Green Jobs for full employment, a Stock Flow Consistent analysis

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Abstract

In most European economies, the potential of saving energy via isolation and more efficient uses of electricity is important. In order to reach the Kyoto Protocol objectives, it is urgent to develop policies that reduce the production of carbon dioxide in all sectors of the economy. This article proposes an analysis of a green job Employer of Last Resort (ELR) program based on a Stock Flow Consistent model with two productive sectors: energy and consumption good; and two household sectors: wage earners and capitalists. By increasing the energy efficiency of dwellings and public buildings, the green job ELR sector implies a change in the consumption patterns from energy consumption towards consumption goods. This could spur the private sector and thus increase its employment. Lastly, the job guarantee programs allows to remove all involuntary unemployment while helping to tackle part of the sources of climate change.

Keywords: Full Employment, Green job, Stock Flow Consistent

JEL classification codes: E24, J08, Q48

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1 Introduction

Unemployment is a fact in present economies. Even without a crisis, unemployment exists and costs a lot to society. Reasons for unemployment are multiple and differ according to the theory at hand. Lack of effective demand, imperfect markets and frictions are example of unemployment justifications. All sorts of policies based on these different theories have been implemented with various results but none has proven to tackle unemployment. Full employment has never been achieved during the last 40 years. Often the problem is that these policies promote indirect jobs creation: public spending, wage subsidies, incentives, tax cuts, job training. Even if they meet some objectives, these policies do not provide an answer to unemployment.

It is of the duty of the state, as Lerner expressed it, to provide jobs when the market fails to do so [Lerner 1944, Lerner 1951]. By guaranteeing a job to all that are willing and able to work, the state would remove all involuntary unemployment. Examples of such job guarantee schemes exist, even if never developed on a full scale. Furthermore, in most european economies the potential of saving energy via isolation and more efficient uses of electricity is important. In order to reach the Kyoto Protocol objectives, it is urgent to develop policies that reduce the production of carbon dioxide in all sectors of the economy. The present paper proposes an Employer of Last Resort (ELR) scheme where ELR workers would try to transform the economy towards a greener one.

The present section will show that unemployment is structurally implied by capitalist economies and that we have observed a change in employment policies from macroeconomic policies towards microeconomic policies. By doing this, unemployment ceased to be the target of these policies and became a collateral of other objectives such as growth, price stability and other. Section 2 introduces the concept of ELR and some of its benefits and challenges. The model and the analysis of the green job ELR is then presented in sections 3 and 4 while concluding comments are done in section 5.

1.1 Unemployment

Mainstream economics usually explain unemployment by market rigidities. Unemployment would disappear if wages were allowed to decline low enough. Labor market is like all other goods market with rigid price and should not be seen as anything else.

However, unemployment is not often recognized for the function is has in a capitalist economy [Forstater 1998, Forstater 2006]. Most of the time, firms are working with excess capacity in order to be able to respond to sudden changes in demand. The process of capital accumulation creates labor reserves. When demand increases, firms are happy to have a "reserve army of labor" from which to hire more workers and increase their output.

Others explain structural unemployment as a mismatch between demand and supply. Pasinetti shows it is highly improbable that, in a multi sectorial model, distribution of demand among different sectors is such that full employment prevails, even when aggregate demand is high enough to imply full employment [Pasinetti 1993].

1 The National Rural Employment Guarantee Act in India and the plan Jefes y Jefas de Hogar Desocupados in Argentina are examples of such policies [UNCTAD 2010, Kostzer 2008].
Ros shows using various two-sectors models that labor surplus economies arise for different reasons [Ros 2000]. He uses efficiency wages on top of a Lewis growth model to show how Kaldorian underemployment appears. In chapter 11, he also shows how unemployment emerges out of domestic or foreign exchange constrained economies, using a Kaleckian dual economy model.

Given these premises, it is illusionary to assume that capitalist economies will ever attain full employment under normal situation. The only period of time in the modern era where full employment was reached in the USA is during World War II [Kaboub 2007]. Kaboub further adds that "Full employment and price stability were achieved, but only during wartime with a considerable number of the male working-age adults being in the army and the rest of the working-age population employed to support the war effort. Therefore, the U.S. full employment experiment must be taken with caution" [Kaboub 2007, Page 4]. In March 1999, US unemployment reached its lowest since the 1960's and was considered as "full employment". It was then at 4.2%, showing clearly that full employment was never reached in the post-war period.

Furthermore, not only full employment is not likely to be achieved but it also follows business cycles. Indeed lack of aggregate demand during crisis leads to higher unemployment, as Keynes explained it in his General Theory of Employment, Interest and Money [Keynes 1936]. All of the components of effective demand are highly sensible to expectations that are depressed during tough times. Therefore not only is it improbable to attain full employment because of structural unemployment, it is also doubtful that it is maintained due to cyclical unemployment [Forstater 2003].

The policy space for employment policies is thus large and important and needs commitment. As Beveridge said it: "Unemployment cannot be conquered by a democracy until it is understood. Full productive employment in a free society is possible but it is not possible without taking pains. It cannot be won by waving a financial wand: it is a goal that can be reached only by conscious continuous organization of all our productive resources under democratic control. To win full employment and keep it, we must will the end and must understand and will the means" [Beveridge 1945] in Papadimitriou 1999.

1.2 Employment policies

Full employment was the objective of employment policies in the post World War II period until the mid-70's. Then, we observed a switch in the goal of employment policies. We went from what Mitchell and Muyskens call a Full Employment Framework to a Full Employability Framework [Mitchell and Muyskens 2008].

From macroeconomic employment policies or Keynesian aggregate demand spur

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1Kaldor defined underemployment as "analogous to Keynes’ definition of “involuntary unemployment”" [Kaldor 1968] in [Ros 2000]. Ros points out that "the Kaldorian notion of underemployment is also different from [...] the type of unemployment analyzed by modern theories of efficiency wages." [Ros 2000, page 96]

2Even if full employment was attained due to an important increase in demand, it would be by working at full capacity or over full capacity and there is a good chance that it would be highly inflationary. As Papadimitriou puts it when talking about Keynesian "pump priming" policies: "The problem is that such policies may lead to labor market tight enough to generate inflation long before "full" employment is reached" [Papadimitriou 1999, page a17]

4Papadimitriou talks about a change from Full Employment policies towards Maximum Employment policies [Papadimitriou 1999]
we have gone to microeconomic policies. Employment is now seen as a micro
problem.

According to the Full Employability Framework, unemployed workers are
unemployed because they are not attractive enough and they need to be more
"sexy" in order to find a job. Active Labor Market Policies (ALMP) are exam-
amples of these micro policies. The effectiveness of ALMP is not encouraging
according to de Koning and Martin [de Koning 2001, Martin 1998]. However,
Martin stresses their potential role in fighting high and persistent unemploy-
ment while de Koning underlines the increasing need for these policies in the
future.

On the macroeconomic side, the "fit all solution" is growth: in order to
have more jobs, an economy needs to grow. According to Minsky, focusing on
pro-growth rather than employment policies is a mistake since a fully employed
economy is bound to grow while a growing economy might not be at full em-
ployment [Minsky 1986]. And indeed correlation between employment growth
and GDP growth are mixed as Table 1.2 shows it.

<table>
<thead>
<tr>
<th>Country</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia (1965-2010)</td>
<td>0.16</td>
</tr>
<tr>
<td>Chile (1987–2010)</td>
<td>0.48</td>
</tr>
<tr>
<td>Germany (1970–2010)</td>
<td>0.14</td>
</tr>
<tr>
<td>Italy (1970-2010)</td>
<td>0.20</td>
</tr>
<tr>
<td>Japan (1970-2010)</td>
<td>0.60</td>
</tr>
<tr>
<td>Turkey (1970-2010)</td>
<td>0.10</td>
</tr>
<tr>
<td>United Kingdom (1970-2010)</td>
<td>0.05</td>
</tr>
<tr>
<td>United States (1970-2010)</td>
<td>0.77</td>
</tr>
</tbody>
</table>

Table 1: Correlation between GDP growth and employment growth, sources: OECD.

What emerges from present employment policies effectiveness analysis is
that, even if some have interesting result, none of them has achieved the outcome
of post WWII period, i.e. low unemployment. Furthermore, these policies do
not aim at full employment anymore but at maximum employment possible
under present conditions. We need a change in employment policies such that
full employment becomes again the target of these policies.

1.3 Market economy

Market economy only choses to produce what has a price and what is profitable
to the producer. As Lunghini puts it "production of goods stops not when
needs are satisfied but when profits realisation imposes it" ([Lunghini 1995], my
translation). Thus, a good without a price would not be produced since no
monetary profits can be extracted from it. What is more is that some needs will
never be satisfied by an economy that is only interested in what is profitable.
Entire sectors of the economy would not exist if it was not for government
programs and policies. Also, governments might have a better vision of which is
the best direction of the economy for the benefit of all (climate change is a good
example). We thus need a government to be able to influence the structure of the
economy and drive it to what would be more profitable for all [Forstater 1998, Mitchell 2007].

Besides, Forstater notes that increased private sector activity can lead to bottlenecks or inflationary pressure due to excess capacities utilisation or resource depletion [Forstater 1998]. Indeed, because of structural rigidities of the economy or competitive pressures, private sector firms may choose not change technology or to engage in natural resource-intensive means of production without observing the negative externalities it would imply. Governments, being free of these rigidities or pressures is thus more able to conduct structural changes.

According to Lerner, we cannot trust the people to drive the economy correctly because even if they know the consequences of their acts, they will misbehave [Lerner 1951]. Consequently, there is a need for the state to take over the steering wheel of the economy. For example, "investments can be undertaken by the governments which shows a money loss but which are considered worthwhile in the social interest because they yield benefits other than those which result in a money income" [Lerner 1951] page 91. Finally, Keynes stresses the importance of public investments pointing "that a somewhat comprehensive socialisation of investment will prove the only means of securing an approximation to full employment" [Keynes 1936, p 378].

2 Employer of last resort

Minsky brought back Employer of Last Resort (ELR) policies as a response to J. F. Kennedy’s War on Poverty. "The war against poverty is a conservative rebuttal to an ancient challenge of the radicals, that capitalism necessarily generates “poverty in the midst of plenty”" [Minsky 1965, page 175]. In this 1965 paper, he strongly criticizes the policies put in place under War on Poverty (such as tax cuts) and advocates in favor of public works in order to reach full employment, the only state of affairs that, according to him, could eradicate poverty [Minsky 1965].

Minsky indicates that policies directed towards spurring aggregate demand often increase high wage demand and thus may not improve the overall employment situation. Having "tight full employment" as a target (i.e. 2.5% unemployment), he notes that "spending programs aimed at directly employing those in the labor market who are poor, and opening up job opportunities for second earners in the families of the present poor, would have a strong impact upon poverty" [Minsky 1965] page 195]. He further adds that those public works would act as minimum wage anchor which would increase low wages and thus improve the situation of many families.

Minsky argues that "our economic leadership does not seem to be aware that the normal functioning of our economy leads to financial trauma and crises, inflation, currency depreciations, unemployment, and poverty in the midst of what could be virtually universal affluence" [Minsky 1986] page 320, his emphasis. He advocates for a true Keynesian revolution that would stabilize the economy.

For Minsky, the problem of an employment strategy is to achieve full employment without having instability and inflation. "The main instrument of such a

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5Not that the private sector is incapable of introducing technical change benefitting everyone but in some cases the cost of introducing those change might be a barrier to these investments even if in the long run it would be profitable
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 offering of employment from the profitability of hiring workers, the infinitely elastic demand for labor must be created by government” [Minsky 1986 page 343]. He advocates for the New Deal’s WPA (Works Progress Administration) for all and at a fixed wage. According to him, this would effectively set a floor for minimum wage but it would also create a buffer stock of workers that would increase or decrease according to the business cycles. He adds that "the employment strategy will lead to tight labor markets, but as WPA wages are to be significantly lower than in private employment, the supply of labor to private employers will be infinitely elastic as long as WPA employment is positive” [Minsky 1986 page 348].

Following Minsky’s ideas, scholars from the The Levy Economics Institute of Bard College and the Center of Full Employment and Equity (CoFEE) propose job guarantee programs [Forstater 1998, Forstater 2006, Mitchell 2007, Papadimitriou 1999, Wray 1998, Wray 2007 a, Wray 2007 b]. According to them, these schemes would be “a universal job guarantee with a single compensation package for all participants” [Wray 2007 a]. The program would provide full time (or part-time when required by the applicant) jobs to anyone who is in legal age, able, ready and willing to work in exchange of a compensation package. Wray states that the compensation package should be composed of a uniform wage and a uniform benefit package. The wage would have to be fixed according to the living conditions in the country. The benefit package could include healthcare, childcare, social security, etc.

Education and training should be part of the activities proposed under ELR schemes. Since the goal of ELR workers is to be hired in private enterprises, they should be given the opportunity to complete/improve their education level. In addition, job searching should be proposed as an activity during the first weeks of the beneficiary life in the program.

ELR programs would thus eliminate all involuntary unemployment. ELR would also spur aggregate demand due to the increase in income for beneficiaries. Furthermore, Wray points out that “the spending will be highly counter-cyclical so that if implementation of ELR does boost aggregate demand and cause the economy to grow quickly, ELR spending will automatically fall sharply (even as government tax revenue grows)” [Wray 2007 a].

The uniform wage would act as an anchor for minimum wage since the private sector would have to pay more than this wage in order to attract worker out of ELR. The benefit package would also become the standard minimum package in the private sector. Substitution effect, often showed as drawback of minimum wage, even if still existing, would have less dramatic results as fired workers could enter ELR programs instead of remaining unemployed. ELR scheme works like a buffer stock for labor. But with an ELR, the reserve army of labor cease to be iddle.

Government, by fixing the minimum wage, fixes the price of labor. Since labor is an input to all production, the stabilisation of wages will improve the stability of production costs. Moreover, consumption of ELR workers and of

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6Of course, not everyone would work, some are unable to work (and a benefit program should be implemented for those); others may decide not to work (either because their reservation wage is higher than the minimum wage or because they do not wish to work for the program or because they are between two jobs).
workers in general will be stabilised which will enhance further the macroeco-
nomic stability.

ELR also helps to reduce the cost of “depreciation” of idle human capital.
An unemployed worker quickly loses its productivity. ELR programs would thus
prevent this depreciation since workers would continue to work. Furthermore,
since education and training would be part of the scheme, skills of workers would
increase, reducing again the cost of hiring ELR worker.

3 The model

Stock Flow Consistent (SFC) models are based on the works of two schools of
thoughts developed by Wynne Godley and James Tobin. Both these approaches
are centered on the importance of consistency between and among stock and
flows: each flow in the model comes from a sector (or account) and goes to
another account. In each period, the sum of flows has to be nil. Stocks are
the sum of inflows and outflows. SFC models are thus evolutionary models

The economy presented here is composed of two households sectors; wage
earners and capitalists, two production sectors; energy and widget and one
public sector. Both productive sectors are vertically integrated. As a result,
investments and intermediate goods are not shown in the economy. Godley
and Lavoie justify this assumption for the sake of simplicity, pointing out that it
however does not allow to observe "production and pricing interdependencies"
page 253] as Lee emphasizes it [Lee 1998, chapter
12]. However, because energy production is represented as a different sector
than widget production, we will be able to observe pricing interdependencies
between these two sectors.

Table 2 describes the Social Account Matrix (SAM) of the economy. With
the Transaction Flow Matrix (TFM), both matrices show how flows circulate in
the economy. The SAM allows to see what are the earnings (row) and spending
(column) of each sector. For example, the first row shows that earnings from the
energy sector is composed of consumption from the widget sector, from both
household sectors and from the public sector while the first column reveals
that the energy sector spends all its income in wages and profits. The TFM
(Table 3) ensures that the sum of all flows is always nil. A plus sign expresses
an inflow while a minus sign represents an outflow. For instance, the second
rows shows that wages are paid by the two productive sectors to wage earners
and thus comes with a minus sign in the Energy column and with a plus sign
in the wage earners sector. From these two tables, we can see that profits
are distributed to the capitalist class. Household sectors consume both energy
and widgets, pay taxes and save everything left. Finally, governments consume
both energy and widgets and transfer an unemployment benefit to jobless wage
earners. The change in stock is represented in the second part of the TFM.
Households savings are set aside as cash and the only source of cash is public
spending. Thus, any positive stock of savings from households has to have a
negative stock (dissaving) from government as a counterpart.

Table 4 illustrates the Balance Sheet. It shows that private wealth is equal
to households cash savings while public wealth is balanced by public deficit. It
is important to note here that public deficit is the result of a desire to save by

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### Table 2: Social Account Matrix

<table>
<thead>
<tr>
<th>Energy</th>
<th>Widget</th>
<th>Households</th>
<th>Capitalists</th>
<th>Government</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{ie}$</td>
<td>$C_{ei}$</td>
<td>$C_{he}$</td>
<td>$C_{ca,e}$</td>
<td>$C_{ge}$</td>
<td>$Y_e$</td>
</tr>
<tr>
<td>$N_e W_e$</td>
<td>$N_i W_i$</td>
<td>$F_e$</td>
<td>$F_i$</td>
<td>$T_h$</td>
<td>$Y_h$</td>
</tr>
<tr>
<td>$T_{ca}$</td>
<td>$Y_{ca}$</td>
<td>$G$</td>
<td>$T$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3: Transaction Flow Matrix

<table>
<thead>
<tr>
<th>Consumption</th>
<th>Energy</th>
<th>Widget</th>
<th>Households</th>
<th>Capitalists</th>
<th>Government</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$+C_e$</td>
<td>$+C_i$</td>
<td>$-C_h$</td>
<td>$-C_{ca}$</td>
<td>$-C_g$</td>
<td>$0$</td>
<td></td>
</tr>
<tr>
<td>$-W_e N_e$</td>
<td>$-W_i N_i$</td>
<td>$+WB$</td>
<td>$+G_T U$</td>
<td>$-G_T U$</td>
<td>$0$</td>
<td></td>
</tr>
<tr>
<td>Transfer</td>
<td>$-T_h$</td>
<td>$-T_{ca}$</td>
<td>$+T$</td>
<td>$0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxes</td>
<td>$-F_e$</td>
<td>$-F_i$</td>
<td>$0$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profits</td>
<td>$-\Delta M_h$</td>
<td>$-\Delta M_{ca}$</td>
<td>$+\Delta M_g$</td>
<td>$0$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 4: Balance Sheet

<table>
<thead>
<tr>
<th>Money deposits</th>
<th>Energy</th>
<th>Widget</th>
<th>Households</th>
<th>Capitalists</th>
<th>Government</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$+M_h$</td>
<td>$+M_{ca}$</td>
<td>$-M_g$</td>
<td>$0$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$-V_h$</td>
<td>$-V_{ca}$</td>
<td>$+V_g$</td>
<td>$0$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.1 Household sectors

#### 3.1.1 Private sector workers

Households disposable income is composed of the wage bill minus taxes, and unemployment benefits \(^1\). We assume nominal wages and unemployment benefits fixed as we are not interested in inflation or redistributive process among households.\(^3\) Wage earners consume both energy and widgets based on their real disposable income and real wealth \(^2\) and \(^3\). All disposable income that is not consumed is saved as cash \(^4\).

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\(^7\) For more information about circuitist and chartalist theory of money, see [Graziani 2003] and [Wray 1998].

\(^8\) Godley and Lavoie suggest a way to endogenize inflation via wage rates in [Godley and Lavoie 2007, chapter 9].
\[ YD_h = (1 - \theta_h) [W_c N_c + W_w N_w] + GTU \]  
(1)

\[ c_{h,e} = \alpha_{h,0} + \alpha_{h,1} yd_h + \alpha_{h,2} v_h \]  
(2)

\[ c_{h,w} = \beta_{h,0} + \beta_{h,1} yd_h + \beta_{h,2} v_h \]  
(3)

\[ C_h = c_{h,e} p_e + c_{h,w} p_w \]  
(4)

\[ \Delta V_h = YD_h - C_h \]  
(5)

3.1.2 Capitalists

Capitalists disposable income is composed of profits from both productive sectors, minus taxes. As wage earners, capitalists consume both energy and widgets and save all income that is not spent as cash.

\[ YD_{ca} = (1 - \theta_{ca}) [F_e + F_w] \]  
(6)

\[ c_{ca,e} = \alpha_{ca,0} + \alpha_{ca,1} yd_{ca} + \alpha_{ca,2} v_{ca} \]  
(7)

\[ c_{ca,w} = \beta_{ca,0} + \beta_{ca,1} yd_{ca} + \beta_{ca,2} v_{ca} \]  
(8)

\[ C_{ca} = c_{ca,e} p_e + c_{ca,w} p_w \]  
(9)

\[ \Delta V_{ca} = YD_{ca} - C_{ca} \]  
(10)

3.2 Production sectors

Both production sectors are demand driven. On top of public and private consumption, the energy sector also has a demand from the widget production sector. This creates a connection between the two productive sectors. As we will see later, this will have an effect on both price and profits for the widget sector.

3.2.1 Energy

The energy sector has a demand equal to household consumption plus demand from the widget sector and the public sector. Employment in the sector is demand determined through sectorial productivity. Prices are kaleckian markup prices based on unit cost. Unit costs are composed only of labor as we consider the sector to be vertically integrated. Profits are thus sales minus wage bill.

\[ y_e = c_{h,e} + c_{ca,e} + c_{w,e} + c_{g,e} \]  
(11)

\[ N_e = \frac{y_e}{p_e} \]  
(12)

\[ p_e = (1 + \phi_e) U C_e \]  
(13)

\[ U C_e = \frac{w_e N_e}{y_e} \]  
(14)

\[ Y_e = y_e p_e \]  
(15)

\[ F_e = Y_e - w_e N_e \]  
(16)

\[ \text{For more informations on pricing theory, see [Lee 1998]} \]
3.2.2 Widget

As for the energy sector, the widget sector is demand driven. Total demand is equal to households and government consumption $\text{(17)}$. Employment and energy consumption is determined through their respective productivity $\text{(18)}$ and $\text{(19)}$. As for the energy sector, prices are markup prices on unit costs which are composed on the wage bill and energy costs $\text{(20)}$ and $\text{(21)}$. Profits are then computed as total nominal output minus wage bill and energy costs $\text{(23)}$.

\[
y_w = c_{h,w} + c_{ca,w} + c_g,w
\]
\[
N_w = \frac{y_w}{p \cdot r_{n,w}}
\]
\[
c_{w,e} = \frac{y_w}{p \cdot r_{e,w}}
\]
\[
p_w = (1 + \phi_w)UC_w
\]
\[
UC_w = \frac{w_w \cdot N_w + c_{w,e}p_e}{y_w}
\]
\[
Y_w = y_w \cdot p_w
\]
\[
F_w = Y_w - w_w \cdot N_w - c_{w,e}p_e
\]

3.3 Unemployment, CPI and inflation

Unemployment is defined as the difference between fixed labor force and employment in both productive sector $\text{(24)}$. We construct a Consumer Price Index (CPI) based on real consumption in both productive sectors $\text{(25)}$ and $\text{(26)}$. Inflation is based on the CPI $\text{(27)}$. Real disposable income of both household sector is affected by inflation and the wealth effect it has on savings. Using Haig-Simons definition of income$^{10}$ and the computation done in chapter 9 of [Godley and Lavoie 2007], we obtain $\text{(28)}$ and $\text{(30)}$. Real wealth is then defined using equations $\text{(29)}$ and $\text{(31)}$.

\[
U = \overline{N} - N_e - N_w
\]
\[
p = \frac{c_{h,e} + c_{ca,e}}{c} p_e + \frac{c_{h,w} + c_{ca,w}}{c} p_w
\]
\[
e = c_{h,e} + c_{ca,e} + c_{h,w} + c_{ca,w}
\]
\[
\pi = \frac{p - p^{-1}}{p-1}
\]
\[
y_{d_h} = \frac{YD_h}{p} - \frac{\pi}{p} V_{h,-1}
\]
\[
v_h = \frac{V_h}{p}
\]
\[
y_{d_{ca}} = \frac{YD_{ca}}{p} - \frac{\pi}{p} V_{ca,-1}
\]

$^{10}$For Haig (1921) and Simons (1938), disposable income is equal to consumption plus change in wealth [Godley and Lavoie 2007].
\[ v_{ca} = \frac{V_{ca}}{p} \] 

### 3.4 Government sector

Public sector income is given by tax receipt \((32)\) while expenditures are composed of energy consumption \((34)\), widget consumption \((35)\) and unemployment subsidies \((33)\). Total money supply is equal to the difference between expenditures and tax receipts \((36)\). Money demand is determined by households savings \((37)\). We assume, at first and with no loss of generality, fixed total nominal public expenditures \((34)\) and \((35)\).

\[
T = \theta_h [W_e N_e + W_w N_w] + \theta_{ca} [F_e + F_w] \\
G = C_{g,e} + C_{g,w} + G_T U \\
c_{g,e} = \frac{C_{g,e}}{p_e} \\
c_{g,w} = \frac{C_{g,w}}{p_i} \\
\Delta M_s = G - T \\
\Delta M_d = \Delta V_h + \Delta V_{ca} \tag{37}
\]

### 3.5 Structural unemployment

As expressed in section 1.1, unemployment has a structural part. In order to reflect that, we will assume markup to be a function of unemployment \((38)\). Higher demand means increased pressure on prices and markup. Higher demand can be observed by increased capacity utilisation. Supposing, as in [Taylor 1991], that output-capital ratio measures capacity utilisation, a higher output-capital ratio should indicate higher demand. Assuming a Leontief production function and assuming that firms try to minimise cost, for each level of capital, there is only one level of employment that minimizes costs (see Figure 1, it would not be optimal to employ \(N_2\) when \(K_1\) is the level of capital). Thus, employment or unemployment could be used as a proxy for capacity utilisation. Thereby, we can assume that markup are a function of unemployment. We will assume that firms respond to lower unemployment level by increasing their markup \([11]\). By doing so, firms increase their price which results in a depressed real wage and thus in a lower aggregate demand, reducing employment. For simplicity and without loss of generality, we will assume that only the widget industry uses variable markup \((39)\).

\[
u = \frac{U}{N} \tag{38}
\]

\[\phi_w = \phi_w(u-1) \tag{39}\]

\[\text{[11] This could be understood as follow: as firms see demand increase, they use more and more of their capacity of production. However, if demand still increases, they will reach their maximum production level. As they cannot increase their output in the short run, the only solution to maximise profits is to increase the markup.}\]
3.6 Simulations

Simulations have been produced based on German data from 2005, the last year a full consumption survey has been conducted\(^\text{12}\). However, these data have only been used to have a magnitude of real values and these simulations are not predictions. They are used only as didactical tools in order to show how the economy would react to shock, changes in policies or expectations.

3.6.1 Steady state

Due to the complexity and non-linearity of the equations, analytical solution for the steady state are very complex. Nonetheless, it is possible to have some clues about steady state values for some variables. First of all, energy price is fixed as the ratio between wages and productivity is constant (41). Second, widget prices is only varying according to the sectorial markup (43). The same analysis can be made for profits in both sectors with the difference that profits also depend on sectorial employment (44) and (45).

\[
p_e = (1 + \phi_e) \frac{W_e N_e^*}{y_e} \tag{40}
\]

\[
= (1 + \phi_e) \frac{W_e}{p_{r, e}} \tag{41}
\]

\[
p_i = (1 + \phi_i(u)) \left[ \frac{W_i N_i^*}{p_{r1,n}} + (1 + \phi_e) \frac{W_e}{p_{r, e}p_{r1, e}} \right] \tag{42}
\]

\[
= (1 + \phi_i(u)) \left[ \frac{W_i}{p_{r1,n}} + (1 + \phi_e) \frac{W_e}{p_{r, e}p_{r1, e}} \right] \tag{43}
\]

\[
F_e^* = \phi_e W_e N_e^* \tag{44}
\]

\(^\text{12}\)Data were collected via Eurostat website: http://epp.eurostat.ec.europa.eu
\[ F_i^* = N_i^* \phi_i(a) \left[ \bar{W}_i + (1 + \phi_e) \frac{W_p^p_{i,n}}{p^p_{i,e}} \right] \] (45)

For a steady state to exist, stocks have to be constant, thus real wealth for both household sectors have to be such that all income is consumed (46). On top of it, we know that public deficit has to be nil for the stock of public debt not to grow. Government spending has thus to be equal to taxes (47).

\[ \Delta V_{XX} = YD_{XX} - C_{XX} = 0 \] (46)
\[ \Delta M_s = G - T = 0 \] (47)

Figure 2 shows the results for a simple simulation. We observe that all variables attain a steady state. Graph (b) shows that energy price (dashed line) is constant at one while both the widget price (thin line) and the CPI (thick line) settle at a constant value after some variations. Money demand (thick line) and nominal wealth (dashed line for wage earners and thin line for capitalists) in graph (c) increase up to the level where all income is consumed. Finally, budget deficit settle to 0 as expected (d).

3.6.2 Structural unemployment

The second simulation shows the effect of markup on unemployment. Two simulation have been run, one were the markup is held fixed to a constant value while in the second widget markup is adjusting to unemployment levels (15). Government spending is increased by 10% at period 100 and then reduced to its previous value at period 150.

\[ ^{13} \text{Prices have been normalized} \]
\begin{align}
  z_1 &= u \leq u_{low} \\
  z_2 &= u \geq u_{high} \\
  \phi_i &= \phi_{i-1} + (z_1(0.01 - z_2)0.01)\phi_{i-1}
\end{align}

Results are shown in Figure 3. Graph (a) shows government spending level, graph (b) and (c) markup values and unemployment rate while graph (d) shows income per household sector (the two solid lines being capitalist income while the two dashed lines are wage earners income, thick lines are cases where markup is fixed).

Graph (c) shows that unemployment rate in the case of fixed markup follows government spending. When government increase its consumption, demand increases for both sectors and unemployment decreases. In the case of markup adjusting to unemployment level, we observe that as markup increases due to low unemployment, unemployment rises. Unemployment then tends to $u_{low}$. The effect of increased government spending is thus countered by an increase in markup. When government spending decrease, unemployment rises. When it surpasses $u_{high}$, markup decreases leading to a decrease in unemployment. However, unemployment does not go back to its initial level since as soon as it is under $u_{high}$, markup cease to decrease.

The income graph (d) shows us what happens when markup rises: capitalists income (solid thin line) rises while wage earners income (dashed thin line) decreases. This clearly indicates that when markup is a function of unemployment rate, structural unemployment exists and cannot be countered by government spending.

If we wanted to observe endogenized inflation process, it would be possible
to introduce wages such as those presented in [Godley and Lavoie 2007, chapter 9]. The increase in price triggered by the augmented markup would provoke an increase in nominal wages. However, as wages are fixed, real wages decrease lowering demand and increasing unemployment, avoiding an inflation spiral.

4 Green jobs

Literature on cost-benefit analysis of green buildings is wide. Some authors focus only on domestic houses [Clinch and Healy 2001, Hens et al. 2001, Levine et al. 2007, POST 2005], while others focus on public buildings [Kats et al. 2005, Kats 2006, Xenergy 2000]. Generally, various benefits are cited: energy and water savings, improved health and decreased mortality, enhanced student learning, increased productivity, job creation, all leading to clear economic and social profits. In this paper, we will only consider energy savings both in dwellings and public buildings.

4.1 ELR model

Introducing a green job ELR in the economy does not change much the model. Table 5 and 6 are the Social Account Matrix and the Transaction Flow Matrix of an economy with a job guarantee scheme. The only difference from the previous model is that now unemployed worker do not receive a unemployment subsidy but are employed by the state for a minimum wage. The balance sheet does not change and is not reproduced here.

<table>
<thead>
<tr>
<th>Energy</th>
<th>Widget</th>
<th>Households</th>
<th>Capitalists</th>
<th>Government</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{i,e}$</td>
<td>$C_{h,e}$</td>
<td>$C_{ca,e}$</td>
<td>$C_{g,e}$</td>
<td>$Y_e$</td>
<td>$Y_e$</td>
</tr>
<tr>
<td>$N_i W_e$</td>
<td>$N_i W_i$</td>
<td>$C_{h,i}$</td>
<td>$C_{ca,i}$</td>
<td>$U W_{ELR}$</td>
<td>$Y_h$</td>
</tr>
<tr>
<td>$F_e$</td>
<td>$F_i$</td>
<td>$T_h$</td>
<td>$T_{ca}$</td>
<td>$Y_{ca}$</td>
<td>$T$</td>
</tr>
<tr>
<td>$Y_e$</td>
<td>$Y_i$</td>
<td>$Y_h$</td>
<td>$Y_{ca}$</td>
<td>$G$</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Social Account Matrix

<table>
<thead>
<tr>
<th>Energy</th>
<th>Widget</th>
<th>Households</th>
<th>Capitalists</th>
<th>Government</th>
<th>Σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>$+C_e$</td>
<td>$+C_i$</td>
<td>$-C_h$</td>
<td>$-C_{ca}$</td>
<td>$-C_g$</td>
<td>0</td>
</tr>
<tr>
<td>$-W_e N_e$</td>
<td>$-W_i N_i$</td>
<td>$+WB$</td>
<td>$-U W_{ELR}$</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>$-T_h$</td>
<td>$-T_{ca}$</td>
<td>$+T$</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$-F_e$</td>
<td>$-F_i$</td>
<td>$+F$</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$-\Delta M_h$</td>
<td>$-\Delta M_{ca}$</td>
<td>$+\Delta M_g$</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Sigma$</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 6: Transaction Flow Matrix

14 Kats computes a net financial benefit of USD 71 per feet of Green School built [Kats 2006]
4.1.1 Equations modifications

There are some substantial changes in the equations. First of all, as already stated, wage earners income is now composed of private sector earnings and ELR income (1A). Second, works done under ELR have an effect both on governmental and household energy consumption. Equation (51) shows that we relax the hypothesis of constant government spending, as public energy consumption decreases proportionally to the size of ELR (measured by the number of ELR workers). Equations (52) and (53) indicate that households propensity to consume energy also diminishes proportionally to the ELR size.

\[ YD_h = (1 - \theta_h) [W_e N_e + W_i N_i] + W_{ELR} U \]  
\[ C_{g,e} = (1 - \xi G U) C_{g,e,-1} \]  
\[ \alpha_{XX,1} = (1 - \xi H,1 U) \alpha_{XX,1,-1} \]  
\[ \alpha_{XX,2} = (1 - \xi H,2 U) \alpha_{XX,2,-1} \]  

4.2 Simulations

Simulations have been conducted based on the data used for the previous simulations. ELR is enacted in period 50. All the graphs presented afterwards show how the economy reacts to ELR. Each aspect of the response is analysed in detail in the following subsections.

4.2.1 Employment

Obviously, unemployment disappears as soon as ELR is put into action. However, not all workers are employed in the private sector. The analysis is conducted on how does private unemployment (i.e. all workers not employed in the private sector, that is ELR workers) varies. Results depend on whether private unemployment decreases under \( u_{low} \) which triggers an increase in markup. Figure 4 shows the two different cases. In case (a), the increase in demand due to higher income for wage earners does not reduce private unemployment under \( u_{low} \) and thus private unemployment decreases abruptly when ELR is implemented. In case (b), private unemployment reached \( u_{low} \) even before ELR is put into effect. Thus, when ELR is enacted, private unemployment is shortly dragged under \( u_{low} \) triggering an increase in markup as shown in Figure 5 (b).

![Figure 4: Unemployment](image-url)
4.2.2 Consumption

Evidently, given the assumptions, energy consumption decreases as ELR is enacted. Given the increased savings resulting from lower consumption, households increase their consumption in widget, increasing total consumption. Figure 6 shows these results. Graphs (a) to (c) exhibits energy consumption, widget consumption and total consumption. This redistribution of consumption leads to an increase in private employment, after a stabilisation process as graph (d) displays it.

4.2.3 Governmental Budget

Budget deficit has a brisk increase when ELR is enacted due to wages paid to ELR workers being higher than unemployment benefits. However, the deficit reduces rapidly as household wealth and income move in the direction of their steady state values. As expressed in section 3.6.1, a steady state is reached...
when real wealth is high enough for households consumption to be equal to their income. Public debt increases with households wealth and tends towards its own steady state value. What is more, the green job ELR also has an energy saving effect and that reduces constantly households consumption and creates savings at each period. This prevents both public debt and households savings to reach their steady state value. We thus observe on Figure 7 two effects on government accounts; an important budget deficit at first, due to increased budget spending, and then a smaller budget deficit due to households savings. It is important to note that this second budget deficit is not due to too much public spending but to increased savings by households. Public debt never settles to its steady state value as a result (Figure 7).

![Figure 7: Budget deficit, Public debt](image)

4.2.4 Income and Wealth

Both income and wealth increases for the two household sectors as Figure 8 shows it for (a) wage earners and (b) capitalists. On both graphs, the thin line displays wealth while the dashed line is income. In both cases, increase in income and wealth is clear. It worth noting that wealth depends on the energy saving propensity of the works done. The larger energy savings are, the larger wealth is increasing. On the other hand, income growth positively depends on ELR wages. Capitalist income also depends on energy savings. If energy savings are such that it reduces consumption drastically, profits from that sector would decrease proportionaly and might not be matched by an equal increase in profits from the widget sector. Finally, as expressed in section 3.6.4 income distribution between both sectors depends on $u_{low}$, the unemployment lower limit at which markup start increasing. If the increase in income leads to a spur in demand yielding unemployment to decrease under $u_{low}$, then we observe a redistribution from wage earners to capitalists.

5 Concluding Remarks

This paper has shown that unemployment is structurally present in a capitalist economy. Employment policies rarely target full employment. Usually these are "maximum employment possible under present situation" policies. We propose a job guarantee scheme that would eradicate unemployment while targeting lower energy consumption. Various analysis have shown that improved insulation in
private and public buildings have a positive cost-benefit analysis. This paper shows that with a green job Employer of Last Resort, not only energy savings would be observed but also that sustainable full employment could be achieved improving the situation for all household sectors. Furthermore, this program would imply a structural change in the economy towards energy efficiency.

References


