to maintain full employment through time. (Pasinetti, 1981, 87)

4.8   Employer of Last Resort in a Leontief Input-Output Model

Kalecki's analysis of capitalism is one in which businesses are operating with excess capacity alongside the with the unemployment of labor (Sawyer, 2007, 7). There is with this the implicit assumption that full employment can be achieved if there was a sufficient level of aggregate demand. Kalecki argued that there must be an appropriate balance between the available labor with sufficient needs in investment in order to employ all available labor, and leave some planned capacity in reserve. If this was the case than there would be full employment without inflation. The high level of demand for both consumption and investment goods, with the appropriate level of productive capacity is sufficient for full employment, however in capitalist economies, this level of demand will not be achieved. Full employment must be a policy by the government which is actively pursued.

> Full employment can only be maintained if it is an actively pursued policy by the government. If the government undertakes public investment (e.g. builds schools, hospitals, and highways) or subsidizes

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mass consumption (by family allowances, reduction of indirect taxation, or subsidies to keep down the prices of necessities), and if, moreover, this expenditure is financed by borrowing and not by taxation (which could affect adversely private investment and consumption), the effective demand for goods and services may be increased up to a point where full empolyment is achieved. *Such government expenditure increases employment, be it noted, not only directly but indirectly as well, since the higher incomes caused by it result in a secondary increase in demand for consumer and investment goods* (Kalecki, 1943, 322, emphasis added).

Kalecki (1943) argument above is essentially the purpose of simulating the implementation of the employer of last resort program over time. Increased government expenditures on a job creation program increases consumption demand, which in turn, as Kalecki notes, results in a secondary increase for investment goods. This secondary increase in the demand for goods and services from the private sector results in an increase in aggregate output and employment in the private sector and a fall in output and employment of the government ELR sector.

Kalecki saw that a major obstacle to the maintenance of full employment was because of political motives. The reason for the opposition of full employment policies by business and political leaders may be due to the dislike of government intervention in general, the dislike of subsidies on consumption and investment, or the dislike of the social and political changes that result from a full employment policy (Kalecki, 1943, 321). However, in his view, laissez-faire capitalism is inconsistent with sustained full employment. Kalecki argued that a full employment capitalism must be coupled with social and political changes (Sawyer, 2007, 14-17). Kalecki has argued that full employment does not serve the interests of capitalists. One would perhaps argue that full employment is mutually beneficial to both the working class and the

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capitalist class. However as Kalecki has argued, full employment compromises the elevated social position of the capitalist class. In a fully employed economy, dismissing workers ceases to be an effective disciplinary device. Furthermore there may be strikes surrounding wages and working conditions (Kalecki, 1943, 325-327). Kalecki argues that economic and political stability (i.e. the prevention of uprising by the working class) is more appreciated by the capitalist class than securing higher revenue which would incur if there was full employment. Further, Kalecki warns that public investment must not interfere or compete with private investment. This position of non-competition between public and private investment follows because if competition were to exist between public and private investment, public investment would exactly crowd out private investment, without a net gain in aggregate employment.

The employer of last resort approach to full employment solves many of these issues that are raised by Kalecki. The output from ELR employment is not meant to compete with the private sector.[15] The government's role as a sector in the economy is to provide for the welfare of its citizens. This role is left unchanged with the implementation of an ELR program. The government would carry out services that promotes the general welfare. The government alone is the only sector in a capitalist economy which can use the outcome of "benefiting the welfare of the general public" as the yardstick which projects are measured on. The private sector does not have this privilege. The private sector is concerned with pecuniary motives, which is a consequence of doing business in a capitalist society.

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[15]For this issue, and a nice overview of the key ingredients of an ELR program see Tcherneva (2003).

> The policy problem is to develop a strategy for full employment that does not lead to instability, inflation, and unemployment. The main instrument of such a policy is the creation of an infinitely elastic demand for labor ...that does not depend upon long- and short-run profit expectations of business. Since only government can divorce the offerings of employment from the profitability of hiring workers, the infinitely elastic demand for labor must be created by government (Minsky, 1986, 308).

A public works program allows for variability in the technique of production, while simultaneously allowing for flexibility of production while maintaining full employment. Only government can provide for, and maintain, a fully employed economy. The government operates with it's own set of rules. Their objective are towards the macro-goals, the micro-goal of profits is of no concern. Furthermore the government does not need to worry about the state of short term or long term expectations as private investors must. The government itself is not concerned about final demand of ELR services, because *"they themselves determine the purpose that investment and its final output is to serve* (Lowe, 1987, 107)."

Public sector employment is not dependent upon the prior construction of real capital goods (Forstater, 2006, 2000; Wray, 2000b, 1998). This statement is not to mean that an ELR sector will not utilize intermediate inputs. In fact they will, and the inputs which the ELR sector requires will be specific to specific types of public sector projects. However, public sector employment can forego automation and be as labor intensive as required, a luxury which is not available for the private sector in capitalist economies (Forstater, 2006; Wray, 1998). The utilization of technology would be employed to complement the labor force, not replace it. Such circumstances for the utilization of capital equipment would be for training and for certification which

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are marketable in the private sector. There is also a vast array of pure services in the fields of health, education, environmental clean-up, etc (Wray, 2000b, 1998).

Simulating the implementation of the employer of last resort program in a modern inter-industry production economy has yet to be accomplished. Here such an analysis will be undertaken. From the input-output tables detailed in Appendix A, it was seen that after the initial time period, because of both technological progress and insufficient effective demand, the economy, left to its own devices, in incapable of achieving let alone maintaining full employment. The first step is to add in the government sector into the original input-output table outlined above in Table 4. The government is going to serve as a producer of pure services, and based upon the previous discussion, its only input will be that of labor. The reason for this assumption is that the purpose of ELR employment is not to compete with the private sector, rather it's purpose is to work in conjunction with the private sector. So the ELR sector will not produce commodities in which to be sold, rather the ELR workers will be providing public works. It makes sense that the ELR sector will use intermediate inputs, however the inputs which the ELR sector uses is dependent upon the work to be performed. The work to be performed is regional, and it will be different based upon the region in which the local ELR office is located. The ELR program is a national program but its implementation is on the local level. Each local ELR will be utilizing specific inputs dependent upon the work being done and the needs to the community. For these reasons, in this analysis, we are simply assuming that the ELR sector uses labor as its only input and produces pure services. Furthermore, given that the government does not compete with the private sector, it will be assumed

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that the government sector determines the final demand for the services of the public sector employees. The input-output table at the initial time period with the inclusion of the employer of last resort sector (Gov't-ELR) is provided in Table 8.

Simulations of Technical Progress and Aggregate Demand in an ELR Model Economy

The simulation of a growing labor force, labor displacing technical progress, and the associated effects on aggregate demand were illustrated. Even with allowing for all other inter-industry coefficients to remain constant besides the value added coefficients (labor and retained earnings), it was still easily shown the devastating effects that technical progress has on the labor force. The input output tables over time from Appendix A clearly illustrates that even though the population is growing, consumption is shrinking. True, this result is generated by the way the model was specified. However, it was done this way to clearly demonstrate the interrelatedness between population growth, technical progress, and the effects both have on aggregate consumption. In any other case, if labor productivity were positive, and less than the growth rate, aggregate consumption would be increasing, but increasing at a slower rate than the increase in the population. For example if the population grew at 3 percent and labor productivity grew at one percent, aggregate consumption would grow at two percent. In either scenario, the one just described or the one which was simulated where labor productivity is faster than the growth rate of the population, policy makers still need to address both Keynesian and Marxian unemployment.

At time period (t+1) the population (and the labor force) grew at 3 percent. This equates to a population of 1,216 people ($1180 \times (1.03) = 1215.4$ or in terms

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of dollars $1215.4). Now of those 1216 there were 1180 people previously employed. Based upon the assumption that the population is our labor force this leaves 36 workers looking for employment. This is the traditional Keynesian aggregate demand problem. However, member of the capitalist class are in heated competition with each other for both market share and profits. Capitalists are compelled to innovate, and they are driven by such motivations. As such, the capitalists do innovate, and labor becomes more productive. In fact, labor can now produce more total output with less labor. Labor productivity increases by 4 percent. So capitalists see the population increasing, expectations of increased sales are developed, and plans are made to increase production by three percent, as aggregate demand is expected to increase by three percent. However in the response to increase production, technical progress displaces four percent of the labor force. The total addition to the labor force is the difference between the growth rate and labor productivity, or minus one percent, So not only does consumption not increase in the next period, but it actually falls by one percent, and employment falls to 1169 (exact calculation is equal to 1168.2).[16] An additional 35.4 workers were added to the labor force because of population growth. However there was no employment available in the private sector. In addition to a growing population 11.8 employees were expelled from the

[16]Expectations of capitalists will be realized, because the drop in consumption spending is made up for my an increase in investment spending, based upon the assumption that there are no savings out of profits. So the whole of total output will in fact be purchased. However, as in the Keynesian model, the level of total output will not be at the full employment level.

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labor force because of increased mechanization.[17] Profits increased to \$884.8, and aggregate demand still rises as the savings in the wage bill is turned over to profits and then towards investment spending which also stands at \$885.8. However even though GDP rises from \$2040 to \$2054, and total output rises from \$5295 to \$5406.65, the economy is still well below potential GDP. All that is being produced is being consumed or invested. However this does not mean that the economy is on it's full employment path. There are approximately 48 workers unemployed.

Now, what happens when public sector employment is added into the input-output model. The model is depicted in Table 10. Originally there were 48 (47.2) workers unemployed after one time period. This level of unemployment was due to a growing population and workforce. An additional 35.4 workers were added to the labor force because of population growth. However there was no employment

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[17]Over the course of the simulation of seven periods it is seen that the production process is becoming increasingly mechanized. This can potentially lead to the occurance where labor makes up such a small component of production that it can be thought of as essentially commodities producing commodities. The working class becomes marginalized. As Marx put it:

In proportion as the bourgeoisie, i.e., capital, is developed, in the same proportion is the proletariat, the modern working class, developed – a class of labourers, who live only so long as they find work, and who find work only so long as their labour increases capital (Marx, 1965, 68).
The unceasing improvement of machinery, ever more rapidly developing, makes their livelihood more and more precarious; the collisions between individual workmen and individual bourgeois take more and more the character of collisions between two classes. Thereupon the workers begin to form combinations (Trades Unions) against the bourgeois; they club together in order to keep up the rate of wages; they found permanent associations in order to make provision beforehand for these occasional revolts. Here and there the contest breaks out into riots (Marx, 1965, 72-73).

available in the private sector. In addition to a growing population 11.8 employees were expelled from the labor force because of increased mechanization. Now with the implementation of the employer of last resort program, initially the 47.2 workers are employed in the government-ELR sector. It is seen from the input-output table that the government-ELR sector simply pays the workers a wage. The ELR sector uses no intermediate inputs. The ELR workers provide services which enhance public welfare; so unlike the other industrial sectors in the economy, there is no final demand for ELR services. The purpose of the ELR is not to make a profit (hence no retained earnings) but to provide employment to those who are unemployed while simultaneously provide retraining laborers and providing public works. However what should be noticed is that consumption is increased in every sector in the ELR-model (Table 10) versus consumption spending in the non-ELR model (Table 9).

It was assumed that the additional income of newly hired ELR workers is spent on consumer goods and the additional consumption expenditure is equally divided among sectors A through E. Therefore, in the ELR-model consumption increased per sector by $9.44. Aggregate consumption in the non-ELR model was $1168.2. After the introduction of the ELR program, aggregate consumption increased to $12515.4. This result is illustrated in Figure 4.8.

The additional consumption provided by ELR-income means that more inputs are needed in the private sector, including labor inputs, than prior to the implementation of the ELR program. It is seen from examining the non-ELR input-output table (Table 9) versus the input output table with an ELR sector (Table 10) that all inputs, including labor inputs, have increased in the ELR-model. In fact, sixteen

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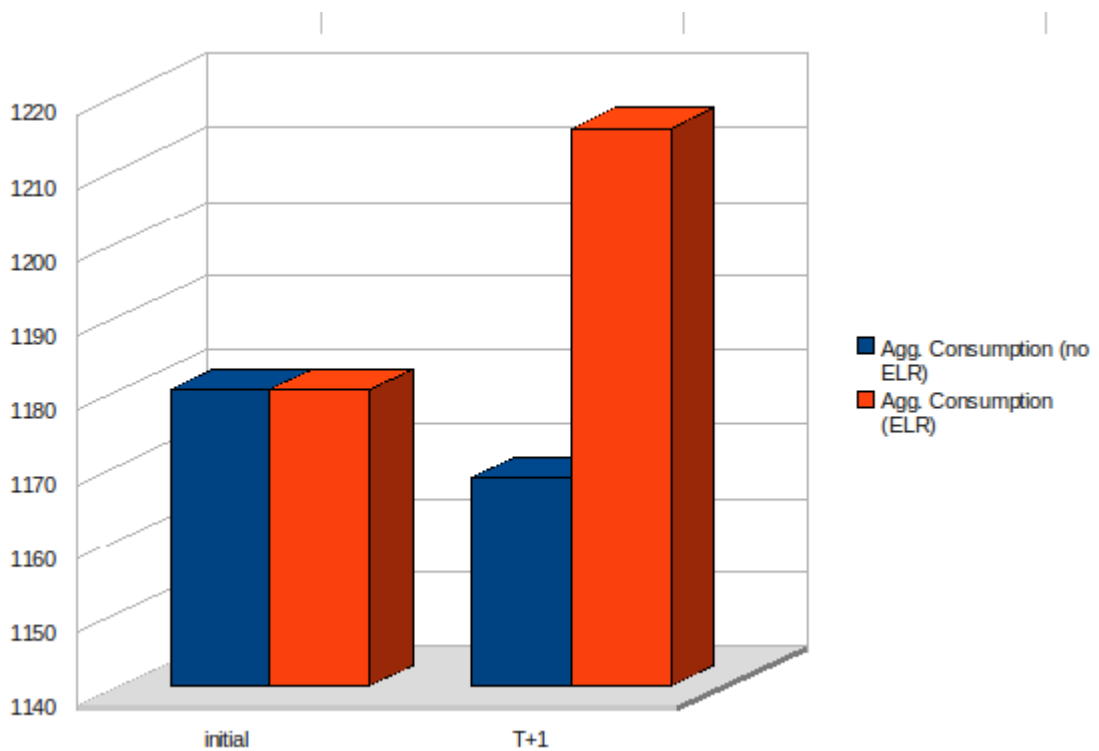
workers (exact calculations is 15.29 workers) moved from ELR employment after the first simulated period.

Thus to accommodate the additional demand, the private sector must hire more workers than previously. The private sector pulls employees from the ELR sector, and the aggregate wage bill increases, however wages per unit of output have still fallen, and profits from the new technique are still realized. The additional employment, reflected by an increase in aggregate wages paid, still falls short of full employment. There is then a small proportion of the labor force who will remain in ELR employment. This result is shown in Figure 4.8

It is noticed from the non-ELR input-output table and the ELR input-output
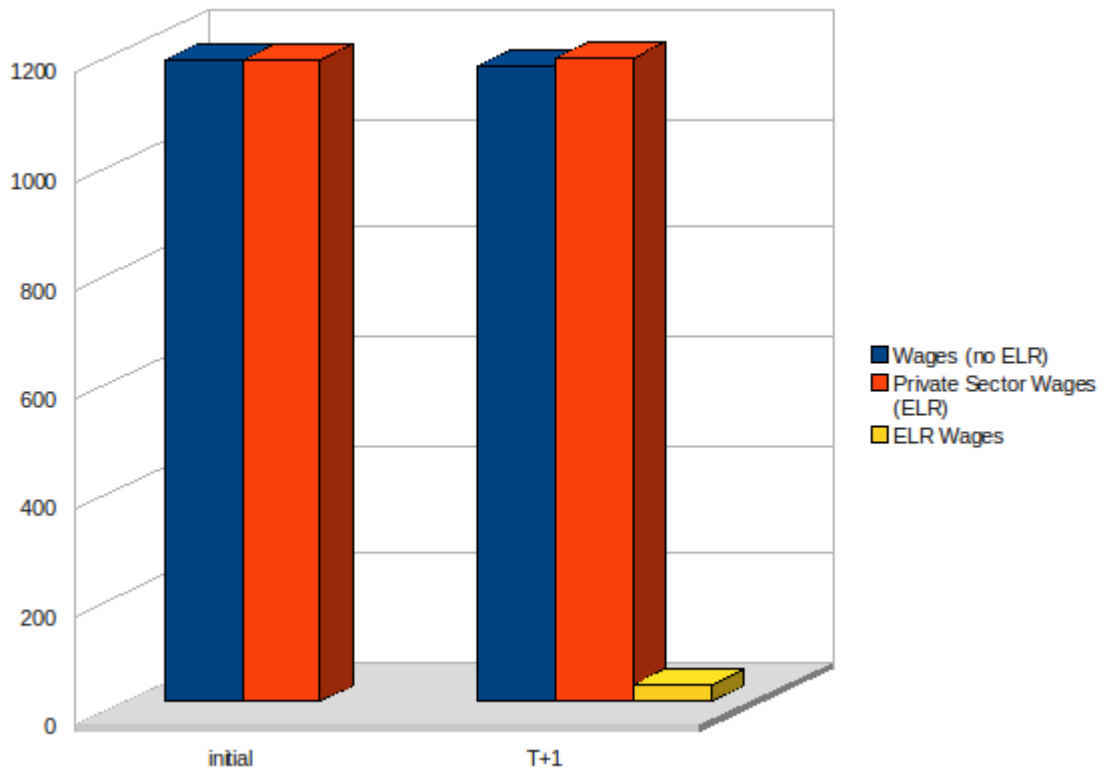
table that total intermediate output has increased from \$3352.65 in the non-ELR model to \$3383.73 after the introduction of the ELR program. Recall, the newer, more profitable technology is still in place in the private sector, even after the introduction of the ELR. So the additional demand for consumption means additional profits for the capitalists. In fact, after the introduction of the ELR, retained earnings actually increased from \$885.8 to \$893.37, reflecting the additional output sold. This result is shown in Figure 4.8.

GDP has grown significantly after the introduction of the ELR program. The government was not assumed to be a component to final demand, they simply em-

ployed ELR workers, and the ELR income was spent on additional consumption. The consumption component was not the only increase to GDP, investment spending also grew. Investment spending grew based upon the assumption that capitalists did not save, and all retained earnings are spent on investment. Thus, as consumption demand grew, so did the level of retained earnings, and in turn the level of investment across sectors. This additional investment demand sets off a further increase in the demand for intermediate inputs to which further increases total demand, which increases the demand for labor in the private sector. However aggregate consumption does not increase again, because these additional workers employed have come from the ELR sector and they are already consuming. So there will just be another shift in employment from the ELR sector to the private sector. This result is is depicted in Figure 4.8. The Figure shows that initially all unemployed workers were employed in the ELR sector. This is depicted in the Figure 4.8 as "Projected ELR Employment" and is equal to the level of unemployment after one time period which is 47 workers. However as just detailed ELR employment sets off multiplier effects throughout the economy, spurring private sector demand for laborers and there is movement from ELR employment to private sector employment. The actual level of ELR employment is less (31.9 ELR workers employed) after the multiplier effects set in.

These results that have been described are shown moving from one time period to the next. During this time technological progress expelled workers from the labor force, and even under a growing economy, full employment could not be maintained. However the ELR program provides for flexible full employment by allowing movement from the ELR sector to the private sector while maintaining full employment.

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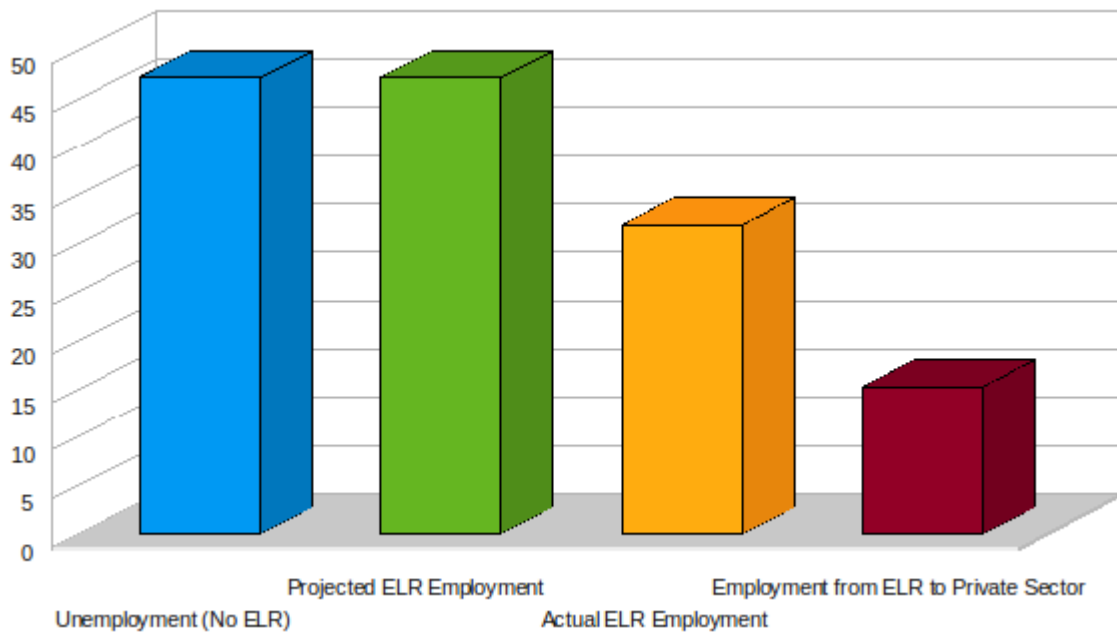
While the results were simply detailed step by step over one time period, these results are the same over time. Technical progress, and the growth rate are continuous functions. While the input output tables are static models, it is easily seen that at any point in time throughout the year and over years an ELR program maintains full employment.

Over time, instead of consumption falling because of technological progress, consumption is maintained. The only change is that profits increase with an increase in labor productivity. These in turn are spent on additional investment, creating multiplier effects and having workers shift back from ELR into the private sector, but consumption spending is maintained. Thus the ELR program addresses both Keynesian and Marxian unemployment seamlessly. The simulations presented provide a

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formalization of the ELR program within dynamic capitalist economies. The results show that the implementation of ELR program does not compete with the private sector, rather the ELR sector complements the private sector.

Table 8.   Hypothetical Input Output Table at Time = 0

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	Gov't-ELR	GDP	Tot. Out.
A	100	20	50	350	200	**720**	250	200	0	**450**	**1170**
B	80	40	20	140	150	**430**	150	150	0	**300**	**730**
C	300	10	60	410	300	**1080**	270	120	0	**390**	**1470**
D	200	50	60	80	150	**540**	290	220	0	**510**	**1050**
E	90	35	40	200	120	**485**	220	170	0	**390**	**875**
Gov't-ELR	0	0	0	0	0	**0**	0	0	0	**0**	**0**
Int. Purchases	**770**	**155**	**230**	**1180**	**920**	3255	-	-	-	-	-
Wages	236	236	236	236	236	-	1180	-	-	-	-
Ret. Earn.	200	150	120	220	170	-	-	860	-	-	-
Total VA	**436**	**386**	**356**	**456**	**406**	-	-	-	-	2040	-
Total Income	**1206**	**541**	**586**	**1636**	**1326**	-	-	-	-	-	**5295**

Table 9.   Input Output Table (No-ELR) at Time = t+1

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	103	20.6	51.5	360.5	206	741.6	247.5	206	453.5	1195.1
B	82.4	41.2	20.6	144.2	154.5	442.9	148.5	154.5	303	745.9
C	309	10.3	61.8	422.3	309	1112.4	267.3	123.6	390.9	1503.3
D	206	51.5	61.8	82.4	154.5	556.2	287.1	226.6	513.7	1069.9
E	92.7	36.05	41.2	206	123.6	499.55	217.8	175.1	392.9	892.45
Int. Purchases	793.1	159.65	236.9	1215.4	947.6	3352.65	-	-	-	-
Wages	233.64	233.64	233.64	233.64	233.64	-	**1168.2**	-	-	-
Retained Earnings	206	154.5	123.6	226.6	175.1	-	-	**885.8**	-	-
Total VA	439.64	388.14	357.24	460.24	408.74	-	-	-	**2054**	-
Total Income	1232.74	547.79	594.14	1675.64	1356.34	-	-	-	-	**5406.65**

Table 10.   Input Output Table w/ELR at Time = t+1

Input/Output	A	B	C	D	E	Gov't-ELR	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	103.81	20.86	51.82	362.67	208.17	0	747.33	256.94	207.63	462.94	2110.27
B	83.05	41.72	20.73	145.07	156.13	0	446.7	157.94	156.46	312.44	468.57
C	311.44	10.43	62.19	434.84	312.27	0	1131.17	276.74	124.37	401.11	1532.28
D	207.63	52.15	62.19	82.90	156.13	0	561.0	296.54	227.96	524.5	1085.5
E	93.43	35.50	41.46	207.23	124.91	0	502.53	227.24	176.95	404.19	906.72
Govt-ELR	0	0	0	0	0	0	-	-	-	-	-
Int. Purchases	863.73	160.66	238.39	1232.71	957.61	0	3388.73	-	-	-	-
Wages	235.49	236.60	235.11	235.05	236.11	31.91	-	1215.4	-	-	-
Retained Earnings	207.63	156.46	124.37	227.96	176.95	0	-	-	893.37	-	-
Total VA	443.12	393.06	359.49	464.07	413.02	31.91	-	-	-	2105	-
Total Income	1306.85	553.72	597.88	1675.64	1370.63	31.91	-	-	-	-	5453.85

CHAPTER 5

CONCLUDING NOTES AND AREAS FOR FURTHER RESEARCH

5.1 Concluding Notes

The employer of last resort approach to full employment is more effective than current policy approaches to the problem of unemployment. The reason is that instead of paying people to not work, such as is currently being done with unemployment compensation, the government pay prople to work. As was addressed in chapter 2, the social costs to unemployment need to be considered. These non-economic costs still linger, even if the unemployed are receiving government compensation. Employing the unemployed helps releive these social costs. As was suggested previously, the rate of technological progress is also important. As technology improves, and improves more rapidly, the skills of the workforce need to be just as dynamic. However, skills are not only maintained overtime during employment, but developed to accommodate new technologies. The unemployed suffer the dual-problem of losing previously acquired skills, but also do not develop new skills for new techniques. Thus the duration of unemployment matters. The ELR sector can counteract this by offering continual training help maintain a skilled workforce.

The main objective of the thesis is to formalize the implementation of the employer of last program in capitalist economies. In doing so the work illustrates how such a job creation program can cordinate with the private sector, rather than competing with the private sector. This was the primary task of previous chapter. An instrumental approach was taken, which investigated not only the macro goal

of full employment, but investigated the appropriate modeling of economic activity which incorporates both decision making and the interrelationships of capitalists with themselves, and capitalists and workers. Static input-output models were found to best incorporate both economic decision making, and properly outline the interrelationships of the production process. The ELR program was modeled in this fashion.

The primary objective of the previous chapter was to demonstrate how the ELR approach to full employment contemporaneously addresses both structural and technological unemployment, and Keynesian unemployment. The ELR approach to full employment is more effective than existing policies. Currently the officially unemployed receive transfer payments from the government to not work. Chapter 2 discussed that unemployment can have a cumulative effect. Given continual technological advancement, the longer the duration of unemployment the harder it becomes for re-employment. Granting transfer payments does not allow for the unemployed to maintain skill levels nor do transfer payments allow for re-training when

There are certain limitations to the simulations provided in the last chapter. As with all attempts to model economic behavior, the conclusions that were given followed from the assumptions being made.[1] However if one agrees with the

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[1]It is arguable that the assumption of a constant rate of technological progress is inappropriate. However, allowing the rate of technical progress to change over time is just as arbritrary as allowing the rate to be constant over time. What the simulations are attempting to demonstrate is the effectiveness of the employer of last resort approach to full employment, and how this approach contemporaneously addresses the both Marxian and Keynesian unemployment. This task is accomplished by allowing a constant rate of technical progress over time. Furthermore, as seen from the simulations from Chapter 4, and detailed further in Appendix A demonstrate that over time, increased mechanization will lead to, in theory, no employment in the private sector. It will become a world where capital, and capital alone produces both

assumptions, than one must agree with the conclusions which are derived from those assumptions. The model which was given may have been over simplistic. However in defense the best models are the ones that are simple and useful. Complexity is not needed solely for complexity sake. However certain objections to the assumptions may be made, which I shall try to briefly clarify.

First, the main objective of the thesis can not get lost. The primary objective was to model the implementation of the ELR program in capitalist economies, and answer how the ELR sector responds to both Keynesian and Marxian unemployment. The first objection is that the entire thesis rests on the assumption that technical progress is a continual function. Without this the problem of technological change is really a non-issue. The problem is that a new technique can be introduced at any time, continuously, not just at the beginning of each period, otherwise there would be greater unemployment at the beginning of each period and the government can simply respond through fiscal stimulus until full employment is attained. And then when a new period begins, and a new technology is introduced, the government simply respond again, and full employment is attained and maintained. But as Robinson (1965) argued, because of the nature of capitalist competition, the profitable life span of capital equipment is shorter than the actual physical life of capital. The fiercer the competition, the greater the speed of technological progress. So technological

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capital and consumption goods. While this is extreme, and unlikely ev in reality, the simulations demonstrate that even if this were to occur, the government is still able to respond contemporaneously, and the whole of the workforce will still remain employed, only in the ELR sector rather than the private sector. The models are made more extreme than neccesary because if the ELR approach is shown to be effective in extreme situations, it must then also be effective less extreme, intermediate cases.

progress can be thought of as a continual function. This also follows the conventional approach of modeling economic behavior.

Secondly, the previous chapter may not have adequately modeled structural change. It was assumed that technological change had an effect on the labor coefficients only. However, as stated this is an over-simplification of the process. Technological change will most likely have an effect on every coefficient in the $\mathbf{A}$ matrix. Thus, a change in technique in Sector i, requires less labor per unit of output in Sector i. But the new technique may require additional inputs from Sector j. If we assume that the technique in Sector j was left unchanged, a portion (or theoretically all) of the labor expelled in Sector i will be reabsorbed in Sector j due to the additional demand for intermediate inputs from Sector j to Sector i. But as stated in the previous chapter, such scenerios requires assumptions regarding which industries are affected, in what direction are they affected, and to what magnitude are these industries affected. Such complexity is not necessary for modeling the ELR program in capitalist economies. All that is needed is the existence of both Keynesian and Marxian unemployment in a dynamic capitalist economy, and to model continual changes to the size of the pool of unemployed overtime to demonstrate how the ELR approach *contemporaneously addresses the problem of unemployment.*

5.2 Secondary Considerations

Secondary consideration of the thesis was towards a discussion of the greater social costs of unemployment. Adolph Lowe has long called for the integration of all the social sciences. It was his viewpoint, that in order to understand economic

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systems, one must first understand the social make-up of societies. The economy is simply one aspect of a social system. However it has linkages in every other aspect of society. Lowe attempts to move "towards a science of political economics." This science, which he refers to as instrumentalism takes into consideration the larger goals of society, the initial state including all relevant social institutions, and the path to which the system can move towards the achievement of the desired goals. Instrumental analysis, then forces one to move beyond economics, and formulate an accurate depiction of society, and its influences, and how these can be altered to- wards the achievement of greater societal goals. The causes and consequences of unemployment go well beyond not having work. Chapter 2 broadened the scope of the problem to incorporate social and psychological costs to unemployment. It was seen that such consequences have an affect on the ability of the unemployed to regain employment.

Unemployment was seen to have many other social costs. The effect of unemployment has on marriages and families was discussed. Unemployment was shown to have a positive effect on criminal activity as well as increased racial antagonism. Thus the argument was made that the benefits of full employment go beyond the labor market.

5.3   Areas for Further Research

Without going into sufficient depth, the remainder of the chapter will outline areas for further research. The input-output approach to modeling the ELR program provided in the previous chapter is the first step to many areas for further research. Because the methodology of the input-output approach is identical to the modeling

of economic activity taken up by local and national governments, the methodology can be extended to provide a realistic outlook of the economic outcomes of the ELR program in actual economies, both at the regional and national level. This will be briefly discussed followed by a brief discussion of the possible environmental impacts of the implementation of the ELR program.

5.4 Simulating ELR in an Input Output Framework

The analysis could be extended to analyze the regional impact of an Employer of Last Resort program. ELR programs are funded nationally, however they are administered at the local level. State and local governments are much more aware of the needs of their own communities than the federal government. The question to ask then is: What are the economic impacts of an ELR program on earnings, output, and private sector employment as a result of spending by the ELR employees? Economic impact studies are done at the regional level when major corporations or other major employers, such as manufacturing companies, waste disposal corporations, etc. enter or leave a town. Such an approach can be taken up. However, the difference is that instead of modeling the economic impact of a private company moving into town, it would be to model the regional economic impact of a federal Employer of Last Resort program. The ELR provides income and employment the same way any major business would. However the key difference here is that ELR output does not compete with private sector, as ELR output is not sold to the private sector.

Employees in the ELR program purchase goods and services from other businesses in the region. These businesses would respond to this increase in demand by making additional purchases and hiring additional employees out of the ELR work-

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force. However, this creates a demand for inputs in other industries as well; as one firm increases it's output, it's demand for inputs (intermediate goods) also increases. Hence this would create a demand for workers in these "input" industries, which increases private sector output and income further. This income generates a third round of spending, which generates additional employment and output, etc. This multiplier effect will continue until it becomes insignificant.

The size of the multiplier is dependent on several factors, one on the most important factors is the size of the geographical region. Larger regions would obviously have a larger multiplier than smaller regions. This means that multipliers of a state, is larger than multipliers for a region. This is because of the greater inter-industry linkages that are reflected by a larger geographical region. Multipliers are calculated by the *Bureau of Economic Analysis* for all fifty states, and counties or regions within each state, and is known as RIMS II (Regional Industrial Multiplier System). It is a handy tool to measure the regional economic impact of an Employer of Last Resort program. The data are readily available, and more importantly, the data are consistent for all regions as they are based on national input-output accounting. Once an economic impact study is done for one region, it may be reproduced for another region, with consistent results.

The regional modeling approach can also be extended to look at the economic impact of the ELR on national economies. If input-output data is available, as it is for all OECD countries, the economic impact on income, output, and employment, of a full fledged ELR program can be modeled in such the same way as it can at the regional level.

5.5 Sustainable Full Employment

The previous chapter has shown that the implementation of the ELR program provides for flexible full employment. It is termed flexible full employment because the ELR program hires all workers ready and able to work. Thus, with an increase in the population over time, and labor expelling technical progress, instead of creating unemployment, there will be the creation of ELR employment. ELR employment maintains consumption spending at the full employment level. As was shown in the previous chapter, in a free market economy aggregate consumption fell because of labor displacing technical progress outweighing the growth rate of the population. This drop in consumption was because the unemployed workers had no income to consume with. But after the introduction of the ELR sector, aggregate consumption grew with the growth rate of the population. This effect was because the unemployed workers, now in ELR employment, had income to consume with. This effect was reflected in the ELR input-output table at time (t+1), as additional final demand for consumption goods was spread evenly across all sectors. The increase in consumption thus created multiplier effects in the private sector. A portion of ELR workers, because of this increase in demand for private sector goods, moved from ELR employment back to private sector employment.

Based upon the assumption that the ELR wage was equal to the private sector wage, neither the level or composition of consumption spending changed with the movement of workers from the ELR sector to the private sector. The ELR sector is capable of maintaining final consumption demand. Aggregate investment grew as the additional consumption is sold. Retained earnings per unit are higher as more units of

output are sold which means additional revenue for the capitalists to be further spent on ever-increasingly efficient methods of production. Thus it was seen that GDP rises with the ELR sector in place, and it was seen that the ELR sector is beneficial to both workers and capitalists. This result is because workers will always be employed in either the private sector or the ELR, and capitalists enjoy additional aggregate profits because of the additional output they are able to sell.

There is a key problem which must still be addressed. Is continuous economic growth a good thing? If the population is to grow than so must production. Leaving the problem of overpopulation aside as it is a whole separate issue, the sustainability of an ever increasing scale of production needs to be addressed. Here we are addressing the second macro-goal of environmental sustainability.

GDP growth has been the yardstick to which economies are measured by. In the initial time period where the economy was at full employment (Table 8), GDP stood at 2105. Without the ELR sector in place, at time $t + 1$, because of technical change, GDP grew to 2040, which is less than the 3 percent growth rate of the population. However after the implementation of the ELR program, (Table 10) GDP grew to 2105, with a growth rate of 3 percent.[2] If GDP is truly to be the yardstick which progress is measured by, it appears that the introduction of an ELR program is successful. However there has been debate, especially in the ecological economic literature, as to whether GDP is the appropriate yardstick and whether growth in physical production is a good thing.

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[2]Actually if one were to calculate this change it is slightly over 3 percent. But this is because the data in the input output table were rounded off, so it appears to be slightly higher, but that is just due to rounding error.

Herman Daly (1991; 1996) argues that GDP growth is not, and should not, be how progress is measured. Daly argues that when studying growth one must consider in the same context the biophysical limitations to growth. It has been suggested that GDP can grow without limit because GDP is measured in value terms rather than in physical units. Even though GDP represents physical units, it is not a one to one relationship. For example, those who claim that GDP growth is just a value measurement, and in turn an appropriate yardstick, often cite the invention of the computer as a justification.

Computer technology has been called a "radical innovation". Meaning that such an innovation radically alters both the method and scale of production, and also changes consumption patterns. With the introduction of the computer, and later the Internet, and all other various kinds of software that goes with it allows GDP, the *value* of goods and services, to increase. However the physical matter required to produce goods and services after the introduction of the computer diminishes. Daly argues that this is a clear case where the conflated concepts of growth and development must be distinguished. With the case of computers, the increase in GDP represents development not growth. For Daly, growth is an increase in the physical matter which is transformed from raw materials into final goods, which is different from development which represents a qualitative change.

> To *grow* means "to increase naturally in size by the addition of material through assimilation or accretion." To *develop* means "to expand or realize the potentialities of; to bring gradually to a fuller, greater, or better state." When something grows it gets bigger. When something develops it gets different. (Daly, 1993, 268)

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ENERGY

WASTE OF MATTER AND ENERGY

WASTE ENERGY

PRODUCTION

CONSUMPTION
OF GOODS
AND SERVICES

MATERIAL GOODS

NATURAL RESOURCE INPUTS

PRODUCTION WASTE

CONSUMPTION WASTE

EXTRACTION

RECYCLING

WASTE DISPOSAL
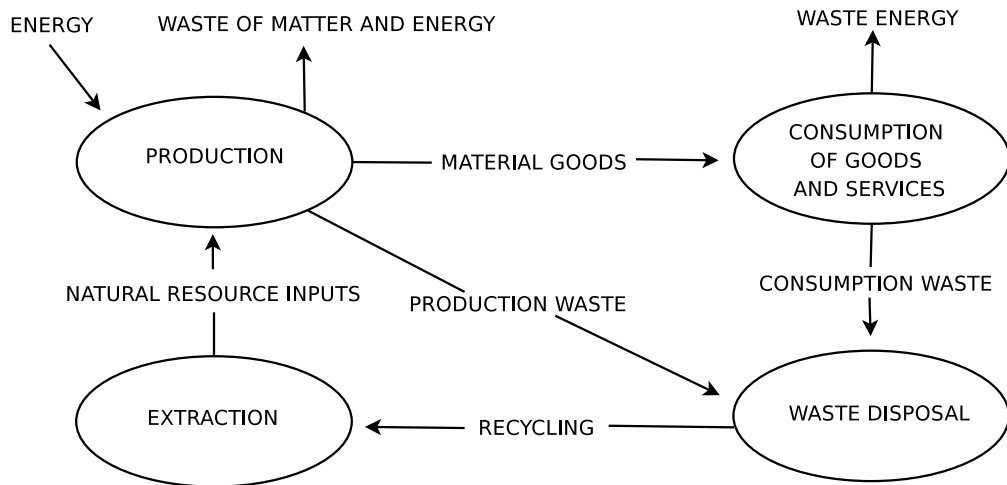
Figure 13.   Energy, Matter, Economic Cycle

Daly advocates that an idealized state would be zero growth. Thus over time production should be steered towards increasing development, but not growth in the physical sense. In other words, Daly advocates that production processes should engage in production which, in the aggregate, would have no net effect on the environment. This is what Daly refers to as the *steady state*. To get a better understanding of this idea we will now turn to an analysis of the interconnectedness of production and the environment.

5.6   Economics and the Environment

Figure 13 illustrates the connection of the economic process, the process of production and consumption of final output, and the environment. What should be noticed first is that there is a circular flow of natural resource inputs from the earth towards production of final goods and services used for consumption. What should be noticed next is that the first law of thermodynamics holds. The transformation of

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production can allow for changes to the distribution of energy in different forms, but the total amount of energy stays the same. Energy consumption is really the wrong term. Energy is being used, however it is not being consumed. Rather energy is simply changing forms from usable, compact energy, to unusable, dissipated energy. This is the concept of entropy. Entropy is defined as "a measure of unavailable energy in a thermodynamic system (Georgscu-Rogen, 1993, 77)". Raw materials, such as natural resources represent low-entropy matter. Production transforms low-entropy matter into high energy waste in the form of heat, pollution, and other non-usable physical matter which must be disposed of.

Take a piece of coal for example. Coal is a fossil fuel which can only be used once. The physical coal stores a great deal of potential energy (low-entropy). But once the coal is burned that energy gets lost in the form of heat, smoke and ashes. This example is the concept of entropy. The piece of coal represents free-energy which can be used to preform mechanical work. Now Figure 13 can be viewed in terms of the transformation of low-entropy matter into high entropy-waste.

The first stage of the analysis is the extraction of natural resources to be used as inputs into the process of production. The physical amount of natural resources required, and the composition of natural resources which are required, is ultimately dependent upon the given technique. As was referenced in chapter 3, Leontief refers to a matrix of capital stocks which lay in the background of the input output table, but ultimately determine the quantity and type of inputs required for production. Natural resources can be thought of in the same way.

There are two types of natural resources available for use in production, stock

resources and renewable resources. Stock resources are natural resources which are absolutely finite in supply, and once they are "used up", meaning once they are transformed from low-entropy useful matter, to high entropy waste, then they are no longer available. Then there are renewable resources. However there are also two types of renewable resources, there are natural resources which are infinitely renewable and natural resources which are exhaustible renewable resources. Such examples of infinitely renewable resources are wind power, solar power, hydro-power etc. Capturing solar energy to be used towards production, or consumption today has no net effect on the availability of that natural resource tomorrow. And then there are exhaustible renewable resources. These resources are renewable, however within a specific time frame these resources can be used up. Such examples are trees and other sorts of plants and wildlife, which have gone extinct. As a human population we have yet to run out of stock natural resources, however we have used up exhaustible renewable resources. This loss has further ecological implications, such as creating less diversity in the biosphere.

The concept of natural resources into the production process is not as black and white as it may seem here. If one were to follow *Zimmerman's World Resources* approach (Peach and Constantin, 1972), natural resources, to be usable in the production process, are a produced means of production. For example, coal to become usable needs to be mined. In order to mine coal requires the combination of labor, capital, and other natural resource inputs. For oil to be usable it needs to be drilled, then refined, then packaged, transported, etc., all of which requires many inputs of labor, capital, and natural resources. So usable low-entropy natural resources within

themselves can't be thought of as simply being available for use in production. Rather natural resources needs to be viewed as another produced means of production.

Usable natural resources is first and foremost a social construction. For a resource to be usable, one must be knowledgeable of their use. Zimmerman refers to this as the transformation of "neutral stuff" into "natural resources". In order for this transformation to occur the population must have a want for it. These wants are combined with science to produce means of discovering and extracting "neutral stuff" to be transformed into natural resources, and in turn to be applied towards production of physical goods and services for the purchase of consumption and investment.

The extraction and production of natural resources also creates high-entropy waste of matter and energy. The extracted natural resources are then applied towards production. Production requires further energy as an input in the production process to transform raw materials into products which people will purchase. Following the first law of thermodynamics the production process creates high-entropy waste of matter and energy, and a physical waste of materials.

The physical use of materials leads to consumption. The consumption of physical output leads to additional waste of both physical matter and heat energy. It is seen that the first law of thermodynamics holds at all stages of the economic process. Given that a consequence of the economic process is high-entropy, unusable waste. Waste takes on many forms. Waste can take the form of physical material waste, or it can take the form of gaseous waste. Both types of waste have implications on the environment. We have briefly introduced this in the opening chapter. Here, it will be considered in more detail.

Pollution

There are two types of pollution, there is pollution which occurs naturally in the environment and there is also pollution which is created because of human activity. The second form of pollution is the type which we are referring to. This type of pollutant has been referred to as qualitative pollutants. The main categories which are being monitored by the Environmental Protection Agency are sulfur oxide, nitrogen oxide, hydrocarbons, carbon monoxide, and as of 2010 carbon dioxide.

These pollutants are formed because of human activity. All of these pollutants are created through the combustion of fossil fuels during the production process and during the consumption process. Sulfur oxides result because of sulfur in coal, and in fuel oil. Once coal and oil is burned off, heat and sulfur dioxide get released into the earth's atmosphere. Once sulfur dioxide is in the air it can become oxidized producing SO_3. This element easily mixes with water or water vapor which produces sulfuric acid (H_2SO_4) which precipitates as acid rain.

Nitric oxide, like sulfur oxide is a pollutant produced from the combustion of fossil fuels. Nitric oxide easily combines with water vapor in the air to produce nitric acid. Which, like sulfuric acid precipitates as acid rain. Hydrocarbons and carbon monoxide are two other pollutants created from the use of fossil fuels. There is whole variety of hydrocarbons which are emitted, the primary concern to environmentalists are the "reactive" hydrocarbons, which combine easily with other elements which results in the formation of harmful smog, and other carcinogens (Ehrilch et al., 1977, 543).

Solid waste from production and consumption would surely grow with an in-

crease in the scale of production. Solid waste ultimately leads to water pollution as biological or chemical compounds seep into the soil and into the groundwater. It has been estimated that one-third of waste water in the United States comes from households and two-thirds come from commerce and industry.

Water pollution can take many forms. Contaminants by households and industry may be less harmful when looking at each individual pollutant. But, as is the same with air pollution, one just can't consider individual pollutants. The severity of pollutants A and B may individually be negligible. But the synergistic effects also need to be considered, because the combination of pollutant A with pollutant B may be harmful.

The synergistic effects of air pollution were addressed above. As concerning water pollution, elements combine to form synthetic organic compounds. Industrial and household chemicals react with each other to form harmful contaminants. Also these chemicals react with water treatment chemicals, which have been added deliberately into the water, to produce other, perhaps more harmful contaminants.

Sources of Water Pollution

Solid waste dumping by both households and industry, whether in landfills or directly in the water create pollution in the ground water and in navigable water bodies. Both ground water and lakes and rivers are sources for drinking water in communities. Water used for drinking in the U.S. has been found to be polluted with inorganic matter such as harmful metals. Metals found in the water supply are the result of disposing of solid waste, or from acid rain, or both. Bacteria and viruses are introduced because of water polluted by organic matter. Water has also been found

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to be polluted by nitrogen and phosphorus which was introduced in the water from soil run-off (Ehrilch et al., 1977, 557).

The sources and the effects of pollution are a classical example of dis-economies of scale. If a few people live in a certain region, and even if they are polluting at heavy levels, the assimilative capacity of the natural environment is capable of natural purification. However with the growth of cities, the assimilative capacity of the environment has been reached. These limits are obvious in many of the high growth, highly concentrated cities in the U.S. like Los Angeles.

The biophysical limits to growth need to be considered when studying economic growth. Fossil fuels are both a limited resource in the sense that there is clearly a finite supply, but also the combustion of fossil fuels is very harmful to public health. Also when considering increased production, the generation of material waste also needs to be considered.

5.7 Green New Deal

The employer of last resort has always been advocating that its implementation is towards the general public welfare. Because of structural and technological change, and because of a growth rate in the population there will always be an excess supply of workers. These workers will be employed within the ELR sector. The question that still remains is: What jobs will they do? Since the government is the only sector that does not base it's production on profitability, the government ELR sector can be as capital intensive or labor intensive as is required.

It has always been argued that the ELR program be as labor intensive as possible. This will have obvious advantages as it will be employ the most people,

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but there will be advantages to the environment as well. With a very limited use of capital equipment, the ELR sector will use the least amount of fossil fuels towards production, and have the least amount of solid and gaseous waste. The ELR simply as a labor-intensive work force will play a role toward achieving environmental sustainability, however there are plenty of tasks which these workers may do which will go farther in achieving this goal.

A recent report by the United Nations Development Program (Lieuw-Kie-Song, 2009) cites many activities which ELR workers may do which will have various environmental affects. Some examples are combating soil erosion, recycling, composting, installation of solar water heaters, water harvesting, greening communities, weatherizing homes and government buildings, etc. (Lieuw-Kie-Song, 2009, 12-13).

These examples of jobs which ELR employees can do are all labor intensive. To combat soil erosion requires regrading the land, and plant vegetation. This task maintains the productivity of the land. Water harvesting increases available water availability of ground water. This requires the construction of underground tanks, and ponds in urban areas. Also water harvesting includes the renovation of existing water bodies (Lieuw-Kie-Song, 2009, 13).

Recycling has been called the biggest environmental success story. While it is impossible to recycle 100 percent of all the recyclable material because of the second law of thermodynamics, recycling is still very important towards achieving environmental sustainability. There are two main aspects to recycling, community based recycling and industrial recycling. In community based recycling efforts, ELR workers could be employed to collect, separate, and transport recyclable material.

It has been proposed (Lieuw-Kie-Song, 2009) that ELR workers could be engaged in the production and installation of solar water heaters, and weatherizing government buildings and homes for poor households. These efforts would reduce carbon dioxide emissions and reduce energy consumption by households and government. Greening has been also suggested as an activity for ELR employment, such as planting trees and other vegetation. Community gardens, rooftop gardens, etc. provide positive externalities in the form of aesthetic appeal for the community. However there are additional environmental benefits to community gardens as well. These gardens can provide a source of fruits, and shade for the public. Also they assist in the reduction of soil erosion and carbon sequestration which reduces the threat of global warming.

5.8   Conclusion

The modern capitalist system is unable to provide either full employment or environmental sustainability. It has been proposed that the degradation of the natural environment is just as serious a problem as many of the other social problems previously discussed. However the difference is that ecological destruction is positively correlated to growth. Thus if public policy implements a full employment program, they must equally look at the devastating environmental effects of a fully employed and growing economy.

To counter-balance the limits to production it has been proposed here that the ELR sector really be a green jobs corp. Such was that in the time of FDR with the development and implementation of the Civilian Conservation Corp, a governmentally

run green jobs corp can be a implemented in solving many present day ecological problems.

It was addressed that the employer of last resort approach to full employment maintains full employment given structural change over time. The ELR approach also compliments the private sector by stabilizing aggregate demand, and thus pushing retained earnings higher than they were previously. So an ELR sector fits in quite well in capitalist economies. However, to maintain full employment over time one needs to consider the biophysical constraints to growth. To do this it was proposed that the ELR sector serve as a green jobs corp to achieve both macro goals of full employment and environmental sustainability. However such a research program is beyond the current scope and is reserved for future work.

APPENDIX A

SIMULATED INPUT OUTPUT TABLES

Table 11.   Hypothetical Input Output Table at Time = t+1

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	103	20.6	51.5	360.5	206	741.6	247.5	206	453.5	1195.1
B	82.4	41.2	20.6	144.2	154.5	442.9	148.5	154.5	303	745.9
C	309	10.3	61.8	422.3	309	1112.4	267.3	123.6	390.9	1503.3
D	206	51.5	61.8	82.4	154.5	556.2	287.1	226.6	513.7	1069.9
E	92.7	36.05	41.2	206	123.6	499.55	217.8	175.1	392.9	892.45
Int. Purchases	793.1	159.65	236.9	1215.4	947.6	3352.65	-	-	-	-
Wages	233.64	233.64	233.64	233.64	233.64	-	**1168.2**	-	-	-
Retained Earnings	206	154.5	123.6	226.6	175.1	-	-	**885.8**	-	-
Total VA	439.64	388.14	357.24	460.24	408.74	-	-	-	**2054**	-
Total Income	1232.74	547.79	594.14	1675.64	1356.34	-	-	-	-	**5406.65**

Table 12.   Hypothetical Input Output Table at Time = t+2

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	106.09	21.22	53.05	371.32	212.18	763.85	245.03	212.18	457.21	1221.05
B	84.87	42.44	21.22	148.53	159.14	456.19	147.02	159.14	306.15	762.34
C	318.27	10.61	63.65	434.97	318.27	1145.77	264.63	127.31	391.94	1537.71
D	212.18	53.05	63.65	84.87	159.14	572.89	284.23	233.4	517.63	1090.51
E	95.48	37.13	42.44	212.18	127.31	514.54	215.62	180.35	395.98	910.51
Int. Purchases	816.89	164.44	244.01	1251.86	976.03	**3453.23**	-	-	-	-
Wages	231.3	231.3	231.3	231.3	231.3	-	**1156.52**	-	-	-
Retained Earnings	212.18	159.14	127.31	233.4	180.35	-	-	**912.37**	-	-
Total VA	443.48	390.44	358.61	464.7	411.66	-	-	-	-	-
Total Income	1260.38	554.88	602.62	1716.56	1387.68	-	-	-	-	**5522.12**

Table 13.   Hypothetical Input Output Table at Time = t+3

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	109.27	21.85	54.64	382.45	218.55	786.76	242.57	218.55	461.12	1247.88
B	87.42	43.71	21.85	152.98	163.91	469.87	145.54	163.91	309.45	779.33
C	327.82	10.93	65.56	448.0	327.82	1180.15	261.98	131.13	393.11	1573.25
D	218.55	54.64	65.56	87.42	163.91	590.07	281.39	240.4	521.79	1111.86
E	98.35	38.25	43.71	218.55	131.13	529.97	213.47	185.76	399.23	929.2
Int. Purchases	841.4	169.37	251.33	1289.42	1005.31	**3556.83**	-	-	-	-
Wages	228.99	228.99	228.99	228.99	228.99	-	**1144.95**	-	-	-
Retained Earnings	218.55	163.91	131.13	240.4	185.76	-	-	**939.75**	-	-
Total VA	447.54	392.9	360.12	469.39	414.75	-	-	-	-	-
Total Income	1288.94	562.27	611.45	1758.81	1420.06	-	-	-	-	**5641.52**

Table 14. Hypothetical Input Output Table at Time = t+4

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	112.55	22.51	56.28	393.93	225.1	810.37	240.15	225.1	465.25	1275.62
B	90.04	45.02	22.51	157.57	168.83	483.97	144.09	168.83	312.92	796.88
C	337.65	11.26	67.53	461.46	337.65	1215.55	259.36	135.06	394.42	1609.97
D	225.1	56.28	67.53	90.04	168.83	607.77	278.57	247.61	526.18	1133.96
E	101.3	39.39	45.02	225.1	135.06	545.87	211.33	191.34	402.67	948.54
Int. Purchases	866.64	174.45	258.87	1328.1	1035.47	**3663.53**	-	-	-	-
Wages	226.7	226.7	226.7	226.7	226.77	-	**1133.5**	-	-	-
Retained Earnings	225.1	168.83	135.06	247.61	191.34	-	-	**967.94**	-	-
Total VA	451.8	395.53	361.76	474.31	418.04	-	-	-	-	-
Total Income	1318.44	569.98	620.63	1802.41	1453.51	-	-	-	-	**5764.97**

Table 15. Hypothetical Input Output Table at Time = t+5

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	115.93	23.19	57.96	405.75	231.85	834.68	237.75	231.85	469.6	1304.28
B	92.74	46.37	23.19	162.3	173.89	498.49	142.65	173.89	316.54	815.03
C	347.78	11.59	69.56	475.3	347.78	1252.02	256.77	139.11	395.88	1647.9
D	231.85	57.96	69.56	92.74	173.89	626.01	275.79	255.04	530.83	1156.84
E	104.33	40.57	46.37	231.85	139.11	562.25	209.22	197.08	406.29	968.54
Int. Purchases	892.64	179.69	266.63	1367.94	1066.53	**3773.44**	-	-	-	-
Wages	224.43	224.43	224.43	224.43	224.43	-	**1122.17**	-	-	-
Retained Earnings	231.85	173.89	139.11	255.04	197.08	-	-	**996.98**	-	-
Total VA	456.29	398.32	363.55	479.47	421.51	-	-	-	-	-
Total Income	1348.93	578.01	630.18	1847.42	1488.04	-	-	-	-	**5892.58**

Table 16.   Hypothetical Input Output Table at Time = t+6

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	119.41	23.88	59.7	417.92	238.81	859.72	235.37	238.81	474.18	1333.9
B	95.52	47.76	23.88	167.17	179.11	513.44	141.22	179.11	320.33	833.77
C	358.22	11.94	71.64	489.56	358.22	1289.58	254.2	143.29	397.49	1687.06
D	238.81	59.7	71.64	95.52	179.11	64.79	273.03	262.69	535.72	1180.51
E	107.46	41.79	47.76	238.81	143.29	579.12	207.13	202.99	410.11	989.23
Int. Purchases	919.42	185.08	274.63	1408.98	1098.53	**3886.64**	-	-	-	-
Wages	222.19	222.19	222.19	222.19	222.19	-	**1110.95**	-	-	-
Retained Earnings	238.81	179.11	143.29	262.69	202.99	-	-	**1026.88**	-	-
Total VA	461	401.3	365.48	484.88	425.18	-	-	-	-	-
Total Income	1380.42	586.38	640.11	1893.86	1523.71	-	-	-	-	**6024.47**

Table 17.   Hypothetical Input Output Table at Time = t+7

Input/Output	A	B	C	D	E	Intrm Out.	Cons.	Invst.	GDP	Tot. Out.
A	122.99	24.6	61.49	430.46	245.97	885.51	233.02	245.97	478.99	1364.5
B	98.39	49.19	24.6	172.18	184.48	528.85	139.81	184.48	324.29	853.14
C	368.96	12.3	73.79	504.25	368.96	1328.26	251.66	147.58	399.24	1727.51
D	245.97	61.49	73.79	98.39	184.48	664.13	270.3	270.57	540.87	1205
E	110.69	43.05	49.19	245.97	147.58	596.49	205.05	209.08	414.13	1010.62
Int. Purchases	947	190.63	282.87	1451.25	1131.48	**4003.24**	-	-	-	-
Wages	219.97	219.97	219.97	219.97	219.97	-	**1099.84**	-	-	-
Retained Earnings	245.97	184.48	147.58	270.57	209.08	-	-	**1057.69**	-	-
Total VA	465.94	404.45	367.55	490.54	429.05	-	-	-	-	-
Total Income	1412.95	595.08	650.42	1941.79	1560.53	-	-	-	-	**6160.77**

Table 18. Summary Data for Model Economy at time=t+1

AGGREGATE CONSUMPTION/AGGREGATE WAGES	1168.2
AGGREGATE INVESTMENT/AGGREGATE RETAINED EARNINGS	885.8
NATIONAL OUTPUT/NATIONAL INCOME	2054
LABOR FORCE	1215.4
UNEMPLOYMENT RATE	4%

Table 19. Summary Data for Model Economy at time=t+2

AGGREGATE CONSUMPTION/AGGREGATE WAGES	1156.52
AGGREGATE INVESTMENT/AGGREGATE RETAINED EARNINGS	912.37
NATIONAL OUTPUT/NATIONAL INCOME	2068.89
LABOR FORCE	1251.86
UNEMPLOYMENT RATE	8%

Table 20. Summary Data for Model Economy at time=t+3

AGGREGATE CONSUMPTION/AGGREGATE WAGES	1144.95
AGGREGATE INVESTMENT/AGGREGATE RETAINED EARNINGS	939.75
NATIONAL OUTPUT/NATIONAL INCOME	2084.7
LABOR FORCE	1289.42
UNEMPLOYMENT RATE	11%

Table 21. Summary Data for Model Economy at time=t+4

AGGREGATE CONSUMPTION/AGGREGATE WAGES	1133.5
AGGREGATE INVESTMENT/AGGREGATE RETAINED EARNINGS	967.94
NATIONAL OUTPUT/NATIONAL INCOME	2101.44
LABOR FORCE	1328.1
UNEMPLOYMENT RATE	15%

Table 22.   Summary Data for Model Economy at time=t+5

AGGREGATE CONSUMPTION/AGGREGATE WAGES	1122.17
AGGREGATE INVESTMENT/AGGREGATE RETAINED EARNINGS	996.98
NATIONAL OUTPUT/NATIONAL INCOME	2119.14
LABOR FORCE	1367.94
UNEMPLOYMENT RATE	18%

Table 23.   Summary Data for Model Economy at time=t+6

AGGREGATE CONSUMPTION/AGGREGATE WAGES	1110.95
AGGREGATE INVESTMENT/AGGREGATE RETAINED EARNINGS	1026.88
NATIONAL OUTPUT/NATIONAL INCOME	2137.83
LABOR FORCE	1408.98
UNEMPLOYMENT RATE	21%

Table 24.   Summary Data for Model Economy at time=t+7

AGGREGATE CONSUMPTION/AGGREGATE WAGES	1099.84
AGGREGATE INVESTMENT/AGGREGATE RETAINED EARNINGS	1057.69
NATIONAL OUTPUT/NATIONAL INCOME	2157.53
LABOR FORCE	1451.25
UNEMPLOYMENT RATE	24%

REFERENCE LIST

Akerlof, G. (2002). Behavioral macroeconomics and macroeconomic behavior. *American Economic Review 92*(3), 411–433.

Akerlof, G. and J. Yellen (1990). The fair wage-effort hypothesis and unemployment. *The Quarterly Journal of Economics 105*(3), 255–283.

Amendola, M., J. Gaffard, and L. Punzo (1999, April-June). Neo austrian process(es). *The Indian Journal of Applied Economics 8*(2), 1–12.

Arestis, P. (1992). *The Post Keynesian Approach to Economics*. Cheltenham, UK: Edward Elgar Publishing Ltd.

Asimakopulos, A. (1971). The determination of investment in keynes's model. *The Canadian Journal of Economics 4*(3), 382–388.

Asimakopulos, A. (1991). *Keynes's General Theory and Accumulation*. Cambridge, UK: Cambridge University Press.

Baranzini, M. and R. Scazzieri (1990). Economic structure: Analytical perspectives. In M. Baranzini and R. Scazzieri (Eds.), *The Economic Theory of Structure and CHange*, pp. 227–333. Cambridge, UK: Cambridge University Press.

Barnes, C. and R. Kingsnorth (1996). Race, drug, and criminal sentencing: Hidden effects of the criminal law. *Journal of Criminal Justice 24*(1), 39–55.

Baskoy, T. (2003). Thorstein veblen's theory of business competition. *Journal of Economic Issues 37*(4), 1121–1137.

Becker, G. (1965). A theory of the allocation of time. *The Economic Journal 75*(299), 493–517.

Becker, G. (1993). Nobel lecture: The economic way of looking at behavior. *The Journal of Political Economy 101*(3), 385–409.

Bortis, H. (1990). Structure and change within the circular theory of production. In M. Baranzini and R. Scazzieri (Eds.), *The Economic Theory of Structure and Change*, pp. 64–92. Cambridge, UK: Cambridge University Press.

Brenner, M. (1973). *Mental Illness and the Economy.* Cambridge, MA: Harvard University Press.

Browman, C., V. Hamilton, and W. Hoffman (2001). *Stress and Distress among the Unemployed: Hard Times and Vulnerable People.* New York, NY: Kluwer Academic/Plenum Publishers.

Carvalho, L. D. and J. L. Oreiro (2008). Capital accumulation, income, distribution, technical progress, and endogenous money in a post keynesian. In L. Wray and M. Forstater (Eds.), *Keynes and Macroeconomics after 70 Years: Critical Assessments of the General Theory*, pp. 137–154. Cheltenham, UK: Edward Elgar Publishing Ltd.

Cohen, S. (2002). *Folk Devils and Moral Panics* (3 ed.). New York, NY: Routledge.

Courvisanos, J. (2006a). Galbraith, and the political economy of technological innovation: Critical perspectives and a heterodox synthesis. In D. U. Blandine Laperche, James K. Galbraith (Ed.), *Innovation, evolution and economic change: new ideas in the tradition of Galbraith*, pp. 205–228. Cheltenham, UK: Edward Elgar Publishing Ltd.

Courvisanos, J. (2006b). Technological innovation: Galbraith, the post keynesians, and a heterodox future. *Journal of Post Keynesian Economics 28*, 85–104.

Courvisanos, J. and C. Richardson (2008). Invention, innovation, investment: Heterodox simulation modeling of capital accumulation. In J. Harvey and R. Garnett (Eds.), *Future Directions for Heterodox Economics*, pp. 185–224. Ann Arbor: The University of Michigan Press.

Daly, H. (1991). *Steady-State Economics*. Washington, D.C.: Island Press.

Daly, H. (1993). Sustainable growth: An impossibility theorem. In H. Daly and K. Townsend (Eds.), *Valuing the Earth*, pp. 267–273. The MIT Press.

Daly, H. (1996). *Beyond Growth*. Boston, MA: Beacon Press.

Darity, W. (1999). Who loses from unemployment. *Journal of Economic Issues 3*, 491–496.

Davidson, P. ([1977] 1991a). Money and general equilibrium. In L. Davidson (Ed.), *Money and Employment*, pp. 196–217. New York University Press.

Davidson, P. ([1980] 1991b). Post keynesian economics: Solving the crisis in economic theory. In L. Davidson (Ed.), *Money and Employment*, pp. 279–299. New York: NY: New York University Press.

Downward, P. (1999). *Pricing Theory in Post Keynesian Economics: A Realist Approach*. Cheltenham, UK: Edward Elgar Publishing Ltd.

Ehrilch, P., A. Enrlich, and J. Holdren (1977). *Econscience: Population Resources, Environment*. San Francisco, CA: W.H. Freeman and Co.

Eichner, A. (1973). A theory of the determination of the mark-up under oligopoly. *Economic Journal 83*(332), 1184–1200.

Eichner, A. (1976). *The Megacorp and Oligopoly: Microfoundations of Macro Dynamics*. Cambridge: Cambridge University Press.

Eichner, A. (1985). *Toward a New Economics: Essays in Post-Keynesian and Institutionalist Theory.* Armonk, NY: M. E. Sharpe.

Feather, N. (1990). *The Psychological Impact of Unemployment.* New York, NY: Springer-Verlag.

Forstater, M. (2002). Full employment policies must consider effective demand and structural and technological change: A prime point of Pasinetti's political economy. In P. Davidson (Ed.), *A Post Keynesian Perspective on 21st Century Economic Problems.* Cheltenham, UK: Edward Elgar Publishing Ltd.

Forstater, M. (2004). Cumulative causation a la lowe: Radical endogenetity, methodology, and human intervention. In *Growth Distrinution and Effective Demand: Alternatives to Economic Orthodoxy*, pp. 309–316. Armonk, NY: M.E. Sharpe.

Forstater, M. (2007). Technology as transsubjective structural context: The uncertainty of investor expectations. *Review of Political Economy 19*(3), 435–440.

Forstater, M. and M. Murray (2009). Circular cumulative causation in the classics: Anticipations, family resemblences and post keynesian economics. In S. Berger (Ed.), *The Foundations of Non-Equilibrium Economics: The Principle of Circular and Cumulative Causation*, pp. 154–171. New York, NY: Routledge.

Fullwiler, S. (2007). Macroeconomic stabilization through an employer of last resort. *Journal of Economic Issues 41*(1), 93–134.

Garegnani, P. (1984). Value and distribution in the classical economists and marx. *Oxford Economic Papers 36*(2), 291–325.

Gehrke, C. (1998). Traverse analysis and flexibility of the production system. In H. Hagemann and H. Kurz (Eds.), *Political Economics in Retrospect: Essays in*

Memory of Adolph Lowe, pp. 208–232. Cheltenham, UK: Edward Elgar Publishing Ltd.

Gehrke, C. (2003). Alfred kähler: a pioneer of input-output analysis. In W. Samuels (Ed.), *European Economists of the 20th Century*, Volume 2, pp. 137–166. Edward Elgar Publishing Ltd.

Georgscu-Rogen, N. (1993). The entropy law and the economic problem. In H. Daly and K. Townsend (Eds.), *Valuing the Earth*, pp. 75–87. The MIT Press.

Gordan, R. (1990). What is new-keynesian economics? *Journal of Economic Literature 28*(3), 1115–1171.

Granovetter, M. (1983). The strength of weak ties: A network theory revisited. *Sociological Theory 1*, 201–233.

Granovetter, M. (2005). The impact of social structure on economic outcomes. *Journal of Economic Perspectives 19*(1), 33–50.

Gussani, P. (1991). Reproduction schema. In Bottomore (Ed.), *A Dictionary of Marxist Thought* (Second ed.)., pp. 471–474. Cambridge, MA: Basil Blackwell Ltd.

Hagemann, H. (1992). Traverse analysis in a post-classical model. In J. Halevi, D. Laibman, and E. Nell (Eds.), *Beyond the Steady-State: A Revival of Growth Theory*, pp. 235–263. London, UK: Macmillan Ltd.

Hagemann, H. (1995a). Employment and machinery. In H. Hagemann and O. Hamouda (Eds.), *The Legacy of Hicks*, pp. 200–224. New York, NY: Routledge.

Hagemann, H. (1995b). Technological unemployment. In P. Arestis and M. Marshall (Eds.), *The Political Economy of Full Employment: Conservatism, Corporatism,and Institutional Change*, pp. 36–53. Aldershot: UK: Edward Elgar Pub-

lishing Ltd.

Hamouda, O. and G. Harcourt (1990). Post-keynesianism: From criticism to coherence? In J. Pheby (Ed.), *New directions in post-Keynesian economics*, pp. 1–37. Cheltenham, UK: Edward Elgar Publishing Ltd.

Harcourt, G. (2001). *50 Years a Keynesian and Other Essays*. New York, NY: Palgrave Macmillian.

Harcourt, G. (2006). *The Structure of Post Keynesian Economics*. Cambridge, UK: Cambridge University Press.

Harcourt, G. and P. Kenyon (1976). Pricing and the investment decision. *Kyklos: International Review for Social Science 29*(3), 449–477.

Hicks, J. (1965). *Capital and Growth.* Oxford, UK: Oxford University Press.

Hicks, J. (1973). *Capital and TIme.* Oxford, UK: Clarendon Press.

Hicks, J. (1984). Time in economics. In D. Helm (Ed.), *The economics of John Hicks*, pp. 263–280. Oxford, UK: Basil Blackwell Ltd.

Holt, R. (2007). What is post keynesian economics. In M. Forstater, G. Mongiovi, and S. Pressman (Eds.), *Post Keynesian Macroeconomics: Essays in Honour of Ingrid Rima*, pp. 89–107. New York, NY: Routledge.

Hudson, J. (2003). Employment. In J. King (Ed.), *The Elgar Companion to Post Keynesian Economics*, pp. 116–117. Cheltenham: Edward Elgar Publishing Ltd.

J., S. (1952). *Maturity and Stagnation in AMerican Capitalism.* Oxford, UK: Basil Blackwell Ltd.

Jahoda, M. (2002 [1933]). *Marienthal: The Sociography of an Unemployed Community.* New Brunswick, New Jersey: Transaction Publishers.

Jorgenson, D. (1960). Growth and fluctuations: A causal interpretation. *The Quarterly Journal of Economics 74*, 416–436.

Kalecki, M. (1943). Political aspects of full employment. *Political Quarterly 14*(4), 322–331.

Kelvin, P. and J. E. Jarrett (1985). *Unemployment, Its Social Psychological Effects*. Cambridge, UK: Cambridge University Press.

Keynes, J. ([1930] 1963). Economic possibilities for our grandchildren. In *Essays in Persuasion*, pp. 358–373. New York, NY: W. W. Norton and Company.

Keynes, J. (1964 [1936]). *The General Theory of Employment Interest and Money*. New York, NY: Harcourt Brace and Co.

Keynes, J. (1973). *The Collected Writings of John Maynard Keynes: The General Theory and After: Part II.*, Volume 14. London, UK: Macmillan.

Keynes, J. M. (1988). *The Collected Writings of John Maynard Keynes*, Volume 29. Cambridge, UK: Cambridge University Press.

Kregel, J. (1987). Effective demand. In J. Eatwell, M. Milgate, and P. Newman (Eds.), *The New Palgrave: A Dictionary of Economics*, Volume 2, pp. 99–102. London, UK: The Macmillan Press Ltd.

Kregel, J. (1998). Keynes and the new keynesians on market competition. In R. Rotheim (Ed.), *New Keynesian Economics and Post Keynesian Alternatives*, pp. 31–50. London, UK: Routledge.

Kriesler, P. (2003). Traverse. In J. King (Ed.), *The Elgar Companion to Post Keynesian Economics*, pp. 355–359. Cheltenham: Edward Elgar Publishing Ltd.

Kurz, H. and N. Salvadori (1995). *A Theory of Production: A Long-Period Analysis*.

Cambridge, UK: Cambridge University Press.

Laibman, D. (1992). Optimal choices of technique and biased technical change. In J. Halevi, D. Laibman, and E. Nell (Eds.), *Beyond the Steady State: A Revival of Growth Theory*, pp. 175–197. St. Martin's Press.

Lavoie, M. (1992). *Foundations of Post Keynesian Economic Analysis*. Cheltenham, UK: Edward Elgar Publishing Ltd.

Lavoie, M. (2006). *Introduction to Post-Keynesian Economics*. New York, NY: Palgrave Macmillan.

Lee, F. (1998). *Post Keynesian Price Theory*. Cambridge, MA: Cambridge University Press.

Lee, F. (2003). Pricing and prices. In J. King (Ed.), *The Elgar Companion to Post Keynesian Economics*, pp. 285–289. Edward Elgar Publishing Ltd.

Leff, E. (1995). *Green Production: Toward an ENvironmental Rationality*. New York, NY: The Guilford Press.

Leontief, W. (1953). Dynamic analysis. In W. Leontief (Ed.), *Studies in the Structure of the American Economy*, pp. 53–92. New York, NY: 0xford University Press.

Leontief, W. (1966). *Essays in Economics: Theories and Theorizing*. New York, NY: Oxford University Press.

Leontief, W. ([1970] 1986b). The dynamic inverse. In *Input-Output Economics* (Second ed.)., pp. 294–320. New York, NY: Oxford University Press.

Leontief, W. ([1970] 1986c). Environmental repercussions and the economic structure: An input-output approach. In *Input-Output Economics* (Second ed.)., pp. 241–272. New York, NY: Oxford University Press.

Leontief, W. ([1972] 1986a). Air pollution and the economic structure: Empirical results of input-output calculations. In *Input-Output Economics* (Second ed.)., pp. 273–293. New York, NY: Oxford University Press.

Leontief, W. (1986d). *Input-Output Economics* (Second ed.). New York, NY: Oxford University Press.

Leontief, W. (1987). Input-output analysis. In J. Eatwell, M. Milgate, and P. Newman (Eds.), *The New Palgrave: A Dictionary of Economics*, Volume 2, pp. 860–864. London, UK: The Macmillan Press Ltd.

Lerner, A. (1943). Functional finance and the federal debt. *Social Research 10*, 38–51.

Lerner, A. (1947). Money as a creature of the state. *American Economic Review 37*(2), 312–317.

Lieuw-Kie-Song, M. (2009, April). Green jobs for the poor. Technical report, UNDP Poverty Reduction Discussion Paper PG/2009/002.

Lowe, A. (1965). *On Economic Knowledge.* New York, NY: Harper and Row Publishers.

Lowe, A. (1976). *The Path of Economic Growth.* Cambridge, UK: Cambridge University Press.

Lowe, A. (1987). *Has Freedom A Future?* New York, NY: Praeger Publishers.

Lowe, A. (2003 [1935]). *Economics and Sociology.* London, UK: Routledge.

Luxemburg, R. (1951). *The Accumulation of Capital.* London, UK: Routledge.

Majewski, R. (2004). Simulating an employer of last resort program. In G. Argyrous, M. Forstater, and G. Mongiovi (Eds.), *Growth, DIstribution, and Effective Demand*, pp. 163–180. Armonk, NY: M.E. Sharpe.

229

Mankiw, N. (1990). A quick refresher course in macroeconomics. *Journal of Economic Literature 28*, 1645–1660.

Marx, K. (1965). *The Communist Manifesto.* New York, NY: Washington Square Press.

Marx, K. (1973). *Grundrisse.* New York, NY: Random House Inc.

Marx, K. (1990). *Capital: A Critique of Political Economy*, Volume One. London, UK: Penguin Classics.

Marx, K. (1992). *Capital: A Critique of Political Economy*, Volume Two. London, UK: Penguin Classics.

Miernyk, W. (1969). *The Elements of Input Output Analysis.* New York, NY: Random House.

Miller, R. and P. Blair (1985). *Input-Output Analysis: Foundations and Extensions.* Englewood Cliffs, NJ: Prentice-Hall Inc.

Miller, R. and P. Blair (2009). *Input-Output Analysis: Foundations and Extensions* (2nd ed.). Cambridge, UK: Cambridge University Press.

Minsky, H. (1986). *Stabilizing an Unstable Economy.* New Haven CT: Yale University Press.

Neisser, H. (1942). "Permanent" Technological Unemployment: "Demand for Commodities is Not Demand for Labor. *American Economic Review 32*(1), 50–71.

Nell, E. (1988). *Prosperity and Public Spending.* Boston, MA: Unwin Hyman.

Nell, E. (1992). *Transformational Growth and Effective Demand: Economics after tje Capital Critique.* London: UK: Macmillan Ltd.

Nell, E. (1998). *The General Theory of Transformational Growth: Keynes after*

Sraffa. Cambridge: Cambridge University Press.

Nellis, A., J. Greene, and M. Mauer (2008). Reducing racial disparity in the criminal justice system: A manual for practitioners and policymakers. The Sentencing Project, 514 10th Street NW, Suite 1000 Washington, DC 20004.

Okishio, N. (1961). Technical change and the rate of profit. *Kobe University Economic Review 7*.

Ono, F. H. and J. L. Oreiro (2006). Technological progress, income distribution and capacity utilization. In N. Salvadori (Ed.), *Economic Growth and Distribution*, pp. 124–147. Cheltenham, UK: Edward Elgar Publishing Ltd.

Papadimitriou, D. and L. Wray (1999, July). Minsky's analysis of financial capitalism. Working Paper 275, The Jerome Levy Economics Institute, Annadale-on-Hudson, NY.

Parada, J. (2008). Post-keynesian theory of business enterprise and the veblenian's approach: Are there commonalities? *evista Economia del Caribe 2*, 1–30.

Pasinetti, L. ([1973] 1980). The notion of vertical integration in economic analysis. In L. Pasinetti (Ed.), *Essays on the Theory of Joint Production*, pp. 16–43. New York, NY: Columbia University Press.

Pasinetti, L. (1977). *Lectures on the Theory of Production*. London, UK: The Macmillian Press Ltd.

Pasinetti, L. (1981). *Structural Change and Economic Growth*. Cambridge, UK: Cambridge University Press.

Pasinetti, L. (1993). *Structural Economic Dynamics*. Cambridge, UK: Cambridge University Press.

Pasinetti, L. (2007). *Keynes and the Cambridge Keynesians.* Cambridge, UK: Cambridge University Press.

Peach, W. and J. Constantin (1972). *Zimmerman's World Resources and Industries* (Third ed.). New York, NY: Harper and Row Publishers.

Polonyi, K. ([1944] 2001). *The Great Transformation.* Boston, MA: Beacon Press.

Raphael, S. and R. Winter-Ebmer (2001). Identifying the effect of unemployment on crime. *Journal of Law and Economics 44*, 259–283.

Ricardo, D. (2004). *The Works and Correspondence of David Ricardo: On the Principles of Political Economy and Taxation*, Volume One. Indianapolis, IN: Liberty Fund.

Richardson, C. and J. Courvisanos (2008). Modeling keynes with kalecki. In L. Wray and M. Forstater (Eds.), *Keynes and Macroeconomics after 70 Years: Critical Assessments of the General Theory*, pp. 99–136. Cheltenham, UK: Edward Elgar Publishing Ltd.

Roberts, J. (1995). New keynesian economics and the phillips curve. *Journal of Money, Credit and Banking 27*(4), 975–984.

Robinson, J. (1965). *The Accumulation of Capital* (Second ed.). New York, NY: St. Martin's Press.

Romer, D. (1993). The new keynesian synthesis. *The Journal of Economic Perspectives 7*(1), 5–22.

Rotheim, R. (1998). New kenyesian macroeconomics and markets. In R. Rotheim (Ed.), *New Keynesian Economics and Post Keynesian Alternatives*, pp. 51–70. London, UK: Routledge.

Sawyer, M. (2007, September). Kalecki on the causes of unemployment and policies to acheive full employment. http://lubswww.leeds.ac.uk/MKB/MalcolmSawyer/.

Scazzieri, R. (1993). *A Theory of Production*. Oxford, UK: Clarendon Press.

Shapiro, N. (1984-1985, Winter). Review: Involuntary unemployment in the long-run: Pasinetti's formulation of the keynesian argument: A review article. *Journal of Post Keynesian Economics 7*(2), 235–245.

Sinha, A. (2001). Surplus approach to political economy. In P. O'Hara (Ed.), *Encyclopedia of Political Economy*, Volume 2, pp. 668–672. Routledge.

Smith, A. (1986). *The Essential Adam Smith*. New York, NY: W.W. Norton & Co.

Snowdan, B. and H. Vane (1997). New-keynesian economics today. In B. Snowdan and H. Vane (Eds.), *A Macroeconomics Reader*, pp. 452–477. Routledge.

Spohn, C. (2001). Thirty years of sentencing reform: The quest for a racially neutral sentencing process. In W. Reed and L. Winterfield (Eds.), *Criminal Justice 2000*, Volume 3, pp. 501. Washington, D.C.: National Institute of Justice.

Spohn, C. and D. Holleran (2000). The imprisonment penalty paid by young, unemployed black and hispanic male offenders. *Criminology 38*(1), 281–306.

Sraffa, P. (1960). *Production of Commodities by Means of Commodities: Prelude to a Critique of Economic Theory*. Cambridge, UK: Cambridge University Press.

Steedman, I. (1981a). Book reviews: Structural change and economic growth: A theoretical essay on the dynamics of the wealth of nations. *The Manchester School 49*, 368–370.

Steedman, I. (1981b). *Marx after Sraffa*. London, UK: Verso.

Steffensmeir, D., J. Ulmer, and J. Kramer (1998). The interaction of race, gender,

and age in criminal sentencing: The punishment cost of being young, black, and male. *Criminology 36*(4), 763–798.

Tcherneva, P. (2003, August). Job or income guarentee. Working Paper 29, Center for Full Employment and Price Stability, Kansas City, MO.

Trigg, A. and F. Lee (2005). Pasinetti, keynes and the multiplier. *Review of Political Economy 17*(1), 29–43.

Veblen, T. (1923). *Absentee Ownership and Business Enterprise in Recent Times: The Case of America.* New York, NY: B.W. Huebsch, Inc..

Veblen, T. (1978 [1904]). *The Theory of Business Enterprise.* New Brunswick, NJ: Transaction Publishers.

Wallman, J. and A. Blumstein (2005). After the crime drop. In J. Wallman and A. Blumstein (Eds.), *The Crime Drop in America* (2nd ed.)., pp. 319–348. Cambridge, UK: Cambridge University Press.

Williamson, S. (2008). *Macroeconomics* (3 ed.). Pearson Education Inc.

Wray, L. (1990). *Money and Credit in Capitalist Economies.* Cheltenham, UK: Edward Elgar Publishing Ltd.

Wray, L. (1998). *Understanding Modern Money: The Key to Full Employment and Price Stability.* Cheltenham, UK: Edward Elgar Publishing Ltd.

Wray, L. (2000a). Currency sovereignty and policy independence: The case of argentina. Unpublished Manuscript.

Wray, L. (2000b, January). Public service employment: Full employment without inflation. Working Paper 3, Center for Full Employment and Price Stability, Kansas City, MO.

Wray, L. (2007). Veblen's theory of the business enterprise and keynes's monetary theory of production. *Journal of Economic Issues 41*(2), 617–624.

Yellen, J. (1984). Efficiency wage models of unemployment. *American Economic Review 74*(2), 200–205.

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