UNIVERSITY OF LJUBLJANA FACULTY OF ECONOMICS

MASTER'S THESIS

THE GREEN NEW DEAL: THE GREEN FISCAL STIMULUS AND ITS EFFECT ON OUTPUT AND EMPLOYMENT

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LIST OF ABBREVATIONS

AAA – Agricultural Adjustment Act

ARRA – American Recovery and Reinvestment Act

 $CO2-\mbox{Carbon dioxide}$

EU – European Union

EE – Energy efficiency

OECD – Organization for Economic Co-Operation and Development

O&M – Operation and Maintenance

GDP - Gross Domestic Product

GND – Green New Deal

GGND – Global Green New Deal

IRF – Impulse-response function

NIRA - National Industrial Recovery Act

VAR – Vector autoregressive model

PED – Primary energy demand

 $PV-{\rm Photovoltaic} \\$

RE – Renewable energy

R&D – Research and development

rGDP - real Gross Domestic Product

RMSPE – Root Mean Square Percentage Error

sVAR – structural Vector Autoregressive model

WTO – World Trade Organization

INTRODUCTION

Can the environmental problems solve the economic ones? This thesis investigates the effectiveness of the green fiscal stimulus as a means of economic recovery from the economic crises. The hypothesis is that in the time of crisis, government spending is necessary and should be done with environmental public investment. Green investment should result in increased employment rates and consumption levels, helping the economy to recover from the crisis and improve long-term economic growth. The environmental investment consists of energy efficiency investments, renewable energy investments and green technology research and development (hereinafter: R&D). These sectors are very labour-intensive and could provide employment, which would facilitate economic growth and economic stabilisation after the economic crises, along with the environmental quality improvement.

The goal of this thesis is to provide an empirical foundation of the Green New Deal policy brief with econometric research and access its positive and negative effects. Further, the thesis aims to provide policy implications and guidelines for the implementation of the Green New Deal. There has been little to no such research done for the case of Slovenia and this study takes a novel approach towards studying the Green New Deal and fiscal multipliers in general. The econometric research in this study will be using the panel Vector Autoregressive (hereinafter: VAR) model, with data from World Penn Tables and World bank for OECD countries, estimating the impact of general and green government spending on the employment levels and real gross domestic product (hereinafter: rGDP). This is a rather novel approach in fiscal stimulus analysis, since most of the literature has examined single country time series.

The main hypothesis of the econometric study in the thesis is that Green New Deal measures are effective in crisis elevation. This hypothesis is first tested for traditional Keynesian policy and later for the green Keynesian measures. The effective government spending hypothesis is divided into two hypotheses:

- 1. Traditional fiscal spending multiplier on output and employment is positive.
- 1.A: The gross domestic product (hereinafter: GDP) size of the economy positively influences the size of the multipliers.
- 1.B: The pace of economic growth negatively influences the size of the multipliers.
- 1.C: Indebtedness of the economy negatively influences the size of the multipliers.
- 2. Green fiscal spending multiplier on output and employment is positive.

The first hypothesis will be tested with time series spanning 25 years, on the sample of 35 OECD economies. It will also be further analysed with three sub-hypotheses, to understand the mechanisms influencing the traditional fiscal multiplier size in depth.

The first sub-hypothesis is predicting positive correlation, because larger economies will engage with larger fiscal stimuli, which would portray larger multiplier, due to the large scope of fiscal spending. The predicted correlations of the second and third sub-hypotheses are negative, because economic theory suggests larger fiscal multipliers in time of the negative economic growth (recessions) and in the countries with low debt-to-GDP ratios, since fiscal spending implies public debt increase.

The second hypothesis will be tested on the sub-sample of OECD economies which adopted the Green New Deal in 2009. This is a much narrower sample, spanning only 5 years after the 2009 crisis.

The empirical part of the study will focus solely on the Green New Deal, with a synthetic economy simulation. The synthetic study will be based on two empirical sub-hypotheses.

- 2. A: The 2009 Green New Deal in S. Korea was effective in providing additional employment and economic output.
- 2. B: The Green New Deal in Slovenia would have been effective in providing additional employment and economic output, if it had been implemented in 2009.

From all of the above hypotheses, we will draw policy implications and recommendations, in order to provide economic justification for the adoption of the Green New Deal measures during economic crises. The thesis strongly justifies the adoption of the Green New Deal policies and provides the empirical ground for such conclusions.

The paper is organized as follows: In the first chapter the traditional and Green New Deal policies are presented, along with historical results and controversies. In the second chapter a theoretical take on the Keynesian traditional fiscal policy, as well as the green Keynesian policy will be introduced. The third chapter will present the empirical model, which presents the main scientific contribution of this thesis. The traditional fiscal spending multipliers will be estimated and examined. After traditional multipliers estimation, the empirical model will focus on the Green New Deal. In the concluding chapter, the policy implications from research will be presented and policy recommendations will be outlined for national and international Green New Deal measures.

1 THE (GREEN) NEW DEAL

In this section, as well as in the next sections, the difference between the traditional New deal and the Green New Deal will be established. The traditional New Deal measures will be studied, and its controversies and economic implications will be presented.

In the second part of this section, an overview of the Green New Deal will be presented. General policy brief of the Green New Deal will be studied, as well as the necessary complementary policies to such project, namely, the green growth policies, green employment policies and emission reduction goals will be evaluated. Finally, we will also provide the comparative data of the different countries stimulus measures, which would classify as a green fiscal stimulus.

1.1 The traditional New Deal

In this section, I will discuss the economic and political motivation for the New Deal of the early 20th century and study the New Deal government intervention after the Great Depression in 1929. We will present the past responses to economic instability and recovery policies, as well as analyse the latest recovery stimulus packages, which took place after the 2008 Big Recession. The main objective of presenting the history of the New Deal here is to understand and learn from it, to design the modern version of the Green New Deal without traditional pitfalls and to learn from the past experience.

1.1.1 The New Deal measures

United States of America and the rest of the western economies suffered from a severe economic downturn at the beginning of the 1930s, which was recursively called the Great Depression. The US did not turn their politics to an autocratic regime, as it was a case in Europe, but approached the social problems with strong government intervention in the economy.

Right after the election of the new president F. D. Roosevelt in 1933, the National Industry Recovery Act (hereinafter: NIRA) was signed, with a goal of "the assurance of a reasonable profit to industry and living wages for labor with the elimination of the piratical methods and practices which have not only harassed honest business but also contributed to the skills of labor." (Rosenman, 1938). This act provided the framework for the development of workers' rights, since it ensured workers minimum wage and maximum working hours, as well as provided rights to collective bargain with representatives of the labour unions. Industrialists achieved to allow many loopholes in pro-labour provisions, as well as production cutbacks and non-competitive, higher prices for most industries (Skocpol & Finegold, 1982). The policy makers claimed that the main purpose of the NIRA was to increase prices and wages, in order to break the deflationary spiral of 1929–1933 (Eggertsson, 2012). This policy was according to a modern economic theory contractionary, however, because of the specific emergency conditions, resulted in expansionary results (Eggertson, 2012).

Another important act of the New Deal was the Agricultural Adjustment Act (hereinafter: AAA), which aimed to raise the prices of the basic agricultural commodities, with a goal to readjust the overall relationship between industry and agriculture. The agricultural measures turned out to be much more successful in organizing commercial farmers for their own collective good, than did the National Recovery Agency for industrial capitalists (Skocpol & Finegold, 1982). The agricultural produce reached parity like pre-World War I with relation to industrial produce. Many crops and cattle were destroyed, for farmers to get

government aid. Critics argued that agricultural measures were directed toward improving farmers' position, as opposed to increasing overall welfare.

Essentially, the two acts mandated the establishment of authoritative new administrative organisations: the NIRA and the AAA, through which economic functions formerly shaped by market competition would be planned and regulated in the public interest (Skocpol & Finegold, 1982). This was highly controversial to American liberal democratic ideal, since government officials were granted high authority to achieve the 3 R's of the New Deal: Relief, Recovery and Reform (see table 1). The two main measures, industrial and agricultural, were both recovery acts.

The relief acts constituted of bank holidays and Emergency Banking Act, which closed the insolvent banks and later only reopened the solvent ones. This was also backed up by the government insurance of bank deposits, held by the Federal Deposit Insurance Act (hereinafter: FDIC), which originally insured deposits up to US\$5000 and later to US\$10.000 (Jackson, 2017). The FDIC was created in 1933, with the so-called Banking Act, designed to mitigate the macroeconomic and monetary instability.

Relief	Recovery	Reform
Bank holiday	NIRA: National Industrial	FDIC: Federal Deposit
(Banks closed for 4 days)	Recovery Act	Insurance Corporation
Emergency Banking Act	AAA: Agricultural Adjustment Act	Social Security Administration
CWA: Civilian Works	WPA: Works Progress	NLRA: National Labor
Administration	Administration	Relations Act

Table 1: The New Deal 3 R's

Source: Jackson (2017).

Civil works programmes were designed to solve the unemployment problem and provide the immediate monetary aid to those in need, under the measure of Federal Emergency Relief Act (hereinafter: FERA). This act gave immediate help to those in need and was a predecessor of modern unemployment compensation. Complementary measure to the FERA is the Civilian Works Administration (hereinafter: CWA) and Civilian Conservation Corps (hereinafter: CCC), which was sending young workforce to work camps, building public infrastructure and providing different public goods. The CWA provided temporary jobs, repairing roads and bridges, whereas the CCC were specially targeting unmarried single adults, who were collectively sleeping in barracks and cleaned after the disaster type situations, with filling the sand bags and repairing the damage (Jackson, 2017).

In the 1935 both acts (NIRA and AAA) were dismissed as unconstitutional by the Supreme Court, but Agricultural Adjustment Act got reformulated, whereas industrial measures were abandoned. In short, the early New Deal's agricultural program ended up being successfully institutionalised, but the industrial program did not (Skocpol & Finegold, 1982). Conflicts between the industrialists and labour unions, who were exercising the bargaining powers granted by industrial acts and corporate management turned to overall strikes, which resulted in the acceptance of National Labor Relations Act, also known as the Wagner Act, which legalised the labour union independence.

The Social Security Administration monitored the older segment of the population, for the old to have enough money to survive and to spend, which would elevate the effective demand. The retired workers older than 65 years received a continuing provision after retirement. This was funded with a payroll tax levied on the working population, with a fixed rate, regardless of the income level, which is today known as the pay-go pension scheme.

The New Deal policies also mobilised young workforce in public infrastructure projects, providing temporary employment. Once the New Deal established large-scale work programs (CCC and WPA, see table 1), about one-fourth or one-third of the workers classified as unemployed held relief jobs (Fleck, 1999). Public infrastructure projects like roads, public buildings, dams, land reclamation provided public goods, as well as job training and experience for the young workforce, providing them with the part-time employment. This was a programme for the young, unemployed workforce, aged from 18—25, which slept in improvised barracks in a semi-military style manner, providing them with the basic income.

The depositors were threatened with the financial system collapse, so the deposit system had to be reformed, to secure the savings on the bank accounts. This was achieved with the Federal Deposit Insurance Corporation, which was securing the deposits up to \$5,000. These reforms were introduced to prevent the economy from another crisis, as well as to help and protect the households against economic disasters. However, the focus of the New Deal was still economic recovery, which turned out to be very controversial.

1.1.2 Results and controversies of the New Deal

The unemployment rates increased dramatically during the Great Recession in the U.S., where the agriculture was hit by soil degradation and severe droughts. From 1931 to 1940, according to the official measure, unemployment constantly remained above 14 percent (Fleck, 1999) and reached 33 percent in some of the U.S. states (Frank & Bernanke, 2007). The gross national product had fallen by 29 percent from 1929 through 1932 and investment levels dropped even more dramatically, by 84 percent, during the same period (Higgs, 1997). There was little to no social security or welfare state to mitigate these social issues. The global economy was also severely hit, with estimated falling global GDP by 15 percent. Household income and profits dropped, while international trade plunged by more than 50 percent (Frank & Bernanke, 2007).

After the adoption of the New Deal policies in 1933, about one third of the workers classified as the unemployed held relief jobs (Fleck, 1999). The economy did not return to full employment equilibrium even after the rGDP regained its initial values before the crisis. The employment recovery was extremely slow according to (Darby, 1975) and normal levels of employment were achieved as late as in 1942, with the introduction of massive military government spending for the purposes of the World War II.

Similarly, the rGDP had regained 96 percent of its loss by the year 1937 and investment recouped 64 percent of its loss during the beginning of the Great Recession of 1930s (Higgs, 1997). Another "depression inside a depression" occurred in the year 1938, after the cut in public New Deal expenditures, with rGDP falling by 4 percent again. This short depression episode of 1938 recovered quickly and in 1939 the rGDP levels were again above its previous peak levels of 1929 (Higgs, 1997). The economy started its steady growth path only after the World War II ended, since the government expenditures rose during the wartime and gross private investment was crowded out significantly. The private investment levels returned to pre-Great depression levels in 1946, which is marked as the Great Escape, where the U.S. economy portrayed a steady growth path until the 1950s (Higgs, 1997).

The theoretical macroeconomic support to the New Deal policy is the Keynesian theory, which will be discussed in the separate section later in this thesis. The purpose of such expansionary fiscal policy is the effective demand shift, which increases both GDP levels and employment. The U.S. economy did in fact start growing after the New Deal measures and grew very fast in the following period, when the cumulative GDP grew by 39 percent in 1933—1937 and monthly industrial production more than doubled over this period (Eggertsson, 2012). However, as soon as it looked better, the Roosevelt administration stopped the government aid again. This resulted in repeated recession in 1937—38, which may prove that the economy did not stabilise itself, but stood on the government subsidies. The unemployment soared again and even after seven years of heavy government spending, millions were left unemployed. This lasted up until the Second World War in 1942, when government spending rerouted to the army expenditures, providing public works in war material production (Jackson, 2017).

The Roosevelt administration remains highly controversial among the economists. He did redefine the role of the government and broke the long lasting laissez-fare economics, but since his policies were novel and ground-breaking, their positive effect was disputed by many historians.

Enormous bureaucracy was established, with enormous costs. The government intervention seemed to be inevitable in the years following the Great Recession, although the republican party opposed it radically, since they saw it as "stepping on someone's toes", because of the tax increase to finance the public spending programmes. This meant government intervention on a large scale, which was also objected by the socialist movements as not defending workers' rights properly, as well as Republican Party libertarians, who fought for low taxes.

Wright (1974) argued that the New Deal was primarily a political action to win the electorate. Wright's econometric study shows that the measures were targeted to the geographic areas, where the Democratic Party influence was not as strong. This resulted in unequal government expenditure among the states. Wright (1974) argues that the allocation of government expenditures among the states and interstate inequalities in per capita federal spending can be explained, in large part, as the resultant of a process of maximizing expected electoral votes. As a political programme, the New Deal was indeed successful, since F. D. Roosevelt was re-elected and governed two full mandates. In economic perspective, its success is not as obvious, since a lot of its outcomes can be attributed to other variables.

A lot of historians and economists are sceptical over high growth rates, since they argue that recovery from the Great Depression was still very slow (Eggertson, 2011). One of the main reasons for slow growth is that the economy was recovering from an extremely low level of output and the other reason is the repeated recession in 1937, which cancelled the momentum established by the New Deal policies. The Great Depression of 1930s marked an extremely low level of output and many argue that the following period should portray even higher growth rates than it did in the case of the New Deal era.

The Great Depression was not expected as such and government intervention seemed inevitable for the macroeconomic stabilisation. The crisis in 2008 was similarly unexpected and massive bailout packages followed in most of the economies hit by the recession. The nature of such packages was highly controversial among the policy makers and economists, and similar questions and controversies were disputed as in the New Deal policy design.

1.1.3 The Great Recession of 2008 and policy response

The discussion of the New Deal initiated again with the latest economic depression, since the governments needed to intervene with a response to the 2008 crisis, which was the biggest economic downturn since the Great Depression. This discussion will roughly outline the causes and scope of the latest economic depression, its origin and sectors which were hit the most. The discussion will also look at social issues that spurred with the crisis, especially unemployment, which is relevant in the (Green) New Deal proposal and what has already been done in the American Recovery and Reinvestment Act (hereinafter: ARRA) and other economies recovery packages.

After the financial system was hit by falling asset prices (most prominently mortgage, which served as collateral for short-term loans) in late 2007, some major financial institutions went bankrupt in the beginning of the 2008. This lead to a liquidity crisis and financial institutions were not able to turn assets into cash, in order to service their loans. This resulted in credit crunch, access to finance diminished and the overall economy started stagnating and eventually contracting. U.S. quarterly growth rates were around negative 6 percent and unemployment exceeding 10 percent (Mishkin, 2011). The crisis spread and become a global issue, with falling global growth rates down to -6.4 percent in the last quarter of 2008 (Mishkin, 2011).

Economies responded with different monetary and fiscal policies, but most notably some rather unconventional monetary policies were used to recover from the 2008 financial crisis. For example, the U.S. response was quick and massive, based on the past experience of the Great Depression, while others hesitated with the response and delayed it, as it was the case in the European Union.

1.1.3.1 Unconventional monetary and fiscal measures following the Great Recession and controversies of the 2009 crisis

The most notable unconventional monetary measure following in the years after the great Recession was dropping the interest rates near or even under zero. This was accompanied with the liquidity provision and asset purchases, which came to be known under the heading Quantitative Easing (Mishkin, 2011). This was a form of cheap money lending from central banks to the commercial banks, with the purpose of stimulating investment, accelerating loans and to provide systemic liquidity. Liquidity provision did in fact help to lower the interbank risk premiums and asset purchases stimulated spending, with increase in some bond prices, which lowered the household relevant interest rates. This, however, came with an enormous cost on the national budget, since the bailout programmes of 2009 increased national deficit and indebted most of the developed economies unprecedentedly.

In the U.S., this began in March 2009; with US\$300 billion Federal Reserve System purchase of long-term treasury bonds and later in 2010 the purchase of US\$1.25 trillion mortgagebacked securities to lower the residential mortgage rates (Mishkin, 2011). The EU followed with a lag, which was also the cause of prolonged crisis, due to slow response of the monetary policy intervention. This may be due to the lack of experience in the Euro zone, since the Euro monetary union did not deal with such large-scale crises, as the U.S. monetary authority did during the Great Recession and in later recessions.

Another unconventional monetary policy adopted was the management of the expectations, since the central bank announced that it would keep low interest rates "for an extended period of time" (Mishkin, 2011). The counterfactual situation, one without the government intervention, would have left interest rates high, which would have even further depressed the consumption and spending, resulting in an even deeper recession.

Another, non-monetary interventionist policy adopted after the crisis was the fiscal stimulus package, which resembled the New Deal policy. In the United States it was known as the American Recovery and Reinvestment Act, a US\$787 billion governmental financial injection introduced to directly increase aggregate demand. Roughly a third of this package consisted of tax cuts and the other two thirds, or US\$499 billion, of direct government spending (Mishkin, 2011). Since the fiscal stimulus was adopted later than monetary intervention, its effect is seemingly less significant, although the debate about its multipliers and real effects remains open. Many studies find output multipliers around 0.6 up to 1; however, many argue that it may be significantly higher due to zero bound interest rates (Mishkin, 2011). Many problems remain unsolved after crisis, such as overly expanded

central bank balance sheets, which have unsustainably high asset capital, in the form of longterm mortgage-backed securities, which cannot just be let off to mature, since this would take a lot of time and would bring several issues with it, such as interest rate and credit risk (Mishkin, 2011). The other necessary clean—up after crisis is the financial regulation, since some financial institutions have become too big to fail and need to be regulated, to prevent such systemic dependence on several institutions.

In the European Union, the response after the 2008 crisis occurred with a bit of a delay and it was far less extensive than the U.S. response. The European Union is not a fiscal union, which means that it cannot provide a unified stimulus package, but it was left for the national states to do it. This is also the reason that the European Union policy response to the crisis turned more to the austerity programme, which focused on cutting public spending and freezing public employment, which is quite the opposite of the Keynesian oriented New Deal policy. The austerity programme was a controversial measure, since many governments of the Euro area froze the public employment, leading to a large social upheaval against the austerity measures. Austerity measures were employed, due to the fact that the European nation states suffered from high post—crisis foreign debt levels, which were usually caused by expansionary fiscal policy to close the recessionary gap. This put a lot of pressure on public finance, which generally responded with cutting the government spending in the EU countries.

Some EU nation states suffered increasing sovereign debt problems, the causes for which were various. In the case of Ireland and Spain, the financial meltdown occurred in the housing sector, whereas in the case of Greece and Portugal, the main cause was the cyclically adjusted structural deficit (Brady, 2015). Countries with low debt—to—GDP ratio did not consider their increasing deficit a problem, whereas the countries with high debt—to—GDP ratio started to increase taxes and avoid austerity, as in the case of Italy. This brought the problem of increasing exchange rates of euro to dollar and sterling. Countries with high level of exports started to overheat, but countries with less flexible labour market started to sink deeper into debt, which all happened in the same monetary union of Eurozone. This was the point where International Monetary Fund started recommending fiscal programmes of austerity in 2009, with reducing excessive government spending and adopting labour market flexibility, under the heading "credible plan for fiscal exit" (Brady, 2015). The outcomes of the austerity programmes are a heated topic, however, current fiscal policies are turning away from austerity toward increasing tax revenue, as in the case of France, which brings in 55 percent of GDP in tax revenues.

The fiscal stimulus packages adopted in 2009 were immediately controversial because of two reasons. Firstly, academic economists viewed monetary policy as more appropriate in crisis elevation than fiscal policy, since monetary policy can act quickly and does not suffer from any significant policy delays, as is the case with the fiscal policy (Miron, 2010). Government spending projects need a lot of time for proper design, planning and implementation, which could start having expansionary effect, when the contractionary policy is already suitable for economic conditions, when the projects take place. Secondly,

a lot of the economies had already suffered from dismal long-term fiscal outlook, such as Medicaid and Social aid in the U.S. (Miron, 2010).

The policy debate between increased spending and austerity is stark, but the Green New Deal may offer a third way out of this dispute. The Green New Deal combines the savings with spending, since short-term stimulus spending provides long-term savings. These savings occur, for example, in energetic sanitation of buildings, which makes them more frugal. Another example is the sustainable transport infrastructure, which brings savings in form of less demand for energy. The short-term stimulus spending helps elevate the aggregate demand, provides employment and pushes the economy back towards the full utilization of the resources. Ideally, when full employment of the Green New Deal spending.

1.2 The Green New Deal

This section will discuss the Green New Deal policy, its components and optimal policy design. The chapter will propose national level, as well as international level policy choice, present complementary policies and conclude with presenting evidence from the latest Green New Deal (hereinafter: GND) packages adopted in 2009.

1.2.1 The Green New Deal policy brief

The GND is an environmental variation of the U.S. New Deal, a series of stimulus packages launched between 1933 and 1938, which created jobs through ambitious governmental programs, including the construction of roads, trails, dams, and schools, which entailed a strong governmental role in alleviating the U.S. economy out of the Great Depression (French, Renner & Gardner, 2009).

The Green New Deal adds its environmental objective to respond the pressing environmental challenges, with decisive governmental role, pursuing a new paradigm of sustainable development.

The Green New Deal is a short-term stimulus measure, adopted to produce more energy efficient economy and to reduce unemployment. This may be achieved with the main priorities of the Green New Deal: greening the infrastructure, especially the transport and energy infrastructure, as well as retrofitting buildings and sustainable production of basic materials (such as steel, aluminium, cement and paper, which are the key materials of modern economies). All these endeavours represent labour-intensive industries, which would in turn reduce unemployment and provide the economy with the elevated effective demand, which is necessary for the economic recovery from the crisis, according to the Keynesian theory discussed later in this thesis. The green stimulus measures represent policy packages that follow CO_2 emission reductions policies and increase employment levels of the economy, in the context of economic recovery (IILS, 2011).

A Global Green New Deal, as proposed by United Nations Environmental Programme (UNEP, 2009), consists of three broad social goals. The first goal of the GND is reviving the world economy, saving and creating jobs and protecting vulnerable groups. The second goal is promoting sustainable and inclusive growth, especially ending extreme poverty and the third goal of the GND is to reduce carbon dependency and ecosystem degradation. The Global Green New Deal endeavour is envisaged to amount to one percent of world GDP or approximately US\$750 billion (Barbier, 2010).

On a nation state level, the green budget reform is recommended by UNEP, which would substantially reduce environmentally harmful subsidies and introduce environmental taxation. This would relieve the tax burden on productive activities, such as labour and transfer this burden to environmentally harmful products and services. The GND as well as the green budget reform are based on the double dividend hypothesis, which states, that well-designed green stimulus measures can both stabilise the economy output and unemployment, while improving environmental quality (IILS, 2011). The green budget reform particularly targets the fossil fuel industry and agriculture, since these are the most subsidised environmentally harmful activities. Since these are very important and sensitive sectors, a comprehensive plan of readjustment and reemployment should be prepared, including the just transition for workers. The green budget reform will be discussed later in this thesis in detail.

According to (UNEP, 2009) there is evidence showing that "green sectors" such as building retrofits and renewable energy have the prospect of leading the global economic recovery while addressing major environmental crises, doing so with better returns than traditional fiscal stimulus infrastructure investment. Falling employment rates and income levels are the destabilising social consequence of the economic crisis. Since new solutions currently trend on protectionist measures, it is important to note that GND is not promoting such protectionism, although fiscal stimulus is usually understood as favouring domestic industry. Discriminatory policy of domestic support does invoke retaliatory measures of foreign trading partners, dragging both economic partners further into the recession.

Government intervention in infrastructure was traditionally done with policies that would increase greenhouse gas emissions. Traditional public investments, such as building roads and heavy industry supposedly perpetrated the climate crisis the world is currently facing. Thus, it is crucial, that recovery from the crises is done with environmentally beneficial stimulus measures, investing in green technologies and infrastructure, which are the basis for long-term green growth.

The Green New Deal is a short-term policy response to economic crisis, which does not necessarily turn an economy on a long-run sustainable path. Supplementary policies of the Green New Deal often adopt a long-term perspective and try to orient an economy on a long-term sustainable path.

1.2.1.1 Green jobs and green growth

The green growth orientation is an internal paradigm of the Green New Deal, which is adopting a long-term decision of an advanced economic growth with a significant environmental protection (Jacobs, 2012). Green growth may not be substituted with the sustainable development paradigm, since this notion has turned out to be limiting economic growth and connotes overly optimistic government commitments, which have turned out to be insufficient for radical change, necessary for the climate change stabilization. The green growth seeks to advance economic growth, with the new technological advancement, especially on the field of green technologies and renewable energy sources.

The Green New Deal would target new job creation, which would be labelled as green-collar jobs. This is a label, which encompasses a wide array of occupations, skill-levels and salaries. From initial focus on waste management and pollution control, the notion of green jobs turned to organic farming, renewable energy production, sustainable automotive industry and others. Global markets for environmentally non-harmful goods and services will likely see a continued strong growth. They are projected to grow from about €950 billion in 2009 to more than €2,000 billion in 2020 (Ghani-Eneland & Renner, 2009). Employment will also continue to grow rapidly in renewables, energy efficiency, and transport alternatives. For further discussion, see also the section on government spending employment multiplier in this thesis.

Figure 1: Total employment effects—job-years created through \$1 billion in green government investment (for the U.S. average annual energy expenditures between 2012 and 2020).



* Long-term energy effects measures the net change in employment (measured in job-years) resulting from energy savings and the change in energy mix for the decade following the initial investment.

** For tax cuts, the lighter field indicates the employment effects of the share of the initial tax cut or rebate saved until future years.

Source: Houser, Mohan & Heilmayr (2009).

More and more workforce will be needed in the green sectors, therefore, it is beneficial for the economy to develop human capital in the emerging new sectors, as well as to use the fiscal stimulus to improve emerging sectors and avoid supporting the sectors without future perspective, such as brown-collar jobs in fossil fuel industries with uncertain and unsustainable perspective. The study (Houser, Mohan & Heilmayr, 2009) shows a positive net impact of green government investments on US job creation and these employment prospects lead well into the future and not just after stimulus spending as in the case of tax cuts and traditional infrastructure investment.

As it can be seen from the figure 1, the public spending employs the most in the field of building retrofits, mass transit, road investment and battery research and development. The long-term energy saving benefits are the highest in the battery R&D spending, smart metering and green school construction. It is estimated that US federal spending produced 7 thousand job-years per US\$1 billion spent and by contrast the traditional infrastructure investment would yield around 25 thousand job-years (Houser, Mohan & Heilmayr, 2009). The measure of the job-hours is somewhat inconvenient. Nevertheless, (Houser, Mohan & Heilmayr, 2009) used it, because this measure shows the longevity of the job created, for example, an investment in building efficiency that created 25,000 jobs-years could mean 25 thousand jobs sustained for one year or 5 thousand jobs sustained for five years.

1.2.1.2 Greenhouse gas emissions reduction commitments

The Green New Deal proposal offers an environmentally friendly government intervention, that would help cut emissions and achieve the goals set first in Kyoto protocol and later in Paris UN Climate Change Conference in 2015. Current government dedications to reducing greenhouse gases became obsolete with the economic crisis, since the greenhouse gas emissions started to fall, due to low economic activity. However, from a long-term perspective, this is still a business-as-usual policy. Thus, a crisis renders a favourable opportunity to divert the economy on a green path, with long-term emission reduction commitments.

For example, the European Union is currently pursuing the "2020 goals", aiming to achieve 20 percent improved energy efficiency, 20 percent renewable source energy production and 20 percent reduction in greenhouse gas emissions compared to the baseline year 1990. These goals are not inherently part of the Green New Deal, but show the political motivation towards the green economic development. The Green New Deal may be the policy of choice in achieving these goals. The EU—28 is doing quite well in reducing its greenhouse gas emissions, with 22.0 percent reduction compared with 1990 level in 2016 (Eurostat, 2018). The year 2009 saw a sharp drop in emissions as the consequence of the global financial and economic crisis, which resulted in reduced industrial activity. Emissions increased in 2010 and have decreased again from 2011 onwards. Incidentally, 2014 marked the year with the lowest emissions on record since the beginning of the time series. This evidence provides strong argument in favour of green stimulus, since the emissions reductions occurred not due to policy regime, but due to economic inactivity.

1.2.2 Policy recommendations for the Green New Deal

This section will provide general framework for the adoption of the Green New Deal. The framework will cover recommendations for the national states and in the second part the international cooperation framework for achieving the Global Green New Deal. No other time in recent world history has seen the possibility of achieving a worldwide consensus over policy package, which would address important economic, social and environmental challenges the world economy is facing today (Berbier, 2010).

1.2.2.1 National state Green New Deal recommendations

On the national level, the energy efficiency measures are the most recommended green spending policies during the economic crises. Building retrofit measures would elevate the depressed demand in the construction sector, provide employment and produce long-term energy savings. Energy efficiency (hereinafter: EE) policy should focus on public buildings retrofits, as well as residential, tertiary and industrial buildings. This can be targeted with special grants for building retrofitting, which should promote renewable energy source installation and follow high-energy efficiency standards. The GND should support cities and regions to develop zero-emission dwellings and introduce zero-emission zones (Schepelmann & Stock, 2009).

Three more EE measures, which should be prioritized by the national state fiscal spending programmes, are recommended (Schepelmann & Stock, 2009). Firstly, energy use of electrical appliances should be lowered with EE measures. Support programmes for the most energy efficient white appliances should be introduced and support programmes for office, communication and entertainment appliances, without a stand-by facility and low on-mode consumption could contribute to the EE improvement. Secondly, the industrial emission reduction schemes should be introduced, based on voluntary agreement and financial incentives, such as tax deductions or subsidised energy audits. The third recommended measure in EE improvement is the introduction of smart metering and energy efficient electricity grids, which can lower energy losses substantially. Smart metering would raise consumer awareness with personal monitoring, as well as create technical solution for managing peak electricity demand more efficiently.

The second main Green New Deal policy package recommended is the sustainable transport policy. Modern economies are dependent on transport as the foreign trade levels increase. This is the reason that more efficient and sustainable transport systems contribute to economic growth.

A sustainable transport policy should focus on three basic strategies (Schepelmann & Stock, 2009):

1. Reducing the need for transport.

- 2. A shift to sustainable modes of transport.
- 3. Increasing the efficiency of vehicles and the traffic flow.

An integrated policy of transport and spatial development is therefore necessary for reducing the transport needs, which still allow mobility to be maintained while reducing the kilometres travelled. Reducing the need for transport are long-term policies, which are not appropriate for short-term stimulus investment, but should be highly prioritised in the Green New Deal policy design.

Short-term fiscal spending boosts can be achieved with investment in sustainable modes of transport, where it is reasonable to support zero-emission mobility over short distances, train and public transport (by bus or tram) over medium-range or longer distances (Schepelmann & Stock, 2009). Purchases of public transport vehicles, mobility management, the provision of information, education and services are all short-term measures, which act as pull-factors in the shift towards a more sustainable transport sector. The recommended push-factors promoting the sustainable transport are measures relating to vehicle technology as well as intelligent traffic management systems and eco-driving (Schepelmann & Stock, 2009). Policy instruments in this field include emission limits, fiscal measures to integrate the external costs of transport and R&D programmes.

The last recommended policy for the Green New Deal is the sustainable resource policy. Modern economies depend on natural resources, with increasing global demand due to the emerging economies. The rising demand for resources is increasing the prices as well as posing a risk of limited access to the resources. Recommended Green New Deal policy prioritises resource-efficiency, with significant potential for cost-reduction. This has two major effects: improved national competitiveness and job creation (Schepelmann & Stock, 2009). The recommended instruments should finance technological advancement in industrial sector towards improved resource efficiency and recycling, to close the productivity gap. The funding should especially target small and medium enterprises, because small firms often lack the capital and know-how to improve resource efficiency. Another recommended instrument in achieving resource efficiency is the improved public procurement, which would invest in more resource-efficient products and services.

Because the environmental problems are global, the national level Green New Deal may not be sufficient in tackling environmental issues; therefore, it is reasonable to design a framework for multilateral policy coordination. Economic interdependence also produces recessions on a global level, which is the reason that economic and environmental policies should not be separated and should become coordinated multilaterally.

1.2.2.2 The Global Green New Deal policy recommendations

As (Barbier, 2010) pointed out, the Great Recession of 2008 has brought governments together to instigate a worldwide recovery, with important international achievements of the

Washington and London G20 summits in 2008/9. Although these summits brought no green policy commitments, they showed a possibility of coordinated agreement on global financial crisis recovery policy, which could also be used to address other important global economic, social and environmental problems. Following (Barbier, 2010) the Global Green New Deal must have three principal objectives:

- 1. Reviving the world economy, create employment opportunities and protect vulnerable groups.
- 2. Reduce carbon dependency, ecosystem degradation and water scarcity.
- 3. Further the agenda of ending extreme poverty.

The global GND strategy stresses the role of the G20 forum in achieving the three principal objectives, as these countries together comprise around 90 percent of the global GDP (Barbier, 2010). The dedication necessary to achieve sustainable levels of the three principal commitments above, is estimated to be a 1 percent GDP green fiscal stimulus by each of the G20 countries, with concerted action and timing, for the Global Green New Deal to be effective. Promoting global governance, facilitating access to financing and enhancing trade incentives are the three priority areas for international community.

Another way in which concerted policy action by the G20 could signal its commitment to greening the world economy is instigating pricing and regulatory reforms for reducing carbon dependency. This consists of green budget reforms (removal of perverse subsidies), which should be internationally coordinated, due to highly competitive energy market. Removing the perverse subsidies may decrease the national competitiveness, which is why it must be agreed upon internationally. In addition, carbon taxes and cap-and-trade regulations should be adopted by the G20 countries, to assist the transition of their economies to low-carbon economic development.

Global Green New Deal should prioritise basic economic security provision (Barbier, 2010), especially in the developing economies. This should be achieved with international financial aid to the developing countries in nutritional support, improvements in water supply and sanitation, as well as the financial aid in low-carbon energy investments, sustainable transport and resource-efficient primary production. To provide such international financial support, the G20 forum is advised to further develop and expand innovative financial mechanisms, such as the International Finance Facility (bonds with government backed guarantees), Climate Investment Funds and the Global Clean Energy Cooperation program (Barbier, 2010). The leading twenty countries should address the issue of expanding the global carbon markets, Clean Development Mechanisms and other carbon-reducing market instruments even further, as an additional way of financing green investments in developing countries.

The G20 countries are responsible for taking the lead in greening the world economy, but low-income countries should also spend at least 1 percent of their GDP national accounts on

agricultural development, improving clean water and sanitation for the poor, as well as develop well-targeted safety net programs. This recommendation must not be taken as a general imperative, due to the mixed economic conditions and necessities of the low-income countries.

The Global Green New Deal is a far-fetched economic framework according to the current economic development. Nevertheless, it was adopted in several national recovery packages. The ground for international cooperation was established during the 2008 Great Recession, which proves a political motivation for greening the global economy, while a number of studies has shown beneficial effects of the green fiscal spending, which could be shaping the recovery policy in the future recessions.

1.2.3 The size of the Green Stimulus Packages (evidence from the 2009 stimulus packages)

In order to define green stimulus, we will borrow the definition from Strand and Toman (2010): "Green stimulus is the application of policies and measures to stimulate short-run economic activity while at the same time preserving, protecting and enhancing environmental and natural resource quality both near-term and longer-term."

Since green stimulus is most often used in stimulating employment and effective demand, the term green stimulus will be used interchangeably with the Green New Deal. Most of the stimulus packages adopted by different countries during the global 2008 crisis included some environmental investment. The global Green New Deal spending amounted to US\$ 522.1 billion or roughly 0.7 percent of the global GDP (Barbier, 2011). For the complete global green spending data see appendix 2. In the following paragraphs the biggest fiscal packages across different economies (specifically the U.S., South Korea, China, and the E.U. with member states and Japan) will be presented separately and in detail.

Pioneering green stimulus spending are the R& green provisions, since these were among the first environmentally targeted fiscal stimuli. The green stimulus funds have been allocated to green investments, mostly rail, electricity smart grids and water infrastructure, along with spending on environmental improvement (EC-IILS, 2011). In the case of ARRA, approximately 12 percent of the general spending can be classified as green spending (French, Renner & Gardner, 2009), supporting endeavours including grid modernisation, building retrofits, rail and other public transportation, as well as renewable energy investment.

The size of different ARRA green provisions can be seen from the table 2. The highest share of ARRA green investment went to energy grid modernisation, transition to smart grids and more energy efficient grids, for the grid losses to be minimized. Other provisions are mass energy retrofits of public buildings and rail infrastructure, where U.S. had significant weaknesses before the crisis and needed additional investment. The detailed division of the stimulus can be seen in table 2, with net worth value of the specific green provisions included

in ARRA. For comparative analysis between different countries stimulus measures see figure 2, which shows the green provisions share in total stimulus spent.

US\$ Billion	Stimulus Provision
11.0	Modernisation of the electrical grid and creation of a smart grid
9.5	Energy efficiency retrofits
9.3	Investments in rail transportation, including Amtrak, high speed and intercity
8.4	Investments in public transportation
6.3	Energy Efficiency and Conservation Block Grants to state and local
6.0	Loan guarantees for renewables and for electricity transmission projects
2.5	Energy efficiency and renewable energy research
2.0	Grants for advanced batteries systems

Table 2: Green provisions of the American Recovery and Reinvestment Act

Source: French, Renner & Gardner (2009).

The only country that exceeded ARRA in the net environmental provisions is China, with US\$218.8 billion with the massive Chinese stimulus package (Barbier, 2011). As the percent of the total stimulus, seen from the figure 2 China followed third, with 33.9 percent of the GND funds.

The Republic of Korea provided the highest share of green stimulus measures, approximately 78.7 percent of its total fiscal stimulus, which amounts to US\$76.1 billion (Barbier, 2011). South Korea is followed by direct EU spending combined with national state funding with around 65 percent.

The European Economic Recovery Plan, worth €22.8 billion, proposed a comprehensive package of measures at both the European Union and the national levels (Barbier, 2011). The largest amount of funding was invested in building retrofitting, with the intention of energy efficiency improvement, which is one of the 2020 emission reduction goals adopted by the European Union. EE accrued almost a third of total EU stimulus spending and the investment in the renewable energy generation amounted to around 6 percent.

Among the European countries, German stimulus plan represents the largest fiscal recovery programme, contributing to over 20 percent of the overall EU stimulus. The plan, valued at \in 81 billion, includes tax cuts and investments in green infrastructure (EC-IILS, 2011). Germany focused on energy efficiency, since approximately 75 percent of the green stimulus was spent on EE improvement. French Economic Revival Plan invested around \in 26 billion, with investment in smart electricity grids, renewable energy, building retrofits and rail, which amounts to 18.2 percent of French total stimulus (EC-ILS, 2011).

Japan, which is one of the countries hardest hit by the recession, provided 6.1 percent or US\$43.2 billion of its two stimulus packages and second supplementary budget for green spending, particularly 52 percent to the EE of buildings, 32.4 percent for low-carbon energy and 15.4 percent for low-carbon vehicles production and research (EC-IILS, 2011). A more detailed green stimulus provisions table is found in the appendix 2, following the (Barbier, 2011) data.



Figure 2. The green stimulus as percent of the total stimulus, by the end of 2009

All of the above described fiscal packages were designed to recover the economies from the Great Recession of 2008 and to do so with investments in clean energy. Clean energy investment is a rather novel approach, but the theoretical Keynesian background of such stimuli stays the same, since the Green New Deal is aiming to elevate the aggregate demand for output and provide the short-term employment. So-called hydraulic Keynesianism (Coddington, 1976) provides a short-term boost to the economy, with countercyclical policies, which are in the case of the Green New Deal environmentally oriented. If the Keynesian doctrine is understood as hydraulic Keynesianism, the overall employment is more a matter of the demand for output than the real wages (Coddington, 1976). In this case, the clean energy investment may not provide the best policy. The clean energy investments provide long-term benefits, since these technologies are currently not as cost competitive as the other conventional methods of electricity generation. Some funds have been granted to research activities in the renewable sector, but the actual infrastructure investment is not as prominent in the 2009 fiscal stimulus packages.

When discussing the Green New Deal, the point of interest is in the question of how much of the fiscal spending was spent on environmental sanitation and environmental infrastructure, as these are the main drivers of aggregate demand elevation. These consist of building retrofitting, water management, renewable energy production infrastructure, sustainable transport etc. These infrastructure investments are crucial for creating short-term

^{*} Includes direct EU contribution and member states; ** Direct EU contribution

Source: EC-IILS (2011).

economic boost and the use of the hydraulic Keynesian policies for bringing the economy back to its full potential.

2 THE (GREEN) KEYNESIAN THEORY

In this section, the theoretical background for the Green New Deal will be discussed. The GND is based on the Keynesian approach to crisis alleviation, which is an opposite rationale to the austerity measures introduced by the European Union, when solving the economic crisis of 2008.

As in the first section of the thesis, this section is divided into two parts, the traditional Keynesian theory and environmentally oriented (green) Keynesian theory. The first will discuss the theory which followed and justified the traditional New Deal, while the environmental Keynesian theory underlies the Green New Deal project.

2.1 The Keynesian project

Why should we discuss the Keynesian theory again? Did not stagflation of the 1970 decade prove Keynesian expansionary policies ineffective? The financial crisis of 2008 spurred a new wave of interventionist theory, since liberal capitalism of the last booming decades hit a historic downturn, which called for more government intervention and regulation. The (neo)classical economic idea of self-regulating markets turned out to be ineffective and market failures systematic, proven with the collapse of Lehman Brothers, that brought serious threat to the banking system (Bembič, 2013). Because of this threat, the governments needed to intervene, which defined a new role of governments, previously set to be only a regulator and a rule of law executive.

This is referred to as the Keynesian project, which redefined the role of the governments during economic crises and constituted a new relationship between the capital and labour (Bembič, 2011). The governments started to intervene towards more or less full employment of the economy after the Great Depression of the 1930s, in order to turn away the radical laissez-fare economic ideas, which threatened the stability of the established, but temporarily broken capitalist system. The new Keynesian compromise between the labour unions and the capital achieved certain workers' rights, which reciprocally steered away the worker's efforts to revolt the capital-labour relations. In turn, the capitalists allowed certain workers' rights in exchange for a profitable and stable economic environment (Bembič, 2011).

Economic paradigm shift occurred, when J. M. Keynes published his General Theory of Employment, Interest, and Money (1936), as a response to the Great Depression, which arguably resulted from the economic policies based on the classical economic theory (Bembič, 2013). The microeconomic perspective of the neoclassical orthodox economic thinking focused on the supply side economics and considered supply to be inelastic in the long run and economic growth could be reached only with technological advancement and population growth. The Keynesian model focused on the aggregated, macroeconomic

variables and analysed the short-run supply as very elastic up to a point of economies full potential utilisation of resources. Due to this fact, the elevated demand could potentially bring economic growth, and this could be achieved with governmental aid (Sheehan, 2009).

Keynes dismissed the idea that the economy would converge to full employment equilibrium in the long-run and analysed the capitalist economy as prone to general gluts, mainly because of the lack of effective demand, meaning that the supply will eventually exceed the demand (Bembič, 2013). Since general gluts do occur, in form of mass unemployment, demand for labour is insufficient and economy is not operating with full potential. The microeconomic problem of how to balance ends with scarce means does not present the accurate tool for analysis of such economic problems. The resources are not as scarce, or put differently, the supply exceeds the demand.

These glutes occur because of the future uncertainty and the expectations that economic agents possess over the economy. Rational expectations of future inflation may detach economic agents from investment and deepen the recession. This is not a rational static economic decision, since it is based on a perception of the future. With the concept of economics, which believed in self-regulating market (Bembič, 2013). Low expectations may bring low investment levels and such sentiment starts to spread over the economy. The Keynesian remedy for such occurrence is the government intervention in public investment, which may restore the confidence in the economy. The Keynesian term of the diminished confidence would be the lack of effective demand, which can occur due to low expectations, since the economy is not in circulation. The most likely cause of changing levels of effective demand is the variations in the volume of total investment spending (Sheehan, 2009).

Before the Keynesian introduction of expectations and public confidence the classical economic theory assumed that static rationality is the only criterion of economic behaviour. Keynes proposed different assumptions, which are presented in the following table 3, which outlines the main paradigm shifts between the classical and Keynesian theory. Pre-Keynesian theory essentially derived the macroeconomic view from the microeconomic perspective, with assumptions, such as market clearing conditions and full employment equilibrium. The orthodox macroeconomic theory of growth was based on the idea of saving rather than spending, where individual and communal parsimony was viewed as the means to the wealth accumulation. The classical view in economics considers frugality as the means to stimulate demand with savings, which supposedly turns into investment with future yields. This view is opposite to the Keynesian idea of increased spending in specific times of low demand, which may reboot the economy to an elevated demand. The classical view of frugal economic agent can be found in the work of Adam Smith, with strong theoretical legacy in (neo) classical economics on this topic.

"Individuals and nations that were prodigal, and spent rather than saved, set themselves on the road to ruin" (Smith, 1976).

Keynes argued that such long-term view does not suffice during economic recessions and government must intervene with federal spending in order to provide a short-term stimulus toward full employment/full production, although the economy will be running budget deficits (Sheehan, 2009). This conclusion is based on the idea, that not all saving translates into investment, since the mass hysteresis during recession and low profit expectations abstain the entrepreneurs from investing.

	Classical view	Keynesian view
Free markets	Self-regulating	Unstable
Say's law	Supply creates its own demand	Lack of effective demand during recessionary downturns
Unemployment	Voluntary/natural	Involuntary/Induced with crises
Role of the government	Rule of law, regulator	Interventions, in order to stimulate demand
Price stickiness	Non- sticky: Prices adjust	Short-term price stickiness

Table 3: The Keynesian paradigm shift

Source: Own work.

Keynes also argued that the government policy is supposed to absorb the depressed private investments with expansionary monetary and fiscal policy. In the time of the economic boom, the monetary policy should contract in order to offset production growth, while during recession, the expansionary monetary policy should be pursued in order to retain the price level and increase the liquidity of money in the economy (Sheehan, 2013).

In times of economic depression, the monetary policy may be ineffective, due to the liquidity trap that economy is stuck in, when banks become flooded with cash and the interest rate is low, but the investment does not occur (Harris, 2013). The second limitation of monetary policy is the inability of monetary policy to create jobs directly, or to target interventions toward environmental investment (Harris, 2013). Thus, expansionary fiscal policy is essential in times of crises following the Keynesian theory and needs to be focused specifically on the goals of full employment, social equity, and lastly, the environmental sustainability in the green Keynesian project of the Green New Deal.

2.1.1 General government spending: the output multiplier

The (neo) classical economic theory assumes fall in private consumption and investment after a government spending shock, because the public spending would crowd-out the private sector spending. Some economists even believe that this offset in private investment is so

large, that the government spending multiplier turns negative, due to the crowding-out of the available credit needed for private investment. The Keynesian theory argues that effective demand rises after government spending shock, which means that fiscal spending brings a rise in household consumption and investment. The study of Eggertson (2011) shows that the government spending multiplier was significantly (eight-times) higher in the times of 2008 crisis than in the pre-crisis period since the interest rates dropped near zero.

Table 4: Labor tax and government spending: output multiplier in the case of positive and zero interest rate

	Labor tax multiplier (% change in output)	Government spending multiplier (% change in output)
Positive interest rate	0.096	0.32
Zero interest rate	-0.81	2.27

Source: Eggertson (2011).

Opposed to the tax cut multiplier, which was significantly lower and contractionary, the spending multiplier is regarded as expansionary (Eggertson, 2011). This is due to the private sectors elevated expectations about future, due to the decline of demand caused by the expectation of deflation and slump. The public investment changes contractionary expectations with the announcement of the fiscal stimulus. The exact timing of the stimulus itself is not as crucial as its announcement, when forming future private sector expectations (Eggertson, 2011). Table 4 presents the government spending multiplier is in both cases of zero and positive interest rates higher than the labour tax cut multiplier. The labour tax multiplier becomes even negative in the times of crisis with low interest rates. This means that the monetary and fiscal policies must be carefully coordinated, since the combination of low interest rates and tax cuts may bring a contractionary effect. The government spending pays off in the times of crisis, with an eight-fold multiplication of its effect.

The seminal paper on dynamic fiscal shocks by (Blanchard & Perotti, 2002) reports similar conclusions, but investigates longer time span of the US economy in post—war period. The general government spending has positive effects on the output level, whereas the positive tax shocks are having negative effects (Blanchard & Perotti, 2002). The paper differs from Keynesian theory on the investment level effects, since (Blanchard & Perotti, 2002) find out that both, tax increases and government spending have a severe negative effect on investment. There are also negative growth impacts from spending, presented in the study of (Alesina & Ardagna, 2010), who found out that one percentage point higher increase in the current spending to GDP ratio is associated with a 75 percentage point lower growth. Larger cuts in taxes do not have statistically significant effects on growth, nor do larger increases in spending affect the amount of capital goods (Alesina & Ardagna, 2010).

A seminal paper (Ilzetzki, 2010) on the multiplier effect of the government spending stresses the importance of different economy characteristics, such as its level of industrialisation, its exchange rate policy, trade openness and indebtedness of the economy. The multiplier is found negative in highly indebted countries. The study finds that the multiplier is larger in industrial, closed and fixed exchange rate economies and smaller in the opposite (Ilzetzki, 2010).

In the study on Slovenian fiscal policy, the resulting spending multiplier estimations are positive, but do not have long-lasting effects (Jemec, Strojan Kastelec & Delakorda, 2011). The general government spending multiplier (mainly compensation of employees and intermediate consumption) turns out to be expansionary, namely a 1 percent shock to government expenditure raised Slovenian real GDP by 0.34 percent during 2009 crisis (Jemec, Strojan Kastelec & Delakorda, 2011). However, in the following period after the shock the multiplier is already insignificant, although still positive. The one-time fiscal shocks in Slovenia thus have a short-lasting effect and are not appropriate for a long-term economic policy.

The fiscal stimulus affects the economy through two channels. Firstly, the direct government purchases of goods and services and secondly, the increased public benefits to the public (Hall, 2010). In the context of the Green New Deal, direct government spending is a measure that targets the employment of idle resources directly and provides a public investment to compensate for the lack of private investment. It is important to note, that direct government spending is justified only when the resources are idle (high unemployment), in order not to crowd out the private investment.

Since the Green New Deal spending is mostly infrastructure investment spending, the multiplier of such stimulus traditionally tends to be around one (Hall, 2010), whereas in an extreme depression, economists agree to be more than one. Government spending multiplier of one means, that an increase in public infrastructure spending for one dollar would increase total output for exactly one dollar (in the case of extreme depression, the multiplier is two, meaning that output grows for two dollars *ceteris paribus*).

The second channel of the fiscal stimulus, the public benefits, has much lower multiplier effect (Hall, 2010), since not all the benefits are directly consumed, but can be saved. If, for example, 70 percent of the benefits are saved, the multiplier would only be 0.3 in normal times and 0.6 in a deep recession. Other types of stimulus measures, such as tax cuts and tax credits, do not target unemployed resources as directly as increased spending does. Tax incentives can be used to promote specific activities, for example clean energy production from renewable energy sources to stimulate the sector.

2.1.2 General government spending: employment multiplier

To stimulate the effective demand and close the recessionary gap, the government spending ought to be labour-intensive, in order to bring down high unemployment levels. The (IILS,

2011) provided an empirical investigation on the fiscal multiplier effect on the employment. As it can be seen from figure 3, the direct government spending has a big impact on the levels of employment; up to about 15 percent of the jobs in the economy can be created with public spending. The government non-wage spending has higher employment multiplier effects than the government wage spending, meaning that the infrastructure and large-scale projects turn out to be more efficient when solving unemployment issues. The labour market spending also has high multiplier effect, especially the unemployment benefits and hiring incentive system spending.

The European unemployment crisis may have persistent effect since the unemployment level is suspected to stabilise at higher levels than pre-crisis unemployment. This is the reason that the governments ought to carry out employment programmes throughout Europe.



Figure 3: The effects of different policy options on job creation

Panel B: Labour market spending: Contributions to job creation (short- vs. long-term



Source: EC-IILS (2011).

The post—2008 recession unemployment may also be structural and does not necessarily portray the traditional cyclical unemployment phenomenon. This may be due to modern production automation, big trade deficits of the western economies and lack of the domestic demand. The solution to the structural unemployment problem may not be effective with the use of the Keynesian expansionary policies, since the unemployment may not itself be cyclical. This structural problem may be leading modern economies in protectionist

measures, since the common diagnosis for structural unemployment stems from the argument of trade deficit, due to cheaper production in export-driven rising economies.

In the case of ARRA fiscal spending the multiplier is found to be around eight jobs per million dollars spent or US\$125,000 per job in the first year of government spending (Wilson, 2012). Wilson argues that ARRA had a positive effect on employment in sub sectors of state and local government, construction, manufacture, education and health sectors in particular cases. Wilson also estimates ARRA to have created and preserved about 2.1 million jobs in the first year, which would be lost without government spending.

It is important to note that ARRA dealt with specific economic environment and its multipliers cannot be generally applicable to all contexts. First, it focused heavily on infrastructure projects and fiscal aid to state governments. Second, the recession portrayed vast underutilisation of resources and multiplier was thus higher as it would have been under normal circumstances (Wilson, 2012). One of the reasons for the ARRA's high employment multiplier effect may be its environmental orientation. Clean energy investment is highly labour intensive and provides high short-term employment effects. In the following section the Keynesian rationale behind the ARRA and other green fiscal packages will be discussed.

2.2 The green Keynesian theory

This section will present a simple macroeconomic model of aggregated variables, which are separated into specific environmentally harmful or non-harmful aggregates. The model is based on the work of (Harris, 2013), who studies green Keynesian economics. The following subsections will apply theoretical green Keynesian model to different fiscal instruments of the economy, namely the green budget reform and government spending.

2.2.1 The green Keynesian model

The green Keynesian model distinguishes between the macroeconomic aggregates that should be strictly limited: resource-intensive consumption and investment in energy-intensive infrastructure (Harris, 2013). It is thus possible to derive an economic model that disconnects environmentally harmful macroeconomic aggregates from aggregates that do not harm the environment directly. The green Keynesian model shows the inadequacy of market incentives for the long-term resource conservation, since the market mechanisms deal poorly with cumulative pollutants, whose impacts build up over time (Harris, 2013). A clear government policy role is indicated to prevent resource overdraft and to sustain a long-term resource and environmental balance. It is essential to separate the three main macroeconomic variables (consumption, investment and trade) based on their impact on the environment. Thus, the general equation of macroeconomic balance can be restated as (Harris, 2013):

$$Y = C + I + G + (X - M)$$
(1)

Broken up, based on their environmental impact:

$$Y = [C_g + C_s + C_m] + [I_m + I_m + I_n + I_h] + [G_g + G_s + G_m + G_m + G_n + G_h] + (X - M)$$
(2)

In which the aggregate symbols are explained in appendix 3.

Regrouping them in environmentally harmful and non-harmful groups:

the bad the good the ugly

$$Y = [C_g + I_{me} + G_g + G_{me}] + [C_s + C_m + I_{mc} + I_n + I_h + G_s + G_{mc} + G_n + G_h] + (X - M)$$
(3)

There are many aggregates that are considered environmentally neutral in the economy and these are an appropriate target for the government spending during recessions. They are called the good in the equation (3). The bad are the aggregates that modern economies ought to avoid if they are committed to the environmental conservation project. These are: consumption of non-durable goods and energy-intensive services, investment in energy-intensive manufactured capital, government consumption of non-durable and energy-intensive manufactured capital.

The ugly is the net export aggregate. Why ugly? Note, that trade comes with negative externalities; if it is a fossil fuel powered trade. It would certainly be possible to break the import and export categories down in a similar fashion, however, this avoided here for the sake of clarity. To create a sustainable trade policy, global trade policy coordination would be necessary (for example additional environmental World Trade Organization (hereinafter: WTO) guidelines). Another issue concerning trade is the problem of green leakage, where the environmentally sustainable economies import non-durable products from the unsustainable ones. Special environmental tariffs should be imposed to prevent the modern green economies importing from the unsustainable economies.

In the green Keynesian model all the government spending aggregates (G) are in the domain of the fiscal policy. Therefore, the government intervention needs to reform the fiscal policy, usually under the heading of the green budget reform. The consumption aggregates (C) may also be affected by tax policy, a carbon tax or equivalent that raises the price of fossil fuels and all fossil-fuel intensive goods and services, as well as by subsidies and tax credits for favoured activities. The investment (I) is responsive to fiscal policy, as well as the other incentives, such as preferential deposit of credit to certain sectors (Harris, 2013). Investment levels are, however, based on the expectations of the future inflation and government may influence it with fiscal and monetary policy.

The green Keynesian model is provided to show the effect of government policy on the environmental impact of the economy. It is a guideline for a more environmentally sustainable government spending and fiscal policy, which controls the latter two of the bad variables $[G_g + G_{me}]$, but other policies can also affect the first two variables $[C_g + I_{me}]$. The model is limiting some of the macroeconomic variables, whereas others, the good, are left

unconstrained, so the economy will still grow, contrary to some environmental economists, which try to limit economic growth altogether.

This poses a problem with the main issue of the Green New Deal, since the GND stimulus focuses on unemployment, which would thus be smaller in the green Keynesian model. It is crucial for an activist fiscal policy to strictly target the environmentally beneficial sector, which creates additional employment. In the appendix 4 the green Keynesian policy list is presented as a rough outline and by no means comprehensive, but it is meant to suggest the outlines for a new and more optimistic approach to economic policy (Harris, 2013).

2.2.2 The green budget reform

In this section, I will present the green budget reform, as this is the fiscal policy theory of the Green New Deal and a part of the green Keynesian model. Green budget reform distinguishes between different macroeconomic aggregates, based on their environmental impact, as in the green Keynesian model described above. The reallocation of government subsidy spending and a shift in the taxation system present different policies on the path towards a green economy. The measure of green budget reform may as well be consistent with the austerity measures, since removing of the environmentally harmful subsidies would cut the government expenditure, as well as with the Green New Deal, with increased spending on the green infrastructure. Green budget reform would alter both sides of the government budget, the government spending (G) as well as the tax revenue (T).

The green budget reform deploys the double dividend hypothesis, which states that such policies aid the economy as well the environment. Green budget reform is a way for government to alter the behaviour of the economic agents, with pricing the externalities, the social costs or benefits of individual economic activity. In the case of negative externalities, the government is correcting the market, which produces these negative externalities. This can be demonstrated by the polluter pays principle, or in economic terms by internalising externalities in the prices of polluting products and activities.

Generally, we could distinguish the Green New Deal from green budget reform in two ways. Firstly, the Green New Deal is a short-term stimulus, whereas green budget reform is a long-term commitment of fiscal policy and tax reallocation plan. The second difference is that the Green New Deal mainly consists of direct government spending and is thus expansionary. Fiscal spending increases national debt and reduces tax revenue, but the green budget reform on the other hand always aims to be contractionary or at least neutral and can be expansionary only with failed policy design, as we will consider its possible pitfalls in the following section. It is also clear that mitigation policies targeted at employment creation may produce many more jobs than tax reform, e.g. through programmes of converting dwellings to low-carbon homes or many schemes of labour-intensive biomass planting and harvesting (Barker, 2009).

The green budget reform can be revenue neutral or revenue positive. In the case of revenue positive reform, the aim is to either cut government expenditure, or raise tax revenue. Raising tax revenue can be done with simply adding the environmental tax to all the environmentally harmful products and activities in addition to all of the existing taxes.

The revenue neutral reform is only a tax shift from the economic activities with positive externalities (such as labour) to the activities with negative externalities (such as energy-intensive activities). The revenue neutral reform does not provide government with any additional tax revenue.

The Umanotera budget reform proposal (Sonnenschein, 2013) follows the maxim "tax the bad, not the good", which presupposes revenue-neutral fiscal shift from labour to environmentally harmful products and activities. The Keynesian theory would propose non—revenue—neutral, expansionary, tax cuts during economic downtimes to stimulate the economy with aggregate demand manipulation, bringing the project of the Green New Deal as the policy of choice. During the economic boom, the fiscal policy would contract, by decreasing federal spending and increased tax rates, to prevent the economy from overheating. Expansionary fiscal policy may create a persistent improvement in living standards, and, symmetrically, the depressing effect of deficit reduction policies may linger for a long time, which demonstrates weakness of the wage and price adjustment mechanisms, which are usually thought to naturally stabilise the economy in the long run (Fazzari, 1994).

There is a possible pitfall in the case of the revenue neutral budget reform because the taxed goods consumption will fall, whereas such occurrence would bring down the tax revenue to the government in the long-run. This could render the budget reform with negative revenue trend, which must be taken into account when considering such reforms.

The crucial aspect of the reform would not be reforming taxes of any kind, but instead, removing the environmentally harmful subsidies and tax exemptions, which burden the national budget account. Identifying and removing environmentally harmful subsidies is a revenue positive reform, which would reduce the environmental impact and the budget deficit with cutting the number of environmentally-harmful subsidies. Subsidy cuts can be done by using the subsidies in a more efficient way or by completely removing them. Since many sectors which are crucial for the economy are energy-intensive and rely on these subsidies, such a reform must be carefully planned and studied in advance, considering the economic impacts on different reliant sectors.

In case of the non-neutral green budget reform the tax revenue could be increased with removing the environmentally harmful subsidies, improved efficiency of subsidies or increasing tax rates on environmentally harmful activities. These include the CO_2 taxes, air travel taxes and other existing environmental tax increases. The excise duty on diesel petrol should be harmonised with other petrol duties, since it produces most of the externality costs, but has the lowest excise duty. The harmonisation process should be done in moderation since transport companies need to gradually adjust to different fuel prices.

The other way to increase tax revenue is to collect tax more efficiently and to improve tax evasion control. Since this topic is so broad and has little to no direct connection with the environmental problems, it will be avoided here.

2.2.3 Green government spending

In this section the breakdown of different green public investments will be presented. The employment and growth multipliers differ within different aspects of government spending, from wage to non-wage spending and multipliers considering different paces of economic growth. Multipliers also differ in time and other circumstances under which the spending is carried out, for example the interest rates. The focus here will be on the crisis multiplier evaluation, which is relevant for this discussion. Different green spending programmes will also be evaluated and the multipliers will be presented from the literature.

2.2.3.1 Energy efficiency investment multiplier

This section will provide an overview of energy efficiency stimulus multiplier effect on output and employment. The EE investment is the most efficient government instrument for achieving greenhouse gas reduction goals and it is an effective employment policy for governments to apply during times of crisis. The EE investment provides a high employment multiplier, the highest of the possible green government spending programmes, according to literature and our empirical study in this thesis.

The definitions of key energy efficiency concepts and terms are based on the EU Energy Efficiency Directive (EED, 2012), which defines EE as 'the ratio of output of performance, service, goods or energy, to input of energy'. This definition encompasses all energy savings, including the changed behaviour of consumers, as well as more energy efficient infrastructure.

Today, buildings account for 40 percent of Europe's total energy consumption. Around 75 percent of the building stock is energy inefficient (EC, 2016). This provides a big potential for investment and employment of idle resources. The Juncker investment plan is partly aiming at such investment, but the optimism in engaging private finance with an estimated leverage factor of around 12 seems highly unrealistic. As the public sector owns 29 percent of non-residential buildings in the EU, this may be a significant barrier to overall energy efficiency investments (Copenhagen economics, 2012). Another major barrier to public EE retrofit investment is that the public buildings are often appropriated to municipalities, instead of the national register. Thus, financing retrofits must be undertaken with the municipality budget, which is not allowed to borrow externally to finance investments and retrofit investments must be taken out of the annual municipality budget. Rent controls may pose a barrier to private sector building renovation, since costs cannot be passed on to tenants and landlords, who lose the incentive to renovate their buildings.
2.2.3.2 Energy efficiency investment output multiplier

The investment in energy efficiency does portray a positive effect on the output (Wei, 2007). Energy use efficiency gains will lower the prices of non-energy goods and at the same time increase the output of non-energy goods. The total income in long term tends to increase together with more energy production efficiency gains (Wei, 2007).

The macroeconomic impacts of the EE investment are generally small but positive. The common measure presented is the energy efficiency investment per primary energy demand (hereinafter: PED). When modelling a range of annual savings targets over a 15—year period, for example, Environment Northeast found that, as the level of government effort increases, the macroeconomic impacts decline, because higher energy demand reduction typically requires more expensive efficiency measures (Barker, Dagoumas & Rubin, 2009). Since the primary energy demand is growing in modern economies, the multiplier is consequentially low, due to large demand. The GDP change multiplier is generally higher than the investment per PED, generally found to be around one, as well as high as three times the worth of the dollar invested. The mean over GDP multipliers found throughout the literature is 1.31 and the median 1.81, as it can be seen from table 5. The multiplier on household income change is the only found negative, but the average throughout the literature is still found to be positive, but small. This is contrary to the intuition, since the energy savings should translate to a higher disposable income, due to lower energy expenditure.

	Range	Mean	Median	Studies
Amount invested per PED (EUR billion/Mtoe)	0.09-0.63	0.51	0.45	Copenhagen Economics, 2012; EC, 2011; Lehr, Lutz and Edler, 2012; OECD, 2013
Change in GDP per unit of investment (EUR/EUR)	0.91-3.73	1.31	1.81	Copenhagen Economics, 2012; EC, 2011; Lehr, Lutz and Edler, 2012
Jobs created per year per unit investment (jobs/EUR million)	9.2-17.07	9.95	7.06	Copenhagen Economics, 2012; Lehr, Lutz and Edler, 2012; Barker and Foxon, 2008
Jobs created per PED savings (jobs per ktoe)	0.76- 19.61	0.92	7.06	Copenhagen Economics, 2012; Lehr, Lutz and Edler, 2012; Barker and Foxon, 2008
Change in household income per investment (EUR/EUR)	-0.16-0.88	0.32	0.34	OECD, 2013; Lehr, Lutz and Edler, 2012; EC, 2011

Table 5: Some indicative values from modelling the energy efficiency macroeconomicimpacts

Source: OECD/IEA (2014).

Considering the longevity of investment, projects of the study (Strand & Toman, 2010) accessed a long-term and short-term effectiveness of energy efficiency public investments. The short-term public investments are most effective in the field of EE building retrofits and medium effective in the green transport infrastructure, such as the railroad renewal (see table 6). Therefore, the Green New Deal proposes fiscal spending in these economic activities. Considering long-term effects of public investments, the power grid expansion and energy efficiency retrofits are the most effective. Energy efficiency retrofits are slightly less effective in the long term. Economically ineffective policies seem to be the car fleet renewal or the Cash for clunkers, the ARRA spending programme, which was a US\$3 billion initiative to renew the U.S. car fleet, for consumers to purchase more fuel-efficient cars. Studies find low job-creating effectiveness of Cash for Clunkers governmental policies, see (Mian & Sufi, 2012) and (Strand & Toman, 2010).

From the climate mitigation policy perspective, the investments in energy efficient new capital and green transport infrastructure have the biggest effect on greenhouse gas emission reductions as well as general environment protection. However, they are not as economically viable as the aforementioned policies. Interestingly, (Strand & Toman, 2010) do not find the EE retrofits as environmentally beneficial, whereas other literature generally considers existing building retrofits to have a higher greenhouse gas reduction potential.

The economic savings are nonetheless significant. Spending \$1 billion on federal retrofits saves the government \$130 million a year through improved efficiency and saves the rest of the economy \$260 million a year by lowering energy prices (Houser, Mohan & Heilmayr, 2009). On average, green recovery scenarios save the economy \$450 million per year for every \$1 billion invested, a sort of efficiency pay-go provision for current government spending.

Program	Short-term stimulus	Long-term growth	Greenhouse gas reductions	Environmental improvement
Energy efficiency	High	Medium	Medium	Medium
Energy efficiency improvements in new capital	Low/Medium	Low/Medium	High	Medium/High
Green transport infrastructure	Low/Medium	Low	Medium/High	Medium/High
Cash for clunkers	Medium	Low	Low	Low/Medium
Power grid expansion	Low	Medium/High	Low/Medium	Variable

Table 6: Short and Long-Term Effects of Various Energy Efficiency Stimulus Measures

Source: Strand & Toman (2010).

The literature mostly finds positive macroeconomic effects of EE investment, with some studies regarding the negative rebound effect. It may occur, that because of the energy efficient economy, the disposable income rises, which would elevate consumption and production levels. The primary energy demand would thus stay the same, or in extreme cases even rise. Some or all of the expected reductions in energy consumption, as a result of EE improvements, are offset by an increasing demand for energy services, arising from reductions in the effective price of energy services resulting from those improvements (Barker, Dagoumas & Rubin, 2009). The estimation shows that if the energy efficiency measures were undertaken globally in the period 2013–2020, the total global average economy-wide rebound could amount up to 31 percent of the projected energy demand reduction potential by 2020, and rise to 52 percent by 2030 (Barker, Dagoumas & Rubin, 2009). Current rebound effects tend to be lower, since the effect builds up over time, as the economy adapts to the higher disposable income. There are two viable options when studying the rebound effect. First, more output with same energy use and second, same output with less energy use. The first model applies to developing economies, whereas the second should be adopted by the developed economies.

2.2.3.3 Energy efficiency investment: employment multiplier

It is estimated that between 97,000 and 275,000 additional jobs in EU—28 could have been supported in 2010 in the absence of barriers to realise energy savings potential (Cambridge Econometrics, 2015). Looking ahead to 2030, there is the potential for between 0.5 million (low end estimate) and 1.3 million jobs (high end estimate) to be created as the result of avoided energy consumption, assuming no productivity improvements in the energy saving activity. Following table 7 presents the sectorial employment projections and data in EE related job creation.

Sector	Jobs per unit energy invested	2010 (# jobs)	2012 (# jobs)	2020 (# jobs)	2030 (# jobs)
Industry	0.07	8,720	12,185	25,885	39,457
Residential	0.16	29,643	41,090	95,870	169,309
Tertiary	0.36	24,916	41,052	106,680	195,101
Transport	0.16	33,991	37,479	52,102	74,945
Total	-	97,269	131,806	280,538	505,812

Table 7: Low estimates of additional EU employment based on savings potential

Source: Cambridge econometrics (2015).

The first column shows a multiplier effect per unit of energy saved on employment. The estimates from the table 7 and table 8 show, that tertiary infrastructure (hotels, restaurants,

health, education, commerce, public and private offices) retrofits portray the highest employment multiplier effect. It is estimated that energy savings could amount to roughly 100 to 275 thousand additional jobs by the year 2020 in EU.

Sector	Jobs per unit energy invested	2010 (# jobs)	2012 (# jobs)	2020 (# jobs)	2030 (# jobs)
Industry	0.27	33,634	47,001	99,846	152,191
Residential	0.49	90,780	152,839	293,603	601,191
Tertiary	0.62	42,910	70,700	183,726	336,007
Transport	0.19	107,637	118,683	164,989	237,326
Total	-	274,961	362,223	742,164	1,326,720

Table 8: High estimates of additional EU employment based on savings potential, high

Source: Cambridge econometrics (2015).

For the U.S. a different study has been carried out, with input-output model of 1\$ million investments to job creation, relating green investment to the conventional fossil fuel investment. The employment creation multiplier for EE — retrofitting and mass transit — is 2.5 times to four times larger than that for oil and natural gas (Pollin, Heintz & Garrett-Peltier, 2009).

Table 9: Employment impacts of energy efficiency measures: Job creation per \$1 millionin output

Energy efficiency	Direct job creation per \$1 million in output (# of jobs)	Indirect job creation per \$1 million in output (# of jobs)	Total job creation per \$1 million in output (# of jobs)	Direct and indirect job creation relative to oil (% difference)
Building retrofits	7.0	4.9	11.9	+221.6%
Mass transit/freight rail (90% MT, 10% FR)	11.0	4.9	15.9	+329.7%
Smart grid	4.3	4.6	8.9	+140.5%

Source: Pollin, Heintz & Garrett-Peltier (2009).

Table 9 shows the biggest job creating potential in the mass transit sector, because it encompasses the most labour-intensive sector in railroad construction. The retrofits follow with 11.9 direct and indirect jobs per million dollars invested, which is still a considerably higher job creating multiplier than same investment in oil industry. The difference in job creation potential is 221.6 percent higher than the same investment in oil-based production.

The estimated number of jobs per 1-million-dollar public investment ranges from 4 to 21 net jobs, depending on the sector and study (Cambridge econometrics, 2015). The total number of net jobs created with the energy efficiency investment in the US economy range from 500,000 to 1,500,000 with a 20 to 30 percent increase in energy efficiency (Laitner & McKinney, 2008). The most jobs are to be created in the construction and government sector, generally around 20 additional jobs in each sector, per million-dollar investment. Net job benefits for Europe tend to be smaller, ranging from 7 to 12 per million-euro investment in EE (Cambridge econometrics, 2015).

Barker, Dagoumas and Rubin (2009) studied impacts of climate mitigation policies and its effects on the GDP and employment. He proposes that the effects on GDP are small, but positive in terms of change from the baseline projections for the year 2020.

In the table 10, different regional assessments are made with the estimation of employment effect on the region of European Union and the world. In the first case, the green stimulus is applied only to the EU, where the employment multiplier in EU is quite high but it does not impact the world employment with such intensity. The greatest benefits for the world employment are shown to come from a global agreement with more stringent targets adopted by developing countries (Barker, Dagoumas & Rubin, 2009). Interestingly, in the case of bilateral action between EU & US, the employment multiplier is significantly lower. This may be due to more stringent and less optimistic bilateral agreement, as opposed to more optimistic unilateral decision to cut emissions.

Policy scenario	EU (% changes from the baseline)	EU & US (% changes from the baseline)	EU & Rest of Annex I (% changes from the baseline)	Annex I & China: 2010 levels (% changes from the baseline)	Annex I & China: 2015 levels (% changes from the baseline)	World: developing 2010 levels (% changes from the baseline)	World: developing 2015 levels (% changes from the baseline)
EU	0.46	0.15	0.10	0.09	0.56	0.16	0.18
World	0.10	0.05	0.06	0.23	0.21	0.38	0.29

Table 10: Changes in employment in 2020 across the policy scenarios for key countries and regions

Source: Barker, Dagoumas & Rubin (2009).

When studying the employment impacts, there are several distinctions to be noted, such as the net and the gross employment impact. The introduction of clean energy policies may affect general employment levels negatively, although climate policies may create some new jobs. Creating new jobs in a specific sector, which the fiscal stimulus or policy is aimed at, is denoted as net employment effect. Since there may be some jobs lost (maybe in the next period) the cumulative employment effect may be even negative. General employment level impact would be denoted the gross employment effect (Lehr, Lutz & Edler, 2012).

The table 10 presents a long-term projection of gross employment, the long-term employment level is rather dubious for the case of Slovenia as it is evident from the conclusion of (Jemec, Strojan Kastelec & Delakorda, 2011). The fiscal shocks are short-lived in terms of a long-term economic activity. This may present a problem to the Green New Deal policy, so the dynamic effects must be considered and studied cautiously, when designing such employment creating policy.

2.2.3.4 Renewable energy investment: output and employment multiplier

An essential objective of the Green New Deal is also to secure the energy supply, since the primary energy demand is rising, which steadily drives conventional energy source prices up. The fossil fuel energy source (oil, gas, coal etc.) prices are steadily inflating and long-term prospects speak in favour of concentration of oil reserves in the rich economies (and increasingly so), with poor economies left without access to them, because of the increasing fossil fuel scarcity. The problem is exacerbated with the falling production from major oil fields (Berbier, 2010).

The Green New Deal renewable energy (hereinafter: RE) policy also aims to lower the carbon dependency, which is currently still rising and will continue to do so, especially in the developing economies. An increasing number of studies have emphasised the importance of reducing fossil fuel use to enhance national and global energy security (Berbier, 2010).

Energy source	Direct job creation per \$1 million in output (# of jobs)	Indirect job creation per \$1 million in output (# of jobs)	Total job creation per \$1 million in output (# of jobs)	Direct and indirect job creation relative to oil (% difference)
Fossil fuels				
Oil and natural gas	0.8	2.9	3.7	n/a
Coal	1.9	3.0	4.9	+32.4%
Renewables				
Wind	4.6	4.9	9.5	+156.8%
Solar	5.4.	4.4	9.8	+164.9%
Biomass	7.4	5.0	12.4	+235.1%

Table 11: Employment impacts of alternative energy sources: U.S. Job creation per \$1million in output

Source: Pollin, Heintz & Garrett-Peltier (2009).

The proponents of traditional energy sources argue with an opposing line of argumentation, however. The fossil fuel sources seem stable and controllable, whereas dispersed electricity producers have less stability and the grid supply is less predictable, since most of the RE relies on the weather conditions. The hydropower system is the most stable in this sense, whereas the solar and wind are heavily dependent on the weather. For example, in Slovenia, most of the electricity demand occurs during the time of less sun in the winter, when the wind is unstable and unpredictable. Thus, the energetic system must have a backup in a coal plant, in case there is not enough supply from dispersed producers. Introducing RE (especially wind and solar) must be done along with modernising the grid and making the grid more efficient. There are renewable energies which do not depend on the weather conditions: hydropower, geothermal and biomass. These are often overlooked by the conservative arguments, since we tend to associate the renewables with wind and solar only. The renewable sector is currently not big enough to be an influencing part of European economy, since the industry is still too small to have much impact on the GDP (Menegaki, 2011).

When comparing the conventional fossil fuel with renewable energy sources, the results indicate that 1 percent increase in RE causes a 4.4 percent increase in GDP per capita, while a 1 percent increase in emissions causes 6.0 percent increase in GDP (Menaki, 2011). These estimates confirm the neutrality hypothesis, which states that the consumption of renewables has minor role on the EU economic growth. Study by (Apergis & Payne, 2010) showed a 1 percent increase in renewable energy consumption causing an increase in real GDP by 0.76 percent, for a selected panel of OECD countries from 1985 to 2005.

Government spending directed toward a clean-energy investment program will have a much larger positive impact on jobs than spending in other areas, including the oil industry, even when considering all phases of oil production, refining, transportation, and marketing (Pollin, Heintz & Garrett-Peltier, 2009). As we can see from table 11, the renewable energy sector is estimated to bring significantly more jobs per \$1 million invested, opposed to the fossil fuel alternative. The model (Pollin, Heintz & Garrett-Peltier, 2009) use differs from the methodology used in this thesis empirical study, since they use the static and linear input-output, as a response to the forecasting failure of 2007 dynamic models, which did not predict the 2008 crisis.

Germany extensively pushed the renewable technology with subsidies, employing the feedin tariff for the RE push. The rationale behind such push of RE is to gain the competitive advantage in the field of technology exports, as well as the environmental concerns. The prospects for photovoltaic markets are good and German PV exports tend to increase in the following years. This will result in increased employment, which tends to rise in the longrun. Figure 4 shows the impact of introducing RE in Germany, with the comparison to baseline scenario, without introducing renewables. The effects tend to be positive in most cases, but minimum and slow in the first years, but in the long run the results again show the positive net employment prospects. The German RE policy has been a success in terms of employment creation, since it doubled from 2004 to 2009, but it will slow its pace, since the labour productivity will increase as well (Lehr, Lutz & Edler, 2012).

Investments in renewable energy sources portray a high job-creating potential. The highskill jobs, as well as the low-skill ones, are necessary in the renewable sources construction, operation and R&D. The highest potential in job creation is the biomass renewable source of energy. The biomass has a 235.1 percent higher job-creating potential than oil investment, with estimated 12.4 jobs per million-dollar government spending in the US, relating to oil and natural gas production sector with estimated 0.8 jobs per million dollars invested (see table 11). While most of the jobs in the fossil fuel industry are in fuel processing, operations and maintenance (hereinafter: O&M), most of jobs created in the RE industry are in manufacturing and construction. Biomass energy is an exception, since much of jobs are also in fuel production and processing (in agriculture), and O&M (Kammen, Kapadia & Fripp, 2004). The model in (Kammen, Kapadia & Fripp, 2004) study is also based on the inputoutput model but measures the employment effect in jobs per megawatt hour of electricity produced, depending on the energy source. The study finds that for a variety of feasible scenarios, the renewable energy industry consistently generates more jobs per MWa in construction, manufacturing and installation, and in O&M and fuel processing, than the fossil fuel industries (Kammen, Kapadia & Fripp, 2004).

Figure 4: Employment in absolute differences to the zero scenarios, in 1000 persons



Source: Lehr, Lutz & Edler (2012).

Figure 4 studies only the net employment of direct jobs stemming from the RE investment. Gross employment attributable to the renewable sector totalled 371,400 persons in 2013, decreasing 7 percent from the preceding year. Some 112,900 of these jobs (or 30 percent) were generated by exports of facilities, components, biomass, and biofuels for transport. (O'Sullivan and others, 2014). The German experience shows that a large domestic market leads to a successful industry in renewable energy sector, but it may be backed by public

finance in the beginning, since it is not necessarily profitable in the first stages of development.

The impact on employment will depend largely on exports in Germany, which is the reason that figure 4 shows separate levels for high photovoltaic (hereinafter: PV) export scenario. Employment prospects increase as the PV export levels are assumed high, due to the increase in domestic production.

As it can be seen from figure 4, the RE employment is projected to rise and will positively affect employment even in the minimal diffusion of RE technology. Even though it is projected that the employment difference will be negative for most of the minimal diffusion, it will certainly have risen above zero by the year 2030.

2.2.3.5 Research and development spending employment multiplier

Investment in technological research and development can, like in other sectors, bring improvements in clean energy sector. It can be a production line solution, information technology, optimising the energy use or simply technical solution to improve energy efficiency, like developing more efficient machinery or new renewable energy sources. It is an economically valuable investment, which is labour-intensive, since it is based on human capital and innovation. It also pays off in the long run with the energy savings and spurs innovation in clean energy solutions. Domestic innovation may bring important improvements in international competitiveness of the economy, since cutting energy use minimises costs of production and improves the total factor productivity.

A way to invest in clean energy R&D is to push the technological frontier as an incentive in economy. An econometric study by (Stern, 2012) found that higher total factor productivity is associated with greater energy efficiency. The elasticity is above unity, a 1 percent increase in general total factor productivity (hereinafter: TFP) results in 1.3 percent improvement in energy efficiency (Stern, 2012). This means that technological change and innovation can have a significant impact on EE. Technological innovation should be included in the energy efficiency improvement policy. There is no need to study the impact of R&D on the renewable energy, since the technology is rather new and the potential for innovation is enormous. However, there are a couple of different technology-push policies, which may be appropriate for adoption in the Green New Deal fiscal stimulus.

Public or private subsidies are needed for the boost to private sector R&D, since the clean energy technology is not yet fully cost competitive compared to the conventional energy. The gains from learning-by-doing as the firms become more familiar with new low-carbon and energy efficient technologies, products and processes, lead to long-run cost reductions and induce additional technological changes (Barbier, 2010). There is also a discussion between the learning curve-pushing or learning curve-following technology. The study of (Shayegh, Sanchez & Caldeira, 2017) found greater benefits from the learning curve-pushing

R&D investments, which means that public investment in innovation yields more economic benefit than technology absorption.

The private sector investment in R&D tends to be sub-optimal, due to the inability of the private investors to fully appropriate the investment returns to R&D. For example, the (NRC, 2001) studied 39 different R&D projects in energy efficiency and reported average yields of over 100 percent on energy efficiency R&D investments. Considering this inability of private investors, the R&D investment falls short of the socially optimal levels, which would maximise net benefits. This provides the rationale for the public R&D subsidy for lowcarbon energy options and energy efficiency. Empirical rationale is provided by (Apergis & Sorros, 2014), who studied the relationship between the R&D expenditure and firm's profitability in traditional fossil fuel-based energy firms and the emerging renewable energy producers. The results document the importance of firm size for R&D expenses as well as for firms' profitability. Larger firms in both groups incur higher R&D spending, but the impact on profitability is stronger if these larger firms come from the renewable energy group (Apergis & Sorros, 2014). Since renewable energy is an emerging market, the R&D may be more profitable in the RE sector than in the traditional fossil fuel energy sector, which is globally depleting. The traditional fossil fuel R&D is mostly oriented toward discovering and developing new oil and gas reserves and since common oil reserves are getting depleted and the discoveries of new areas are getting costlier, the emerging scarcity of fossil fuels and an increase in energy demand is driving primary energy prices up, which drives firms into induced innovation.

The induced innovation hypothesis implies that when energy prices rise, the characteristic energy efficiency of items on the capital goods menu should improve faster than it otherwise would (Newell, Jaffe & Stavins, 1998). With high energy prices, the firms are obliged to improve total factor productivity, since increasing energy prices drive costs of production up. Government regulations may also induce innovation, since firms are constrained with certain rules of production. Proper design of environmental standards can induce innovation, which may partially or more than fully offset the costs of complying with them (Porter & Van der Linde, 1995). The government regulations signal likely resource inefficiencies and potential technological improvements for firms to meet the standards. For government to control these regulations, corporate data must be gathered. These data raise the awareness of management to produce more efficiently and pressures them to innovate. Regulation also reduces the uncertainty that investments to address the environment will be valuable. Greater certainty encourages investment in any area (Porter & Van der Linde, 1995). Governments should consider the proper regulation policy, based on the highest yielding benefits from the innovation and research.

On the microeconomic level, the firm's financial success is also somewhat linked to its environmental impact, since the market mechanism may punish polluting firms. Micro level data model with fixed effects shows that the emitting corporation gets persistently penalised due to its pollution, which decreases its firm value (Lee, Min & Yook, 2015). The market punishment mechanism relies heavily on trends and cannot be completely reliable, when

approaching the environmentally sustainable economic development. Environmental sustainability needs a top-down approach, with coordinated action, which is not present in the ever-changing market forces, driven by private interests.

2.3 Keynesianism and environmentalism

Government regulations, as well as the market punishment mechanisms may be a complementary path towards a green economy, but crucial environmental policy must be centrally coordinated. Fiscal stimulus is an example of a centrally coordinated boost toward environmental investment, but there are tensions between environmentalism and Keynesian countercyclical policy.

Two conflicting issues were identified with green Keynesian ideas by (Harris, 2013). Firstly, the traditional Keynesianism is growth oriented, but environmentalism stresses the ecological limits of economic growth. Thus, either a different type of growth is needed or an adaptation to lower- and no-growth economy is needed (Harris, 2013). The Green New Deal proposal turned to green growth policies and denied the no-growth scenario, with fiscal stimulus spending on environmental services, which turned out to have small, but positive output and employment multipliers identified in this chapter.

Second theoretical issue is that expansionary policies needed to deal with the recession may be in conflict with the resource preservation, emission reduction and energy use reduction, which is the main goal of environmental economics. The Green New Deal again provided the answer to this issue, since the expansionary policy is achieved with stimulus that brings long-term savings in resources and emissions, while returning the economy back to its full potential. The most prominent channel identified in this chapter are the energy efficiency measures, which have the highest employment multipliers, especially in the mass transit and building renovation sector, as it is evident from table 9 above. The mean over output energy efficiency multipliers found throughout the literature is 1.31 and the median 1.81, as it can be seen from table 5, which is again higher than other green public investments, in renewable energy, for example.

The Keynesian policy is generally used for government interventions with countercyclical policies and the green Keynesian proposal steers this emergency intervention into environmental investment, since fiscal stimulus can be specifically targeted (Harris, 2013). However, to what extent is this intervention going to recover the economy and to what extent is it possible to green the economy during the economic downturns? Can the government run environmental sanitation programmes, which would also boost the economic development and bring the economy out of the slump? In the following section these questions will be analysed in detail with econometric modelling.

3 EMPIRICAL MODEL AND DATA

The empirical model will consist of two parts. First, the multiplier model study will provide panel OECD country analysis on the employment and growth multipliers of fiscal shocks, namely the traditional New Deal government spending. This will represent the traditional outcome of fiscal multiplier effect and try to explain what the channels of government spending are that affect the economy.

Second, the green multipliers are to be examined, since they differ from the traditional government spending multipliers. The subsample multipliers of countries with the Green New Deal spending will be estimated and different channels of green government spending will be analysed.

After the fiscal multiplier studies, a more particular comparative study will be presented, based on synthetic economies, comparing the actual economy time series with the synthetic ones. The case of Korean Green New Deal will be analysed, using synthetic no-policy scenario and comparing it with the actual GND spending scenario. Korea was chosen because it is the OECD economy with largest green fiscal stimulus in 2008 crisis, amounting to around 5 percent GDP (Barbier, 2011). Similar comparative study will be performed for the case of Slovenia, where a placebo GND spending will be synthesised and compared to the actual Slovenian time series, where such spending shock did not occur in 2009, which is the year after the Great Recession of 2008 had started.

3.1 Literature review

The following literature review will mainly cover the multiplier modelling approaches throughout literature, separate them into methodological groups and study the effects found in these groups. Our model builds on the established approaches of studying fiscal multipliers, which are not the only methodology used in such endeavour. The empirical comparative study used in the second part of this study is a rather new methodological approach, so the literature is picked from different fields of study to learn from it and apply it to the study of the Green New Deal effects.

When studying multipliers, (Wilson, 2012) adopted the cross-state IV/GMM approach when estimating the job multiplier from the ARRA fiscal spending multipliers on employment and found positive multipliers with around eight jobs per US\$ million spent. Pollin (2009), who the discussion of EE multipliers relied heavily on, is using an input-output model, based on achieving emission reduction goals and estimating the necessary stimulus for achieving such goal.

The Slovenian study (Jemec, Strojan Kastelec & Delakorda, 2011), following (Blanchard & Perotti, 2002), was modelling dynamic effects of fiscal shocks for Slovenia, with structural vector autoregressive (hereinafter: sVAR) model, which is also the methodology we will be using, since sVAR modelling is generally used for dynamic fiscal effects estimation and forecast. Several other fiscal multiplier studies have adopted this methodology, such as

(Ilzetzki, Mendoza & Végh, 2013), (Corsetti, Meier & Müller, 2012) and a more conservative approach of (Barro, 2013; Ramey 2013), who used national defence data to estimate government spending multipliers and generally found peacetime multipliers lower than one. Other studies adopt different approaches, such as general equilibrium model stimulus studies, which can be found in (Cogan, Cwik, Taylor & Wieland, 2009), who find multipliers in the 0.6 range. (Eggertsson, 2011), (Curdia & Woodford, 2010), and (Christiano, Eichenbaum & Rebelo, 2011) find similar results in calibrated New Keynesian models. No negative effects of fiscal multipliers have been found throughout literature, which makes this thesis research novel and interesting.

Since our empirical model will be working with a panel of OECD countries, the panel VAR empirical model will be used, based on the work of (Abrigo & Love, 2016). This study integrated the sVAR methodology in the research, using the impulse-response functions to deduct the dynamic effects in the style of sVAR approach discussed above.

For the second part of the study the new approach of comparative synthetic analysis will be adopted, based on the work of (Abadie, Diamond & Hainmueller, 2014), who used this method to study tobacco control programmes between US states and their effectiveness. No other studies which would be using comparative synthetic analyses have been found in the field of fiscal policy, which opens up an interesting field of study. These methods could provide intercountry comparison, especially in the Euro area, which is not a fiscal union. This political establishment allows us to isolate fiscal shocks for comparative studies on fiscal policy.

3.2 General government spending multiplier model

In our estimation of the government spending impact on employment, the panel data vector autoregression (Abrigo & Love, 2016) will be used. The data on the OECD countries are gathered from the Penn World Tables (Feenstra, Inklaar & Timmer, 2015) and combined with the World Bank data on government spending (Azevedo, 2011). The impulse response functions will be calculated from the regressions, with dynamic multipliers as indicative correlations of the impact.

The panel VAR model can be represented as:

$$ln. emp_{t,i} = \beta_1 \sum_{j=1}^{4} ln. emp_{t-j,i} + \beta_2 \sum_{j=1}^{4} ln. rgdpna_{t-j,i} + \beta_3 \sum_{j=1}^{4} ln. g. sp_{t-j,i} + \beta_4 \sum_{j=1}^{4} ln. pop_{t-j,i} + e_{i,t}$$
(4)

$$ln.rgdpna_{t,i} = \beta_1 \sum_{j=1}^{4} ln.emp_{t-j,i} + \beta_2 \sum_{j=1}^{4} ln.rgdpna_{t-j,i} + \beta_3 \sum_{j=1}^{4} ln.g.sp_{t-j,i} + \beta_4 \sum_{j=1}^{4} ln.pop_{t-j,i} + e_{i,t}$$
(5)

Where *emp* is employment in a thousand persons, which is then regressed on its 4 lags, j representing the lags and t represents years in time series. The under-script i represents country identifier, since we are dealing with panel data. Second variable *rgdpna* is the real

GDP of the national accounts in fixed 2010 prices. Government spending (g.sp) represents the total government consumption expenditure as a share of GDP and population (pop)measured in millions. Variables *pop* and *g.sp* are assumed exogenous in this model, since the government spending shock occurs as an external event. Up to a point, the decision of whether to act on the spending side or the revenue side of the government is dictated by political preferences and political bargain which is, at least to a point, exogenous to the economy and generated by ideological or policy preferences (Alesina & Ardagna, 2009).

All of the variables are logarithmic and first differenced for estimation purposes, and the model is estimated across all variables. The parameter of interest is β_3 in both equations, which represent the correlation between government spending on employment and real GDP. The model assumes contemporaneous causation, which will be presented with the impulse-response functions dynamic multiplier (with the exogenous variable $ln_g.sp$ as impulse and ln_emp and ln_rgdpna as responses). Model is regressed with the first differenced variables due to stationarity issues and is estimated with GMM-style instruments.

All the models will be tested for stability, based on the eigenvalue condition after estimating the parameters of a panel VAR. Another test after estimation will be the Granger-causality Wald test, which is a convenient alternative to the usual t—test of the model.

The exogeneity of the government multiplier is assumed, but the problem of reverse causation persists. For example, natural disasters can have a common effect of the third factor, when government reacts with spending to the disaster, while economy is severely influenced by it. Another example of reverse-causation is the pro—cyclical nature of government purchases, which rise in the times of economic booms and fall during downturns. This is partly compensated with counter—cyclical automatic stabilisers, such as welfare-related transfers.

3.2.1 General government spending multiplier estimates

Our estimation of the general government spending multiplier denied the first hypothesis of effective stimulus during the economic downturn. The general government spending output multiplier turned out to be negative, which implies that government spending has been ineffective in creating stimulating growth in the OECD countries panel. This has troublesome consequences for effectiveness of the traditional fiscal stimulus spending. In the case of employment multiplier, the estimation is positive, which means that fiscal stimulus did have a positive employment impact in our sample. Further explanation is therefore necessary to explain the exact channels which pull the output multiplier into negative area. But first, let us look at the results of the estimation.

These results may be interpreted as the elasticity, since all the variables in the regression or log transformed, using natural logarithms. The interpretation of the coefficients is a

percentage change in dependent variable, when the independent variable is increased for one percent, *ceteris paribus*. This holds true for all the variables.

	ln.emp	ln.rgdpna
	Number of persons employed (% change)	Real GDP at constant 2011 prices (% change)
L.log_emp	0.486*** (0.0409)	-0.690*** (0.0885)
L.log_rgdpna	0.181*** (0.0179)	0.512*** (0.0441)
log_g_sp	-0.0588*** (0.0193)	-0.264*** (0.0516)
log_pop	0.0440 (0.0836)	2.633*** (0.216)
Observations	845	845

Table 12: Results of the general government spending multiplier in a pVAR regressionover 35 OECD countries from year 1990 to 2014.

Standard errors in parentheses. *** *p*<0.01, ** *p*<0.05, * *p*<0.1

Source: Own work (obtained from Stata).

There is no constant variable, since it is omitted by the panel VAR method, because the panel-specific fixed effects are removed. This is done with the first difference manipulation of the independent variables in the panel VAR regression. The dependent variables are regressed on themselves, meaning that they are regressed on the lags. These results are not of our interest here, so we can quietly disregard the lagged estimates in table 12. The area of interest in our results table is the third column, representing the general government spending multiplier elasticity.

All of the crucial coefficients are highly statistically different than zero, which means that the zero hypothesis of no correlation between government spending, employment and growth can be denied. This is in turn tested with the Granger-causality test, which just replicates the p-values in the panel VAR setting. The model is also tested for stability, for over-identifying restrictions and the optimal lags are chosen based on the Hensen's J—test. From the resulting table 12 we can see all the variable cross effects.

To first turn our attention to government spending multiplier (third row estimates), we can find negative values, both in employment and in rGDP coefficients. Interpreting these results in percentages would show a decrease in employment levels by 0.058 percent and a decrease in output by 0.26 percent for a one percent increase in government spending.

The regression in table 12 reports a static effect, but with the impulse-response function, we can portray the dynamic response of the dependent variable. In figure 1 and figure 2 of the appendix 5, both Impulse-response functions (hereinafter: IRF) are presented with impulse variable government spending and response variables defined as employment and rGDP respectively. The confidence intervals are estimated based on the Monte Carlo simulation with 1000 draws.

As we can see from both dynamic multipliers, the effect is negative in first three to four periods, but jumps to positive around the fifth period, which means that the negative effect dies out around five lags after the intervention with government spending. The rGDP variable response to government spending shock dies out significantly more quick (in two periods) than the response of employment variable, which phases out at around fifth period after the spending intervention (see figure 1 and figure 2 of the appendix 5). The positive value after the fifth period quickly approaches zero again, which shows that the multiplier has decreased output and employment more than the positive offset after the fifth period.

The explanation of these negative effects may lie in the crowding out argument, which states that the government spending is pulling away funds available to the private sector, which lowers the investment and consumption levels and affects the economy negatively. Because the results portray a different conclusion than our theoretical Keynesian predisposition above, these effects are to be further analysed in depth in the following sections.

3.2.2 General government spending sub-hypotheses:

Since our main hypothesis on the effectiveness of Keynesian spending multiplier effectiveness has been found out to be false, further research is needed on negative multiplier. The multiplier could be in some cases positive, depending on the state or characteristic of the economy. From economic theory, three main sub-hypotheses are stated, which need to be tested, in order to conclude policy recommendations for crisis government spending. These are:

- 1. A: The GDP size of the economy positively influences the size of the multipliers.
- 1. B: The pace of economic growth negatively influences the size of the multipliers.
- 1. C: Indebtedness of the economy negatively influences the size of the multipliers.

3.2.2.1 The size of the economy and the size of the multipliers

The first sub-hypothesis studies the impact of the size of the economy on output and employment multipliers, related to the government spending impact. No such studies have been found throughout the literature, but some have pointed out, that the nature of their estimated sample countries has influenced the size of the multiplier. In the study of (Kraay, 2012), the estimated low government spending multiplier is attributed to his sample of low-income countries, which supposedly have not developed big financial markets, which could attribute to a higher government spending multiplier.

When estimating the correlation of the government spending and economy size, different percentiles of rGDP size will be isolated to estimate the regression again in the subsample of only small countries (under .10 and .25 percentiles of rGDP size in our sample) and only large countries (above .75 and .90 percentile). The subsamples take smaller than .10 and .25 percentiles of rGDP and on the other hand larger economies than .75 and .90 percentile rGDP size in our sample. The main purpose of this analysis is to study the effect of government stimulus in the different sizes of the economy.

Table 13: Economy size impact - estimated coefficients for log_g_sp (logged government spending) on employment and GDP, for different economy size subsamples.

Percentile	log_emp	log_rgdpna	Observations
	Employment (% change)	Real GDP (% change)	
.10	-0.361***	-0.426***	65
Smallest countries	(0.0548)	(0.0618)	
.25	0.0782**	-0.0198	123
Small countries	(0.0383)	(0.0308)	
.75	0.229***	0.0796***	290
Large countries	(0.0396)	(0.0309)	
.90	0.143	0.316***	125
Largest countries	(0.0879)	(0.0933)	

Source: Own work (obtained from Stata).

As we can see from the table 13, the size of the economy does influence the effectiveness of government spending multiplier in terms of employment and does vary a lot depending on the size of the rGDP. This confirms our hypothesis, that the size of the economy positively influences the size of fiscal spending multipliers, since the bigger the size of the economy, the bigger the multiplier.

The smallest economies (smaller than 0.1 percentile in our sample) show a negative impact of government spending on the employment and the output multiplier. Thus, we could conclude that the size of the economy does positively influence the effectiveness of government spending multiplier.

The largest economies have positive, but insignificant, employment multiplier, whereas output multiplier is found positive and highly significant. This phenomenon may be explained with the large scope of government consumption, which can only have an effect, if it is carried on such a large scale. In other words, the government spending must be massive, to have an effect on the economy.

The small countries tend to have strongly significant negative output multiplier in our model, which is compatible with the discussion of (Kraay, 2012), who suggests that low government spending multiplier may be attributable to underdeveloped financial markets. In case of non-

developed financial markets, these offer bad private investment opportunities, so the investors divert their funds to consumption. In this case, the government investment does not crowd out the private.

In our case, the countries in the sample have developed their financial markets, since our sample consists of the OECD countries. Negative multipliers occur, because the financial markets function and in the case of the government spending, the funds get crowded out of private markets, with developed financial systems.

If the low-income countries, according to (Kraay, 2012), engaged in investment spending, opposed to consumption spending, the multiplier on output may rise, due to the nature of underdeveloped financial markets. Further research could include low-income (non-OECD) countries in our sample and run similar regression on output and employment multipliers. Another indicator of economic development is the pace of growth, which is studied in the next section.

3.2.2.2 The pace of economic growth and the size of the multiplier

The second general economic characteristic estimated in our empirical model is the pace of the economic growth. More precisely, how does the government spending affect the economy, when the country is a fast-growing economy (more than 5 percent), when it is growing around 2 percent and when the economy is in the phase of negative growth?

rGDP growth range	log_emp	log_rgdpna	Observations
	Employment (% change)	Real GDP (% change)	
Negative	-0.371*** (0.0739)	-0.761*** (0.159)	100
Between 1-3%	-0.154*** (0.0363)	0.177** (0.0804)	789
High growth (above 5%)	-0.173*** (0.0541)	0.00841 (0.0407)	629

Table 14: Growth impact - estimated coefficients for log_g_sp (logged government spending) on employment and GDP, for different economic growth pace subsamples.

Source: Own work (obtained from Stata).

Economic theory, relying on Keynesian expansionary policies, would suggest that government should increase consumption in the times of sluggish growth or negative growth rates. This hypothesis is however not confirmed by our estimates and the results show that even in the negative range of growth, the government spending multipliers tend to be negative, as is evident from the table 14. This holds true for both, employment creation and economic growth acceleration. For employment creation the least effective government spending will be in the negative growth economies, whereas the most effective, but still negative, in the economies with stable growth between 1–3 percent annually.

We must deny our second sub-hypothesis, that the growth pace negatively influences the size of the multiplier and the results speak in favour of crowding out the argument, as it was found in table 12 (the traditional New Deal regression). In terms of employment, the second sub-hypothesis can be rejected. The employment multiplier persists as negative in all ranges of economic growth, which means that the pace of growth does not influence the employment multiplier and does not classify any pace of growth more appropriate for fiscal spending as an employment creating policy.

As we can see from the table 14, most of the observed growth rates in our sample range from 1-3 percent. This range also portrays the most positive effect of government spending on rGDP growth, which means that countries with stable growth could intervene with government spending. This is also an economic condition in which the economic theory does not suggest any fiscal spending, as this is considered a functioning economy, with a steady growth, without the need for government intervention.

3.2.2.3 Indebtedness of the economy and the size of the multiplier

The last general economic characteristic, which could influence the government spending impact, is the economy indebtedness. Will highly indebted countries show negative effect of the government spending, since it would indebt the country even further? Or might the spending provide boost to indebted economy, which could accommodate for the debt shock of spending?

The chosen levels of indebtedness are based on the work of (Reinhart & Rogoff, 2010), who suggest that the relationship between external government debt and economic growth below a threshold of 90 percent growth is weak, but above 90 percent the median growth falls by one percent for the developed economies. Further, (Iltzeki, Mendoza & Végh, 2013) have pointed out that fiscal stimulus may be counterproductive in highly indebted countries; in countries with debt levels as low as 60 percent of GDP, government consumption shocks may have strong negative effects on output.

The employment creation expansionary policy appears to be ineffective across all of the levels of country indebtedness. In the countries with low debt-to-GDP ratio, the general government spending multiplier is positive, but insignificant, whereas our model outcome portrays a 0.02 percent increase, when government spending increases by one percent. This could render fiscal spending effective, but as soon as the debt levels exceed the 60 percent threshold, the spending multiplier effectively shows no effect on the economy.

Spending) on employment and GDPGeneral government
indebtedness (% of
GDP)log_emp
Employment (% change)log_rgdpnaObservationsSustainable
(below 60% GDP)-0.234***
(0.0328)0.0296
(0.0479)356

0.0206

(0.0403)

-0.387***

(0.100)

278

511

-0.250***

(0.0413)

-0.0965***

(0.0340)

High (Between 60-90% GDP)

Unsustainable

(Above 90%)

Table 15: Indebtedness impact - estimated coefficients for log_g_sp (logged government)
spending) on employment and GDP

Source: Own work (obtained from Stata).

The output multiplier turns negative and statistically significant in the countries with unsustainable debt levels, which generally confirm the findings of (Reinhart & Rogoff, 2010) and (Iltzeki, Mendoza & Végh, 2013). Since the fiscal spending is usually financed through borrowing from international monetary institutions, the highly indebted countries pay higher interest rates and indebt the country even further, which has detrimental effects on the economy performance. Our estimation shows that countries which are indebted above the sustainable level of 60 percent debt—to—GDP ratio should not intervene with fiscal stimulus. The fiscal spending of low indebted countries cannot be recommended with certainty, since the coefficient is statistically insignificant, but the spending may have a small, but positive effect in the countries with low debt—to—GDP ratio.

Generally, we can confirm the third hypothesis too, since the fiscal spending in highly indebted countries is decreasing economic growth and employment, whereas the low debt-to-GDP ratio countries could possibly benefit from output boost with fiscal spending. The employment multiplier hypothesis effectiveness is rejected in table 15, since the employment multiplier stays negative throughout all of the economy indebtedness levels.

This research showed that fiscal spending positively affects the economy only in one economic circumstance: big economies with a slow pace of positive growth rate and with sustainable amounts of debt—to—GDP ratio. This economic circumstance is also very inappropriate for governments to intervene in the markets, since these are usually functioning well in these economic conditions.

Since the two out of three sub-hypotheses were confirmed, this research shows some insights on which economic characteristics the government spending has the most beneficial effects. The size of the economy was found out to have a positive correlation with the multiplier effectiveness, as it is evident from table 13, where massive fiscal stimulus portrays higher multiplier effectiveness both in rGDP and employment.

The pace of economic growth denied a negative correlation hypothesis, since it was assumed, that the fiscal stimulus is the most effective in recessionary economies. Our estimates, as

seen from the table 14, showed that the only positive multiplier is found in the countries with stable, positive growth, which is not a suitable economic condition for fiscal spending. The last sub-hypothesis on negative correlation with economy indebtedness can also be confirmed for output multiplier, but not for the employment multiplier. This means that the highly indebted countries portray negative output multiplier, but if the economy is not burdened with an excessive amount of public debt, the fiscal spending may boost the output effectively. This, however, does not hold for employment creating policies, regarding the economy indebtedness, as it can be seen from the table 15.

Further, we are interested in underlying fiscal spending mechanisms that would support the, now confirmed, hypothesis of crowding out. In the next section, several crowding out transmission mechanisms are identified from the economic theory and tested for significance.

3.2.3 Channels of crowding out

When studying fiscal transmission mechanisms, we are interested in the effect of government spending on the employment levels and GDP. We have to analyse through which channel the government spending crowds out employment and GDP. The possible mechanisms that could reduce employment and GDP growth were identified from the economic theory as following: Gross fixed capital accumulation, labour supply, financial development measured in credit/GDP ratio, non-performing loans, capital stock, total factor productivity and the share of industry in the economy.

Crowding out effect may occur in any of these measures, for instance, the gross fixed capital and capital stock could get diminished due to lowered levels of private investment, which would not be offset by the government spending. The labour supply may fall due to the crowding out effect, if the government spending did not employ as many people, as the number of workers who lost their jobs in the deprived private sector. Domestic credit/GDP ratio is a measure, which would get depleted when the funds for public spending purposes were steered away from the private sector. Non-performing loans were chosen, because these may rise, due to the liquidity trap in which the firms get caught, as a consequence of diminished credit provision, which disables firms to borrow for credit servicing or investment purposes. This is also reflected in the measure of industry share of the economy, because the crowding out effect may orient the economy towards a service economy, due to diminished investment in capital, essential for industrial sector development. The last measure included in this study of transmission mechanisms is the total factor productivity, which could get decreased due to a more ineffective public R&D, as opposed to privately funded R&D, which is hard to finance with low credit provision to the private sector.

The model for studying the transmission mechanisms can be represented as:

$$ln X_{i,t} = \beta_1 \sum_{j=1}^{4} ln X_{i,t-i} + \beta_2 \sum_{j=1}^{4} ln g sp_{i,t-i} + e_{i,t}$$
(6)

Where ln.X_{i,t} is a blank variable in the equation 6, filled with each dependent variable (see the table 16). The dependent variable ln.X_{i,t} is regressed first on its own lags and on the lags of the variable government spending.

From the empirical investigation, we can observe specific transmission mechanism through which the government spending is negatively affecting the economy. The most prominent negative affect are the non-performing bank loans induced by the government spending which portray a 4.2 percent increase in non-performing loans (see table 16), as the government spending increases for one percent. Since the coefficient is positive, an expansionary fiscal policy could possibly result in a more inefficient fund lending.

All the variables from equation 6 are treated as dependent variables on government spending in a bivariate regression from year 2000 to 2014, since most World Bank data are available only for this period. This will show the concise effect of government spending on each of the crowding out channel. All the regressions take the similar form as above, but in a bivariate regression as a panel VAR model with appropriate lags estimated. It is important to note that government spending will not be treated as exogenous, as we are trying to find a channel through which the government spending affects the economy. The data on capital stock and total factor productivity will be taken from the Penn World Tables database (Feenstra, Inklaar & Timmer, 2015) and the variables: gross fixed capital accumulation, financial development measured in credit/GDP ratio, public debt, non-performing loans and the share of industry will be gathered from the World Bank open data (Azevedo, 2011).

Dependent variable	Government spending (% change)	Observations
Domestic credit to private sector (% of GDP)	-0.742*** (0.273)	454
Central government debt, total (% of GDP)	0.491 (0.523)	189
Gross Fixed capital formation (at constant local currency unit)	-0.456** (0.208)	510
Bank non-performing loans to total gross loans (%)	4.200*** (1.402)	247
Capital stock at constant 2011 national prices	-0.0277 (0.0293)	455
Total Factor Productivity At constant prices (2011=1)	-0.143*** (0.0388)	455
Industry share (% of GDP)	-0.208 (0.162)	495

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Tabla 16. Ca	noman out on	anding the	anguaigaian	machaniama
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Source: Own work (obtained from Stata).

From the empirical investigation, we can observe specific transmission mechanism through which the government spending is negatively affecting the economy. The most prominent negative affect is the non-performing bank loans induced by the government spending which portrays a 4.2 percent increase in non-performing loans (see table 16), when the government spending increases for one percent. Since the coefficient is positive, an expansionary fiscal policy could possibly result in a more inefficient fund lending.

From economic theory, the most prominent channel, through which the government spending negatively affects the economy, is the crowding out of credit to private sector, measured with domestic credit available to private sector. Since the government must lend funds with running budget deficits in order to afford spending, the funds are 'crowded out' from the economy. Our estimation confirms this hypothesis, since the coefficient on domestic credit to private sector is negative (-0.74 percent decrease in credit to private sector after a one percent increase in government spending) and the coefficient is significantly different from zero.

Gross fixed capital formation, or net increase in physical assets, is negatively affected by government spending in our estimation, which means that most of the government spending would not be converted to fixed capital or physical assets, but rather spent on wages or some other, non-physical, purchases. As it can be seen from table 16, gross fixed capital formation is reduced by 0.456 for the one percent increase in government spending. This is quite severe decrease, which could be due to the crowding out, which would decrease the capital investment in private sector.

The correlation with total factor productivity is also negative as it can be seen from table 16, which could be further explained by crowding out of private research and development investment, which may be more frontier pushing than such public investment. It is much less severe decrease than in the gross fixed capital formation, with -0.143 reductions for the one percent increase in government spending. This shows, that the publicly financed R&D is not significantly less effective in raising total factor productivity in the economy, than the private R&D. Privately financed R&D is more market oriented, which may help to push frontier more effectively, but with a small margin of difference, than the publicly financed research.

Capital stock and industry share are estimated to be reduced by government spending. This means that the private sector was not offset by the government spending and the level of capital stock fell in the economy, due to the low private investment. Public spending is usually more service oriented and does not provide investment in capital. This is also reflected in the falling industry share, which means that the economy became more service oriented, due to public spending and investment in manufacture declined. The external debt levels increased in table 16, which is also a consequence of the public spending, financed through the public debt. These coefficients do not significantly differ from zero, but they still speak in favour of crowding out argument of the general government multiplier, which does negatively affect the economy.

One of the main drivers of the negative multiplier effect in our study are the non-performing loans. Non-performing loans increase extensively as the government engages in fiscal stimulus spending. It is important to note the issue of reverse causality here, because the economic recession depresses the aggregate demand, which causes a decline in the firm's revenue. This reduces the chance for the firm to successfully service the loans, which may result in defaulting. The firm debt defaults result in a liquidity crunch, where the banks are not able to provide same amounts of credit to private sector as before the crisis.

Thus, the fiscal stimulus may not necessarily cause the increase in non-performing loans, but may help perpetuate the diminished domestic credit provision to the private sector. Since the government borrows funds, with issuing bonds, the funds divert into bond investments. This has significant effects on employment and rGDP, which are the main variables of our interest. Since the credit provision is diminished, the firms do not invest as much as in the times of economic expansion, which results in decreased labour demand and less value added.

Gross fixed capital is also estimated to diminish in our model. According to two-sector neo-Keynesian model, as developed by (Monacelli & Perroti, 2008), the sector that receives more of the government shock, forms more fixed capital and exhibits an increase in the real wage. Manufacturing plausibly receives disproportionately more share of the government spending shock, since the rGDP and employment are interlinked, as the demand for manufacturing goods also translates to the labour demand. If rGDP falls, for whatever reason described above, the result will be a decrease in employment. Decline in gross fixed capital may again be explained by fall in aggregate demand during economic crises and not causally linked to the government spending. In contrast, the crowding out can have an effect in gross fixed capital formation, because the firms do not invest, due to the credit crunch. The real transmission mechanism of fiscal policy lays somewhere in between crowding out and external economic climate during the recession for the negative multiplier on gross fixed capital formation.

My model does not capture long-term private sector increased productivity effect, caused by fiscal stimulus spending (Perroti, Reis & Ramey, 2007). This long-term increased productivity may increase employment in the long run, when the expansionary period is more pronounced, due to improved infrastructure. This is the uncaptured positive externality of government non-transfer fiscal spending.

Another methodological issue is with the use of annual data in my model, as it was noticed by (Blanchard & Perroti, 2002) in a panel VAR approach. Since the government response comes with a lag, the effects are not appropriately captured and it is likely to impart a negative bias to the observed aggregates of employment and rGDP. This could be solved with the use of quarterly data, but the Penn World Tables do not provide such. Another issue with data, observed by (Perroti, Reis & Ramey, 2007) is that the quality of national account data deteriorates severely as one goes back in time. This holds true for our key variable here, the government spending.

3.3 The green government spending model

This section will present the empirical estimates of the Green New Deal spending, as opposed to the traditional stimulus spending. The Green New Deal spending multipliers are generally found to be positive, but less statistically significant. The purpose of this section is to analyse green government spending effectiveness in opposition to the negative outcomes of traditional government spending. Furthermore, the channels of green spending will be discussed and estimated.

In the second part of this section the synthetic comparative analysis will be made, creating a counterfactual scenario in S. Korea with no Green New deal spending, while placebo effect will be synthesised for Slovenia, with the Green New Deal, that did not in fact happen. The natural experiment will again consider employment and output time series in real and counterfactual scenario.

3.3.1 Green government spending multiplier estimates

In this section the effect of Green New Deal 2009 stimulus will be estimated and put into the opposition to the traditional government spending multiplier, which turned out to be negative in both cases. The green government spending multipliers result to be positive in our model.

$$ln.emp_{i,t} = \beta_1 \sum_{j=1}^{2} ln.emp_{i,t-j} + \beta_2 \sum_{j=1}^{2} ln.rgdpna_{i,t-j} + \beta_3 \sum_{j=1}^{2} ln.g.sp_{i,t-j} + e_{i,t}$$
(7)

$$ln.rgdpna_{i,t} = \beta_1 \sum_{j=1}^{2} ln.emp_{i,t-j} + \beta_2 \sum_{j=1}^{2} ln.rgdpna_{i,t-j} + \beta_3 \sum_{j=1}^{2} ln.g.sp_{i,t-j} + e_{i,t}$$
(8)

Similar panel VAR model as above will be estimated, but the selected subsample panel now consists of countries who adopted the green government spending in 2009 response to the great recession. The population variable is omitted in this regression and model is estimated on two lags, due to the short span of the sample, on which the population should not have any effect, considering the employment and output multipliers.

The countries in our Green New Deal subsample are handpicked from the appendix 2, where only countries that portrayed some GND spending are considered. China, South Africa and Saudi Arabia were added to the subsample of OECD countries that utilised green fiscal stimulus in 2009, which altogether amounts to 12 countries. The model will be estimated with a narrowed timespan, analysing the government spending effect since the last economic downturn of 2008. The model is regressed on two lags, since the time span is narrowed to eight years, because the data are available up until the year 2016.

As we can see from the table 17, the Green New Deal is much more efficient in bringing economic recovery (in terms of rGDP) than the traditional fiscal stimulus. The government spending coefficient is positive in both, output growth and employment, which means that

an increase in green government spending increases the dependent variable by 0.073 percent in employment levels and 0.44 percent in rGDp.

	log_emp Employment (% change)	log_rgdpna Real GDP (% change)	
L.log_emp	0.746*** (0.106)	-0.343*** (0.113)	
L.log_rgdpna	-0.00989 (0.0330)	0.893*** (0.0816)	
L.log_g_sp	0.0727** (0.0304)	0.439*** (0.0468)	
Observations	78	78	

Table 17: The Green New Deal model estimates

Source: Own work (obtained from Stata).

It is slightly less statistically significant in the case of employment, but highly significant in the output growth correlation. Both variables are also tested with Granger causality test, which essentially confirms that government spending happened before the responding variables of employment and growth.

The impulse-response functions are represented in the appendix 6, which depict the IRF of the employment dynamic multiplier in the figure 1 and the figure 2 found in the appendix 6 represents the growth dynamics. The IRF confidence intervals are estimated with Monte Carlo simulations, based on 1000 draws. As we can see from the width of the confidence intervals, the employment multiplier effect is much more uncertain, whereas the output multiplier remains equally constrained throughout the resulting period after the shock. The confidence intervals are larger than traditional spending IRFs, due to narrowed set of panel countries and narrower time span.

The estimates differ significantly from the traditional fiscal stimulus multipliers, described in table 12. Green government spending multipliers turned to positive values, which implies that the use of the green fiscal stimulus as a countercyclical tool for economic recovery is reasonable. This generally confirms our second hypothesis of the Green New Deal effectiveness, when dealing with the economic crises.

3.3.2 Green indicators: Traditional vs. green government spending

In this section, empirical estimation on the green and traditional government spending output and employment multipliers will be presented. Environmental aggregates, such as energy efficiency, renewable energy use, rail infrastructure and R&D will be studied, specifically their impact on output and employment. These variables were chosen, because they are targeted in the Green New Deal measures. Studying the impact of these will help with the design of the most appropriate Green New Deal policy design. The study will compare the impact of clean energy variables under the traditional government spending and under the Green New Deal spending. This study will give us an insight on the environmental impact of the Green New Deal adopted in 2009, with comparison to the traditional New Deal spending, which was not environmentally oriented. The variables studied are the same, but the sample on which these are regressed differs. The sample of traditional New Deal countries consists of 35 OECD economies, with a 14-year timespan from 1990 onwards. The Green New Deal data sample consists of only 12 countries that adopted the Green New Deal, which are 9 OECD countries and China, South Africa and Saudi Arabia, as it can be seen from the appendix 2.

In this analysis the four above mentioned variables (EE, RE, Rail, R&D) will be regressed as exogenous on employment and output in a panel VAR setting. For the Green New Deal spending the timespan is again from 2008 to 2014 on selected GND countries, while traditional spending is regressed from the year 2000 to 2014 on a panel of all the OECD countries. The following regression is estimated in the table 18.

$$ln X_{i,t} = \beta_1 \sum_{j=1}^2 ln . emp_{i,t-j} + \beta_2 \sum_{j=1}^2 ln . rgdpna_{i,t-j} + e_{i,t}$$
(9)

The variable *ln.X* again represents a blank variable in equation 9, which is filled with the four dependent variables (EE, RE, Rail, R&D) from the table 18. These variables are regressed on employment levels and rGDP time series as described above. In the regression, these are treated as exogenous independent variables, but because the panel VAR setting estimates variables in a contemporaneous cross-regression, the following results present them as dependent variables. This framework allows us to check the effects and shocks of each variable on all other variables.

The traditional government spending may not be particularly useful in providing additional employment and economic growth as seen from the table 18. As the results from the green government spending multiplier (table 17) show, the green government spending is reasonable in providing environmental public service as it can be seen from the table 18.

In terms of energy efficiency, as defined above, the aggregate of energy use (GDP per unit of energy use in constant 2011 PPP \$ per kg of oil equivalent) is used as an exogenous variable on employment and rGDP. This variable shows us the impact of rising energy efficiency (creating more output with the same unit of energy) on employment gains and economic growth.

.In the emerging sector of renewable energy consumption, the government spending is estimated to have a positive but insignificant impact. This may be due to subsidised renewable energy, which may again crowd out private investment in renewable energy. The variable used is RE production as a percent of total energy production, excluding the hydro energy. This may not reflect the employment and growth gains completely, since the production of RE may be seasonal and depends on other exogenous variables, such as weather, but it is nonetheless closest proxy to the number of RE unit installations.

	Traditional government spending		Green New Deal government spending	
	Employment	rGDP	Employment	rGDP
Energy efficiency (GDP per unit of energy use)	0.0871 (0.0634)	0.283** (0.118)	0.231** (0.0946)	0.159 (0.187)
Renewable energy (% total energy production)	0.0139* (0.00788)	0.0558*** (0.0159)	-0.00505 (0.0114)	0.00989 (0.0217)
Rail infrastructure	0.212 (0.207)	0.186 (0.254)	0.141 (0.203)	0.420 (0.285)
R&D	0.0889 (0.0639)	0.164** (0.0774)	-0.0105* (0.00587)	0.0376*** (0.00459)

 Table 18: Traditional vs. Green New Deal government spending multipliers

Source: Own work (obtained from Stata).

The kilometres of rail lines are positively correlated with government spending, since most of the spending is done in infrastructure investment. The multiplier is quite low and insignificant in both cases, but it is, nonetheless, positive, which justifies the infrastructure government spending as an environmentally beneficial intervention. The Green New Deal renders more effective infrastructure spending than the traditional New Deal, considering the output multiplier, but it is less effective as employment creating policy, as it is evident from the table 18.

In the field of research and development, a positive output multiplier has been found in our research, which is surprisingly higher in the case of the traditional New Deal. This results may capture the informational revolution of the past decades, which had a high output multiplier of R&D spending, due to a fast pace of innovations. The green innovations seem to have a lower multiplier, but it is still positive. The employment multiplier is small and negative in the case of green spending. This may speak in favour of crowding out and may be also correlated with a general lack of funds during crisis, when the cuts in R&D are the most present. In the case of the Green New Deal spending on R&D is not really beneficial due to a very low output multiplier and a negative one in employment.

The impact of energy efficiency spending is much more labour intensive in the case of Green New Deal data, opposed to the traditional spending (see table 18). The GND spending does increase energy efficiency employment with 0.2 percent coefficient, whereas the traditional multiplier is close to zero and statistically insignificant. This confirms the hypothesis that the GND spending is labour inducing and has positive effect on the economy. The rGDP is

higher and significant in the traditional model, but that may be attributable to a larger time span, since the GND subsample is only capturing the crisis data from 2009 to 2014. The output multiplier is higher and statistically significant in the case of the traditional New Deal, which could be explained with energy efficiency rapid increases during last decades.

Renewable energy is surprisingly ineffective in our results, presented in table 18. This may be due to the crowding out argument, where private investors may use the RE investment more efficiently and provide more economic gains, as it can be seen from the traditional government spending subsample, where the growth multiplier in the traditional spending model is the only significant result.

The results on the rail infrastructure are surprisingly low and insignificant. The correlations are positive, but we cannot attain any statistical significance to it. However, we can still observe, that the multiplier on growth is much higher in GND setting than in the traditional spending model.

3.3.3 Synthetic economy comparative analysis

In the following part of the thesis, the synthetic method will be used when comparing different policy scenarios, based on the work of (Abadie, Diamond & Hainmueller, 2014), which is a method for comparative political studies of government interventions. The data for Slovenia are not available before the 1990, so that all the 35 OECD economies are analysed from year 1990 on due to the nature of estimation, which takes the data from the donor pool of countries. The intervention period is set to 2009 (a year after the crisis, when most GND stimuli occurred). The 19 year results period is sufficient enough for a panel of 35 countries for our purpose. In the synthetic estimate time series, the dotted line represents the counterfactual scenario and the treated line represents the state of the world, which did in fact happen.

In the following empirical study, we will present two natural experiments with the use of counterfactual scenarios. First, we will look at South Korean economy with and without the Green New Deal intervention in 2009. Second, we will look at Slovenia without and with the placebo GND intervention in 2009. This will provide an insight into the empirical nature of the speculative notions of government spending multipliers studied above.

3.3.3.1 South Korean natural experiment

First, the S. Korean natural experiment is presented, describing an economy in a counterfactual scenario with the absence of the Green New Deal in South Korea. Synthetic economy shows a clear opposite employment trend in the absence of intervention a year after. The employment would fall, if the intervention did not happen. The employment was picked up by the GND intervention and would have been be significantly lower in the absence of the Green new deal intervention in 2009 as the synthetic counterfactual shows. The model seems not to fit the employment trend line completely in the 1990 decade, but

the model is set in the way that the variables focus on the period around the intervention, which fits the model better in the period around crisis and disregards the volatility in the decade before the year 2000.



Figure 5: Synthetic Korean employment without 2009 Green New Deal

Source: Own work (print from Stata).

The synthetic simulation of the real growth in the natural experiment scenario did not portray as significant results as it did with the employment aggregate. The results are not as meaningful and less significant, so these must be taken carefully. As we can see from figure 6, the real growth would be following a similar trend, but it is well below the treated unit. This simulation is not really fitting, but it is nonetheless shown here for the sake of completeness. The reported statistics are quite significant, but still around 30 percent probability of the synthetic economy happening by chance, which can be seen from the appendix 7 statistic reports.

Intervention effects the employment with a lag, as it can be seen from the figure 5, since both curves shifted upward in a period after intervention. This presents an uncertainty in examining the first post-intervention periods, whereas the following tend to be more predictable, as it is evident from the appendix 7, which displays the p—values for the post—intervention period synthetic estimates and the pool of donor countries and Root Mean Square Percentage Error (hereinafter: RMSPE) statistics.

From figure 5 and figure 6, we can draw the conclusion that the government intervention was indeed effective in Korea after 2008 crisis, since the synthetic lines are both below the treated, which means that the counterfactual scenario would be worse than the actual. This conclusion is contrary to the traditional New Deal multiplier results described above in table 12, which describe the ineffectiveness of general government spending in creating additional employment. Nonetheless, the synthetic analysis confirms the Green New Deal spending multiplier estimates from table 17, since the Korean economy would be worse without the green government spending in 2009. This also confirms the fact, that the general multiplier

models must be taken with caution and economies must be regarded individually, as in the case of South Korea.



Figure 6: Synthetic Korean rGDP without 2009 Green New Deal

Source: Own work (print from Stata).

The first year after the intervention, the synthetic employment level is statistically insignificant from zero, with a high probability of the depicted downfall happening by chance, as we can see in the appendix 7. The second period is statistically more significant, with low chance of such employment levels happening by chance, but further periods again diminish in significance. In the case of growth projections for S. Korea, the counterfactual simulation is more statistically significant, although it can still happen by chance, with the estimated 30 percent possibility. This is evident from the figure 2 in the appendix 7 for the first three periods and after the fourth period, the chance of counterfactual rGDP happening by chance rises significantly.

3.3.3.2 Slovenian placebo GND intervention

In this second part of the empirical investigation, the placebo GND intervention in Slovenia is presented. Slovenian economy did not experience any additional fiscal stimulus clean energy investment in 2009 and the synthetic Slovenian economy in presents such a Green New Deal intervention, synthesised based on the donor pool out of the OECD economies. In the figure 7 we can see, that the synthetic Slovenian economy would have portrayed even higher employment downfall in the case of intervention in 2009. Since the intervention did not happen, we observe the treated line as an actual time series, which also portray a big downfall in employment, which happened after the 2008 crisis.

The results again confirm our estimates on the green government spending multipliers. Slovenian subsample comparative study, however, is much less statistically significant than the Korean subsample, with most of the events having a high probability to happen by chance. The p-values can be seen from the appendix 7, where spending intervention is likely

to die out after 2 periods and converge to the treated (actual) levels in 4—5 years. This confirms the (Jemec, Strojan Kastelec & Delakorda, 2011) conclusion that the stimulus effects are not long lasting and die out after around two periods after the intervention.



Figure 7: Synthetic employment with hypothetic 2009 Green New Deal in Slovenia

Source: Own work (print from Stata).

The model fits better in the case of Slovenian real growth (see figure 8), but reports statistics, which are much less convenient than the Korean example, seen in the appendix 7. It is almost certain that the synthetic economy would happen by chance, but it is still picking up trends from the other donor countries, which may allow us to draw positive conclusions about the studied placebo effect of Slovenian Green New Deal proposal.

Figure 8: Synthetic rGDP with hypothetic 2009 Green New Deal in Slovenia



Source: Own work (print from Stata).

Synthetic rGDP line follows the treated scenario closely in figure 8, where the first period after the crisis portrays a downfall in rGDP. The trend-line in the placebo intervention picks up a growing trend, instead of a negative one in the treated unit, which again speaks in the favour of effectiveness of the placebo 2009 intervention.

3.3.3.3 Issues with the 'synth' methodology

There are some methodological problems with the reported synthetic simulations. The first issue is that the donor countries are picked up in a statistical manner, which best reproduces the effect of intervention, but it cannot be specified what kind of intervention should be indeed picked up. This poses a problem in the case of Green new deal simulation, which cannot be directly specified to pick up trends of green public investment from the donor pool of countries. The donor countries are picked by non-specified statistical matches and in the case of Slovenia these donor countries also had no GND intervention, which makes it hard to tell whether the synthetic economy really shows the placebo GND intervention or a traditional New Deal. Since the model is picking countries by their statistical time series similarities, we have no discretion over the pool of donor countries when the placebo effect is constructed. This is open to further research and improved methodology, which is beyond the scope of this thesis.

The second methodological issue is that our OECD country panel data are not as convenient for synthetic comparative study, as are the US federal states in the case of tobacco prohibition study (Abadie, Diamond & Hainmueller, 2014), which portray a high amount of similarity. This is not the case with OECD country aggregates, which differ significantly in terms of employment, rGDP and government spending and provide a large heterogeneity within the observed pool of countries. This opens a further area of research and new methodological proposals for counterfactual scenario studies.

3.4 Results of the empirical model

Empirical estimation in this thesis denied the first hypothesis on the traditional fiscal spending effectiveness, but confirmed the second hypothesis on the Green New Deal spending effectiveness. Traditional fiscal spending resulted with negative multiplier effects in our analysis, both in output and employment multipliers, as it can be seen from the table 12. This finding directed us to the investigation of the alternative hypothesis of private investment crowding out and fiscal transmission mechanisms. Three economic characteristics, which influence the size of the multiplier, were identified, and two out of the three sub-hypotheses (1.A—1.C) were confirmed. These state that economy size has a positive effect on rGDP and employment multipliers, with the reasoning, that the fiscal stimulus must be massive for any significant effects. This hypothesis was confirmed by the regression results found in the table 13.

Pace of growth and indebtedness influence the size of the fiscal spending multiplier negatively in our hypotheses, since recessionary and low indebted countries should portray the most effective multipliers, based on economic theory. The pace of growth hypothesis was denied (table 14), since countries with stable growth portrayed the most effective multipliers, which is contrary to our hypothetical reasoning. The indebtedness hypothesis was partly confirmed with output multipliers, but denied with employment multipliers in table 15. These results confirmed that the fiscal spending is justified in the countries with

low debt—to—GDP ratio, but not in the highly indebted countries. Government spending on employment is not justified with low debt—to—GDP ratio, based on our estimation, which partly denied the third sub—hypothesis.

Research on the economic characteristics provided some insights on fiscal spending effectiveness, but generally confirmed the crowding out argument from the first hypothesis on traditional New Deal spending multiplier effectiveness rejection. The investigation on transmission mechanisms showed that the main drivers of crowding out are the non-performing bank loans, as a result of the diminished domestic credit provision to the private sector. The gross fixed capital is also found out to be severely decreased with the crowding out, due to low levels of private investment, as is evident from table 16.

In terms of employment providing policy, traditional fiscal spending is not advised either, due to the crowding out effect. Under certain circumstances, the fiscal spending may be an effective employment policy. In large countries for example, our results showed a positive impact on employment levels after the spending shock.

Second hypothesis on the Green New Deal spending effectiveness was confirmed in our research. The multipliers on employment and output were found positive and effects of the Green New Deal measures were found to generally boost the economic output and employment (see table 17). The GND measures were compared to the traditional New Deal spending, where especially energy efficiency measure increased employment and economic growth much more in comparison with the traditional New Deal.

Two empirical sub-hypotheses (2.A and 2.B) of the Green New deal were both confirmed in our comparative study. S. Korean synthetic economy without the 2009 Green New Deal spending performed worse in our model than the real time series, which engaged in the GND spending, as it is evident from the figure 5 and figure 6. The Slovenian example can also confirm the second empirical hypothesis, but with less statistical significance. Placebo intervention in Slovenia portrayed higher output levels than the actual time series in which such spending did not occur, as is evident from the figure 8. Results on employment effects are not confirming the hypothesis of Green New Deal spending effectiveness in Slovenia (see figure 7).

The topic on general government multipliers turned out to be perplexed and cannot leave us with a straightforward policy implication, but the policy design depends on the economic circumstances. The results from the Green New Deal evidence tell a more convincing story of a crisis elevation policy. Countries that engaged in the Green New Deal spending generally portrayed positive fiscal spending multipliers in our model, both in employment and output spending. These findings have important policy implications, presented in the following section. The thesis will conclude with the Green New Deal policy recommendations for policymakers and decision-makers during the times of economic recessions.

4 POLICY IMPLICATIONS AND POLICY RECOMMENDATIONS

This section will draw some policy implications from our empirical findings, as well as propose the most optimal Green New Deal policy recommendations to the policymakers. The chapter will be divided in two parts. The first part will cover the traditional New Deal spending policy implications and the second part Green New Deal policy implications from our regression results.

4.1 Traditional New Deal policy implications

Policy implication for the traditional New Deal, based on this thesis analysis, is simply: don't use it. This conclusion is based on our empirical model results in table 12, which showed that the employment and output multipliers of traditional fiscal spending are negative. Government spending as an output boosting policy is more appropriate in big economies with a slow pace of positive growth rate and with sustainable amounts of debt-to-GDP ratio. These are also the economic circumstances, which are not likely for economies to engage in the fiscal spending, since fiscal spending is usually considered as a crisis measure, adopted in the economy with negative growth.

Traditional government spending could be an effective employment creating policy in only one circumstance and that is in the case of massive fiscal stimulus spending in large countries, based on our results from the table 13.

Employment multiplier is negative across all paces of growth, even in a recessionary economy and across all levels of economy indebtedness. This brings us to a conclusion that stimulus may be used in large countries, but the effects should be further studied on a particular case.

The general multiplier estimations can be too general, as it was proven with our comparative study on Slovenia, which portrayed Green New Deal as ineffective in employment creation, but effective as the output boosting policy in our research. Optimal policy design should take specific country in question and estimate the effects of fiscal spending on the isolated case, with specific economic circumstances.

In the case of (non-green) fiscal spending, the government should invest in capital goods and provide systemic liquidity, as the non-performing loans and reduced gross fixed capital stock were the main transmission mechanisms of the negative multipliers found in our research. Our research also concluded that the domestic credit to private investors got diminished with government spending, which implies that such spending should take this into account. This implies that the government spending should be directed towards private credit provision; as such spending would not divert the funds from the private capital markets.

4.2 The Green New Deal policy implications

Empirical model confirmed the hypothesis on the effectiveness of the Green New Deal, both in employment creating measures, as well as in the output growth boosting multiplier. This has an important policy advantage of the Green New Deal over the traditional New Deal spending, which turned out to be negatively affecting the economy. According to our estimation of the empirical model, the Green New Deal is appropriate for adoption during crises, whereas the traditional New Deal is not.

The comparative analysis in chapter 3.3.3 provided an important insight into South Korean and Slovenian economy, which showed significantly positive impact of the Green New Deal during the last Great Recession of 2008. As it can be seen from figure 5, South Korea would have been worse off without the massive fiscal spending in post-crisis years, since the employment would have fallen even more during the recession, as well as the economic output. Slovenian economy would have benefited greatly, in case it had engaged in 2009 Green New Deal spending, based on our results in figure 7. After the fall of economic output in 2008 the Slovenian output stagnated, whereas it is projected that it would have picked up in the case of fiscal spending, which did not in fact occur. This has an important policy implication that Slovenian economy would benefit from Green New Deal during the recessions. However, the employment creating potential of the Green New Deal is low in Slovenia and should not be adopted as an employment creating policy, according to our estimates.

Another important policy advantage over the traditional New Deal is the environmental orientation, towards a low-carbon economy, which came into discussion due to the scientific concerns over climate change, which result from the greenhouse gas emissions, stemming from the traditional production methods, which were also facilitated by the traditional New Deal. The greenhouse gas reductions are not the sole environmental commitment of the Green New Deal, but also several other environmentally friendly infrastructure projects are included, such as mass transit and railroad expansion, water sanitation, energy conservation and environmental restoration.

Some of these policies were implemented in traditional New Deal spending, but the crucial difference in types of infrastructure project investments are that the GND is aiming at the infrastructure projects with potential to save in the long-run. The traditional infrastructure projects were designed to boost the economy, with more spending, but were not particularly frugal in the long run. If we take the energy efficiency for example, its capability to save energy in the long run crucially differentiates such project from the traditional spending, where such long-term savings are not as accentuated.

Important policy implication of the Green New Deal is that it is inducing technological change, whereas the traditional New Deal projects are not specifically technologically advanced. In the case of the Green New Deal main infrastructure projects introduce modern technologies, while some policies, such as the green budget reform, induce innovations, due to its impacts on the market. Technology-push measures are an important part of the Green
New Deal policy, since they improve total factor productivity in the long run and introduce new services and products to the market.

Government spending should prioritise emerging sectors, in this case the "low-carbon" innovations, as it did in the times of heavy industry subsidisation, from which the subsidies should be now removed. Since the traditional heavy industry is not a sustainable sector today, due to automatization and environmental concerns, the subsidies should divert into cleaner sectors, with a low-carbon and labour-intensive approach to economic production. This subsidy reallocation came to be known under the heading green budget reform. Green budget reform particularly aims at removing the subsidies from the polluting industries, while the introduction of new subsidies to the emerging clean energy should be adopted with caution and parsimoniously, due to the stubborn fashion of subsidised sector public finance dependence. Subsidising emerging sectors may be problematic in the long-run, since it is hard to take away granted subsidies, on which industry depends on. In the short run, the subsidisation may be beneficial, because the emerging industry (clean energy in our case) is not cost competitive with the traditional industry on the market.

The renewable energy sources rely heavily on subsidisation and the green budget reform should focus on removing the perverse subsidies from the polluting sectors and not introducing additional subsidies, which may turn burdensome for the national budget accounts in the long run. The empirical estimation also showed low employment and output multipliers in the renewable energy sector. The multipliers estimated were even lower in the R&D public investment, where the crowding out effect seems to take place.

The empirical research in this thesis concluded, that renewable energy and R&D investments are not as appropriate for the optimal Green New Deal policy design (see table 18). The kilometres of rail lines are positively correlated with government spending, since most of the spending is done in infrastructure investment. The multiplier is quite low and insignificant in both cases, but it is, nonetheless, positive, which justifies the infrastructure government spending as an environmentally beneficial intervention. The Green New Deal renders more effective infrastructure spending than the traditional New Deal, considering the output multiplier, but it is less effective as employment creating policy, as it is evident from the table 18.

CONCLUSION

In this thesis a comprehensive study on the impact of traditional and green fiscal multipliers has been carried out. The study consists of literature review, empirical model research and policy recommendations, based on the research results.

The main conclusion of the study is that green government spending may be effective in providing economic recovery, whereas traditional general government spending is found to be ineffective and even detrimental with negative multipliers. Negative multipliers of the traditional fiscal spending suggest that traditional government spending crowds out private

investment, since the non-performing loans increase and credit to private investors decrease in the case of traditional government spending. The general characteristics of the economy (size, pace of growth, indebtedness) and their relation to growth and employment multipliers were also studied. Largest countries in our sample with stable growth and sustainable debtto-GDP ratio economies were the only countries that benefited from traditional government spending. These economic circumstances are not appropriate for recovery fiscal spending, which is considered a crisis elevation economic initiative.

The first chapter of this thesis presented an overview of the traditional and Green New Deal policy, its results and controversies, which followed from the recessionary measures. The New Deal followed the Great Recession, with massive public employment spending and government intervention. This policy relied on the Keynesian expansionary response to recessionary shocks. As it was shown, the economists still argue on the topic of New Deal effectiveness and appropriateness of adoption in economic crises. The Green New Deal policy is suggested in current economic crisis, with a double dividend hypothesis, which states, that the economic recovery could provide also positive environmental externalities. As it was shown in the first chapter of this thesis, recovery packages of 2009 already invested some funds in the green development, but the scope of such funds was not, with some exceptions (for example S. Korea), nearly enough for full environmental recovery and climate stabilisation.

In the second chapter the theoretical ground for the Green New Deal was developed, which relies heavily on the Keynesian economics. The literature review of different output and employment multipliers were found to be mostly positive on the environmental investment, especially in the field of energy efficiency spending.

In the empirical research of this thesis, found in the third chapter, the Green New Deal spending multipliers are found to boost the economy, since the employment and output multipliers turned positive in our empirical model. The multipliers on specific Green New Deal policies were studied, where only energy efficiency provided us with undoubtful evidence, that this policy is significantly effective in boosting economic recovery.

Econometric modelling in this thesis provides a novel approach in fiscal spending research, since most of the multipliers throughout the literature were estimates with structural VAR, based on time series only, but not in a panel data setting. There is a pitfall to the generalised multipliers based on the panel data, since these results may be too general and do not show the complete picture of the specific country multipliers, which are necessary for the employment of right economic recovery strategy in the case of economic crises.

This pitfall is indeed tested with synthetic economy comparative analysis. A placebo Green New Deal intervention is constructed for Slovenia, where such intervention did not occur, to study the results in a counterfactual. Similar counterfactual scenario studied the economy of S. Korea, which adopted the biggest Green New Deal fiscal spending globally. The counterfactual predicts the Korean economy without such spending and finds that the economy would be worse off without the Green New Deal spending, both, in employment

levels and output. The Slovenian placebo effect is not as statistically significant, but it also provides us with an insight, that the economy would generally benefit from the Green New Deal spending.

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APPENDIX

Appendix 1: Povzetek naloge v slovenskem jeziku

Zeleni New Deal je ekonomski ukrep javnih izdatkov za čisto energijo v času ekonomske krize. Zeleni javni izdatki pripomorejo k okoljski vzdržnosti gospodarstva, hkrati pa ustvarjajo nova delovna mesta in prispevajo k ekonomski blaginji. Magistrska naloga analizira Keynesiansko fiskalno politiko in empirično ocenjuje vpliv tradicionalnih ter zelenih fiskalnih izdatkov na vzorcu 35 OECD držav.

Fiskalni multiplikacijski učinek tradicionalnih javnih izdatkov je ocenjen kot negativen, kar potrjuje hipotezo o izrinjanju zasebnih investicij, saj v empiričnem modelu sredstva za zasebni kredit med krizo upadejo in količina slabih posojil naraste. Vzorec gospodarstev, ki so implementirala Zeleni New Deal leta 2009 kaže pozitivni vpliv zelenih javnih izdatkov na gospodarsko rast in zaposlenost. Ukrepi za izboljšanje energetske učinkovitosti v raziskavi izstopajo kot krizni ukrepi k povišanju stopnje zaposlenosti in gospodarske rasti.

Drugi del empirične raziskave primerja sintetično ustvarjeno ekonomijo z dejanskimi časovnimi serijami gospodarstev. V empiričnem modelu J. Koreje je bil Zeleni New Deal uspešen v primerjavi s sintetično ekonomijo J. Koreje, v kateri Zelenega New Deal ni bilo. Za slovensko gospodarstvo raziskava potrdi enak pozitivni vpliv, vendar je le ta manj statistično značilen.

Ključne besede: Fiskalni stimulus, (Zeleni) New Deal, Okoljska ekonomija, Ekonomska kriza 2008

Appendix 2: Global Green Stimulus, from September 2008 through December 2009

	Total fiscal stimulus (US\$ bn)	Low carbon power (US\$ bn)	Energy efficiency (US\$ bn)	Waste, water and pollution (US\$ bn)	Total Govern- ment spending (GS) (US\$ bn)	GDP (US\$ bn)	Government Spending as % of Total Spending	Government Spending as % of Total fiscal Spending
Argentina	13.2					526.	0.0%	0.0%
Australia	43.8	3.5	6.5	9.9	9.3	773.	22.7%	1.3%
Brazil	3.6					1,84	0.0%	0.0%
Canada	31.8	1.1	1.4	0.3	2.8	1,27	8.7%	0.2%
China	649.1	1.6	182.4	34.0	218.8	7,09	33.6%	3.1%
France	33.7	0.9	5.1	0.2	6.2	2,07	18.2%	0.3%
Germany	104.8		13.8		13.8	2,80	13.2%	0.5%
India	13.7		1.0		1.0	2,96	7.3%	0.0%
Indonesia	5.9	0.1	0.0		0.1	843.	1.7%	0.0%
Italy	103.5		1.3		1.3	1,80	1.3%	0.1%
Japan	711.9	14.0	29.1	0.2	43.3	4,27	6.1%	1.0%
Mexico	7.7		0.8		0.8	1,35	9.7%	0.1%
Russia	20.0					2,09	0.0%	0.0%
Saudi	126.8			9.5	9.5	546.	7.5%	1.7%
South	7.5		0.7	0.1	0.8	467.	10.7%	0.2%
South	76.1	30.9	15.2	13.8	59.9	1,20	78.7%	5.0%
Turkey						853.		0.0%
United	35.5	0.9	4.9	0.1	5.8	2,13	16.3%	0.3%
United	976.9	39.3	58.3	20.0	117.7	13,7	12.0%	0.9%
European	38.8	13.1	9.6		22.8	14,4	58.7%	0.2%
Total	3,004.3	105.3	330.1	78.1	513.5	63,1	17.1%	0.8%
Total	314.1	2.3	5.3	1.0	8.6	6,90	2.7%	0.1%
Global	3,318.4	107.6	335.4	79.1	522.1	70,0	15.7%	0.7%

Source: (Barbier, 2010).

Appendix 3: The green Keynesian model aggregates

Cg = consumption of non-durable goods and energy-intensive services

 C_s = consumption of human-capital intensive services

Cm= household investment in consumer durables

Ime = investment in energy-intensive manufactured capital

 $I_{mc} = investment$ in energy-conserving manufactured capital

In = investment in natural capital

Ih = investment in human capital

 G_g = government consumption of non-durable goods and energy-intensive services

G_s = government consumption of human capital-intensive services

Gme = government investment in energy-intensive manufactured capital

Gmc = government investment in energy-conserving manufactured capital

Gn = government investment in natural capital

Gh = government investment in human capital

Appendix 4: Policies for Full Employment, Climate Stabilization, and Ecological Balance

Increased hiring in public sector: teachers, police, transit and park workers, etc.

Large-scale building retrofit publicly financed but carried out by private contractors

Increased public R&D expenditures with accompanying higher education investment (like the "Sputnik" push for stronger science education in the 1950s)

Major energy efficiency and renewable energy investment, partly public and partly incentivized private investment

Investment in public transit and infrastructure

Carbon tax or equivalent (cap & trade with auction)

Recycle carbon tax revenues for energy efficiency, renewables, progressive rebates

Infrastructure investment – hi-speed rail, public transit, green buildings

Efficiency standards for cars, machinery, buildings

Preferential credit or subsidy for energy efficiency investments

Financial reform and re-regulation including the equivalent of Glass-Steagall "firewall" between basic banking and risky investments (another Keynesian precedent).

And at the international level:

A Global Investment Fund for efficiency and renewable energy investment (like the World Bank but with a non-carbon energy focus).

Integrated cap-and-trade schemes for industrialized economies with carbon credits for developing countries, including agriculture and forestry.

Efficiency and renewable energy technology transfer, with waiver of intellectual property and WTO subsidy rules for least developed economies.

Microcredit schemes for local solar, wind, ecological preservation, etc.

Source: (Harris, 2013).

Appendix 5: Dynamic multipliers of the traditional New Deal

Figure 1: Dynamic multipliers: Impulse-Response function of the employment variable



Source: Own work (print from Stata).





Source: Own work (print from Stata).

Appendix 6: Dynamic multipliers of the Green New Deal

Figure 1: Green government spending multipliers: Impulse-Response function of the employment variable



Source: Own work (print from Stata).

Figure 2: Green government spending multipliers: Impulse-Response function of the rGDP



Source: Own work (print from Stata).

Appendix 7: Synth statistic reports





Source: Own work (obtained from Stata).

Table 1: Numerical p-Values for synthetic simulations of Korean employment

	estimates	p-values	p-values: standard deviations
c1	.0200892	.5588235	.4411765
c2	.0049748	.9117647	.8529412
сЗ	.0140495	.8823529	.7647059
<i>c4</i>	.0108499	.9411765	.8235294
c5	.020004	.8235294	.7647059
RM	SPE		
(Root Mean Square Percentage Error)		.0191252	

Source: Own work (obtained from Stata).

Figure 2: p-Values for synthetic simulations of Korean rGDP



Source: Own work (print from Stata).

	estimates	p-values	p-values: standard deviations		
c1	.0900433	.2647059	.6176471		
c2	.1182694	.2647059	.5588235		
c3	.1148385	.2941176	.6764706		
c4	.0989505	.4705882	.8235294		
с5	.1000486	.5588235	.8529412		
RM	SPE		.0783327		

Table 2: Numerical	<i>p</i> -Values for	synthetic simul	lations of	Korean rGDP
	P			

Source: Own work (obtained from Stata).

Figure 3: p-Values for synthetic simulations of Slovenian employment



Source: Own work (print from Stata).

Table 3: Numerical p-Values for synthetic simulations of Slovenian employment

	estimates	p-values	p-values: standard
c1	.04744	.3823529	.1470588
<i>c2</i>	.0511627	.3529412	.1470588
<i>c3</i>	.0073783	.9705882	.9411765
c4	0088909	.9705882	.8529412
<i>c</i> 5	0322817	6764706	.6176471
RMSPE		.0189181	

Source: Own work (obtained from Stata).





Source: Own work (print from Stata).

	Estimates	p-values	p-values: standard	
c1	0197568	1.7058824	.7352941	
c2	.0032552	.9411765	.9705882	
c3	0150832	.9411765	.8823529	
c4	052705	.6764706	.4117647	
<i>c5</i>	0877076	.5	.2941176	
RMSPE		.0208281		

Table 4: Numerical p-Values for synthetic simulations of Slovenian rGDP

Source: Own work (obtained from Stata).

	Employment	"CDD
	Employment	IGDI
South Korea	Chile (37,6%)	Chile (63,2%)
	Japan (27,5%)	USA (36,8)
	Luxemburg (7,2%)	
	USA (27,7%)	
Slovenia	Switzerland (9%)	Chile (1,6%)
	Estonia (42,6%)	Estonia (11,8%)
	Hungary (21,7%)	Hungary (29,7%)
	Iceland (19,8%)	Iceland (40,6%)
	Slovakia (6,9%)	Slovakia (1.9%)

Table 5: Pool of donor countries for synth analyses

Source: Own work (obtained from Stata).